CURRICULUM

FOR

FOURTH SEMESTER

OF

THREE-YEAR DIPLOMA COURSE

IN

ARCHITECTURAL

ASSISTANTSHIP

STUDY SCHEME FOURTH SEMESTER

Code	Subjects	Study Scheme			Total Hours L+T+P/D	Credits			Total Credits L+T+P/D
		Periods Per Week							
		L	T	P/D		L	T	P/D	
AAPC401	Architectural Design-III	3	0	0	3	3	0	0	3
AAPC402	Building Construction-II	3	0	0	3	3	0	0	3
AAPC403	Climatology	3	0	0	3	3	0	0	3
AAPC404	H.O.A-II	3	0	0	3	3	0	0	3
ES405	Surveying	3	0	0	3	3	0	0	3
AAPC406	Computer Application In Architecture	0	0	4	4	0	0	2	2
ES407	Surveying Lab	0	0	2	2	0	0	1	1
AAPC408	Building Construction Practical –II	0	0	2	2	0	0	1	1
AAPC409	Architectural Design Practical-III	0	0	4	4	0	0	2	2
AU410	Universal Human Values	2	0	0	2	0	0	0	0
SL411	Skill Learning/Prior Learning/ Extra Learning/Online Learning	0	0	2	2	0	0	1	1
Total		**17**	**0**	**14**	**31**	**15**	**0**	**7**	**22**

HS	BS	ES	PC	PE	OE	MP	SL/PR	AU	Total
0	**0**	**4**	**17**	**0**	**0**	**0**	**1**	**0**	**22**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **AAPC401**	Course Title: **ARCHITECTURAL DESIGN-III**
Semester: **4th**	Credits: **3 (L: 3 T: 0 P: 0)**
Hours per week: **3 (L:3 T:0 P:0)**	

COURSE OBJECTIVES:

The objective of the subject is to familiarize students how to analyse the area requirement. Provide the knowledge to Students about the uses of traditional indigenous materials & construction systems in basic building forms, Comprehension of arrangement/ organization of spatially/ functionally similar units resulting in varied outdoor spaces. Also assimilate the modifying spatial qualities of indoor & outdoor spaces due to varying configurations.

COURSE CONTENT

1. Design of a double storied structure such as Residence/Duplex House. Drawings to be produced:
   - Site plan
   - Detailed floor plans showing furniture layout
   - Elevations
   - Sections
   - Views

2. Design of a double storied small health-centre and Nursery school. Drawings to be produced:
   Site plan
   - Site plan
   - Detailed floor plans showing furniture layout
   - Elevations
   - Sections
   - Views

COURSE OUTCOMES

After successful completion of this course, students shall be able:

- Design a double-storied residential/duplex structure, producing essential drawings such as site plans, detailed floor plans with furniture layout, elevations, sections, and views.
- Demonstrate the ability to design a double-storied small health center and nursery school, generating necessary drawings including site plans, detailed floor plans with furniture layout, elevations, sections, and views.

RECOMMENDED BOOKS

1. 'Principles of three Dimensional Design' by Wucius Wong.
2. "Time Saver Standards for Architectural Design Data" by John Hanock.
3. "Architectural Graphic Standards" by Ramsay and Sleeper.
4. "Space, Time and Architecture" by Gideon.
5. "Elements of Architecture from Form to place" by Von Meiss, Pierre.
6. Architecture: Form, Space and Order by Francis D. K. Ching, John Wiley & Sons, 2007.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (% age)
1	24	50
2	24	50
Total	**48**	**100**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code:**AAPC402**	Course Title: **BUILDING CONSTRUCTION-II**
Semester:**4th**	Credits: **3 (L:3 T:0 P:0)**
Hours per week: **3 (L:3 T:0 P:0)**	

COURSE OBJECTIVES:

The objective of the subject is providing knowledge to the students of architectural assistantship diploma about building materials and various components of building construction are as roofs, stairs, Expansion joints, counters. Partition walls, formwork and shuttering etc. Also provide knowledge about how to draw working/construction detail drawing of various components of building.

COURSE CONTENT

1. Staircase

1.1 Definition and technical term related to stairs as per Nomenclature
1.2 Location of stairs
1.3 Requirements of a good stair
1.4 Calculation of riser and tread in building
1.5 Classification of Stairs
1.6 Drawing of R.C.C and wooden Dog legged Staircase with their construction details.
1.7 Drawing of Steel spiral staircase.

2. Roof and Roof Covering

2.1 Definition and Technical term used in timber pitched roof construction
2.2 Classification of Roofs-Pitched roof and flat roof
2.3 Types of pitched roof.
2.4 Drawing of king post and queen post trusses along with their constructional detail.
2.5 Drawing of fixing and layout of A.C Sheets and G.I Sheets

3. Expansion Joints

3.1 Definition of Expansion Joints
3.2 Materials used for expansion joint
3.3 Detail Diagram of Provision of Expansion joint in walls.
3.4 Detail Diagram of Provision of Expansion joint in roofs and floors
3.5 Detail Diagram of Provision of Expansion joint in framed structure and also showing details of expansion joint between two columns.

4. Formwork

4.1 Definition and types of formwork,
4.2 Material used for formwork and construction of formwork.
4.3 Order and method of Removing Formwork.
4.4 Detail drawing of timber formwork for circular, square and rectangular R.C.C column.
4.5 Detail drawing of timber formwork for R.C.C beam and slab floor.

5. Interiors of Building

5.1 Introductions
5.2 Drawing of different types of Partition walls.
5.3 Simple drawing of Stud or common partition and Trussed partition
5.4 Draw different types of counters as per usages.

COURSE OUTCOME:

After successful completion of this course, students shall be able to;

- Gain proficiency in staircase design, covering terminology, location, design requirements, and drawing techniques for RCC, wooden, and steel staircases.
- Acquire skills in roof and roof covering, understanding terms, classifying roofs, and producing drawings for trusses and sheet layouts.
- Understand expansion joints, including their definition, materials, and detailed diagrams for walls, roofs, floors, and framed structures.
- Develop expertise in formwork, covering types, materials, construction, and detailed drawings for various RCC elements.
- Learn about building interiors, with a focus on drawing partition walls, including stud or common partitions and trussed partitions, as well as different types of counters based on their usage.

RECOMMENDED BOOKS: -

1) Building Construction, S.C Rangwala.
2) A Text book of Building Construction, B.C Punmia.
3) Building Construction, Sushil Kumar.
4) Building Construction, Mackay WB vol. 1-4.
5) Construction Technology, Chudley Vol. 1-6

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO	TIME (HOURS)	MARKS
01	12	25
02	12	25
03	07	15
04	10	20
05	07	15
Total	**48**	**100**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
CourseCode:**AAPC403**	Course Title: **Climatology**
Semester:**4th**	Credits:**3 (L:3 T:0 P:0)**
Hours perweek:**3 (L:3 T:0 P:0)**	

COURSE OBJECTIVES:

The objective of the subject is help the students to understand the various climates and help them to design the building accordingly, familiarize students with the elements constituting climate and the role in creating responsive designs. It also helps the students with human thermal comfort as an essential function of the building.

COURSE CONTENT

1. **General introduction& ecology**
   - 1.1 Introduction to Climatology
   - 1.2 Study of the various elements of climate
   - 1.3 Movement of earth around Sun
   - 1.4 Change of Seasons
   - 1.5 Basics elements of ecology
   - 1.6 Concept of natural cycles in Eco-system

2. **Climatic Zones and Human Comfort**
   - 2.1 Different types of climatic zones
   - 2.2 Introduction to Macroclimate and Micro Climate
   - 2.3 Relation of Climate and comfort
   - 2.4 Use of landscape elements for micro and macro climate

3. **Sun Control and Shading Devices**
   - 3.1 Sun Chart
   - 3.2 Internal and External sun shading Devices
   - 3.3 Horizontal and vertical louvers
   - 3.4 Introduction and objectives of Solar Passive Design
   - 3.5 Natural Lighting
   - 3.6 Amount of light ,sky as a source of light and day light factor
   - 3.7 Effect of size and shape of the opening in different planes with Or without obstructions.

4. **Orientation of the building and wind control**
   - 4.1 Introduction to Orientation of the building
   - 4.2 Factors affecting the orientation of building.
   - 4.3 Wind protection devices
   - 4.4 Effective temperature and its use
   - 4.5 Ventilation and air movement in the buildings
   - 4.6 Examples of climate responsive building projects from India

COURSE OUTCOME:

After successful completion of this course, students shall be able:

- Gain insights into climatology, covering elements of climate, Earth's movement, and natural cycles in ecosystems.
- Understand climatic zones, differentiating between macroclimate and microclimate, and grasp the correlation between climate and comfort.
- Master sun control and shading devices, utilizing sun charts, recognizing shading methods, and comprehending solar passive design principles.
- Explore the importance of building orientation, factors influencing it, and methods for wind control.
- Acquire knowledge about natural lighting, ventilation, and examples of climate-responsive building projects from India.

REFERENCE BOOKS:

1. Manual of Tropical Housing and Building: Climate Design by O.H. Koenigs berger et.al, Madras: Orient Longman, 1984.
2. Design with Climate by Arvind Krishan, Publisher, Tata McGraw Hill, New Delhi
3. Microclimatic Landscape Design by Robert D. Brown and Terry J. Gillespie, John Wiley & Sons, 1995.
4. Energy-efficient Buildings in India by Mili Majumdar, TERI Press,
5. Thermal control in passive solar buildings by S.C. Kaushik, G.N. Tiwari and J.K. Nayak, IBT Publishers & Distributors, 1988

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO	Time (Hours)	Marks (% age)
01	14	30
02	08	15
03	14	30
04	12	25
Total	**48**	**100**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
CourseCode:**AAPC404**	Course Title: **HISTORY OF ARCHITECTURE-II**
Semester: **4th**	Credits: **3 (L:3 T:0 P:0)**
Hours perweek:**3 (L:3 T:0 P:0)**	

COURSE OBJECTIVES:

The objective of the subject is to understand the role of geo-physical, societal, political and technological factors in the evolution of Architecture, and develop a holistic approach to Architecture as an integral component of the built environment. Also inform about the development of architecture in the ancient world and the cultural and contextual determinants that produced that architecture.

COURSE CONTENT

1. **Egyptian Architecture**
   - 1.1 Introduction to Egyptian Civilization,
   - 1.2 Tomb Architecture (Pyramids and mastabas) in the ancient period – explain with examples of the buildings.
2. **History of Western Architecture**
   - 2.1 Introduction to Mesopotamian Civilization,
   - 2.2 Ziggurats (temple) and ancient Hanging gardens of Babylon, its Architectural characteristics – explain with examples of the building
3. **Greek Architecture & Roman Architecture**
   - **3.1 Greek Architecture**
     - 3.1.1 Introduction to Greek Architecture
     - 3.1.2 Classical orders and constituent elements of architecture - Column orders and the articulation of temples(Acropolis and Parthenon).
   - **3.2 Roman Architecture**
     - 3.2.1 Introduction toRoman Architecture
     - 3.2.2 Classical orders and Building types to correspondthe complex social functions and structure (Pantheon, Basilica, Thermae and Amphiteatres).
4. **Early Christian Architecture & Byzantine Architecture**.
   - **4.1 Early Christian Architecture**
     - 4.1.1 Development of church plan (Basilican),
     - 4.1.2 General architectural characteristics of St. Peters,
   - **4.2 Byzantine Architecture**
     - 4.2.1 Introduction to Byzantine Architecture
     - 4.2.2 General architectural characteristics of St. Sophia Church
5. **Romanesque Architecture & Gothic Architecture.**
   - **5.1 Romanesque Architecture**
     - 5.1.1 Introduction to Romanesque Architecture
     - 5.1.2 General architectural characteristics, Materials and construction methods for the Pisa group of buildings.
   - **5.2 Gothic Architecture**
     - 5.2.1 Introduction to Gothic Architecture (flying buttresses, rose window, pinnacles)

5.2.2 General architectural characteristics of Gothic Arch at Notre Dame Paris.

6. Renaissance Architecture

6.1 Early Renaissance Architecture.

6.2 General characteristics and Role of Michael Anglo & Palladio e.g. St. Peter's Rome.

7. Modern Architecture in India, Europe and America.

7.1 Introduction to modern architecture in India, Europe and America.

7.2 New building materials (concrete, steel and glass) and their architectural expression.

7.3 Philosophy and key works of Frank Lloyd Wright, Mies Van De Rohe, Walter Gropius.

7.4 Philosophy and key Work of Le Corbusier in India, Louis Kahn, Charles Correa, B.V. Doshiand Raj Rewal.

COURSE OUTCOMES

After successful completion of this course, students shall be able to;

- Understand architectural elements, forms, development trends, construction techniques, materials and technologies used in built environment during through the times.
- Understand transformation patterns in architecture during various kingdoms / time periods and analyse the contributing factors for the design development of different styles.
- Familiarize themselves with the socio–economic, historical and political influences of time period in architectural development.

RECOMMENDED BOOKS

1. "The History of Architecture" by Sir Bannister Fletcher.
2. "A Global History of Architecture" by Fransis D. K. Ching.
3. "World History of Architecture" by Fazio M.
4. "History Encyclopedia' by Adams Simon.
5. "Modern Architecture – A Critical History" by Frampton Kenneth.
6. History of Architecture – J E Swain
7. History of Architecture by Dora Couch
8. The Great Age of World Architecture – by GK Hiraskar

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (% age)
1	05	10
2	05	10
3	09	20
4	08	16
5	09	20
6	05	10
7	07	14
Total	**48**	**100**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **ES405**	Course Title: **Surveying**
Semester: **4th**	Credits:**3 (L:3 T: 0 P: 0)**
Hours per week: **3 (L:3 T:0 P:0)**	

COURSE OBJECTIVE

The main objective of subject surveying is to make the student of diploma in architecture Assistantship aware about the basic topics of surveying like chain survey ,compass survey, leveling for which they will normally called to perform. Plane table surveying, contouring, theodolite surveying, curves and use of minor instruments have also been included in this subject.

COURSE CONTENT

1. Introduction

1.1 Basic principles of surveying
1.2 Types of surveying.
1.3 Concept of surveying,
1.4 Purpose of surveying,
1.5 measurements-linear and angular,
1.6 units of measurements
1.7 Instruments used for taking these measurement,
1.8 classification of survey based on instruments
1.9 System of conversion of land measurements from traditional revenue maps/records to MKS.

2. Chain surveying

2.1 Introduction of chain surveying
2.2 Purpose of chain surveying,
2.3 principles of chain surveying
2.4 Errors in chain surveying
2.5 Corrections to chain length, simple related problems.

3. Compass surveying

3.1 Purpose of compass surveying.
3.2 Construction and working of prismatic compass,
3.3 Use of prismatic compass: Setting and taking observations
3.4 Concept of:
- Meridian - Magnetic and true,
- Bearing- Magnetic, True and Arbitrary,
- Whole circle bearing and reduced bearing,
- Fore and back bearing

3.5 Local Attraction-causes, Detection & precautions against local attraction

4. Levelling

4.1 Purpose and concept of levelling,
4.2 reduced level and bench marks
4.3 Construction of Dumpy level
4.4 Concepts of: line of collimation, axis of the bubble tube, axis of the telescope and vertical axis
4.5 Temporary adjustment: setting up and levelling

4.6 Concept of: back sight, foresight, intermediate sight, station change point, to determine reduced levels.

4.7 Level book and reduction of levels by
- Height of instrument method,
- Rise and fall method,
- Arithmetic checks, problems on reduction of levels,

5. Plane Table Surveying

5.1 Purpose of plane table surveying,

5.2 Equipment used in plane table survey: Plane table and its accessories

5.3 Setting of a plane table:
- Centering
- Leveling and
- Orientation

5.4 Methods of plane table surveying:
- Radiation,
- Intersection and
- Traversing,

6. Contouring and Modern Surveying Instrument

6.1 Contouring

6.1.1 Concept of contours,

6.1.2 Purpose of Contouring

6.1.3 Contour interval and

6.1.4 Horizontal equivalent.

6.2 Modern Surveying Instrument

6.2.1 Introduction to use of Total station,

6.2.2 Introduction to use of EDM instruments

6.2.3 Introduction to use of Planimeter

6.2.4 Introduction to remote sensing and GPS.

COURSE OUTCOME:-

After successful completion of this course, students shall be able to understand;

- Understand surveying principles, types, and measurement concepts. Learn the system of converting land measurements from traditional maps to MKS.
- Grasp the purpose and principles of chain surveying. Identify and correct errors in chain surveying through practical problems.
- Comprehend the purpose of compass surveying. Learn about prismatic compass construction, use, and concepts like meridian and bearing.
- Understand levelling concepts, including reduced level and bench marks. Learn dumpy level construction and leveling procedures, including temporary adjustments and methods for reduction of levels.
- Familiarize themselves with plane table surveying equipment and methods. Understand contouring concepts and modern surveying instruments, including total stations, EDM instruments, planimeters, remote sensing, and GPS.

RECOMMENDED BOOKS

1. "Surveying"; Narinder Singh; New Delhi, Tata McGraw Hill Publishing Co Ltd.
2. "Text Book of Surveying"; Hussain, SK and Nagraj, MS; New Delhi,
3. "A Text Book Surveying and Levelling"; Deshpande, RS; Poona,
4. "A Text Book of Surveying" Kocher, CL; Ludhiana, Katson Publishing House
5. "Surveying and Leveling, Kanetkar,TP and Kulkarni, SV., ", Poona, AVG Parkashan
6. "Surveying and Leveling-Vol.2" Kanetkar, TP; and Kulkarni, SV; Poona, AVG Prakashan

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME ALLOTED (HRS)	MARKS ALLOTED (%)
1	05	10
2	08	16
3	10	22
4	12	26
5	08	16
6	05	10
Total	**48**	**100**

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **AAPC406**	Course Title: **Computer Application in Architecture -II**
Semester:**4th**	Credits:**2 (L: 0 T: 0 P: 2)**
Hours per week: **4 (L:0 T:0 P:4)**	

COURSE OBJECTIVES:

The objective of the subject is providing knowledge to the students about 3D Software like AutoCAD & SketchUP. Also Train the students to make 3d models of their design proposals in SketchUP.

COURSE CONTENT

1. Introduction to 3D Software

1.1 Introduction to 3D Software like Auto CAD ,SketchUP
1.2 Importance of 3Ds Software for Architecture Students.

2. Modeling with SketchUP

2.1 Basics of Google Sketchup,
2.2 Drawing & Measurement Tools,
2.3 Creation of geometrical shapes & forms,
2.4 Union and intersection of forms.
2.5 Application of colour & materials.
2.6 Introduction to editing tools,
2.7 Modifying existing shapes and forms,

3. **Introduction to 3D Rendering Models**

3.1 3D creation and rendering,
3.2 Material application.
3.3 Lighting.
3.4 Camera setting.
3.5 Background.

Exercises

- Students will take their Architectural Design-III proposals and Prepare complete 3D models.

RECOMMENDED BOOKS

- Architectural Design with SketchUP by Alexender C. Schreyer.
- Mastering Adobe Photoshop.

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **ES407**	Course Title: **Surveying Lab**
Semester:**4th**	Credits:**1 (L: 0 T: 0 P: 1)**
Hours per week: **2 (L:0 T:0 P:2)**	

COURSE OBJECTIVE

The practical course includes fundamental surveying techniques such as chain surveying (ranging, chaining, testing, offsets, and setting out right angles), compass surveying (prismatic compass study, angle measurement, and plotting), leveling (dumpy level study, temporary adjustments, and staff readings), plane table surveying (setting, orientation, and plotting), and a demonstration of digital instruments like auto level, digital Planimeter, total station, and EDM instruments. Students will gain hands-on experience in these essential surveying methods

LIST OF PRACTICAL

I. Chain surveying:

a) Ranging a line
b) Chaining a line and recording in the field work
c) Testing and adjustment of chain
d) Taking offsets - perpendicular and oblique (with a tape only)
e) Setting out right angle with a tape

II. Compass Surveying:

a) Study of prismatic compass
b) Setting the compass and taking observations
c) Measuring angles between the lines meeting at a point
d) Plotting of readings and applying corrections.

III. Leveling

a) Study of dumpy level and levelling staff (single piece and folding)
b) Temporary adjustments of a Dumpy level
c) Taking staff readings on different stations from the single setting and finding differences of level between them
d) Taking staff readings on different stations from the single setting and finding differences of level between them

IV. Plane Table Surveying:

a) Setting the plane table
b) Plotting a few points by radiation method
c) Orientation by - Trough compass - Back sighting
d) Plotting a few points by intersection method

VI. Demonstration of digital instruments

a) Auto level,
b) digital Planimeter,
c) Total station,
d) EDM instruments.

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code:**AAPC408**	Course Title: **BUILDING CONSTRUCTION PRACTICAL-II**
Semester:**4th**	Credits: **1 (L:0 T:0 P:1)**
Hours per week: **2 (L:0 T:0 P:2)**	

COURSE OBJECTIVES:

The course aims to enhance students' skills in architectural detailing, covering topics such as drawing R.C.C and wooden dog-legged staircases, steel spiral staircases, king and queen post trusses, expansion joints, and timber formwork for columns, beams, and slabs. Additionally, it includes diverse counter types for various applications

LIST OF PRACTICAL/DRAWING SHEETS (Minimum 12 Sheets)

1. Draw R.C.C and wooden Dog legged Staircase with their construction details.
2. Draw Steel spiral staircase detail.
3. Draw king post truss along with their constructional detail.
4. Draw queen post truss along with their constructional detail.
5. Draw detail diagram of provision of expansion joint in walls, roofs and floors.
6. Draw detail diagram of provision of expansion joint in framed structure and also showing details of expansion joint between two columns.
7. Draw detail drawing of timber formwork for circular, square and rectangular R.C.C column.
8. Draw detail drawing of timber formwork for R.C.C beam and slab floor.
9. Draw different types of counters as per usages.

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **AAPC409**	Course Title: **ARCHITECTURAL DESIGN PRACTICAL-III**
Semester: **4th**	Credits: **2 (L:0 T:0 P:2)**
Hours per week: **4 (L:0 T:0 P:4)**	

COURSE OBJECTIVE:

The course objective is to develop students' proficiency in designing double-story structures, including residences, health centers, and nursery schools, by creating comprehensive site plans, floor plans, furniture layouts, elevations, sections, and views using a minimum of 6 sheets for each project. The emphasis is on practical application and skill enhancement in architectural design.

LIST OF PRACTICAL/DRAWING SHEETS (Minimum 18 Sheets)

1. **Double storied structure such as Residence/Duplex House.** **(Minimum 6 Sheets)**
   - 1.1 Draw its Site plan
   - 1.2 Draw its detailed Ground floor and First Floor plan showing furniture layout.
   - 1.3 Draw its Elevations
   - 1.4 Draw its Sections
   - 1.5 Draw its Views

2. **Double storied small health-centre.** **(Minimum 6 Sheets)**
   - 2.1 Draw its Site plan
   - 2.2 Draw its detailed Ground floor and First Floor plan showing furniture layout
   - 2.3 Draw its Elevations
   - 2.4 Draw its Sections
   - 2.5 Draw its Views

3. **Double storied Nursery school.** **(Minimum 6 Sheets)**
   - 3.1 Draw its Site plan
   - 3.2 Draw its detailed Ground floor and First Floor plan showing furniture layout
   - 3.3 Draw its Elevations
   - 3.4 Draw its Sections
   - 3.5 Draw its Views

PROGRAM : THREE YEARS DIPLOMA PROGRAM IN ARCHITECTURAL ASSISTANTSHIP	
Course Code: **AU410**	Course Title: **Universal Human Values**
Semester:**4th**	Credits: **0 (L: 0 T: 0 P: 0)**
Hours per week: **2(L:2 T:0 P:0)**	

COURSE OBJECTIVES

The main objective of subject is to help the students having the clarity about human aspirations, goal, activities and purpose of life. its facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence. It also help the students to develop the understanding of human tradition and its various components

COURSE CONTENT

1. **Introduction**

The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.

2. Understanding human being and its expansion

The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human being in existence (human conduct).

3. Activities of the Self

Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self

4. Understanding co-existence with other orders

The need and the process of inner evolution (through self-exploration, self-awareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

5. Expansion of Harmony From Self To Entire Existence

Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.

Course Outcome:

- The outcome of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
- It is free from any dogma or set of do's and don'ts related to values.

- It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
- This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

REFERENCE BOOKS:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8- 174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME ALLOTED(HRS)	MARKS ALLOTED (%)
1	06	20
2	07	20
3	06	20
4	06	20
5	07	20
Total	**32**	**100**

CURRICULUM

FOR

FOURTH SEMESTER

OF

THREE-YEAR DIPLOMA COURSE

IN

AUTOMOBILE ENGINEERING

STUDY SCHEME FOR 4TH SEMESTER AUTOMOBILE ENGINEERING									
Course code	Subjects	Time in hours				Credits			
		Theory	Tutorial	Practical	Total	Theory	Tutorial	Practical	Total
AEPC401	Advanced Automobile Engines	3	0	0	3	3	0	0	3
AEPC402	Advanced Automobile Engines Lab	0	0	2	2	0	0	1	1
AEPC403	Automotive Chassis Systems	3	0	0	3	3	0	0	3
AEPC404	Automotive Chassis Systems Lab	0	0	2	2	0	0	1	1
AEPC405	Automotive Electrical systems	3	0	0	3	3	0	0	3
AEPC406	Automotive Electrical systems Lab	0	0	2	2	0	0	1	1
AEPC407	Mechanical Sciences-II	3	0	0	3	3	0	0	3
AEPC408	Mechanical Sciences-II Lab	0	0	2	2	0	0	1	1
AEPC409	Motor Vehicle Act & Transport Management	3	0	0	3	3	0	0	3
*	Core Elective I	3	0	0	3	3	0	0	3
AU410	Indian Constitution (Audit Course)	3	0	0	3	0	0	0	0
Total		**21**	**0**	**8**	**29**	**18**	**0**	**4**	**22**

*Core Elective-1		
S. No.	**Course Code**	**Course Name**
1	AEPE01	Alternative Fuels and Combustion
2	AEPE02	Automotive Aerodynamics
3	AEPE03	Two and Three-wheeler Technology
4	AEPE04	Automotive Safety Systems

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC401**	Course Title: **Advanced Automobile Engines (AEE)**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

This course equips students with the ability to comprehend the constructional aspects and operational mechanisms of contemporary automobile engines. They will gain proficiency in evaluating internal combustion (I.C.) engine performance and interpreting performance curves. Additionally, students will acquire insights into I.C. engine fuels, their ratings, and combustion processes. The course delves into various fuel technologies applied in modern vehicles, exploring both potential and constraints. Furthermore, students will grasp the operational principles behind comfort and safety features in automobiles. A comprehensive understanding of automotive emissions and their control mechanisms will also be imparted.

COURSE CONTENT:

1. Theoretical engine cycle

1.1. The constant volume cycle (Otto cycle)
  1.1.1. Thermal efficiency of the theoretical Otto cycle
  1.1.2. Thermal efficiency in terms of compression ratio
  1.1.3. Effect of compression ratio on thermal efficiency
1.2. Relative efficiency
1.3. Diesel or constant pressure cycle
1.4. The dual combustion cycle
  1.4.1. Operation of dual combustion cycle
1.5. Comparison between Otto, Diesel and Dual combustion engine cycles
1.6. Comparison between theoretical and practical engine cycles

Simple numerals based on IC engines are expected

2. Combustion and Emissions

2.1. Calorific value
2.2. Combustion
  2.2.1. Products of combustion, relevant combustion equations
  2.2.2. Air–fuel ratio, fuel equivalence ratio
  2.2.3. Petrol engine combustion, detonation, pre-ignition, octane rating
  2.2.4. Compression ignition: compression ignition engine combustion chambers
  2.2.5. Diesel fuel: flash point, pour point, cloud point
2.3. Exhaust emissions
  2.3.1. Factors affecting exhaust emissions
2.4. Bharat emissions standards: emissions and their causes

2.5. Methods of controlling exhaust emissions
  2.5.1. Emission control devices: exhaust gas recirculation, catalysts, diesel particulate filters
2.6. Alternate Fuels: Biofuels, Liquefied petroleum gas (LPG), Hydrogen, Zero emissions vehicles (ZEVs)

3. Computer Controlled Petrol Engines.

3.1. Introduction
  3.1.1. Drawbacks of carburetted (SI) engines: Fuel distribution, Emission, Drivability, Power output, Fuel consumption, Air fuel ratio.
3.2. Throttle body injection (TBI) and Port fuel injection (PFI) systems
  3.2.1. Construction and working of TBI and PFI systems
  3.2.2. Methods of fuel Injection: Sequential, Continuous, grouped, simultaneous injection.
  3.2.3. Comparison of carburetted engine fuel supply system with TBI and MPFI System.
3.3. Sensors and Actuators of MPFI engine
  3.3.1. List, Function and Location of sensors and actuators of MPFI engine
  3.3.2. Construction and working of pressure regulators, fuel injector, and fuel pump.
  3.3.3. Electronic Control Module: Input and output control functions as fuel injection, idle speed control, EGR, canister purge.

4. Computer controlled Diesel Engines.

4.1. Electronically controlled Fuel injection system
  4.1.1. Block diagram of electronic control system
  4.1.2. Electronically controlled diesel injection pump.
4.2. Common rail direct injection system (CRDI)
  4.2.1. Block diagram of CRDI system, Features of CRDI system.
  4.2.2. Major Components-Fuel injector, Block diagram of electronic diesel control unit (EDC). High pressure fuel pump, High pressure accumulator.
  4.2.3. CRDI System operation and advantages.
  4.2.4. Diesel Engine Glow plugs: Construction and working.
  4.2.5. Circuit diagram and operation of glow plug

5. Engine Performance and testing

5.1. Basic engine math: Displacement, stroke and bore; Compression ratio; Piston speed; Air capacity and volumetric efficiency
5.2. Effect of above-mentioned parameters on engine performance
5.3. Engine Power: Indicated Mean Effective Pressure; Indicated Power; Brake Power; Brake Mean Effective Pressure
5.4. Engine efficiencies: air-standard efficiency; indicated and brake thermal efficiencies; mechanical efficiency; relative efficiency; volumetric efficiency; scavenging efficiency; charge efficiency; combustion efficiency

5.5. Variables affecting performance characteristics: combustion rate and spark timing; air-fuel ratio; compression ratio; engine speed; mass of inducted charge; heat losses
5.6. Methods of improving engine performance; Factors affecting fuel economy
5.7. Energy balance of an automotive engine

COURSE OUTCOME

After the completion of the course the student will be able to:

- Acquire the fundamental knowledge of combustion.
- Understand the thermodynamics of combustion.
- Understand the kinetics of combustion.
- Understand the combustion aspects in SI and CI Engine
- Critically examine the combustion parameters of engines.
- Understand emerging engine technologies: Students should be aware of the latest advancements in automotive engine technology, such as hybrid powertrains, electric vehicles, and alternative fuels. They should understand the basic principles behind these technologies and their impact on automotive engine design and operation.
- Apply the knowledge gained in engine testing laboratory and evaluate the performance parameters of engines.
- Analyse and select a suitable power plant for particular application and justify the selection.
- Deliberate the developments and suggest improvements for automotive power system.
- Acquire the basic knowledge of MPFI and CRDI fuel supply systems
- Perform calculations to evaluate the heat transfer in IC engines.
- Investigate the state variables of combustion and heat flow in IC engines

RECOMMENDED BOOKS

1. I.C Engines Dr. S. S. Thipse, Jaico publications
2. Internal Combustion engines by V. Ganeshan, Tata McGraw - Hill
3. Automobile Engineering Vol-2 by Kirpal Singh, Standard Publishers
4. Fundamentals of I.C. Engines by H.N. Gupta, PHI Learning Pvt. Ltd
5. Internal Combustion Engines K.K. Ramalingam, SCITECH
6. L Mathur R.P. Sharma, DhanpatRai Publication
7. A textbook of internal combustion engines by R. K. Rajput, Laxmi Publication
8. Internal Combustion Engine Fundamentals, John B. Heywood, McGraw-Hill
9. Automotive Mechanics by Crouse &Anglin, Tata McGraw Hill
10. Alternative Fuel by SS THIPSE, Jaico Publication

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (%age)
1	10	22
2	09	18
3	09	18
4	08	16
5	12	26
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: AE**PC402**	Course Title: **Advanced Automobile Engines (AEE) lab**
Semester: **4th**	Credits: **01**
Periods Per Week: **02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

This course's hands-on sessions delve into modern automobile engines, covering measurement techniques, performance analysis, and advanced fuel systems. Students gain practical skills in calculating displacement, evaluating compression ratios, and grasping volumetric efficiency. Exercises include constructing performance curves, Morse tests, and fuel calorific value determination. Further, students explore advanced fuel injection and emission control components. These experiences offer insights into optimizing engine performance and understanding contemporary automotive technologies.

COURSE CONTENT:

LIST OF PRACTICALS:

1. Practice of measuring stroke length and cylinder bore and calculation of engine displacement of an IC engine
2. Practice of measuring Compression ratio of a multi-cylinder diesel engine.
3. Study of devices and design consideration used to improve volumetric efficiency of modern petrol and diesel engine
4. To prepare a heat balance sheet and plot performance characteristics curve of an engine after trial.
5. To conduct morse test on multi-cylinder engine & to calculate frictional power & mechanical efficiency of an automotive Engine
6. Determination of calorific valve of petrol and diesel fuel using any one of the standard apparatuses
7. Practice of dismantling and study of study of major components of MPFI system
8. Practice of dismantling and study of study of major components of CRDI system of diesel car
9. On-board identification and study of major components of LPG kit of a retrofitted LPG car
10. On-board identification and study of major components of Exhaust Gas Recirculation of a diesel car.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC403**	Course Title: **Automotive Chassis Systems (ACS)**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L:03, T: 00, P: 00)**	

COURSE OBJECTIVE:

In this automotive chassis systems course, students will acquire a comprehensive understanding of chassis components and systems. Safety considerations and regulations related to chassis systems will be emphasized, along with the importance and function of common safety features. The curriculum also covers various vehicle maintenance types and their significance, teaching routine procedures like oil changes, filter replacements, tire rotations, and fluid checks. Basic troubleshooting techniques will be imparted to enable students to diagnose common automotive issues effectively. Furthermore, students will grasp the principles, components, and operation of heating, ventilation, and air conditioning systems in vehicles.

COURSE CONTENT:

1. Suspension systems

1.1. Suspension systems
- 1.1.1. Rigid and independent suspension.
- 1.1.2. Types of independent suspension system: McPherson strut, Wishbone type.
- 1.1.3. Semi-elliptical leaf spring, coil spring, torsion bar arrangement
- 1.1.4. Construction and working of air suspension system.

1.2. Construction and working of:
- 1.2.1. Shock absorbers -telescopic and gas filled
- 1.2.2. Anti-roll bar or stabilizer bar.

2. Front axle and steering

2.1. Front axle
- 2.1.1. Types of front axle - dead axle, live axle.
- 2.1.2. Type of stub axle arrangements- Elliot, reverse Elliot, LaMoine, reverse LaMoine
- 2.1.3. Front wheel assembly

2.2. Steering system
- 2.2.1. Steering linkages; Ackerman principle and linkage.
- 2.2.2. Steering geometry and its effects–caster, camber, king pin inclination, toe in– toe out, correct steering angle. Understeering and oversteering, turning radius.
- 2.2.3. Construction, working and application of steering gear box–rack and pinion type, recirculating ball type, and worm and roller type.
- 2.2.4. Power assisted steering and its types (hydraulic and electrical)

3. Automotive safety systems

3.1. Concept of safety - active and passive safety systems
3.2. Active safety systems (need and working only)
  3.2.1. ABS, TCS, ESP, EBD, TPMS, HUD, antiroll bar, adaptive cruise control, rainsensors, frontal object detection system, rear object detection system, daytimerunning lights
3.3. Passive safety systems (need and working only)
  3.3.1. Crumple zone, seat belts, airbags, collapsible steering, tiltable steering wheels,energy absorbing bumpers, fuel pump kill switch, LATCH, roll over bar, passengersafety cell, pedestrian safety protection
3.4. Automotive safety standards

4. Automotive Heating Ventilation and Air Conditioning System (HVAC)
4.1. Fundamentals of Refrigeration and air conditioning.
4.2. Description of vapour compression cycle with components in the circuit.
4.3. Layout and operation of Automotive HVAC.
4.4. Type of refrigerants used in car air conditioning and their properties.
4.5. Human comfort conditions
4.6. Temperature control system, humidity control

5. Garages and Maintenance
5.1. Types of motor vehicle companies, Company structure, Role of a franchised dealer
5.2. Reception and booking systems, Parts department, Estimating costs and times, Job cards and systems, Invoicing, Warranties, Computerized workshop system
5.3. Automotive career opportunities, technician skill levels and pay, automotive job classification, organizational chart of independent shop
5.4. Necessity of vehicle maintenance
5.5. Types of vehicle maintenance: Preventive maintenance, Scheduled preventive maintenance, Condition-based preventive maintenance, Breakdown maintenance
5.6. Typical maintenance schedule for cars

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Describe various types of axles and braking systems used on Indian motor vehicles
- Acquire an understanding of the diverse elements comprising an automotive chassis, including suspension systems, steering systems, and axles.
- Cultivate an understanding of safety aspects pertaining to chassis systems, encompassing crashworthiness, occupant protection, and the incorporation of safety features such as airbags and stability control systems.
- Perform routine maintenance of a car
- Develop the ability to diagnose typical chassis system issues and carry out regular maintenance tasks. It is crucial for them to recognize the significance of consistent upkeep. inspections, alignment checks, and component replacement to ensure optimal chassis performance and longevity.

RECOMMENDED BOOKS

1. Automotive Heating, Ventilation, and Air Conditioning CDX Master Automotive Technician Series by Kirk Vangelder,
2. Today's Technician_ Automotive Heating Air Conditioning Classroom Manual and Shop Manual by Mark Schnubel, NATEF
3. Automobile Engineering by RB Asthana, KK Jain, McGraw Hill Publications
4. Automotive Mechanics by Crouse &Anglin, Tata McGraw Hill
5. A textbook of Automobile Engineering by SK Gupta, S Chand
6. Automotive systems, principles and practices by GK Awari and VS Kumbhar, CRC Press
7. Automobile Engineering by K.K. Ramlingam, Scitech Publications
8. Automobile Engineering Vol-1, Dr.Kirpal Singh, Standard Publishers
9. Automobile Mechanics by NK Giri, Khanna Publishers
10. Automobile Mechanics by S Srinivasan, McGraw-Hill
11. Automobile Engineering, RL Singhal, Katson Books
12. Automobile Mechanical and Electrical Systems, Tom Denton, BH Publishing
13. Automobile Engineering by GBS Narang, Khanna Publishers

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	10	20
2	10	22
3	10	20
4	08	18
5	10	22
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC404**	Course Title: **Automotive Chassis Systems Lab**
Semester: **4Th**	Credits: **01**
Periods Per Week: **02 (L:00, T: 00, P: 02)**	

COURSE OBJECTIVE:

This hands-on course provides practical exploration of automotive chassis systems and components. Through dismantling and assembly exercises, students will comprehend the inner workings and nomenclature of steering systems, leaf spring suspension, and hydraulic dampers. They will learn to measure chassis components, evaluate steering geometry, and analyze power steering mechanisms. Additionally, students will gain proficiency in adjusting front suspension using modern tools and will grasp the functioning of HVAC systems. A workshop visit will offer insights into maintenance practices and workshop operations.

LIST OF PRACTICALS:

1. Dismantling the rack and pinion type steering system of a car to understand the working and location, nomenclature of components.
2. Practice of dismantling and assembly of major components of rear leaf spring suspension of a heavy-duty vehicle.
3. Measurement of Automotive Chassis and Identification of various parts & types of frame and its Cross Section.
4. Evaluate the steering geometry practically by eye vision also find steering value angle of outside lock of front wheel and true turning circle radius.
5. Study the power steering and manual steering mechanism also find steering gear ratio.
6. Practice of checking and adjusting front suspension and steering geometry using computerized wheel aligner (Adjustment of camber, toe etc.)
7. Dismantling and assembly of a hydraulic telescopic damper to understand its internal construction and working.
8. Identification, removal and re-installation of HVAC system of a car to understand the function and operation of major parts
9. Visiting a local Automobile workshop to understand the layout, vehicle maintenance schedules and organizational chart

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC405**	Course Title: **Automotive Electrical Systems (AES)**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVES:

This course aims to foster a solid grasp of fundamental concepts in electricity, magnetism, and automobile wiring. Participants will delve into the construction, characteristics, charging techniques, and maintenance of lead acid batteries. They will gain insight into the operation and structure of starting components like the motor and switch. Moreover, an understanding of ignition systems in spark-ignition engines and diverse spark advance mechanisms will be nurtured.

COURSE CONTENT:

1. Automotive Electrical and Electronic Components

1.1. Purpose and operation of electrical components and circuit protection devices
- 1.1.1. Switches (SPST, SPDT, ganged switch, mercury switch)
- 1.1.2. Relays, solenoids, buzzers, resistors.
- 1.1.3. Fuses, maxi fuses, fusible links, circuit breakers (manual and automatic resetting types.)

1.2. Working of electromagnetic gauges and electrical accessories
- 1.2.1. Temperature gauges, fuel gauge, engine oil pressure gauge, speedo-meter gauge
- 1.2.2. Washer pumps, blower motor (only simplified wiring / block diagrams).
- 1.2.3. Electro chromic mirror, power seat, power window (only simplified wiring / block diagrams).

2. Automotive Battery

2.1. Battery: Types
- 2.1.1. Construction and working of following types: Lead acid battery, Maintenance free battery, Low maintenance battery, Hybrid Battery
- 2.1.2. Battery ratings and specifications.

2.2. Battery charging
- 2.2.1. Initial charging procedure, Slow, fast rate charging and trickle charging. Precautions during charging.
- 2.2.2. Concept of dry charged battery.

2.3. Factors affecting battery life and Battery failures
- 2.3.1. Cycle failure, internal short circuit, overcharging and sulphation

3. Starting System

3.1. Starting System
- 3.1.1. Construction and working of starting system.

3.2. Types of starter drive: construction and working.

3.2.1. Bendix and overrunning clutch types only

4. Charging System

4.1. Construction and operation of alternator. Initial excitation and self-excitation.
4.2. Regulation
4.3. Electronic, Computer Regulation circuit: layout and operation. Operation of charge indicator light circuit with simple wiring diagram

5. Ignition System

5.1. Conventional Ignition System
5.1.1. Need of ignition system, working of different components (ballast resister, ignition coil, distributor, spark plug, cords and condenser).
5.2. Electronic ignition system
5.2.1. Triggering of Primary circuit: Purpose, use of Transistor, Methods of triggering (magnetic pick up, Optical, Hall effect, HEI)
5.2.2. Electronic spark timing (EST): operation and block diagram
5.2.3. Computer controlled ignition system: operation and block diagram
5.2.4. Distributor less ignition system: operation and block diagram
5.2.5. Sensors: List and functions of Crankshaft Position Sensor, Camshaft Position sensor, Detonation sensor, Cylinder Identification sensor] (No construction and working)

6. Lighting system

6.1. Lighting fundamentals: Lighting terms and definitions, necessity of car lights
6.2. External and internal lights
6.3. Types of automotive light Bulbs, Headlight reflectors, Complex shape reflectors, Headlight lenses
6.4. Lighting circuits: Basic lighting circuit, Dim-dip circuit
6.5. Gas discharge lamps, Xenon lighting, Ultraviolet headlights, LED lighting, Infrared lights

COURSE OUTCOME:

After completion of the course, students will able to:

- Apply the electrical and electronic principles.
- Install the electrical systems & circuits in an automobile.
- Demonstrate working of a Lead Acid Battery
- Identification and demonstration of basic electrical system components
- Perform installation of various light bulbs
- Demonstration of major components of ignition, starting and charging system
- Perform specific gravity testing and replacement of electrolyte of a car battery

RECOMMENDED BOOKS

1. Automotive Electrical and Electronic Systems by Tom Denton
2. Automotive Electrical Equipment by PL Kohli, Mc-Graw Hill Publication
3. Auto Electrics and Electronics Equipment by RB Gupta, SatyaPrakashan
4. Automotive Mechanics by Crouse &Anglin, Tata McGraw Hill Publication
5. Automotive Electrical Systems by Nick Prague
6. Automotive Electrical Equipment by William H. Crouse, Tata McGraw Hill
7. Automotive Electrics and Instrumentation by S Sheebarani& Co, Educreation Publishing
8. Automotive Electrical and Electronics by A K Babu, Khanna Publishers
9. Automotive Electrical and Electronics Systems by S V Dishore, Laxmi Publishers
10. Automobile Mechanics by S Srinivasan, McGraw-Hill
11. A Textbook of Automobile Engineering by S. K. Saxena, Laxmi Publications
12. Bosch Automotive Electrics and Automotive Electronics, Bosch
13. A text book of Automobile Engineering by RK Rajput, Laxmi Publication

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	09	18
2	10	20
3	06	13
4	06	13
5	10	20
6	07	16
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC406**	Course Title: **Automotive Electrical Systems (AES) Lab**
Semester: **4th**	Credits: **01**
Periods Per Week: **02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

This course aims to equip participants with comprehensive practical knowledge of automotive electrical systems. Through hands-on exercises, learners will gain proficiency in tasks such as alternator and starter motor removal and reinstallation, battery maintenance, circuit defect diagnosis, and electrical accessory testing. Participants will also study battery construction, charging procedures, and safety measures. The course further covers in-depth analyses of alternator components, testing methods, and jump-starting procedures, fostering a deep understanding of vehicle electrical systems and enhancing overall automotive troubleshooting and repair skills.

LIST OF PRACTICALS:

1. Practice of removing and re-installing alternator, cranking motor, and battery.
2. Dismantling and assembly of starter motor assembly to understand the nomenclature and working of all major parts
3. Disassemble and assemble of an alternator used in automobiles. Identification of various components of an alternator. Servicing and testing of the alternator. Study of circuit diagram
4. Constructional details of a lead acid battery and identification of its components. electrolyte in correct ratio of acid and distilled water, charging procedure and output voltage. Determination of specific gravity of electrolyte. Battery rating.
5. Constructional details of Nical Cadmium (NicCd) battery, Nickel –Metal Hybrid (NiMH) Batteries and their circuit diagrams. Charging and testing procedure.
6. Testing of circuit defects: Open circuit, short circuit, shorts to grounds, voltage drop.
7. Battery testing: Battery terminal test, Leakage test, Specific Gravity Test, Open circuit test, Battery drain test.
8. Testing of starting system: Quick testing, Current draw test, insulated circuit resistance test (voltage drop test), Ground circuit test, No crank test, free speed test.
9. Alternator components testing: Rotor, Stator, Internal regulator and rectifier.
10. Alternator testing: Current output test, Field current draw test. Regulator output test, charging circuit resistance test (voltage drop test).
11. Jump starting-Procedure and precautions.
12. Battery maintenance and safety precautions.
13. Study of wiring system and the colour coding of wires in an automobile
14. Study of electrical accessories:
    14.1. Electric horn circuit, test and tune the horn.

15. Wiper motor, power window, central lock, rain sensing wiper, Windshield washer. Power window, electrically adjusted ORVM, defogger.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC407**	Course Title: **Mechanical Sciences-II (MS-II)**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00 P: 00)**	

COURSE OBJECTIVE

This course aims to provide a comprehensive understanding of solid mechanics principles, focusing on concepts like bending stress in beams, stress and strength analysis of power-transmitting shafts, and biaxial stress considerations. Participants will gain insights into diverse machine elements, power drives, and mechanisms employed in machinery, enabling them to classify, describe, and evaluate the applications and limitations of these components. Additionally, the course covers material selection and manufacturing processes, equipping learners with the skills to make informed engineering decisions.

COURSE CONTENT

SECTION I: MECHANICS OF MATERIALS

1. Simple stresses & strains

1.1. Mechanical properties: elasticity, plasticity, plastic flow, ductility, malleability, hardness, toughness, brittleness, stiffness & strength

1.2. Types of loads, stresses- tensile, compressive, shear, single & double shear, concept of plain strain –tensile, compressive, direct shear strain, torsional shear strain, lateral strain, Hooke's law

1.3. Poisson ratio, common values for C.I. & M.S. Relation between stress strain. Stress-strain diagram for tensile & brittle materials, important points on the stress-strain diagram

1.4. Modulus of elasticity & modulus of rigidity, volumetric strain, bulk modulus, relation between modulus of elasticity & modulus of rigidity.

1.5. Stress concentration, definition, factors affecting stress concentration, fatigue (definition, SN Curve, Factors affecting fatigue) Creep (Definition, creep curves)

1.6. Thermal stresses - Temperature stresses & strains of uniform section.

Simple numerical problems based on Automotive Systems are expected

2. Torsion

2.1. Concept of torsion-difference between torque and torsion, Concept of mean and maximum torque

2.2. Assumptions in theory of pure Torsion, Torsion equation for solid and hollow circular shafts (Derivation)

2.3. Comparison between solid and hollow shaft with regard to their strength and Weight

2.4. Power transmitted by shaft

Simple numerical problems based on Automotive Systems are expected

3. Bending stresses

3.1. Concept of Axial load, eccentric load, direct stresses, bending stresses, maximum & minimum stresses. Stress distribution diagram, moment of resistance

3.2. Theory of simple bending, Use of the equation **(M/I =σ/y=E/R)**

3.3. Calculation of maximum bending stress in beams of rectangular, circular, and T-section.

3.4. Permissible bending stress, Section modulus for rectangular, circular and symmetrical I-section.

3.5. Concept of beam and form of loading, Concept of bending moment and shearing force

Simple numerical problems based on Automotive Systems are expected

SECTION II: THEORY OF MACHINES

4. Fundamentals of Mechanisms

4.1. Kinematics of Machines: - Definition of Kinematics, Dynamics, statics, Kinetics, Kinematic link, Kinematic pair and its types, constrained motion and its types, Kinematic chain and its types, mechanism, inversion, machine and structure.

4.2. Inversion of Kinematic Chain

4.2.1. Inversion of four bar chain, coupled wheels of Locomotive, Beam engine, Pantograph.

4.2.2. Inversion of single slider Crank chain –Pendulum pump, Rotary I.C. Engine mechanism, Oscillating cylinder engine, Whitworth quick return mechanism. Quick return mechanism of shaper.

4.2.3. Inversion of Double Slider Crank Chain- Scotch Yoke Mechanism, Elliptical trammel, Oldham's Coupling

Simple numerical problems based on Automotive Systems are expected

5. **Power Transmission**

5.1. Gear Drives – Classification of gears, law of gearing, gear terminology. Types of gear trains, their selection for different applications. Train value & velocity ratio for simple, compound, reverted and epi-cyclic gear trains.

5.2. Gear ratio; gear speed, torque and power relationship

5.3. Belt Drives- flat belt, V-belt & its applications, material for flat and V-belt. Selection of belts, angle of lap, length of belt, slip and creep. Determination of velocity ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (simple numerical)

5.4. Chain drives: types of chains and sprockets, velocity ratio. Advantages & disadvantages of chain drive over other drives, selection of chain & sprocket wheels, methods of lubrication.

Simple numerical problems based on Automotive Systems are expected

COURSE OUTCOME:

After completion of this course the students will be able to:

- Demonstrate kinematics of shafts and gears of a typical automotive synchromesh gearbox
- Describe stresses acting on the various automotive components like chassis frame, engine parts
- Gain the knowledge of deflection of beams
- Obtain the acquaintance in loading on Shaft, springs, columns

RECOMMENDED BOOKS

1. Strength of Material by RS Khurmi, S. Chand Company Ltd. Delhi
2. Strength of Material by S.S. Ratan, Tata McGraw Hill New Delhi
3. Strength of Material by R K Bansal, Laxmi Publications
4. Strength of Material by SS Bhavikatti, Vikas Publication
5. Strength of Material by Chakraborti,
6. Theory of Machines by SS Rattan, Tata McGraw Hill New Delhi
7. Theory of Machines by RS Khurmi, S. Chand Company Ltd. Delhi
8. Theory of Machines by BS Ubhi and RK Singhal, Katson Books
9. Theory of Machines by Thomas Bevan, Pearson
10. Theory of Machines by Sadhu Singh, Pearson
11. Theory of Machines by R K Bansal, Laxmi Publications

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	12	24
2	09	18
3	09	18
4	08	18
5	10	22
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC408**	Course Title: **Mechanical Sciences-II lab**
Semester: **4th**	Credits: **01**
Periods Per Week: **02 (L: 00, T: 00 P: 02)**	

COURSE OBJECTIVE:

This course aims to provide hands-on experience in mechanical engineering principles applied to automotive systems. Participants will perform tests to understand material behaviour, such as tension, torsion, and fatigue tests. They will explore chassis design, load analysis, and stress distribution in vehicles. Additionally, learners will gain practical insights into gears, transmissions, and steering mechanisms, enhancing their ability to analyze and design components critical to automotive performance and functionality.

LIST OF PRACTICALS

1. Tension test on a mild steel rod
2. Carry out experiments to demonstrate thermal stresses
3. Double shear test on mild steel and aluminium rods
4. Torsion test on mild steel rod
5. Bending test: determination of bending stresses;
6. Fatigue Test
7. Sketch chassis layout of a front engine-rear wheel drive vehicle with body on frame construction. Study the various types of loads, moments and resulting stresses acting on the various chassis components (from piston to tyres)
8. Force analysis of integral car body. Identifications of body members subjected to compression, tension, shear and bending loads.
9. To study the working of elliptical trammel and Oldham's coupling
10. To determine the ratio of times for the crank and slotted lever quick-return mechanism.
11. Identify and define the types of gears used in automotive applications.
12. Trace power flows through an automotive synchromesh transmission and calculate its gear ratios, gear speed, gear pitch, and torque multiplication
13. To study the working of a Simpson epicyclic gear trains and automotive differential
14. Study of Ackerman's steering gear mechanism and calculation of velocity ratio of a rack and pinion steering gear mechanism.
15. To determine the coefficient of friction between a flat belt and a pulley

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPC409**	Course Title: **Motor Vehicle Act & Transport Management**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00 P: 00)**	

COURSE OBJECTIVES:

This course aims to provide a comprehensive understanding of transportation planning fundamentals, emphasizing the significance of travel demand forecasting techniques and traffic assignment methods. Participants will explore long-term transportation planning principles and gain insights into transit planning, design, and scheduling. Additionally, the course aims to familiarize learners with essential concepts of transport management and various types of motor insurance, equipping them with knowledge and skills crucial for effective and efficient transportation systems and operations.

COURSE CONTENT:

[Part A]: Motor Vehicle Act

1. Licensing and registration

1.1. Introduction to Motor vehicles act
  1.1.1. Short Titles and different Types of Forms used in MVA
  1.1.2. Definitions, Terms regarding Vehicle

1.2. Licensing of Drivers and Conductors of Motor Vehicle:
  1.2.1. Necessity, Eligibility, Documents required, Age limit, Extent of effectiveness of Licenses to Drive Motor Vehicles, Restriction on Holding a Driving License.
  1.2.2. Learners License, Driving License, Renewal of Driving Licenses, Addition of Driving Licenses
  1.2.3. Suspension or Cancellation of Driving License in certain Cases.
  1.2.4. Duties and Responsibilities of Conductors.

2. Registration of Vehicles

2.1. Necessity, where to be made, how to be made.
2.2. Temporary registration, production of vehicle at the time of registration, transfer of ownership of motor vehicle, certificate of fitness of transport vehicles.
2.3. Suspension or Cancellation of Registration in certain Cases.
2.4. Form and manner of Display of Registration Mark, Size of Letters and Numerals of Registration Mark. High Security Registration Number Plate.

3. Authorities and Control of Transport

3.1. Transport Authorities and their Functioning, Difference between STA and RTA.

3.2. Necessity of Permit, Types of Permits, Transfer of Permit, Temporary Permit, Tourist Permit, National Permit, Exemption from permit

4. Insurance and Taxation

4.1. Motor Vehicle Insurance, No-fault Liability.

4.2. Procedure for Accident Claim, Motor Accident Claim Tribunal.

4.3. Objectives and Basis of Taxation.

4.4. Methods of Levying Tax, Tax Exemption.

[Part B]: Transport Management

5. Basics of transport management

5.1. Terms used in Transportation: Road Transport Service, Transport Vehicle, Public Service Vehicle, Goods Vehicle, Public Place, Depot, Route, Trip, Time Table, Vehicle Schedule, Fare.

5.2. Market Potential: Type of Goods/Availability of Passengers, Period of Use, Probable Competition.

5.3. Selection of Vehicle: Type of Load, Class of Passenger, Type of Service.

5.4. Organization Setup: Government, Semi-Government, Private

5.5. Legal Compliance: Documents required as per MVA, Registration. • Policies of Transport Organization: Policies towards Passenger, Employees, like Long Distance Service, Express Service, Night Service and Others.

6. Depot layout and Scheduling

6.1. Location, Elements considered in Site Selection.

6.2. Passenger Amenities, Infrastructural facilities required.

6.3. Basic factors in Bus, Crew (staff) and Maintenance Scheduling.

6.4. Frequency, Calculation of Buses.

7. Freight Calculation and Record keeping

7.1. Time Base, Distance Base, Contract, Per Passenger, Volume Base, Weight Base Method.

7.2. Structure of Fare, Fixed Cost, Maintenance Cost, Depreciation Cost, Insurance,

7.3. Interest on Capital, Variable Cost, Hiring of Trucks, Toll, Staff Wages, Miscellaneous Cost.

7.4. Monthly Operational Sheet, Goods Consignment Note, Various Types of Bookings.

7.5. Log book, Trip Operational Sheet, Vehicle Ledger, Truck History Card.

[Part C]: Automotive Econimics

8. Estimation and Valuation of Vehicle

8.1. Role of Surveyor
- 8.1.1. Accident Survey Report
- 8.1.2. Valuation of Vehicle

8.2. Buying a vehicle:
- 8.2.1. Buying a New Vehicle: Factors to be considered Ex-showroom Price and on Road Price, Use of Vehicle, When and Where to Buy, Closing the Deal, Running in, Inspecting the Vehicle, Points to check: Test Drive, Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior Storage.
- 8.2.2. Buying a Used Vehicle: When and Where to Buy: Dealers, Used Car Firms, Private Sellers, Garages, Auctions.

8.3. Factors to be Considered:
- 8.3.1. Importance of Warranty System and Protection of Law, Depreciation, Model and Year, Oil Leak, Oil Pressure, Exhaust, Battery, Odometer, Bonnet.
- 8.3.2. Crash Damage, Suspension Damage, Tyres, Switches and Accessories, Lights, Chrome, Wiring, Steering, Hydraulic System, Structural Corrosion, Floor, Test drive.

8.4. Preparations for selling
- 8.4.1. When to sell, how to sell, auctions, garages
- 8.4.2. Private sale, preparing the car documentation, selling price

COURSE OUTCOME:

After completion of the course, the students will be able to:

- Demonstrate transport management systems
- Implement advance techniques in traffic management
- Demonstrate understanding of motor vehicle act.
- Interpret about vehicle insurance and taxation.
- Illustrate the knowledge of passenger transport operation.
- Illustrate the knowledge of goods transport operation
- Illustrate about the transportation planning.
- Explain the importance of travel demand forecasting techniques.
- Manage the traffic assignments.
- Plan for the long-term transportation.
- Implement the principles of transit planning, design and scheduling.

RECOMMENDED BOOKS

1. Transport Management and Motor Vehicle Act by Dilip M Kupade, NiraliPrakashan
2. Fleet Operation and Management by AniketShivajiPatil

3. The Motor Vehicle Act, 1988 along with latest state amendments, Commercial Law Publishers
4. Transport in Modern India by KP Bhatnagar, SatishBahadur, DN Aggarwal and SC Gupta.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	06	15
2	06	15
3	05	10
4	05	10
5	07	15
6	05	10
7	06	10
8	08	15
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPE01**	Course Title: **Alternative Fuels and Combustion**
Semester: 4th	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

This course aims to provide participants with a comprehensive understanding of alternate fuels and their role in mitigating automobile emissions. It will delve into the current emissions landscape and standards, elucidate the formation of emissions in both spark-ignition (SI) and compression-ignition (CI) engines, and explore effective emission control techniques for both engine types. Participants will also gain insights into emission measurement techniques and testing procedures, fostering a well-rounded grasp of emissions management in modern engines.

COURSE CONTENTS:

1. Petroleum Fuels

1.1. Crude oil; petroleum refining process; derivatives of crude oil and their applications
1.2. Chemical structure and combustion properties of petroleum: paraffin series; olefin series; naphthene series; aromatic series
1.3. Important qualities of engine fuels; SI engine fuels, CI engine fuels
1.4. Rating of fuels; rating of SI engine fuels; rating of CI engine fuels
1.5. Petrol fuel additives; diesel fuel additives; LSD, ULSD; diesel blends; unleaded petrol

2. Alternative Automotive Fuels

2.1. Concept and necessity of alternative fuels; future of alternative fuel vehicles; alternative fuel vehicles in Indian market
2.2. Summary of bi-fuel, tri-fuel, dual-fuel, flexible fuel and dedicated alternative fuel vehicles; engine rebuilding concerns with alternative fuel engines
2.3. Properties, composition and fuel supply systems of methanol, ethanol, LPG, CNG, LNG, biodiesel, e-diesel; hydrogen fuels
2.4. Electric energy and solar power

3. Combustion

3.1. Air-fuel ratios: stoichiometric air-fuel ratio; mixture strength and side effects; air-fuel mixture requirements of petrol and diesel engines; air-fuel ratio and power output; determination of air-fuel ratios of common hydrocarbon fuels
3.2. Combustion; calorific value; products of combustion; relevant combustion equations
3.3. Detonation; pre-ignition; octane rating and its types

3.4. Combustion process of petrol engines
3.5. Combustion calculations: laws of chemical combustion
3.6. Actual combustion cycle in a diesel engine: ignition delay; period of rapid combustion; third phase of combustion; after burn phase; detonation

4. Automobile emissions

4.1. Sources of pollutants in an automobile
4.2. Products of complete and incomplete combustion
4.3. Constituents of automotive exhaust; Effects of engine emissions on human health
4.4. Pollutant formation; causes of HC, CO, NO_X and particulate emissions
4.5. Effect of air-fuel ratio on exhaust emissions; Effect of driving mode on exhaust emissions
4.6. Smoke, types of smoke, photochemical SMOG and its formation
4.7. EURO emission standards; Bharat stages; EURO standards vs Bharat stages

5. Emission control

5.1. Methods ofcontrollingexhaustemissions from Automobiles
5.2. Modification in design parameters: stroke to bore ratio, compression ratio, cylinder displacement, surface to volume ratio, valve timings
5.3. Modification in operating variables: loads, speed, spark retard, air-fuel ratio
5.4. Exhaust after-treatment: air injection, exhaust gas recirculation, catalytic convertor, DPF and its types and regeneration, SCR
5.5. Fuel modifications: mixing of various types of additives, blending of the fuels

COURSE OUTCOME:

After completion of this course the students will be able to:

- Describe and identify the source of pollution from automobile.
- Analysis the causes of formation of SI engine.
- Evaluate the emission formation from the CI engine.
- Design and analysis the emission control system for IC engine.
- Conducted the emission cycle for automobile vehicle.
- Analysis the effect of surrogated fuel on engine emission

RECOMMENDED BOOKS

1. Internal Combustion Engines by V Ganesan, McGraw-Hill
2. Automotive Mechanics by Crouse &Anglin, Tata McGraw Hill
3. IC Engines: Combustion and Emission by BP Pundir, Narosa
4. A textbook of Internal Combustion Engines by R. K. Rajput, Laxmi Publications
5. Fundamentals of Internal Combustion Engine by H N Gupta, PHI Learning Private Learning
6. Automobile Engineering by K. K. Jain, R. B. Asthana, McGraw-Hill

7. Engineering fundamentals of the internal combustion engine by Willard W Pulkrabek, Pearson
8. Internal Combustion Engine Fundamentals by John B Heywood, McGraw-Hill
9. I.C Engines Dr. S. S. Thipse, Jaico publications
10. Fuels and Combustion by Samir Sarkar, Universities Press

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	08	16
2	07	15
3	12	25
4	11	22
5	10	22
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPE02**	Course Title: **Automotive Aerodynamics**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVES:

This course comprehensively covers the fundamental principles of air flow, automotive aerodynamics, and wind tunnel testing, providing a deep understanding of aerodynamic forces and their impact on road vehicles. Students will explore topics ranging from boundary layers, drag, lift, and aerodynamic efficiency to techniques for drag reduction and lift control. The course delves into wind tunnel testing methods, data acquisition, and computational fluid dynamics, while also addressing practical aspects such as cabin ventilation, stability, and active aerodynamics in passenger cars.

COURSE CONTENT:

1. Air flow fundamentals

1.1. Boundary layer; skin friction and surface finish; air streamlines; airflow around a car; air speed vs pressure distribution over the car; laminar and turbulent boundary layer; flow separation and reattachment;

1.2. D'Alembert's paradox; Reynolds numbers; Bernoulli's Theorem; Airflow venturi

2. Automotive Aerodynamics

2.1. Objectives of aerodynamics on road vehicles; Aerodynamics influence on performance and handling

2.2. Bluff and streamlined bodies

2.3. Aerodynamic forces and moments: drag force; lift force; side force; pitching moment; yawing moment; rolling moment; aerodynamic efficiency

3. Aerodynamic drag

3.1. Aerodynamic drag; drag force and drag coefficient; frontal area of car; figure of merit; effect of drag on fuel economy

3.2. Types of drag: form, lift, surface friction, interference, and internal flow.

3.3. Drag reduction: profile edge rounding; bonnet slope and windscreen rake; roof and side panel cambering; rear side panel taper; underbodyrearend upward taper; rear end tail extension; underbody roughness; air tabs, underbody dimples, vortex generators

3.4. Afterbody drag: squareback drag; fastback drag; hatchback drag; notchback drag; cabriolet cars

4. Aerodynamic lift

4.1. Basic mechanisms of lift production; lift coefficient; Lift balance; effect of lift on vehicle stability

4.2. Lift control: underbody dams; exposed wheel airflow pattern; rear end spoiler; negative lift aerofoil wings

5. Wind tunnel testing

5.1. Purpose of wind tunnel tests; types of wind tunnels; construction of a closed wind tunnel; working of a wind tunnel

5.2. Standard wind tunnel equipment; Summary of data acquisition and sensors; flow visualization techniques

5.3. Full size wind tunnel testing; scale model testing

5.4. Concept of computational fluid dynamics

6. Passenger car aerodynamics

6.1. Aerodynamic noise

6.2. Cabin ventilation; underhood ventilation

6.3. Stability and cross-winds

6.4. Active aerodynamics

6.5. Dust flow patterns at the rear

COURSE OUTCOME:

After completion of this course the students will be able to:

- Illustrate various flow phenomenon related to vehicles.
- Demonstrate and analyse different types of drag forces.
- Optimize various shape configurations in automobiles.
- Illustrate the principle of wind tunnel technology.
- Comprehend stability of vehicle under aerodynamics forces.
- Demonstrate various techniques used for drag reduction.

RECOMMENDED BOOKS

1. Aerodynamics of Road Vehicles by Thomas Christian Schuetz, SAE International
2. Automotive systems, principles and practices by GK Awari and VS Kumbhar, CRC Press
3. Advanced Vehicle Technology by Heinz Heisler, Butterworth Heinemann
4. Automotive Engineering Powertrain, Chassis System and Vehicle Body, edited by David Corolla, BH Publication
5. Automotive Handbook from Bosch, 11th Edition, SAE publication

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (%age)
1	10	20
2	06	14
3	10	22
4	07	14
5	08	16
6	07	14
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPE03**	Course Title: **Two and Three-wheeler Technology**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

This course aims to provide a comprehensive understanding of the construction, design, and operational aspects of two-wheelers and three-wheelers. It equips learners with the knowledge to comprehend the operating characteristics, engines, and transmission systems of these vehicles. Additionally, the course imparts insights into braking systems, wheels, tires, as well as electrical and electronic subsystems, including sensors, enhancing learners' capabilities in this domain.

COURSE CONTENT:

1. Frames, Body and Transmission system

1.1. Type of frames

1.1.1. Single cradle frame, Double cradle frame, Tubular frame (Single Down-tube frame using the engine as a stressed member),

1.1.2. Body- Monocoque Construction.

1.2. Selection of Transmission system components.

1.2.1. Cable Actuated Wet Multi-disc clutch, Centrifugal clutch.

1.2.2. Chain drive, Belt drive with variator mechanism, Gear drive.

1.3. Working of Gear box, its comparison with four wheelers.

1.3.1. Gear ratios in scooter and motorcycle.

2. Engines systems

2.1. Induction system

2.1.1. Air filter/ Air Cleaner: construction and function - Washable oiled sponge element, washable Dual foam wet type

2.1.2. Two Stroke Engines - Arrangement of Ports in the cylinder, Decomposition Valve arrangement.

2.1.3. Four Stroke Engines - Overhead Valve and Overhead cam arrangements. Advantages of Multiple valves

2.2. Fuel supply system

2.2.1. Gravity feed and vacuum operated system.

2.2.2. Down draught and horizontal/ Side draught carburettor.

2.2.3. Carburettor functions and working under various Engine operating conditions like – Idling, Starting, accelerating, normal running.

2.2.4. Advantages of electronic fuel injection system.

2.3. Exhaust system

2.3.1. Construction and function of Exhaust system: Header pipe, Muffler Types and their application, Tail Pipe arrangement and location.

2.4. Lubrication Systems

2.4.1. Petrol Lubrication with Separate Oil Pump for Two stroke engines.

2.4.2. Wet sump Pressurized Lubrication in four stroke engines.

2.5. Emission Control Systems
  2.5.1. Block diagram and working of pollution control measures
  2.5.2. Catalytic convertor, Exhaust Gas Recirculation, Positive Crankcase Ventilation.

3. Steering and Suspension System

3.1. Handle Bar arrangement, Steering fork, Purpose of providing Caster angle.
3.2. Use of Dampers/ Double acting type of shock absorbers.
3.3. Use of Variable Rate coil spring, Coil in coil spring arrangement.
3.4. Advantages of Mono-shock suspension system.
3.5. Advantage of Gas filled shock absorber for rear end suspension.

4. Brakes, Wheels and Tyres

4.1. Drum (Mechanical Expanding Shoe type) and disc Brakes (Fixed Caliper and Floating Caliper types.)
4.2. Mechanical and Hydraulic brakes.
4.3. Lever operated and pedal operated brakes.
4.4. Application and criteria for selection of wheels and tyres, their specification for motorcycles, scooters, sports bike.

5. Electrical System

5.1. Ignition System
  5.1.1. Working of Condenser Discharge Ignition (CDI) system
  5.1.2. Microprocessor controlled Ignition system block diagram and working.
  5.1.3. Benefits of Twin Spark Ignition system
5.2. Starting system and Charging System
  5.2.1. Kick Start and Button Start arrangements. Components of starting system and their functions: D C motor, Battery, Battery Rating for use in Button start vehicles.
  5.2.2. Schematic circuit and working of charging system. Schematic diagram showing AC and DC circuits.
5.3. Lighting System and accessories- Specifications and Application of
  5.3.1. Head Lamp, Tail and number plate Lamp, Purpose of using LED lights in tail lamp, Turn Signal Lamp, Side Stand Indicator Lamp, High Beam Indicator Lamp, Neutral Indicator Lamp, Speedometer Lamp,
  5.3.2. Horn, Mobile Charger point, Head lamp and tail lamp Reflectors used in two wheelers. Dash units
  5.3.3. Use of Speedometer (Analog and digital), Trip meter
  5.3.4. Use of Engine Speed indicator/ Tachometer

6. Aerodynamics, Ergonomics, Aesthetics and Safety Aspects

6.1. Aerodynamic Aspects; Head lamp shape (Sealed beam and conventional); Tail lamp and indicator light arrangements- body enclosed and separate; Shape of Fuel Tank in Motorcycles
6.2. Ergonomic Aspects; Seat Arrangement for rider and pillion rider; Handle bar position; Floor/ Foot rest for driver and pillion rider
6.3. Aesthetic Aspects; Headlamp fairing of motorcycles.; Side panels for scooter/ scooterate and motorcycle.; Ground clearance; Mud guard shape and position.
6.4. Safety Aspects; Crash bar, Saree guard; Driving Habits.; Drive gear – Jacket, Helmet, Day night goggle.

COURSE OUTCOME:

On completion of the course students should be able to

- Extrapolate the constructional details of various types of two and three wheelers.
- Analyze the requirement and performance of the two and three wheelers' transmissions systems.
- Summarize the construction of different types steering and suspension system.
- Demonstrate the construction details and design consideration of Braking system, wheel and tyres.
- Apply the basic element while develop a two-wheeler frames and body.
- Develop comprehensive knowledge about the functioning of two wheelers and three wheelers and analyze the vehicle performance.

RECOMMENDED BOOKS

1. Two and Three-Wheeler Technology by Dhruv U Panchal, PHI
2. Two and Three-Wheeler Technology by Smith ManilalSolanki, NiraliPrakashan
3. Two-Wheeler Technology by D M Kupade, NiraliPrakashan
4. Motorcycle Handling and Chassis Design by Tony Foale,

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (%age)
1.	07	14
2.	12	25
3.	06	12
4.	07	14
5.	09	20
6.	07	15
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING	
Course Code: **AEPE04**	Course Title: **Automotive Safety Systems**
Semester: **4th**	Credits: **03**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

This course aims to provide a comprehensive understanding of vehicle safety, focusing on both active and passive safety systems. Students will gain insights into the stages and factors involved in vehicle collisions, energy conservation, and major causes of accidents. They will learn about body design considerations for safety, including crumple zones, bumper design, and windshield materials. The course covers passive safety systems such as seat belts, airbags, and headrests, as well as active safety technologies like collision warning systems and object detection. Additionally, students will explore crash testing methodologies, crashworthiness ratings, and gain insights into the future of vehicle safety within the context of emerging technologies and autonomous vehicles.

COURSE CONTENT:

1. **Introduction**
   - 1.1. Stages of vehicle collision; energy and force are involved in the crash; energy conservation in car crashes; major causes of car accidents
   - 1.2. Deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle
   - 1.3. Importance of vehicle safety
   - 1.4. Classification of vehicle safety
     - 1.4.1. Active safety: driving safety, conditional safety, perceptibility safety, operating safety
     - 1.4.2. Passive safety: exterior safety, interior safety, deformation behavior of vehicle body, speed and acceleration characteristics of passenger compartment on impact

2. **Body design for safety**
   - 2.1. Design of the body for safety
   - 2.2. Engine location, passenger safety cell
   - 2.3. Design and material of bumper, bonnet design and windshield
   - 2.4. Concept of front and rear crumble zones, safety sandwich construction
   - 2.5. Design of steering wheel
     - 2.5.1. Height adjustable, collapsible, tiltable and aligning steering systems
   - 2.6. Body glasses: laminated and tempered glasses

3. **Passive safety systems**
   - 3.1. Seat belt: purpose, operation and types of seat belts; seat belt pretensioners and remainders

3.2. Airbags: purpose, components, operation and types (location based) of air bag system, electronic system for activating air bags
3.3. Headrests, ISOFIX child mount, Door trims, Occupant monitoring
3.4. B-pillar structure and doors Roof structure Materials for passive safety

4. Active safety systems

4.1. Collision warning system
4.2. Causes of rear end collision
4.3. Frontal object detection
4.4. Rear vehicle object detection system
4.5. Object detection system with braking system interactions

5. Crash testing

5.1. Necessity of crash tests;
5.2. Human testing, dummies, crash test sensors, sensor mounting, crash test data acquisition, braking distance test.
5.3. Types of crash tests: pole crash testing, rear crash testing, vehicle to vehicle impact, side impact testing
5.4. Global and Indian crash test agencies; Crashworthiness rating

6. Future of Crash and safety

6.1. Introduction Autonomous (driverless) vehicles, Regulation changes, Hyperloop
6.2. Crash and safety in future mobility

COURSE OUTCOME:

After completion of this course the students will be able to:

- Comprehend Vehicle design from safety point of view.
- Apply concepts of accident reconstruction analysis in real world.
- Enumerate interrelation ship among occupant, restraint systems and vehicles in accidents.
- Illustrate role and significance of seat in Rear crash safety
- Demonstrate different active and passive safety systems available in vehicles
- Illustrate various standards related to vehicle safety.

`RECOMMENDED BOOKS

1. Automotive Handbook from Bosch, SAE publication
2. Automotive Engineering Powertrain, Chassis System and Vehicle Body, edited by David Corolla, BH Publication
3. Automobile Engineering by K. K. Jain, R. B. Asthana, Tata Mc-Graw Hill Publications
4. A Textbook of Automobile Engineering by S. K. Saxena, Laxmi Publications

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks (%age)
1.	11	22
2.	09	18
3.	08	18
4.	06	12
5.	08	18
6.	06	12
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING/OMCA	
Course Code: **AU410**	Course Title: **Indian Constitution (IC)**
Semester: **4th**	Credits: **00**
Periods Per Week: 03**(L: 03, T: 00 P: 00)**	

COURSE OBJECTIVES:

This course aims to deepen students' awareness of the Indian Constitution's relevance across diverse backgrounds, facilitating comprehension of its core principles. Participants will recognize the significance of fundamental rights and duties and grasp the operations of India's federal structure involving Union, State, and Local Governments. The course further focuses on educating students about emergency procedures, the election commission's role, and the process of constitutional amendments, fostering a holistic understanding of India's governance and legal framework.

COURSE CONTENTS:

1. Introduction to Constitution

1.1. Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance.

2. Union Government

2.1. Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary- Supreme Court of India – composition and powers and functions.

3. State and Local Governments

3.1. State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to74th Amendment.

4. Election provisions, Emergency provisions, Amendment of the constitution

4.1. Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.

RECOMMENDED BOOKS

1. M.V. Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication,2005
2. Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19th edition, Prentice-Hall EEE, 2008.
3. "Introduction to the Constitution of India" by Durga Das Basu Publisher: LexisNexis
4. "Our Constitution: An Introduction to India's Constitution and Constitutional Law" by Subhash C. Kashyap Publisher: National Book Trust, India
5. "Indian Polity" by M. Laxmikanth Publisher: McGraw-Hill Education
6. "The Framing of India's Constitution: Select Documents" by B. R. Ambedkar Publisher: Oxford University Press
7. "Constitutional Law of India" by Dr. J. N. Pandey Publisher: Central Law Agency

COURSE OUTCOMES:

At the end of the course the student should be able to:

- Understand and explain the significance of Indian Constitution as the fundamental law of the land
- Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building
- Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail
- Understand Electoral Process, Emergency provisions and Amendment procedure.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	17	25
2	13	24
3	14	25
4	20	26
Total	**64**	**100**

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
CIVIL ENGINEERING

STUDY SCHEME FOR FOURTH SEMESTER INCIVIL ENGINEERING

Code	Subjects	Study Scheme			Total Hours L+T+P	Credits			Total Credits L+T+P
		Periods Per Week							
		L	T	P		L	T	P	
PC401	Geotechnical engineering	3	0	0	3	3	0	0	3
PC406	Geotechnical engineering Lab	0	0	2	2	0	0	1	1
PC402	Advanced Surveying	3	0	0	3	3	0	0	3
PC407	Advance surveying lab	0	0	2	2	0	0	1	1
PC403	Water resource engineering	2	0	0	2	2	0	0	2
PC404	Public Health engineering	3	0	0	3	3	0	0	3
PC411	Public Health engineering Lab	0	0	2	2	0	0	1	1
PC405	Fluid Mechanic	3	0	0	3	3	0	0	3
PC408	Fluid Mechanic Lab	0	0	2	2	0	0	1	1
PE409	Elective -1	2	0	0	2	2	0	0	2
OE410	Open elective-1	2	0	0	2	2	0	0	2
Total		**18**	**0**	**8**	**26**	**18**	**0**	**4**	**22**

Elective -1

- Construction Quality control
- Rural Construction Technology

Open elective-1

- Renewable energy technologies
- Introduction to E-Governance
- Artificial Intelligence

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC401**	Course Title: **Geotechnical Engineering**
Semester: **4th**	Credits: **3**
Periods Per Week: **(L: 3, T: 0, P:0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

COURSE CONTENT

1. Overview of Geology and Geotechnical Engineering (06 Hours)

1.1 Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.

1.2 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures.

1.3 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.

2. Physical and Index Properties of Soil (08 Hours)

2.1 Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.

2.2 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index.

2.3 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.

3. Permeability and Shear Strength of Soil (08 Hours)

3.1 Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of

permeability by constant head and falling head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net,(No numerical problems).

3.2 Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test –laboratory methods.

4. Bearing Capacity of Soil (10 Hours)

4.1 Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity.

4.2 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888&IS:2131.

4.3 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.

5. Compaction and stabilization of soil (12 Hours)

5.1 Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content(OMC), maximum dry density(MDD),Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumaticty red roller, Rammer and Vibrator, Difference between compaction and consolidation.

5.2 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization. California bearing ratio(CBR)test-Meaning and Utilization in Pavement Construction

5.3 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret soil bearing capacity results.

- Compute optimum values for moisture content for maximum dry density of soil through various tests.

INSTRUCTIONAL STRATEGY

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

RECOMMENDED BOOKS:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A textbook of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T. N. & Sitharam, T. G., Geotechnical Engineering (Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B.J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	20
4	10	25
5	12	25
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC406**	Course Title: **Geotechnical engineering Lab**
Semester: **4th**	Credits: **1**
Periods Per Week: **2(L: 0, T: 0, P: 2)**	

COURSEOBJECTIVE:

Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C. B. R test.
- To learn various compaction methods for soil stabilization.

LISTOFPRACTICALS:

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720(Part-II).
3. Determine specific gravity of soil by Pycnometer method as per IS2720 (Part-III).
4. Determine dryunit weight of soil in field by core cutter method as per IS2720 (Part-XXIX).
5. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part-XXVIII).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS2720 (Part-V).
7. Determine Shrinkage limit of given soil sample as per IS2720 (Part-V).
8. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS2720 (Part-IV).
9. Use different types of soil to identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
10. Determine coefficient of permeability by constant head test as per IS2720 (Part-XVII).
11. Determine coefficient of permeability by falling head test as per IS2720 (Part-XVII).
12. Determine shear strength of soil by direct shear test as per IS2720(Part-XIII).
13. Determine shear strength of soil by vane shear test as per IS2720 (Part-XXX).
14. Determine MDD and OMC by standard proctor test of given soil sample as per IS2720 (Part-VII).
15. Determination of CBR value on the field as per IS2720 (Part-XVI).

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC402**	Course Title: **Advanced Surveying**
Semester: **4th**	Credits: **3**
Periods Per Week: **4 (L: 3, T: 1, P: 0)**	

COURSE OBJECTIVE:

The objectives of this course are to introduce fundamental knowledge of land measurement and modern survey application. After completion of this course students will be able to implement modern survey techniques in map making and its applications in relevant to Civil Engineering projects.

COURSE CONTENT

1. Theodolite Surveying: (10 Hours)

Working of a transit vernier theodolite axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

2. **Tacho-metric surveying (06 Hours)**

Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problem

3. **Curves: (10 Hours)**

3.1 Simple Circular Curve:

Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:

- Offsets from the tangent

- Successive bisection of arcs
- Offsets from the chord produced

b) By tangential angles using a theodolite

3.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

3.3 Vertical curve

Setting out of a vertical curve

4. Advanced Surveying Equipment's: (06 Hours)

4.1 Principle of Electronic Distance Meter (EDM)
- 4.1.1 Its component parts and their functions
- 4.1.2 Use of EDM

4.2 Use of
- 4.2.1 Micro Optic Theodolite
- 4.2.2 Electronic Digital Theodolite

4.3 Use of Total Station
- 4.3.1 Use of function keys
- 4.3.2 Measurement of horizontal angles, vertical angles
- 4.3.3 Distances and coordinates using Total Station
- 4.3.4 Traversing, Profile survey and Contouring with Total station

5. Remote Sensing, GPS and GIS: (06 Hours)

5.1 Remote Sensing
- 5.1.1 Overview
- 5.1.2 Remote Sensing System
- 5.1.3 Application of Remote Sensing in Civil Engineering
- 5.1.4 Land use/ Land Cover
- 5.1.5 Mapping, Disaster Management

5.2 Use of Global Positioning System (G.P.S.) instruments

5.3 Geographic Information system (GIS)
- 5.3.1 Overview
- 5.3.2 Components
- 5.3.3 Applications
- 5.3.4 Name of common software for GIS

COURSE OUTCOME

After completion of the course the student is able to:

Unit 1: To measure vertical and horizontal angles and finding level differences.
Unit 2: To prepare contoured maps or plans requiring both the horizontal as well as vertical control.
Unit 3: Setting out the curve by different methods.
Unit 4: Prepare plans by using Advanced Surveying Equipment
Unit 5: To know the concept of Remote Sensing, G.P.S. and G.I.S.

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS:

1. Hussain, SK and Nagraj, MS "Text Book of Surveying";, S Chand and Co Ltd., New Delhi
2. Deshpande, RS "A Text Book Surveying and Levelling"; United Book Corporation, Pune,
3. Kocher, CL; "A Text Book of Surveying"; Katson Publishing House Ludhiana,
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" AVG Prakashan, Pune
6. Punima, BC; "Surveying and Leveling ", Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"
9. Mahajan, Sanjay, "Surveying-II", SatyaPrakashan, Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	6	15
3	10	25
4	6	20
5	6	20
Total	**38**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC407**	Course Title: Advanced Surveying lab
Semester: **4th**	Credits: 1
Periods Per Week: **2(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVES:

The objective of the course is to determine horizontal and vertical angles by using theodolite, setting out the curves, measure horizontal distance by using EDM/Total Station and to locate coordinates of a station with the use of G.P.S.

LIST OF PRACTICALS:

1. Reading the vernier of transit Theodolite and working out the least count.
2. Use of Transit theodolite/ Digital theodolite measurement of horizontal angles by direct, repetition and reiteration methods
3. Use of Transit theodolite/Digital theodolite measurement of vertical angles.
4. Height of objects with and without accessible bases by using of theodolite.
5. Use Theodolite as a tacheometer to compute reduce level and horizontal distances.
6. Setting out of a simple circular curve with given data by the following methods
   a) Offsets from the chords produced
   b) One theodolite method
7. Use EDM to measure horizontal distances.
8. Use Total Station to measure horizontal distances.
9. Use Total Station to carry out survey projects for closed traverse for minimum five sides.

10. Use GPS to locate the coordinates of a station.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC403**	Course Title: **Water Resource Engineering**
Semester: **4th**	Credits: 2
Periods Per Week:2 **(L: 2, T: 0, P: 0)**	

COURSE OBJECTIVE:

Following are the objectives of this course:

- To learn estimation of hydrological parameters.
- To understand water demand of crops and provisions to meet the same.
- To know planning of reservoirs and dams.
- To design irrigation projects, canals and other diversion works.

COURSE CONTENT:

1. Introduction to Hydrology (06 Hours)

1.1 Hydrology: Definition and Hydrological Cycle
1.2 Rain Gauge
1.2.1 Symons Rain Gauge
1.2.2 Automatic Rain Gauge
1.3 Methods of Calculating Average Rainfall
1.3.1 Arithmetic Mean
1.3.2 Isohyetal
1.4 Runoff
1.4.1 Factors affecting run off
1.4.2 Computation of Run off

2. Crop Water Requirement and Reservoir Planning (08 Hours)

2.1 Irrigation and its Classification
2.2 Crop Water Requirement
2.2.1 Cropping Seasons
2.2.2 Crop Period
2.2.3 Base Period
2.2.4 Duty
2.2.5 Delta
2.2.6 CCA
2.2.7 GCA
2.2.8 Intensity of Irrigation
2.2.9 Factors Affecting Duty
2.2.10 Problems on Water Requirement and Capacity of Canal
2.3 Methods of Application of Irrigation Water and its Assessment

3. Dams and Spillways (08 Hours)

3.1 Dams and its Classification

- 3.1.1 Earthen Dams
- 3.1.2 Gravity Dams (masonry and concrete)

3.2 Earthen Dams

3.3 Spillways

- 3.3.1 Definition
- 3.3.2 Energy Dissipaters

4. Minor and Micro Irrigation (08 Hours)

4.1 Lift Irrigation Scheme

- 4.1.1 Components and their Functions
- 4.1.2 Lay Out

4.2 Drip and Sprinkler Irrigation

- 4.2.1 Need
- 4.2.2 Components and Layout

4.3 Well Irrigation

- 4.3.1 Types and Yield of Wells
- 4.3.2 Advantages and Disadvantages of Well Irrigation

5. Diversion Head Works & Canals (10 Hours)

5.1 Weirs

- 5.1.1 Components
- 5.1.2 Parts
- 5.1.3 Types
- 5.1.4 K.T. Weir: Components and Construction

5.2 Diversion Head Works

- 5.2.1 Layout
- 5.2.2 Components and their functions

5.3 Barrages

- 5.3.1 Components and their functions
- 5.3.2 Difference between Weir and Barrage

5.4 Canals

- 5.4.1 Classification according to Alignment and Position in the Canal Network
- 5.4.2 Cross section of Canal in Embankment and Cutting
- 5.4.3 Partial Embankment and Cutting

5.5 Canal lining

- 5.5.1 Purpose
- 5.5.2 Material used and its properties
- 5.5.3 Advantages

5.6 Cross Drainage Works

- 5.6.1 Aqueduct
- 5.6.2 Siphon Aqueduct
- 5.6.3 Super Passage
- 5.6.4 Level Crossing

5.7 Canal Regulators

- 5.7.1 Head Regulator

5.7.2 Cross Regulator
5.7.3 Escape
5.7.4 Falls and Outlets

COURSE OUTCOMES

After completing this course, student will be able to:

1. Estimate hydrological parameters.
2. Estimate crop water requirements of a command area and capacity of canals.
3. Execute Minor and Micro Irrigation Schemes.
4. Select the relevant Cross Drainage works for the specific site conditions.
5. Design, construct and maintain simple irrigation regulatory structures.

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare and interpret drawings of various irrigation works.

RECOMMENDED BOOKS:

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
5. Basak, N.N., Irrigation Engineering, McGraw Hill Education
6. Asawa, G.L., Irrigation and water resource Engineering, New Age
7. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
8. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
9. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	07	15
3	07	25
4	07	20
5	09	25
Total	**36**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code:**PC404**	Course Title: **PHE Engineering**
Semester: **4th**	Credits: **3**
Periods per week: 3 **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The rationale of PHE Engineering revolves around safeguarding public health, meeting the basic human needs, conserving water resources, promoting sustainable development and complying with regulatory frameworks. The subject aims at providing the basic knowledge and skills in the field of waters supply and waste water engineering and thus contributing towards the sustainable management of water resources and the well-being of communities.

COURSE CONTENT:

(A) WATER SUPPLY ENGINEERING

UNIT 1: (12 Hours)

1.1 Introduction

1.1. Necessity and brief description of water supply system.

1.2 Quantity of Water

1.2.1 Water requirement
1.2.2 Rate of demand and variation in rate of demand
1.2.3 Per capita consumption for domestic, industrial, public and firefighting uses as per BIS standards (no numerical problems)
1.2.4 Population Forecasting

1.3 Quality of Water

1.3.1 Meaning of pure water and methods of analysis of water
1.3.2 Physical, Chemical and bacteriological tests and their significance
1.3.3 Standard of potable water as per Indian Standard
1.3.4 Maintenance of purity of water(small scale and large scale quantity)

UNIT 2: (18 Hours)

2.1 Water Treatment(brief introduction)

**2.1.1Sedimentation-purpose, types of sedimentation tanks
**2.1.2Coagulation flocculation –usual coagulation and their feeding
**2.1.3 Filtration -significance, types of filters, their suitability
2.1.4Necessityof disinfection of water, forms of chlorination, break point

chlorine, residual chlorine, application of chlorine. Flow diagram of different treatment units, functions of (i) Areation fountain (ii) mixer (iii) floculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

2.2 Conveyance of water

**2.2.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types Conveyance of Water of pipes.

2.2.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses

2.2.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes

2.2.4 Systems of water supply-Intermittent and continuous service reservoirs-types, necessity and accessories.

2.2.5. Wastage of water-preventive measures

2.2.6 Maintenance of distribution system

2.2.7 Leakage detection

2.3 Building Water Supply

2.3.1 Connections to water main (practical aspect only)

2.3.2 Water supply fixtures and installations and terminology related to plumbing

B. WASTE WATER ENGINEERING

UNIT 3: (10 Hours)

3.1 Introduction

3.1.1 Purpose of sanitation

3.1.2 Necessity of systematic collection and disposal of waste

3.1.3 Definition of terms in sanitary engineering

3.1.4 Collection and conveyance of sewage

3.1.5 Conservancy and water carriage systems, their advantages and Disadvantages

3.1.6 (a) Surface drains (only sketches) : various types, suitability

(b)Types of sewage: Domestic, industrial, storm water and its seasonal variation

3.2 Sewerage System

3.2.1 Types of sewerage systems, materials for sewers, their sizes and joints

3.2.2 Appurtenance: Location, function and construction features. Manholes, drop man holes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts, Traps, seals, causes of breaking seals

UNIT 4: (09 Hours)

4.1 Sewage characteristics:

4.1.1 Properties of sewage and IS standards for analysis of sewage
4.1.2 Physical, chemical and bacteriological parameters

4.2 Natural Methods of Sewerage Disposal

4.2.1 General composition of sewage and disposal methods
4.2.2 Disposal by dilution
4.2.3 Self purification of stream
4.2.4 Disposal by land treatment
4.2.5 Nuisance due to disposal

UNIT 5: (08 Hours)

5. 1 Sewage Treatment

5.1.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifers, secondary clarifers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)

** Afield visit may be planned to explain and show the relevant things.

INSTRUCTIONAL STRATEGY:

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students.

RECOMMENDED BOOKS:

1. Duggal,KN;"ElementsofPublicHealthEngineering";,S.ChandandCo.NewDelhi
2. Rangwala,SC;"WaterSupplyandSanitaryEngineering";AnandCharotarBookStall
3. Hussain, SK;"Text Book of Water Supply and Sanitary Engineering"; Oxford and IBH Publishing Co, NewDelhi,
4. Garg, Santosh Kumar; "Water Supply Engineering";Khanna Publishers,Delhi
5. Garg, Santosh Kumar;"Sewage and Waste Water Disposal Engineering"; Khanna Publishers, Delhi
6. Duggal, Ajay Kand Sharma, Sanjay," A Laboratory Manual in Public Health Engineering", Galgotra Publications,2006,New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	12	21
2	18	32
3	10	15
4	09	16
5	08	16
Total	**57**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code: **PC411**	Course Title: **PHE Engineering Lab**
Semester: **4th**	Credits: 1
Periods per week: 2 **(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

The rationale of PHE Engineering revolves around safeguarding public health, meeting the basic human needs, conserving water resources, promoting sustainable development and complying with regulatory frameworks. The subject aims at providing the basic knowledge and skills in the field of waters supply and waste water engineering and thus contributing towards the sustainable management of water resources and the well-being of communities.

LIST OF PRACTICALS

1) To determine turbidity of water sample
2) To determine dissolved oxygen of given sample
3) To determine pH value of water
4) To perform jar test for coagulation
5) To determine BOD of given sample
6) To determine residual chlorine in water
7) To determine conductivity of water and total dissolved solids
8) Study of water purifying process by visiting a field lab.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code: **PC405**	Course Title: **Fluid Mechanics**
Semester: **4th**	Credits: 3
Periods per week**: 3(L:3, T:0, P:0)**	

COURSE OBJECTIVE:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses

COURSE CONTENT

1. Pressure Measurement and Hydrostatic Pressure (12 Hours)

1.1. Technical terms used in Hydraulics:
- 1.1.1. Fluid, Fluid Mechanics
- 1.1.2. Hydraulics, Hydrostatics and Hydrodynamics
- 1.1.3. Ideal and Real Fluid 1.1.4. Application of Hydraulics

1.2. Physical Properties of Fluid:
- 1.2.1. Density-Specific Volume
- 1.2.2. Specific Gravity
- 1.2.3. Vapors pressure, Surface Tension, Capillarity
- 1.2.4. Viscosity - Newton's Law of Viscosity, Dynamic and Kinematic viscosity

1.3. Various Types of Pressure:
- 1.3.1. Atmospheric Pressure
- 1.3.2. Gauge Pressure
- 1.3.3. Absolute Pressure
- 1.3.4. Vacuum Pressure

1.4. Concept of Pressure Head and its unit

1.5. Pascal's law of fluid pressure and its uses

1.6. Measurement of Differential Pressure
- 1.6.1. Manometers
- 1.6.1.1 Piezometer - its limitation
- 1.6.1.2 U-tube - simple, differential, inverted
- 1.6.1.3 Micro-manometers

1.7. Variation of Pressure with Depth:
1.7.1. Pressure Diagram
1.7.2. Hydrostatic Pressure
1.7.3. Center of Pressure on immersed surfaces and on tank walls

2. Fluid Flow Parameters (10 Hours)

2.1 Types of flow
- 2.1.1 Gravity and Pressure Flow
- 2.1.2 Laminar, Turbulent
- 2.1.3 Uniform, Non-uniform
- 2.1.4 Steady, Unsteady flow

2.2 Reynolds Number
2.3 Discharge and its unit
2.4 Continuity Equation of Flow
2.5 Energy of flowing Liquid
- 2.5.1 Potential
- 2.5.2 Kinetic
- 2.5.3 Pressure Energy

2.6 Bernoulli's Theorem: Statement, Assumptions, Equation

3. Flow through Pipes (10 Hours)

3.1 Major Head Loss in Pipe
- 3.1.1 Frictional loss and its computation by Darcy's Weisbach Equation

3.2 Minor Losses in Pipe
- 3.2.1 Loss at Entrance, Exit
- 3.2.2 Sudden Contraction, Sudden Enlargement
- 3.2.3 Fittings

3.3 Flow through Pipes
- 3.3.1 Pipes in Series
- 3.3.2 Pipes in Parallel

3.4 Hydraulic Gradient Line and Total Energy Line
3.5 Water Hammer in Pipes: Causes and Remedial measures
3.6 Discharge measuring device for Pipe Flow: Venturimeter
3.7 Discharge measurement using Orifice.

4. Flow through Open Channel (12 Hours)

4.1 Geometrical properties of channel section
- 4.1.1 Wetted Area
- 4.1.2 Wetted Perimeter
- 4.1.3 Hydraulic Radius for Rectangular and Trapezoidal Channel Section

4.2 Determination of discharge by Chezy's equation and Manning's equation
4.3 Conditions for Most Economical Rectangular and Trapezoidal Channel Section

4.4 Discharge measuring devices:
- 4.4.1 Triangular Notch
- 4.4.2 Rectangular Notch

4.5 Velocity measurement devices
- 4.5.1 Current Meter
- 4.5.2 Floats
- 4.5.3 Pitot's Tube

4.6 Froude Number

5. Hydraulic Pumps (06 Hours)

5.1 Concept of Pump

5.2 Types of Pump
- 5.2.1 Centrifugal
- 5.2.2 Reciprocating
- 5.2.3 Submersible

5.3 Suction Head, Delivery Head, Static Head, Manometric Head, Selection and choice of pump

COURSE OUTCOMES

After completing this course, student will be able to:

- Measure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications

INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

RECOMMENDED BOOKS:

1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.

2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	10	20
3	10	20
4	12	25
5	06	10
Total	**50**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code:**PC408**	Course Title: **Fluid Mechanic Lab**
Semester: **4th**	Credits: **1**
Periods per week: **2(L:0, T:0, P:2)**	

COURSE OBJECTIVE:

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

LIST OF PRACTICALS:

1. Use Piezometer to measure Pressure at a given point.

2. Use U tube Differential Manometer to measure Pressure Difference between two given points.

3. Use Reynold's Apparatus to determine type of flow.

4. Use Bernoulli's Apparatus to apply Bernoulli's Theorem to get Total Energy Line for a flow in a closed conduit of varying cross sections.

5. To find out venturimeter coefficient

6. To determine coefficient of velocity (Cv), Coefficient of discharge (Cd) Coefficient of contraction (Cc) of an orifice and verify the relation between them

7. To determine coefficient of discharge of a rectangular notch/triangular notch.

8. Use Current meter & Pitot Tube to measure the velocity of flow of water in Open Channel.

9. To verify loss of head in pipe flow due to
a) Sudden enlargement
b) Sudden contraction
c) Sudden bend

Elective-1

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code:**PE409**	Course Title: **Construction Quality Control**
Semester: **4th**	Credits:**2**
Period Per Week:**2(L:2,T:1,P:0)**	

COURSE OBJECTIVE:-

Developing country like India where lots of infrastructure development is undergoing, knowledge and understanding of Quality Control & Monitoring in construction work is very important in order to achieve good quality product within the stipulated time period. For any civil construction work, day to day monitoring and inspection plays a very important role for durable and sustainable structure. Lots of infrastructure development works underway and construction resource material are depleting, under this circumstances, use of natural resources are very essential and necessary. That's why for diploma students, study of quality control aspects are essential to perform their job, duties in the field efficiently.

COURSE CONTENT

Unit-I (10 Hours)

Total Quality Management (TQM) in Construction. Concept of quality control, Quality assurance, Quality management. Aims of TQM. Development and design Concept of TQM. Accuracy and precision in observation, reading theodolite, digital theodolite, total station, calibration, etc. Accuracy in calculation, finding area, volume, etc.

Unit-II (08 Hours)

Construction Quality Control Inspection Program. Duties, responsibilities, qualification of staff in organization. Checklists for - Quality of Materials - Masonry - Plastering, - Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing - Reinforcement Work - Formwork - Timber & steel construction, - Doors & windows, - Plumbing & drainage.

Unit-III (07 Hours)

Quality standards in construction related to Building materials and other inputs for construction processes. Quality standards for Construction outputs, products and services. Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references. National Building code (NBC 2005) (a) Why to refer & How to refer (b)

Methods of referring it & application. Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.

Unit-IV (07 Hours)

Green building – Definition – Green Building, Green Construction, Sustainable building. Goals of Green building. Advantages and disadvantages. Strategies Certification Agencies – GRIHA, LEED (Highlights & Criteria). Life cycle assessment (LCA). Sitting and structure design efficiency. Energy efficiency Water efficiency. Materials efficiency. Indoor environmental quality enhancement. Operations and maintenance optimization. Waste reduction

COURSE OUTCOMES:

The theory should be taught and exercises should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. i. Apply total quality management in civil construction. ii. Check the quality in civil construction works. iii. Identify the variations in quality of civil works. iv. Use various standard codes in civil construction works. v. Design energy efficient buildings

INSTRUCTIONAL STRATEGY: -

i. Arrange site visit to a large construction project and discuss different quality control and monitoring measures being employed.
ii. Show video films on testing of different materials
iii. Arrange expert lectures of reputed contractors/builders/Engineers of Civil departments on quality control issues.
iv. Present case studies of failures in construction projects due to quality problems.

RECOMMENDED BOOKS:

1. Total Quality Management; G.Kanji; Springer Science &Business Media
2. Fundamentals of Quality Control and improvement: Amitva Mitra : Wiley India Private Limited.
3. Manual on Quality Control
4. Ambuja Technical Literature Series.
5. National Building Code.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	8	25
3	7	25
4	7	25
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PE409**	Course Title: **Rural Construction Technology**
Semester: **4th**	Credits: **2**
Periods Per Week:**2 (L: 2, T: 0, P:0)**	

COURSEOBJECTIVE:

Following are the objectives of this course:

- To learn development and planning of low cost housing infrastructure.
- To know about different government schemes for rural development.
- To understand techniques for rural road construction as per IRC stipulations.
- To learn rural irrigation techniques and water shed management.

COURSECONTENT

1. Rural Development and Planning (04 Hours)

1.1 Scope; development plans; various approaches to rural development planning.

1.2 Significance of rural development.

1.3 Rural development programme/projects.

2. Rural Housing (12 Hours)

2.1 Low cost construction material for housing

2.2 Composite material-ferro-cement& flyash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.

2.3 Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rat-trap bond for walls; Panels for roof, ferro-cement flooring/roofing units.

2.4 Biomass-types of fuels such as firewood, agricultural residues, dung cakes.

2.5 Renewable energy and integrated rural energy program-Objectives, Key elements, Implementation, Financial provisions, sources of renewable energy.

2.6 Working of gobar gas and bio gas plants.

3. Water Supply and Sanitation for Rural Areas (12 Hours)

3.1 Sources of water: BIS & WHO water standards.

3.2 Quality, Storage and distribution for rural water supply works.

3.3 Hand pumps-types, installation, operation, and maintenance of hand pumps.

3.4 Conservation of water-rain water harvesting, drainage in rural areas.

3.5 Construction of low cost latrines: Two pit pour flush water seal, septic tank etc.

3.6 Low cost community and individual Garbage disposal systems, Ferro-cement storage tanks.

4. Low Cost Rural Roads (07 Hours)

4.1 Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases.

4.2 Guidelines for Surfacing of Rural Road as per relevant IRC codes.

4.3 Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.

5. Low Cost Irrigation (07 Hours)

5.1 Design consideration and construction of tube-well, drip & sprinkler irrigation systems.

5.2 Water shed and catchment area development–problems and features of water shed management.

5.3 Water shed management structures-K.T.weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Bandhara system.

Course outcomes:

After completing this course, student will be able to:

1. Plan low cost housing using rural materials.
2. Make use of relevant government schemes for construction of roads and housing.
3. Use guidelines for rural road construction.
4. Implement different irrigation systems for rural areas.
5. Identify the need of water shed management in rural areas.

INSTRUCTIONAL STRATEGY

Being an Elective subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to arrange site visits so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work being carried out by research institutes.

RECOMMENDED BOOKS:

1. Madhov Rao AG, and Ramachandra Murthy, DS, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt. Ltd.

2. CBRI, Roorkee, Advances in Building Materials and Constriction.

3. Desai, Vasant, Rural Development in India: Past,Present and Future: a Challenge in the Crisis, Himalaya Publishing House, Delhi.

4. Rastogi, A. K. Rural Development Strategy, Wide Vision, Jaipur.

5. Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications India Pvt Ltd.

6. Gaur, KeshavDev, Dynamics of Rural Development, Mittal Publications, Delhi.

7. Document Published by Ministry of Rural development, Govt. of India, Ministry of Rural development.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	12	25
3	12	25
4	07	20
5	07	20
Total	**42**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL/PHE (CIVIL)	
Course Code: **OE410**	Course Title: **Renewable Energy Technologies (Open Elective- I)**
Semester: **4th**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P:0)**	

COURSE OBJECTIVES:

- To understand energy scenario, energy sources and their utilization.
- To explore society's present needs and future energy demands.
- To Study the principles of renewable energy conversion system.
- To exposed to energy conservation methods.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective 1. Use pie chart showing distribution of renewable energy sources 2. Use wind turbine models 3. Use sun path diagrams

COURSE CONTENTS

1. Introduction:

Principles of renewable energy; energy and sustainable development, fundamentals and social implications worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

2. Solar Energy:

Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar Pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system

3. Wind Energy:

Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Bio fuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

4. **Tidal Power**:

Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC

5. **Green Energy**:

Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy

COURSE OUTCOME

At the end of the course the student will be able to:

Chapter-1 Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations.

Chapter-2 Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.

Chapter-3 Understand the conversion principles of wind and tidal energy

Chapter-4 Understand the concept of biomass energy resources and green energy.

Chapter-5 Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy

INSTRUCTIONAL STRATEGY

Renewable energy is a complex and multidisciplinary topic that requires different types of learning methods to address different aspects and levels of understanding. Teacher can use a variety of methods, such as lectures, demonstrations, simulations,

games, experiments, projects, case studies, debates, discussions, and field trips, to introduce, explain, apply, and evaluate renewable energy concepts and applications. Teacher can also use different media and formats, such as text, images, videos, audio, graphs, charts, maps, models, and online tools, to present and illustrate renewable energy information and data.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	20
2	6	20
3	6	20
4	6	20
5	6	20
Total	**29**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL/PHE (CIVIL)	
Course Code: **OE 409**	Course Title**: Introduction to E-Governance (Open Elective-I)**
Semester: **4th**	Credits:**2**
Periods Per Week: **2(L: 2, T:0, P:0)**	

COURSE OBJECTIVE:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency. To develop the basic understanding on the topic of E-Governance and learn the fundamentals involved in the subject.

COURSE CONTENT

1. **Introduction:**
   - 1.1 Definition,
   - 1.2 Needs of E-Governance,
   - 1.3 Evolution of E-Governance,
   - 1.4 Its scope and content,
   - 1.5 Basic Structure of e- Governance,
   - 1.6 Advantages of e-governance
2. **E-governance approaches in India-The National e-Governance plan:**
   - 2.1 Introduction to NeGP (National e-Governance Plan)
   - 2.2 NeGP Vision
   - 2.3 The framework for e-Governance
   - 2.4 Infrastructure pillars of NeGP
   - 2.5 Capacity Building initiatives under NeGP
3. **E-Governance Project Development And Management**
   - 3.1 Introduction to e-Government Project Development
   - 3.2 Conceptualization Phase
   - 3.3 Architect Phase, Define Phase, Support Phase
   - 3.4 e-Government Project Management Phase.
   - 3.5 Public Private Partnership for e-Government.
4. **Government Process Re-Engineering**
   - 4.1 Process Reforms for e-Governance Projects,
   - 4.2 Tools and techniques for Government Process Re-engineering,
   - 4.3 Legal Reforms
   - 4.4 Technology Management and Enterprise Architecture for e-Governance,

5 Capacity Building and change Management

5.1 Capacity Building for e-Governance,

5.2 Focusing on Indian initiatives and their impact on citizens

5.3 Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context.

5.4 Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc)

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Understand and appreciate the essence of e-Governance.
- Know the scope and basic structure of e-Governance
- Understand the National- Governance Plan
- Develop and manage e-Governance projects

INSTRUCTIONAL STRATEGY

The Teacher should familiarize students with practical aspects of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security, and data warehousing and data mining for e-governance. Teacher should work towards implementing e-governance models and systems using suitable platform.

RECOMMENDED BOOKS:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
3. C. S. R. Prabhu : E-Governance: Concepts and Case Studies, Prentice Hall of India Pvt. Limited (2004).
4. Implementing and managing e-Government, Richard Heeks, 2006.
5. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted (%)
1	10	25
2	8	20
3	10	20
4	8	15
5	8	20
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL/PHE (CIVIL)	
Course Code: **OE410**	Course Title: **Artificial Intelligence (Open Elective-I)**
Semester: **4th**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P: 0)**	

COURSE OBJECTIVES:

Have a thorough understanding of classical and modern AI applications. Be able to implement a Wide range of AI concepts using Prolog. Understand non-classical AI approaches such as genetic Algorithms and neural networks. Be able to assess the potential of AI in research and real-world Environments.

COURSE CONTENT:

1. Introduction

1.1 History and foundations of AI, Problem solving: Uninformed and informed Search; Constraint Satisfaction Problems and Constrained Optimization problems (complete and incomplete techniques).

2. Adversarial Search

2.1 Two players' games, games with uncertainty; Decision support systems and technologies; Knowledge representation, Reasoning, Expert systems Contents (2/2), Planning (basics).

3. Machine learning Basics

3.1 Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation, Neural networks, Problems, data, and tools; Visualization;

4. Linear regression

4.1 SSE; gradient descent; closed form; normal equations; features, Over fitting and complexity; training, validation, test data, and introduction to Matlab.

COURSE OUTCOME

At the end of the course, the student will be able to:

- Identify problems that are amenable to solution by AI methods.
- Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

- able to design and implement various machine learning algorithms in a range of real-world applications.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

INSTRUCTIONAL STRATEGY

When teaching Artificial Intelligence start with the basics: Introduce fundamental AI concepts and build upon them gradually. Use real-world examples: Connect AI to practical applications to demonstrate its relevance and capture students' interest with real-world problem solving practices with Artificial Intelligence. Make it fun: Incorporate interactive activities, games, and projects to engage students in Artificial Learning. Be patient: AI can be complex not only for students but for teachers as well, so provide clear explanations, encourage questions, and foster a supportive learning environment.

RECOMMENDED BOOKS:

1. Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/PrenticeHall.
2. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, New Delhi (2018)
3. V.K. Jain, Machine Learning, Khanna Publishing House, New Delhi (2018)
4. Ethem Alpaydin, Introduction to Machine Learning, Second Edition

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	10	25
3	10	25
4	10	25
Total	**40**	**100**

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
COMPUTER ENGINEERING

STUDY SCHEME 4TH SEMESTER

Code	Subjects	Periods Per Week			Total Hours L+T+P	CREDITS			Total Credits L+T+P
		L	T	P		L	T	P	
COPC401	Computer Organization and Architecture	3	0	0	3	3	0	0	3
COPC402	Object Oriented Programming using Java	3	0	0	3	3	0	0	3
COPC403	Object Oriented Programming using Java Lab	0	0	4	4	0	0	2	2
COPC404	Internet of Things	3	0	0	3	3	0	0	3
COPC405	Internet of Things Lab	0	0	2	2	0	0	1	1
COPC406	Full Stack Web Development	2	0	0	2	2	0	0	2
COPC407	Full Stack Web Development Lab	0	0	4	4	0	0	2	2
COPC408	Database Management Systems	3	0	0	3	3	0	0	3
COPC409	Database Management Systems Lab	0	0	2	2	0	0	1	1
HS410	Basics of Entrepreneurship Development	2	0	0	2	2	0	0	2
		16	**0**	**12**	**28**	**16**	**0**	**6**	**22**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC401**	Course Title: **Computer Organization and Architecture**
Semester: **4th**	Credit: **3**
Periods Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

This course provides detail of computer system's functional components, their characteristics, performance and interactions including system bus, different types of memory and input/output organization and CPU. This course also covers the architectural issues such as instruction set program and data types. On top that, the students are also introduced to the increasingly important area of parallel organization. This course also serves as a basic to develop hardware related projects. And hence it is an important course for all students of computer engineering branch.

COURSE CONTENT:

1. Introduction:

1.1. Functional units of digital system.
1.2. Buses, bus architecture, types of buses.
1.3. Introduction to computer languages machine language, assembly language, higher level languages
1.4. Translators (Assembler, Compiler, Interpreter)
1.5. BIOS, Functions of BIOS

2. Processor Organization

2.1. Processor Registers Accumulator, Data Register, Address Register, program counter (PC), Memory Data Register (MDR), Index register, Memory Buffer Register.
2.2. Instruction format (three address, two address, one address, zero address)
2.3. Addressing modes: Immediate, register, direct, in direct, relative, indexed.
2.4. CISC RISC characteristics, and their comparison.
2.5. CPU Design: Microprogrammed v/s hard wired control (Basic idea only).

3. Basic Computer Organization

3.1. Computer Instructions, Timing and Control.
3.2. Instruction Cycle, Memory Reference Instructions.
3.3. Input-Output and Interrupt.

4. Memory Organization

4.1. Memory Hierarchy
4.2. RAM and ROM chips.
4.3. Magnetic disks and magnetic tapes.
4.4. Cache memory
4.5. Virtual memory

5. I/O Organization

5.1. Peripheral devices, I/O interface, I/O ports,
5.2. Interrupts and types of interrupts. Modes of Data Transfer: Programmed I/O,
5.3. interrupt initiated I/O and Direct Memory Access,
5.4. Serial Communication: Synchronous & asynchronous communication,

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Have a complete idea computer organization fundamental, including component functions and programming languages.
- Analyze processor organization, instruction formats, and addressing modes, distinguishing between CISC and RISC architectures.
- Understand computer instruction execution, memory organization, and I/O principles.
- Develop proficiency in using assemblers, compilers, and interpreters for software development.
- Design and manage input/output operations, including serial and parallel communication methods, in computer systems.

RECOMMENDED BOOKS:

1. Computer system Architecture Mano, M. Morris Pearson publication, Latest Edition ISBN: 978-81-317-0070-9.
2. Computer Architecture and Organization Ghoshal, Subrata Pearson publication, Latest Edition.
3. Computer Architecture Parhami, Behrooz Oxford publication, Latest Edition ISBN: 978-0-19-808407-5.
4. "Computer Organization and Design" by P.V. Shanbhag - Publisher: PHI Learning Pvt. Ltd.
5. "Computer Architecture and Organization" by John P. Hayes - Publisher: Tata McGraw-Hill Education
6. "Computer Organization and Architecture: Designing for Performance" by William Stallings - Publisher: Pearson Education India
7. Advanced Computer Architecture: Parallelism, Scalability, Programmability" by Kai Hwang and Naresh Jotwani - Publisher: McGraw-Hill Education

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	12	30
3	10	25
4	08	10
5	08	10
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC402**	Course Title: **OBJECT ORIENTED PROGRAMMING USING JAVA**
Semester: **4th**	Credit: **3**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVES:

Object orientation is a new approach to understand the complexities of the real world. In contrast to the earlier approaches like procedural etc, object orientation helps to formulate the problems in a better way giving high reliability, adaptability and extensibility to the applications. This course offers the modern programming language JAVA that will help the students to implement the various concept of object orientation practically.

COURSE CONTENT:

1. Introduction to Java and Object-Oriented Programming Concept

1.1. Concept of Procedure Oriented Language and Object-Oriented Language and the difference between the two.
1.2. Background of Java and Java Features
1.3. Java Virtual Machine, Byte code, JIT Compiler, Java IDE Tools, Introduction of NetBeans (IDE) for developing programs in Java.
1.4. Basics of OOP: Abstraction, Inheritance, Encapsulation and Polymorphism (Basic concept only)

2. Classes and Objects

2.1. Class fundamentals, declaring objects, creating and accessing variables and methods, static variables and methods.
2.2. Constructor (Default and Parameterized)

3. Language Constructs in Java

3.1. Primitive Data Types: Integers, Floating Point type, Characters, Booleans
3.2. User Defined Data Type, Declarations, Constants, Identifiers & Literals,
3.3. Type Casting,
3.4. Variables: Variable Definition and Assignment, Default Variable Initializations,
3.5. Operators: Arithmetic, Rational, Logical, Assignment, Conditional, Ternary, Auto Increment and Decrement

3.6. Control Statements: Selection Statement (If, Switch), Loops (While, Do-while, for), Jump statements (Break, Continue, Return)

4. Inheritance, Interfaces and Packages

4.1 Inheritance

4.1.1. Concepts of Inheritance, subclass, superclass.

4.1.2. Types of inheritance, single inheritance, multilevel inheritance, hierarchical inheritance, hybrid inheritance.

4.1.3. Using 'extends' keyword to demonstrate single and multilevel inheritances.

4.1.4. Abstract Classes and final Classes

4.2. Interfaces

4.2.1. Defining an interface, difference between classes and interface.

4.2.2. Implementation of multiple inheritances through interface.

4.3. Packages

4.3.1. Packages: Defining a package, Importing and using a package in-built.

4.3.2. packages, user defined packages.

4.4. Access modifiers

4.4.1 Public, protected, default, and private (visibility and scope)

5 Polymorphism

5.1 Constructor overloading

5.2 Method Overloading

5.3 Method Overriding

5.4 Use of Keyword "super"

6 Exception Handling

6.1 Basics of Exception and types: Checked and Unchecked

6.2 Handling Exceptions: try, catch, finally

6.3 Use of throw and throws for built-in exceptions

7 Multithreading

7.1 Threads, Difference between multi-threading and multi-tasking

7.2 Thread life cycle

7.3 Implementing Threads: extension of Thread Class and Implementation of Runnable Interface.

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Perform Java programming, understanding its background and key features, including the role of Java Virtual Machine and Byte code.
- Utilize the NetBeans IDE proficiently for Java development.
- do manipulation of data by working with primitive and user-defined data types, variables, type casting, and operators.
- apply Object-Oriented Programming (OOP) principles, including abstraction, inheritance, encapsulation, and polymorphism, to design efficient Java programs.
- Create Java applications by applying class fundamentals, object creation, and constructors.
- Utilize inheritance, interfaces, and packages to organize and structure Java code effectively.
- Implement access modifiers to control the visibility and accessibility of Java classes and members.
- Demonstrate polymorphism through constructor overloading and method overriding.
- Implement effective exception handling mechanisms for error management in Java programs.
- Apply multithreading concepts, understanding the thread life cycle to develop concurrent and responsive Java applications.

RECOMMENDED BOOKS:

1. Java: A Beginner's Guide by Herbert Schildt
2. Head First Java, O-REILLY, Kathy Sierra & Bert Bates.
3. Programming with Java: A Primer; E. Balagurusamy
4. Programmer's Guide to Java, Pearson, Khalid E Mughal
5. Java in a Nutshell" by Benjamin J. Evans and David Flanagan - Publisher: O'Reilly Media
6. "Java Programming 24-Hour Trainer" by Yakov Fain - Publisher: Wrox
7. "Java for Dummies" by Barry A. Burd - Publisher: For Dummies

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	10
2	10	20
3	07	15
4	10	25
5	02	5
6	05	10
7	09	15
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: COPC403	Course Title: **OBJECT ORIENTED PROGRAMMING USING JAVA LAB**
Semester: 4th	Credit: 2
Periods Per Week: 04 (L: 00, T: 00, P: 04)	

COURSE OBJECTIVES:

The objectives of the course is to determine the resultant of various forces and to compute support reactions using equilibrium conditions for various structures and to understand the significance of friction in equilibrium problems, basic machine rules and their application in different engineering problems

LIST OF PRACTICALS:

1. Install JDK and NetBeans, write a simple "Hello World" or similar java program, compilation, debugging, executing using java compiler and interpreter.
2. Develop minimum five (05) programs to explore java data types, operators, control structures and decision statements.
3. Develop minimum two (02) programs to explore labelled loop.
4. Develop minimum two (02) programs to explore arrays.
5. WAP to create a simple class to find out the area and perimeter of rectangle and box using super and this keyword.
6. WAP to design a class account using the inheritance and static that show all function of bank (withdrawal, deposit).
7. WAP to design a class using abstract methods and classes.
8. WAP to design a string class that perform string method (equal, reverse the string, change case).
9. Develop minimum four (04) programs based on overloading methods.
10. Modify created classes in during the previous practical sessions to provide constructor and retest all classes.
11. Develop minimum five (05) programs based on inheritance.
12. Develop minimum two (02) programs based on package and also test all the visibility modifiers.
13. Develop minimum two (02) programs to explore the multiple inheritance concept using interfaces.
14. Consider we have a Class of Cars under which Hyundai-i20, Alto-800, and Ignis represents individual Objects. In this context each Car Object will have its own, Model, Year of Manufacture, Colour, Top Speed, etc. which form

Properties of the Car class and the associated actions i.e., object functions like Create (), Sold (), display () form the Methods of Car Class.

15. In a software company Software Engineers, Sr. Software Engineers, Module Lead, Technical Lead, Project Lead, Project Manager, Program Manager, Directors all are the employees of the company but their work, perks, roles, responsibilities differ. Create the Employee base class would provide the common behaviors of all types of employees and also some behavior's properties that all employee must have for that company.

16. Using the concept of multiple inheritance create classes: Shape, Circle, Square, Cube, Sphere, Cylinder. Your classes may only have the class variable specified in the table below and the methods Area and/or Volume to output their area and/or volume.

Class	Class Variable	Constructor	Base class
Shape	String name	Shape ()	
Circle	double radius	Circle (double r, String n)	Shape
Square	double side	Square (doubles, String n)	Shape
Cylinder	double height	Cylinder (double h, double r, String n)	Circle
Sphere	None	Sphere (double r, String n)	Circle
Cube	None	Cube (doubles, String n)	Square

17. WAP that show the partial implementation of interface.

18. WAP to handle the exception using try and multiple catch block.

19. WAP that implement the Nested try statements besides usage of throw and throws.

20. Develop minimum two (02) programs using multiple thread concepts.

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC404**	Course Title: **Internet of Things (IoT)**
Semester: **4th**	Credit: **3**
Periods Per Week: **03 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The objective of the course is to develop skill set and domain knowledge in students of the field of Internet of Things, which is considered as one among the advancements in Computer Engineering and to further provide them with the knowledge for classification of Real World IoT applications in various Domains. The course focuses on hands-on IoT Concepts such as Sensing, Actuation and Communication

COURSE CONTENT:

1. Introduction to Internet of Things (IoT)
- 1.1. Definition and characteristics of IoT
- 1.2. Physical design of IoT
- 1.3. IoT Protocols (M2M vs IOT)
- 1.4. Logical Design of IoT
- 1.5. IoT functional blocks
- 1.6. IoT communication Models

2. Introduction to Arduino
- 2.1. Arduino Uno Architecture and its setup
- 2.2. Basics of Embedded C-Programming-Revision of Variables (Global/Local), data types ,loops and functions and setup() and loop() function
- 2.3. Interfacing LED , push button and buzzer with Arduino

3. Sensors and Actuators working
- 3.1. Overview of Sensors Working
- 3.2. Analog and Digital Sensors
- 3.3. Interfacing of
  - 3.3.1. Temperature Sensor
  - 3.3.2. Humidity Sensor
  - 3.3.3. Motion Sensor
  - 3.3.4. Light Sensor
- 3.4. Interfacing of Actuators
- 3.5. Interfacing of Servo Switch and Servo Motor with Arduino

4. Wifi Module and Raspberry Pi
- 4.1. Basics of Wireless Networking

4.2. Introduction to ESP8266 WiFi Module
4.3. General Overview of Raspberry Pi (Without Coding)

5. Applications of IOT
5.1. Applications of IoT
5.2. IoT Wearables
5.3. Smart Home Applications
5.4. Health Care
5.5. Smart Cities
5.6. Agriculture
5.7. Industrial Automation

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Interpret the vision of IoT from a global context.
- Understand the differences and Similarities between IoT and M2M.
- Develop real time applications using Sensors/Actuators/Arduino Uno
- Explain the concept of Wi fi module functionalities and its applications.
- Enumerate and illustrate the applications of IOT in various domains

RECOMMENDED BOOKS:

1. Internet of Things – A Hands on Approach, By Arshdeep Bahga and Vijay Madisetti Universities Press
2. Internt of Things by Michael Miller ,Pearson
3. Arduino Programming: The Ultimate Intermediate Guide to Learn Arduino Programming Step by Step, Ryan Turner
4. IOT for Begineers ,Vibha Soni
5. Getting Started with Arduino" by Massimo Banzi, Michael Shiloh
6. The ESP8266 Wi-Fi Module for Dummies" by Cefn Hoile
7. Building the Internet of Things" by Maciej Kranz

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	20
2	08	20
3	18	30
4	07	15
5	07	15
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC405**	Course Title: **Internet of Things(IoT) Lab**
Semester: **4th**	Credit: **1**
Periods Per Week: **02(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

The objective of the course is to develop practical knowledge and hands on practice to the candidate pertaining to various IOT Applications

LIST OF PRACTICALS:

1. Working With Arduino Uno/Nano and IDE
2. Revision of C-Language Basics
3. Revision of C-Language Loops and functions
4. Use of Embedded C for Arduino Uno and Switching On/Off of LED-Working with Digital output Pins
5. Interfacing Digital Output Based Sensors with Arduino
6. Interfacing Analog Output
7. Interfacing Analog Input
8. Interfacing of
    a. Temperature Sensor
    b. Humidity Sensor
    c. Motion Sensor
    d. Light Sensor
9. Controlling LED and Buzzer using WIFI server
10. Controlling Relays using ultrasonic sensor.
11. Controlling brightness of LED using PWM.
12. Built an intrusion detection system or a similar/different case study
13. Visit to Industry/Other Institute dealing with IOT

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC406**	Course Title: **Full Stack Web Development**
Semester: **4th**	Credit: **2**
Periods Per Week: **02 (L: 02, T: 00, P: 00)**	

COURSE OBJECTIVES:

To impart the basic knowledge of web development concepts this course makes the students to learn how to create responsive and visually appealing user interfaces. Also how to build dynamic and interactive web applications using component-based architecture and state management. Learn server-side programming languages like Node.js, Php, etc. It also gives students the skill to perform database operations.

COURSE CONTENT:

1. Introduction to Web Development

1.1 Overview of web technologies(Web Browsers, HTML, CSS and JavaScript)
1.2 Client-server architecture of web applications
1.3 Application development
  1.3.1 Frontend Development
  1.3.2 Backend Development
  1.3.3 Database
1.4 Basic concept of Responsive design

2. Front-end Design

2.1 HTML5
  2.1.1 Basic Structure of an HTML Document
  2.1.2 HTML Elements and Tags
  2.1.3 Headings and Paragraphs, Text Formatting
  2.1.4 Lists
  2.1.5 Links and Images
  2.1.6 HTML Forms and Tables
2.2 CSS Basics
  2.2.1 Introduction to CSS,
  2.2.2 Inline, Internal and External CSS
  2.2.3 CSS Selectors
  2.2.4 CSS Properties(color, font-size, background-color, and margin)
  2.2.5 Box Model(content, padding, border, margin).
  2.2.6 Borders and Backgrounds
  2.2.7 CSS Display and Positioning (display property :block, inline, inline-block)
2.3 JavaScript
  2.3.1 Introduction to JavaScript
  2.3.2 Variable , Operators , Conditions, loops
  2.3.3 Functions
  2.3.4 DOM manipulation

2.3.5 Popup Boxes (Alert ,Confirm)
2.3.6 Client side form validation
2.4 Bootstrap (Responsive design)
2.4.1 Introduction to bootstrap
2.4.2 Grid layout in Bootstrap (containers, rows, columns)
2.4.3 Bootstrap Buttons, Forms, Navbars

3. Back-end Development

3.1 PHP and MYSQL
3.1.1 Introduction to PHP, PHP variables, Data types, Operators, Control Statements, Embedding PHP in HTML, Embedding HTML in PHP,
3.1.2 PHP Session Management(Starting, Using, Unset and Destroy only)
3.1.3 Handling HTML form data using GET and POST
3.1.4 Introduction to MySQL Database. Connecting PHP with MySQL, Performing basic database operation(Select, Insert, Delete and Update)
3.2 Node js and MongoDB
3.3.1 Introduction to Node JS Platform
3.3.2 Environment Setup for Node js
3.3.3 Node Package Manager
3.3.4 Callbacks
3.3.5 Events And Event Loop
3.3.6 Introduction To MongoDb
3.3.7 Connecting Node.Js To Database

COURSE OUTCOME:

After the completion of the course the student will be able to:

- understand the foundational elements of web development, including web technologies, client-server architecture, and the distinction between frontend and backend development.
- Demonstrate proficiency in frontend design using HTML5, CSS, and JavaScript, covering essential concepts such as HTML structure, CSS styling, and basic JavaScript functionalities.
- Develop responsive web design skills using Bootstrap, encompassing grid layout, buttons, forms, and navigation components.
- Gain practical knowledge in backend development using PHP and MySQL, focusing on PHP fundamentals, session management, and basic database operations.
- Explore alternative backend development using Node.js and MongoDB, including environment setup, Node Package Manager, callbacks, events, and connecting Node.js to a MongoDB database.

RECOMMENDED BOOKS:

1. Learning Web Development with React and Bootstrap by Harmeet Singh, Mehul Bhatt, and Ravi Kant Son

2. Modern Full-Stack Development: Using Type Script, React, Node.js by Frank Zammetti, Apress, 1st Edition.
3. Full Stack Web Development For Beginners by Riaz Ahmad, Atlantic Publishers and Distributors
4. Web Design with HTML, CSS, JavaScript and jQuery Set by Duckett Jon, John Wiley & Sons Inc
5. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Robbins (Publisher: O'Reilly Media)
6. JavaScript: The Good Parts" by Douglas Crockford (Publisher: O'Reilly Media)
7. Eloquent JavaScript" by Marijn Haverbeke (Publisher: No Starch Press)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	14	45
3	14	45
Total	**32**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC407**	Course Title: **Full Stack Web Development Lab**
Semester: **4th**	Credit: **02**
Periods Per Week: **04 (L: 00, T: 00, P: 04)**	

COURSE OBJECTIVES:

The course objectives for full-stack development practical aim to provide students with hands-on experience and practical skills in various aspects of full-stack web development.

LIST OF PRACTICALS:

1. Create a HTML page and demonstrate use of all the tags which you have read in theory part.
2. Demonstrate the use of the CSS techniques read in theory part.
3. Build a static webpage using HTML and CSS, use different layout techniques, styling.
4. Create a HTML form with more than five different fields and validate them using Java script.
5. Develop a responsive web application using a Bootstrap front-end framework.
6. Test all data types and operators in PHP.
7. Build a server-side application using Node.js. Create routes, handle requests and responses, and integrate with a database.
8. Build a server-side application using php. Create routes, handle requests and responses, and integrate with a database.
9. Make a HTML form which accepts required inputs from a user. Perform all arithmetic operation using php then display the result on same page also connect to MySQL database and save all the inputs and results in table.
10. Implement user registration, login, and authentication using session management.
11. Work on a comprehensive full-stack project using PHP as Backend Scripting Language, applying the concepts and skills learned throughout the course. This project should include front-end and back-end development, database integration, and user authentication

PRACTICAL MARKS DISTRIBUTION

Topic	Time Allotted (Hrs)	Marks Allotted (%)
Front End Design	16 Hrs	50
Back End Design	16 Hrs	50
Total	**32Hrs**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC408**	Course Title: **Database Management Systems**
Semester: **3rd**	Credit: **4**
Periods Per Week: **4 (L: 04, T: 0, P: 0)**	

COURSE OBJECTIVE:

The objective of the course is to develop backend programming skills for data storage and data retrieval and to enable him to work on/develop applications based on client server architecture.

COURSE CONTENT:

1. Introduction to Database

1.1. Basic Concepts of Database Management System and its advantages over File System
1.2. Basic Mathematical Concept of a Set, Cross Product of Sets, Relation and Function.
1.3. Concept of Data Models, Schemas and Database Architecture.
1.4. Role of a Database Administrator

2. Relational Database Management System

2.1. Concept of Relational Database Management System
2.2. Concept of ER-Diagram- Entities, Attributes, Domain of Entities, Types of Entities, Relationship between Entities - 1:1, 1: N, N: 1 and M : N
2.3. Mapping of ER Diagram into Relational Model.
2.4. Concept of Primary Key, Unique Key, Candidate Key and Foreign Key.

3. Normalization

3.1. Definition and Need of Normalization: Insertion Anomaly, Deletion Anomaly and Update Anomaly.
3.2. Concept of Functional Dependency A->B, Full Functional Dependency and Partial Functional Dependency.
3.3. 1N, 2N, 3N and BCNF and Conversion from one normal form to higher Normal form.

4. Database Language (SQL)- I (DDL)

4.1. Various Types of Database Languages: MSSQL, MySQL, Oracle- brief idea about each.
4.2. Details Concept of SQL and types of queries: DDL, DML and DCL
4.3. Create /Drop/Alter Commands

5. Database Language (SQL)-II (DML)

5.1. Select Command with Argument List/all arguments

5.2. Select Command with one table and Where Condition with
   5.2.1. Only One Condition
   5.2.2. Multiple Conditions joined by Boolean Operators (AND/OR/NOT)
5.3. Select Command with Multiple Tables: Concept of Join, Cross-Join, Full Join, Natural Join, Inner Join, Outer Join-Full Outer Join, Left Outer Join, Right Outer Join etc.
5.4. Select Command with Exists, ANY & ALL.

6. Database Language (SQL)-III(Aggregate Commands & DCL)

6.1. Select Command with Group by and Having, Aggregate Commands like Sum, Count, and Maximum etc.
6.2. Authorization Privileges- Grant/Revoke Commands

7. Indices, Views and Transactions

7.1. Basic Concept of Transaction-ACID properties.
7.2. Basic Concept of Views as Virtual Tables-Need
7.3. Basic Concept of an Index and its Need

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Define the basic concepts of databases in general and relational databases in particular
- Design and draw the ER diagram for any database system
- Illustrate the concept of normalization
- Write various DDL commands/Queries in SQL.
- Write various DML commands with various conditions including "Group By"
- Write various DCL commands
- Illustrate the concepts of Indices, Views and Transactions

RECOMMENDED BOOKS:

1. Fundamentals of Database Systems by Elamasari & Navathe, A. Wesley
2. Introduction to Database Systems by C.J. Date, Narosa
3. Introduction to Databases Systems by Korth, Silberschatz , Tata McGraw Hill
4. Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke.
5. Database Systems: Concepts, Design and Applications" by S. K. Singh and A. K. Singh.
6. SQL Programming and Database Design Using Microsoft SQL Server" by Kalman Toth.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	08	12
3	14	20
4	06	10
5	18	30
6	06	09
7	06	09
Total	**64**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC306**	Course Title: **Database Management Systems Lab**
Semester: **3rd**	Credit: **1**
Periods Per Week: **02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

The objective of the "Database Management Systems Lab" is to provide hands-on experience in implementing and managing databases, covering schema creation, query design, and data manipulation. Students will gain practical skills in administration, optimization, and data integrity, preparing them for real-world database scenarios.

LIST OF PRACTICALS:

1. Installation of MySQL using XAMPP and successful execution of the same using PHPMYADMIN
2. Installation of Workbench for MySQL.
3. Installation of SQL Server for MSSQL.
4. Use of Create Command in MySQL-for creating Databases and Tables
5. Use of Alter Command in MySQL for Altering the Structure of a table
6. Use of Drop Command in MySQL for Deleting the database/table
7. Use of Insert Command in MySQL for Inserting Data in a table
8. Use of Select Command in MySQL with No or Single Condition
9. Use of Select Command in MySQL with 02 or more Conditions
10. Use of Select Command in MySQL with Two or more tables: Cross Join
11. Use of Select Command in MySQL with Two or More tables: Natural Join.
12. Use of Select Command in MySQL with Two or More Tables: Inner Join and Outer Join.
13. Use of Select Command in MySQL with EXISTS, ANY & ALL
14. Use of Select Command in MySQL with Group By and Having and use of Aggregate functions.
15. Use of Grant/Revoke Commands in MySQL.

Note: All practical from S.No. 04 to 15 to be performed using MySQL Workbench, SQL Server Management Studio & Direct Command Prompt as well.

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER EGINEERING	
Course Code: **HS410**	Course Title: **BASICS OF ENTREPRENEURSHIP DEVELOPMENT**
Semester: **4th**	Credit: **2**
Periods Per Week: **2 (L: 02, T: 0, P: 0)**	

COURSE OBJECTIVE:

The course provides a comprehensive understanding of the concept of an entrepreneur and intricacies involved in managing entrepreneurial projects. The prime aim is to imbibe the necessary entrepreneurial competencies among students and motivate them to choose entrepreneurship as a feasible and desirable career option.

COURSE CONTENT:

1. Introduction to Entrepreneurship

1.1 Meaning and concept of entrepreneurship.
1.2 History of entrepreneurship development,
1.3 Entrepreneurs, Managers and Intrapreneurs
1.4 Barriers to entrepreneurship
1.5 Role of Entrepreneurship in economic development.
1.6 Types of Entrepreneurships.

2. Entrepreneurial process and Entrepreneurship Development

2.1 Entrepreneurial competencies.
2.2 Traits and characteristics, motives, attitude, achievement orientation, self-assessment required to be an entrepreneur.
2.3 Entrepreneurial decision process, Skill gap analysis,

3. Entrepreneurship as career

3.1 Identification and selection of business opportunities.
3.2 Market assessment, technology search, production capacity.
3.3 Assessment of infrastructure requirements and other resources.
3.4 Business plan and its importance

4. Institutional infrastructure to promote entrepreneurship

4.1 Overview, roles, promotional schemes.
4.2 Financial, regulatory and other support system institutions.

5. Emerging trends in Entrepreneurship

5.1 Technopreneurship
5.2 Webpreneurs, Agripreneurs
5.3 Women Entrepreneurship
5.4 Franchising

6. Legal and financial aids

6.1 Definition and purpose of legal aid
6.2 Legal Aid Providers
6.3 Challenges in Legal Aid
6.4 Financial Aid Programs
6.5 Student Financial Aid
6.6 Financial Aid for Small Businesses
6.7 Social Welfare Programs

COURSE OUTCOME:

After completion of the course the student will be able to

- Understand the meaning and concept of entrepreneurship, its historical development, and its role in economic development.
- Differentiate between entrepreneurs, managers, and entrepreneurs and identify the barriers to entrepreneurship.
- Identify the traits, characteristics, and attitudes required to be a successful entrepreneur and perform a self-assessment to evaluate one's potential in entrepreneurship.
- Analyze business opportunities, conduct market assessments, and assess resource requirements for entrepreneurial ventures.
- Recognize and explore emerging trends in entrepreneurship, such as technopreneurship, webpreneurs, Agripreneurs, women entrepreneurship, and franchising.

RECOMMENDED BOOKS:

1. Desai Vasant, Fundamentals of entrepreneurship and small business management, Himalya publishing house.
2. Gupta C.B. Srinivasan N.P. Entrepreneurship development in India, Text and cases, Sultan Chand and Sons, New Delhi.
3. Charantimath, P.M. Entrepreneurship development and small business management, Pearson Education.
4. Generic skills and entrepreneurship development by Ishan Publishers, Ambala.
5. A handbook of entrepreneurship edited by B.S. Rathore and Dr. J.S. Saini.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Topic	Time (hrs)	Marks (%age)
1.	Introduction to Entrepreneurship	05	20
2.	Entrepreneurial process and Entrepreneurship Development	04	15
3	Entrepreneurship as career	05	20
4	Institutional infrastructure to promote entrepreneurship	05	18
5	Emerging trends in Entrepreneurship	04	15
6	Legal and financial aids	04	12
	Total	**32**	**100**

CURRICULUM FOR FOURTH SEMESTER OF THREE-YEAR DIPLOMA COURSE IN ELECTRICAL ENGINEERING

Study Scheme 4th semester

Code	Subjects	Classes per week			Total Hours	Credits			Total credits L+T+P
		L	T	P		L	T	P	
EEM 202	Electrical Machines -II	3	0	0	3	3			3
EEM 204	Electrical Machines -II Lab	0	0	2	2	0	0	1	1
EEM 206	Power Electronics	3	0	0	3	3			3
EEM 208	Power Electronics Lab	0	0	2	2	0	0	1	1
EEM 210	Electrical Power – II	3	0	0	3	3			3
EEM 212	Electrical Power - II Lab	0	0	2	2	0	0	1	1
EEM 214	Renewable Energy	3	0	0	3	3			3
EEPE 202	Elective – I	3	0	0	3	3			3
EEPE 204	Elective – I LAB	0	0	2	2	0	0	1	1
EEPR 202	Electrical workshop Practice – III			6	6			3	3
		15		14	29	15		7	22

Elective-1:

1. INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING
2. ELECTRICAL ESTIMATION AND CONTRACTING
3. ELECTRICAL TESTING AND COMMISIONING

Overall

HS	BS	ES	EEM	PE	OE	MP	SL/PR	AU	Total
0	0	0	16	4	0	0	2	0	22

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 202	Course Title: Electrical Machines- II
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

COURSE CONTENT

1. Three Phase Induction Motor

1.1 Constructional details of 3 phase induction motors: Squirrel cage and Slip ringinduction motor
1.2 Working principle: production of rotating magnetic field, Synchronous speed, rotor speed and slip.
1.3 Rotor quantities: frequency, induced emf, power factor at starting and running condition.
1.4 Characteristics of torque versus slip (speed),
Torques: starting, full load and maximum with relations among them.
1.5 Power flow diagram of an induction motor
1.6 Starters: need and types; stator resistance, auto transformer, star delta, rotor resistance
1.7 Speed control methods: stator voltage, pole changing, rotor resistance
1.8 Motor selection for different applications as per the load torque-speed requirements.
1.9 Harmonics and its effects, cogging and crawling in Induction Motors.

2. Single phase induction motors

2.1 Double field revolving theory, principle of making these motors self-start.
2.2 Construction and working: Resistance start induction run, capacitor start induction run, capacitor start capacitor run, shaded pole, repulsion type, series motor, universal motor.
2.3 Comparison between three phase and single phase Induction motors.
2.4 Applications of single phase induction motors.

3. Three phase Alternators

3.1 Constructional details: parts and their functions, rotor constructions, moving and stationary armatures
3.2 Working Principle, Windings: Single and Double layer. E.M.F. equation of an Alternator with numerical by considering short pitch factor and distribution factor.
3.3 Alternator loading: Factors affecting the terminal voltage of alternator; Armature resistance and leakage reactance drops.
3.4 Armature reaction at various power factors and synchronous impedance.
3.5 Voltage regulation: direct loading and synchronous impedance methods.

3.6 Need and necessary conditions for parallel operation of alternators
3.7 Synchronizing of an alternator (Synchroscope method) with the bus bars

4. Synchronous motors

4.1 Construction and Principle of operation
4.2 Effect of change in excitation of synchronous motor at constant load (no numerical)
4.3 Synchronous motor as condenser
4.4 Causes and effects of hunting, Prevention of hunting
4.5 Applications of synchronous motors

5. Fractional horse power (FHP) Motors

5.1 Construction and working principle of: Synchronous Reluctance Motor, Hysteresis motor, Brushless DC (BLDC) motor
5.2 Brief idea about: Permanent Magnet Synchronous Motors, stepper motors, AC and DC servomotors.
5.3 Applications of above mentioned motors

COURSE OUTCOME

After the completion of the course the student will be able to:

- Operate and maintain three phase induction motor used in different applications.
- Operate and maintain single phase induction motor used in different applications.
- Operate and maintain three phase alternators used in different applications.
- Operate and maintain synchronous motors used in different applications.
- Operate and maintain FHP motors used in different applications

RECOMMENDED BOOKS:

1. Electric Machines by P.S. Bimbhra, Khanna Book Publishing Co., New Delhi (ISBN: 978- 93-86173- 294)
2. Basic Electrical Engineering by Mittle, V.N. and Mittle, Arvind., McGraw Hill Education New Delhi, ISBN :9780070593572
3. Electrical Machines by Kothari, D. P. and Nagrath, I. J., McGraw Hill Education. New Delhi, ISBN:9780070699670
4. Electrical Machines Bhattacharya, S. K., McGraw Hill Education, New Delhi, ISBN:9789332902855
5. (AC and DC machines by Theraja, B.L.,), S.Chand and Co. Ltd., New Delhi, ISBN: 9788121924375
6. Special Purpose Electrical Machines by Sen, S. K., Khanna Publishers, New Delhi, ISBN: 9788174091529
7. Special Electrical Machines Janardanan E. G, Prentice Hall India, New Delhi ISBN: 9788120348806
8. Electrical Technology Hughes E. ELBS
9. Electrical Technology Cotton H., , ELBS
10. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
11. Electrical Engineering by JB Gupta, SK Kataria and sons, New Delhi
12. Electrical Machines by Samarjit Ghosh, Pearson Education (Singapore) Pte, Ltd. 482, FIE Patparganj, Delhi 110092
13. Electrical Machines by DR Arora, Ishan Publications, Ambala City.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	15	30
4	5	10
5	8	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 204	Course Title: Electrical Machines- II LAB
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain Induction, Synchronous and FHP Machines used in different applications.

LIST OF PRACTICALS:

1. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor
2. Connect and run the three phase squirrel cage induction motors (in both directions) using the DOL, star-delta, auto-transformer starters (any two phase)
3. Conduct the No-load and Blocked-rotor tests on given 3-f squirrel cage induction motor and determine the equivalent circuit parameters.
4. Control the speed of the given three phase squirrel cage/slip ring induction motor using the applicable methods: i) auto-transformer, or ii) VVVF.
5. Measure the open circuit voltage ratio of the three phase slip ring induction motor.
6. Conduct the direct load test to determine the efficiency and speed regulation for different loads on the given single phase induction motor; plot the efficiency and speed regulation curves with respect to the output power.
7. Perform the direct loading test on the given three phase alternator and determine the regulation and efficiency.
8. Determine the regulation and efficiency of the given three phase alternator from OC and SC tests (Synchronous impedance method)
9. Control the speed and reverse the direction of stepper motor/ AC/DC servo motor
10. To study the effect of a capacitor on the starting and running of a single- phase induction motor by changing value of capacitor and also to reverse the direction of rotation of a single phase induction motor

COURSE OUTCOME

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency: a) Maintain three phase induction motor used in different applications. b) Maintain single phase induction motor used in different applications. c) Maintain three phase alternatorsused in different applications. d) Maintain synchronous motors used in different applications. e) Maintain FHP motors used in different applications.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 206	Course Title: Power Electronics
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

COURSE CONTENT

1. Power Electronic Devices

1.1 Power transistor: construction, working principle, V-I characteristics and uses.
1.2 IGBT: Construction, working principle, V-I characteristics and uses.
1.3 Concept of single electron transistor (SET) - aspects of Nano- technology.

2. Thyristor Family Devices

2.1 SCR: construction, two transistor analogy, types, working and characteristics. SCR mounting and cooling.
2.2 Types of Thyristors: SCR, LASCR, SCS, GTO
2.3 Thyristor family devices: symbol, construction, operating principle and V-I characteristics of UJT, DIAC AND TRIAC
2.4 Protection circuits: over-voltage, over-current, Snubber

3. Turn-on and Turn-off Methods of Thyristors

3.1 SCR Turn-On methods: High Voltage thermal triggering, Illumination triggering, dv/dt triggering, Gate triggering.
3.2 Gate trigger circuits – Resistance and Resistance-Capacitance circuits. SCR triggering using UJT, PUT: Relaxation Oscillator and Synchronized UJT circuit.
3.3 SCR Turn-Off methods:
Class A- Series resonant commutation circuit, Class B-Shunt Resonant commutation circuit, Class C-Complimentary Symmetry commutation circuit, Class D –Auxiliarycommutation, Class E- External pulse commutation, Class F-Line or natural commutation.

4. Phase Controlled Rectifiers

4.1 Phase control: firing angle, conduction angle. Single phase half controlled, full controlled and midpoint controlled rectifier with R, RL load:
4.2 Circuit diagram, working, input- output waveforms, effect of free wheeling diode.
4.3 Different configurations of bridge controlled rectifiers:
Full bridge, half bridge with common anode, common cathode,

5. Industrial Control Circuits Applications:

5.1 Illumination control and fan speed control using Diac / TRIAC/SCR
5.2 SMPS. UPS: Offline and Online SCR based(Brief Idea with Block Diagram)

COURSE OUTCOME

After the completion of the course the student will be able to:

- Select power electronic devices for specific applications.
- Maintain the performance of Thyristors.
- Troubleshoot turn-on and turn-off circuits of Thyristors.
- Maintain phase controlled rectifiers.
- Maintain industrial control circuits

RECOMMENDED BOOKS:

1. An Introduction to Thyristors and their applications by Ramamoorty M. East-West Press Pvt. Ltd., New Delhi, ISBN: 8185336679.
2. Thyristors: Theory and Applications by Sugandhi, Rajendra Kumar and Sugandhi, Krishna Kumar,New Age International (P) ltd. Publishers, New Delhi, ISBN: 978-0-85226-852-0
3. Fundamentals of Power Electronics by Bhattacharya, S.K., , Vikas Publishing House Pvt. Ltd. Noida ISBN: 978-8125918530
4. Power Electronics Circuits Devices and Applications Rashid, Muhammad, Pearson Education India, Noida, ISBN: 978-0133125900.
5. Power Electronics by Singh, M. D. and Khanchandani, K.B.,Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2008 ISBN: 9780070583894
6. Power Electronics by Dr. PS Bhimbra, Khanna Publishers, New Delhi
7. Fundamentals of Power Electronics by S Rama Reddi, Narosa Publishing House Pvt Ltd, New Delhi
8. Power Electronics and its Applications ,Jain & Alok,Penram International Publishing(India) Pvt. Ltd, Mumbai, ISBN: 978-8187972228
9. SCR Manual by Grafham D.R , General Electric Co., ISBN: 978-0137967711
10. Industrial Control Electronics, John Webb, Kevin Greshock, Maxwell, Macmillan International editions.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	7	15
2	14	30
3	15	30
4	8	15
5	4	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 208	Course Title: Power Electronics Lab
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of power electronic devices.

LIST OF PRACTICALS:

1. Test the proper functioning of power transistor and IGBT.
2. Test the proper functioning of DIAC to determine the break over voltage.
3. Determine the latching current and holding current using V-I characteristics of SCR
4. Draw the V-I characteristics of a DIAC.
5. Draw the V-I characteristics of a TRIAC
6. Draw the V-I characteristic of UJT
7. Observe the output wave of an UJT relaxation oscillator.
8. Test the variation of R, C in R and RC triggering circuits on firing angle of SCR.
9. Test the effect of variation of R, C in UJT triggering technique.
10. Perform the operation of Class – A, B, C, turn off circuits.
11. Use CRO to observe the output waveform of half wave controlled rectifier with resistive Load and determine the load voltage
12. Use CRO to observe the output waveform of Full wave controlled rectifier with R load, RL load, freewheeling diode and determine the load voltage.
13. Observe the wave shape across SCR/ DIAC/ TRIAC and load (lamp or motor)
14. Simulate above circuits on SCILAB software (only those ckts which can be simulated on SCILAB) .

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 210	Course Title: Electrical Power – II
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

COURSE CONTENT

1 Basics of Transmission and Distribution

1.1 Single line diagram of Electric power system, standard voltage level used in India.
1.2 Classification of transmission lines: based on type of voltage, length and construction
1.3 Advantages of high voltage for Transmission of power in both AC and DC
1.4 Comparison of different systems: AC versus DC for power transmission, conductor material for over head lines
1.5 Method of construction of electric supply transmission system – 110 kV, 220 kV, 400 kV. Method of construction of electric supply distribution systems – 220 V, 400V, 11 kV, 33 kV

2 Line parameters

2.1 Concepts of R, L and C of line parameters and types of lines.
2.2 Performance of short line: Efficiency, regulation, effect of power factor, vector diagram for different power factors
2.3 Performance of medium line: representation, nominal 'T', nominal 'π' and end condenser methods (Introduction only).
2.4 Transposition of conductors and its necessity.
2.5 Skin effect and proximity effect
2.6 Concept of corona. Effects of corona and remedial measures

3 A.C Distribution System

3.1 AC distribution: Components classification, requirements of an ideal distribution system, primary and secondary distribution system. Feeder and distributor, factors to be considered in design of feeder and distributor.
3.2 Types of different distribution schemes: radial, ring and grid, layout, advantages, disadvantages and applications. Voltage drop, sending end and receiving end voltage.

4. Sub-Station

4.1 Classification, site selection, advantages, disadvantages and applications.
4.2 Symbols and functions of substation components.
4.3 Single Line diagram (layout) of 33KV/11KV Sub-Station, 11KV/400V sub-station.

5. Components of Transmission and Distribution Line

5.1 Overhead Conductors: Properties of material, types of conductor with trade names, significance of sag, calculation of sag (Level Supports), effects of wind and ice related problem

5.2 Line supports: Requirements, types of line structures and their specifications, methods of erection.

5.3 Line Insulators: Properties of insulating material, types of insulators and their applications, causes of insulator failure, derivation of equation of string efficiency for string of three suspension insulator, methods of improving string efficiency.

5.4 Underground Cables: Requirements, classification, construction, comparison with overhead lines, cable laying methods

RECOMMENDED BOOKS:

1. Utilization of Electric Power & Electric Traction by G.C. Garg, , Khanna Book Publishing Co., New Delhi (ISBN: 978-93-86173-355)
2. Principles of Power System, S. Chand by Mehta, V.K., and Co. New Delhi, ISBN: 9788121924962
3. A Course in Electrical Power Soni;Gupta; Bhatnagar, , Dhanpat Rai and Sons New Delhi, ISBN: 9788177000207
4. A Course in Power Systems Gupta,J.B., , S.K. Kataria and sons, New Delhi, ISBN:9788188458523
5. A Textbook of Electrical Technology Vol. III by Theraja, B.L.; Theraja, A.K., , S.Chand and Co. New Delhi, ISBN : 9788121924900
6. A Course in Electrical Power by Uppal,S.L., , S.K.Khanna Publisher New Delhi, ISBN : 9788174092380
7. Electrical Power Transmission and Distribution by Sivanagaraju S.; Satyanarayana S., Pearson Education, New Delhi, ISBN:9788131707913
8. Electrical Power System: A First Course Ned Mohan by Wiley India Pvt. Ltd. New Delhi, ISBN:9788126541959
9. Power System Analysis and Design by Gupta, B.R., S. Chand and Co. New Delhi, ISBN: 9788121922388
10. Electrical Power Distribution System by Kamraju, V., Tata McGraw-Hill, New Delhi, ISBN:9780070151413
11. Electrical Power System and Analysis by CL Wadhwa, 3rd edition, New Age International Publishers, New Delhi
12. Substation Design and Equipment by Satnam and PV Gupta, Dhanpat Rai & Sons, New Delhi
13. Electrical Power –I by SK Sahdev, Uneek Publications, Jalandhar
14. Sub-Station Design by Satnam, Dhanpat Rai and Co., New Delhi
15. Electrical Power Distribution System by AS Pabla, Tata McGraw Hill, New Delhi
16. Electrical Power System by S Channi Singh, Tata McGraw Publishing Co. New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	10	20
4	9	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 212	Course Title: Electrical Power- II Lab
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Maintain the proper functioning of the electrical transmission and distribution systems.

COURSE CONTENT

Following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

1. Prepare a report based on transmission line network in J & K
2. Collect the information on components of transmission line.
3. Evaluate transmission line performance parameters of a given line.
4. Library/ Internet survey of electrical high voltage line and HVDC lines.
5. Visit a 132kv /33 KV Substation and write a report on it
6. Visit a 33kv /11 KV Substation and write a report on it
7. Visit 11KV/400V Distribution Substation and write a report on it.
8. Prepare a model showing: i. Single line diagram of electric supply system. ii. Single line diagram of a given distribution system. iii. Short line and medium transmission line. iv. Write a report on the same by giving the details of lines in J &K
9. Draw a layout diagram of 132 kv /33 KV Grid station
10. Draw a layout diagram of 33kv /11 KV substation
11. Draw a layout diagram of 11KV/400 V substation in your campus/ adjacent substation.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEM 214	Course Title: Renewable Energy
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The course is designed to give knowledge of various renewable energy sources, systems and applications in the present context and need.

COURSE CONTENT

1. Energy Scenario in India:

1.1 Renewable and Non-renewable Energy sources,
1.2 Causes of Energy Scarcity, Solution to energy Scarcity,
1.3 Need for Renewable Energy, Advantages and Disadvantages of Renewable energy, Renewable Energy statistics worldwide and India.

2. Solar Energy

2.1 Solar photovoltaic, PV Technologies-Amorphous, monocrystalline, polycrystalline.
2.2 VI characteristics of a PV cell, PV module, array.
2.3 Maximum Power Point Tracking (MPPT) algorithms, Concentrated Solar Power, types of collectors, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond.
2.4 Application of Solar Power, Economic Policies to Promote Solar Energy.

3. Wind Energy

3.1 Introduction, Electricity Generation using Wind Energy Generators (WEG),
3.2 Evaluating Wind Turbine Performance,
3.3 Wind Potential, Wind Energy in India, Wind Turbine Size and Power Ratings,
3.4 Advantages of Wind-Generated Electricity, Cost Issues, Environmental Concerns, Supply and Transport Issues.

4 Bio Energy, Tidal Energy

4.1 Types of Bio Gas Plants, Tidal energy.
4.2 Classification of Tidal Plants, Ocean Thermal Energy systems, Open OTEC Cycle, Closed OTEC Cycle.
4.3 Introduction to Magneto Hydro Dynamics (MHD) Power & Fuel cells.
Note: Solar power plants and Wind power plants should be demonstrated to students in the lab .

COURSE OUTCOME:

After learning the subject, student will be able to:

- Appreciate the importance of energy crises and consequent growth of the power generation from the renewable energy sources
- Demonstrate the knowledge of physics of solar power generation and the associated issues.
- Demonstrate the knowledge of the physics of wind power generation and all associated issues.
- Understand the utilization of Bio Gas Plants, Tidal, MHD, Fuel Cells by identifying the sites where their production is feasible.
- Demonstrate the ways by which energy can be stored in different forms.

RECOMMENDED BOOKS:

1. Solar Energy, S. P. Sukhatme and J. K. Nayak, McGraw-Hill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional energy resources, ShobhNath Singh, Pearson India
4. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
5. Principles of Solar Energy, Frank Krieth& John F Kreider, John Wiley, New York
6. From Sunlight to Electricity: a practical handbook on solar photovoltaic application; Deambi, Suneel: TERI, New Delhi ISBN:9788179935736
7. Renewable Energy Systems, David M. Buchla, Thomas E. Kissell, Thomas L. Floyd - Pearson Education New Delhi , ISBN: 9789332586826,
8. Wind Power Technologies Rachel, Sthuthi; Earnest, Joshua –, PHI Learning, New Delhi, ISBN: 978-93-88028-49- 3; E-book 978-93-88028-50-9
9. Biogas Technology: Towards Sustainable Development Khoiyangbam, R S Navindu; Gupta and Sushil Kumar;; TERI, New Delhi; ISBN: 9788179934043
10. Wind Energy Basics Gipe, Paul:, Chelsea Green Publishing Co; ISBN: 978-1603580304
11. Renewable Energy Sources and Emerging Technologies Kothari, D.P. et al:, PHI Learning, New Delhi, ISBN: -978-81-203-4470-9
12. Wind Electrical Systems installation Bhadra, S.N., Kastha, D., Banerjee, S,; Oxford University Press, New Delhi, ISBN: 9780195670936
13. Energy Technology O.P. Gupta,Khanna Publishing House, New Delhi (ISBN: 978-9386173-683)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	20
2	15	30
3	15	30
4	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: ELECTRICAL TESTING AND COMMISIONING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industryidentified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment

COURSE CONTENT

1. Electrical Safety and Insulation

1.1 Do's and don'ts regarding safety in domestic electrical appliances as well for substation/ power station operators

1.2 Electrical safety in industry/power stations/ substations at the time of operation/ control/ maintenance.

1.3 Fire detection alarm, fire-fighting equipment.

1.4 Factors affecting life of insulating materials, classifications of insulating materials. Measuring insulationresistance by Megger

1.5 Insulating oil : properties of insulating oil, causes of deterioration of oil, testing of transformer oil

2. Installation and Erection

2.1 Concept of foundation for installation of machinery. Requirements of foundation for static and rotating electrical machinery.

2.2 Concept of leveling and aligning: Procedure for leveling and aligning, alignment of direct coupled drive, effects of mis-alignment

2.3 Procedure for installation of transformer, Requirements of installation of pole mounted transformer.

2.4 Devices and tools required for loading, unloading, lifting, and carrying heavy equipment and precautions to be taken while handling them.

3. Testing and Commissioning

3.1 Concept of testing, Objectives of testing. Roles of I.S.S in testing of electrical equipment,

3.2 Types of tests and concepts, Routine tests, type tests, supplementary test, special tests, Methods of testing - Direct/Indirect/Regenerative testing.

3.3 Tests beforeCommissioning for transformer, induction motor and DC Machine.

4. Maintenance

4.1 Concept of maintenance, types of maintenance, Routine, preventive and breakdown maintenance.

4.2 Causes of failure of electrical machines

4.3 Preventive maintenance-procedure or developing maintenance schedules for electrical machines.

4.4 Factors affecting preventive maintenance schedules.

4.5 Maintenance schedules of the following as per I.S.S.

1. Distribution transformer as per I.S.1886-1967
2. Single phase and three phase Induction motors as per I.S.900-1965.
3. Batteries

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	15	30
3	15	30
4	9	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: ELECTRICAL TESTING AND COMMISIONING LAB
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Follow standard safety procedures in testing and commissioning of electrical equipment.

LIST OF PRACTICALS:

1. Determine breakdown strength of transformer oil.
2. Perform insulation resistance test on any one motor/transformer.
3. Prepare trouble shooting charts for Transformer
4. Prepare trouble shooting charts for induction motor
5. Measure impedance voltage and load losses of three-phase transformer
6. Determine efficiency of D.C. machine by Swinburne's test
7. Determine efficiency of D.C. machine by Hopkinson's test
8. Perform reduced voltage running up test on three-phase Induction motor as per I.S.325 -1967.
9. Perform no load test on single phase Induction motor for the measurements of no load current, power input, and speed at rated voltage.
10. Perform temperature rise test on single-phase transformer.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: ELECTRICAL ESTIMATION AND CONTRACTING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design electrical installation with costing for tendering

COURSE CONTENT

1. Electric Installation and Safety

1.1 Scope and features of National electric code 2011
1.2 Types of electrical installation
1.3 Fundamental principles for electrical installation, Permit to work, safety instructions and safety practices

2. Purpose of estimating and costing

2.1 Estimation and Costing: Meaning and purpose of rough estimate, detailed estimates, supplementary estimate, annual maintenance estimate and revised estimate
2.2 Factors to be considered while preparation of detailed estimate and economical execution of work
2.3 Contracts- Concepts of contracts, types of contracts, contractor, role of contractor
2.4 Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and method of opening of tender
2.5 Quotation, quotation format, comparison between tender and quotation, Comparative statement, format comparative statement, Order format, placing of purchasing order.

3. Non-Industrial Installations / Industrial Installation

3.1 Types of Non-industrial installations; Office buildings, shopping and commercial centre, residential installation.
3.2 Design consideration and procedure of electrical installation in commercial buildings.
3.3 Estimating and costing of unit Earthing of commercial installation.
3.4 Single line diagram, Installation plan along with estimating and costing for small workshops - (Single phase motors, Three Phase motors etc)

4. Public Lighting Installation

4.1 Classification of outdoor installations streetlight/ public lighting installation Street light pole structures.
4.2 Selection of equipments, sources used in street light installations.
4.3 Cables, recommended types and sizes of cable.
4.4 Control of street light installation.
4.5 Design, estimation and costing of streetlight

5. Distribution Lines and LT Substation

5.1 Materials used for HT and LT Over head line.
5.2 Design, estimation and costing of HT and LT overhead line.
5.3 Types of 11 KV Distribution substations and their line diagrams,
5.4 Design, estimation and costing of outdoor and indoor 11KV/ 400v substation.

COURSE OUTCOME

After the completion of the course the student will be able to:

- Follow National Electrical Code 2011 in electrical installations.
- Estimate the electrical installation works 193 Electrical Engineering Curriculum Structure
- Estimate the work of non-industrial electrical installations.
- Prepare abstract, tender, quotation of public lighting and other installations
- Prepare abstract, tender, quotation of low tension (LT) substations.

RECOMMENDED BOOKS:

1. Electrical Design Estimating and Costing by Raina, K.B.; Dr. S. K. Bhattacharya New Age International Publisher First, Reprint 2010, ISBN: 978-81-224-0363-3
2. Electrical Estimating and Costing by Allagappan,, N. S. Ekambarram, Tata Mc-Graw Hill Publishing Co. Ltd, , ISBN 13: 9780074624784
3. Electrical Estimating and Costing by Singh, Surjit Ravi Deep Singh, Dhanpat Rai and Sons, , ISBN 13:1234567150995
4. A Course in Electrical Installation Estimating and Costing by Gupta, J.B. S.K. Kataria and Sons Reprint Edition, ISBN 10: 935014279113: 978-9350142790.
5. Code of Practice for Electrical Wiring Installation by Bureau of Indian Standard. IS: 732-1989,
6. National Electrical Code 2011 by Bureau of Indian Standard. SP-30:2011,

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	9	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: ELECTRICAL ESTIMATION AND CONTRACTING LABORATORY
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Design electrical installation with costing for tendering.

LIST OF PRACTICALS:

1. Prepare a tender notice for purchasing a transformer of 200 KVA for commercial installation.
2. Prepare a quotation for purchasing different electrical material required.
3. Prepare a comparative statement for above material
4. Prepare purchase order for the above material
5. Design drawing, estimating and costing of hall
6. Estimate the material and cost required for 11kv HT distribution line
7. Estimate the material and cost required for 415v/ 220 v LT distribution line
8. Estimate the material and cost required for 100KVA, 11/ 0.415 KV outdoor Substation.
9. Estimating and costing of unit Earthing of commercial installation
10. Estimating and costing of two room domestic installation.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 202	Course Title: INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING
Semester: 4th	Credits: 3
Hours per week: 3 (L:3 T:0 P:0)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: • Use instrumentation equipment for condition monitoring and control.

COURSE CONTENT

1. Fundamentals of instrumentation

1.1 Basic purpose of instrumentation.
1.2 Basic block diagram (transduction, signal conditioning, signal presentation) and their function.
1.3 Construction, working and application of switching devices- Push button, limit switch, float switch, pressure switch, thermostat, electromagnetic relay.

2. Transducers

2.1 Distinguish between Primary and Secondary, Electrical and Mechanical, Analog and Digital, Active and Passive. Mechanical devices pry. and sec. transducers
2.2 Advantages of electric transducers
2.3 Required characteristics of transducers.
2.4 Factors affecting the choice of transducers
2.5 Construction and principle of resistive transducer, Potentiometer, variac and strain gauges, No derivation. Only definition and formula for gauge factor Typesof strain gauges like unbonded, bonded and semiconductor.
2.6 Construction and principle of Inductive transducers-L.V.D.T. and R.V.D.T, their applications.
2.7 Construction, principle and applications of transducers–Piezo-Electric transducer, photoconductive cells, photo voltaic cells.

3. Measurement of Non-Electrical Quantities

3.1 Temperature measurement - Construction and Working of RTD, Thermistor and Thermocouple, radiation pyrometer, technical specifications and ranges.
3.2 Pressure measurement – Construction and working of bourdon tube, bellow diaphragm and strain gauge, Combination of diaphragm and inductive transducer, Bourdon tube and LVDT, bellow and LVDT, diaphragm capacitance and bridge Circuit.
3.3 Construction and Working of Speed measurement by contacting and non- Contact Type- DC tachometer, photo- electric tachometer, toothed rotor tachometer Generator - magnetic pickup and Stroboscope.
3.4 Construction and Working of Vibration measurement by accelerometer-LVDT

accelerometer, Piezo electric type.

3.5 Construction and Working of Flow measurement by electromagnetic and Turbine Flow meter.

3.6 Construction and Working of Liquid level measurement by resistive, inductive, Capacitive gamma rays and Ultrasonic methods.

4. Signal Conditioning

4.1 Basic Concept of signal conditioning System.

4.2 Draw pin configuration of IC 741.

4.3 Define Ideal OP-AMP and Electrical Characteristics of OP-AMP.

4.4 Different Parameters of op-amp:-Input offset voltage, Input offset current, Input bias current, Differential input resistance, CMMR, SVRR, voltage gain, output voltage, slew rate, gain bandwidth.

4.5 Use of op-amp as inverting, non- inverting mode, adder, subtractor.

5. Data Acquisition System

5.1 Generalized DAS- Block diagram and description of Transducer, signal conditioner, multiplexer, converter and recorder. Draw Single Channel and Multi-channel DAS-Block diagram only. Difference between Signal Channel and Multi- Channel DAS.

5.2 Data conversion- Construction and Working of Analog to digital conversion-successive approximation method.

5.3 Digital to Analog conversion- Construction and Working of binary weighted resistance method.

5.4 Digital display device- operation and its application of seven segment display.

6. Condition Monitoring and Diagnostic Analysis

6.1 Definition of condition monitoring

6.2 Insulation deterioration Mechanism- factors affecting occurrence and rate of deterioration, types of stresses responsible for deterioration. Different tests on transformer, their purpose and the necessary condition of machine.

6.3 Power factor, capacitance /tan delta test

COURSE OUTCOME

After the completion of the course the student will be able to:

- Select relevant instruments used for measuring electrical and non-electrical quantities.
- Select relevant transducers/sensors for various applications.
- Use relevant instruments for measuring non-electrical quantities.
- Check the signal conditioning and telemetry system for their proper functioning.
- Use data acquisition systems in various applications.
- Undertake condition monitoring for diagnostic analysis of electrical equipment

RECOMMENDED BOOKS:

1. Electric and Electronic Measurement and instrumentation Sawhney, A.K., Dhanpat Rai and Co. Author, Nineteenth revised edition 2011 reprint, 2014, ISBN:10: 8177001000
2. Instrumentation devices and system, Rangan, C.S. G.R.Sharma. and V.S.V.Mani, Pen ram International Publishing India Pvt. Ltd. Fifth edition, ISBN:10: 0074633503
3. Electronics and instrumentation Mehta, V.K., Third edition-S.Chand and company Pvt Ltd Reprint, 2010, ISBN:81-219-2729-3
4. Industrial instrumentation and control, Singh, S.K., Tata McGraw-Hill, 1987. ISBN: 007451914X, 9780074519141.
5. Electronic Measurement and Instrumentation J.G. Joshi, , Khanna Publishing House, New Delhi (ISBN: 978-93-86173-621)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Alloted (Hrs)	Marks Allotted (%)
1	5	10
2	14	30
3	14	30
4	5	10
5	5	10
6	5	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPE 204	Course Title: INDUSTRIAL INSTRUMENTATION AND CONDITION MONITORING LABORATORY
Semester: 4th	Credits: 1
Hours per week: 2 (L:0 T:0 P:2)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use instrumentation equipment for condition monitoring and control.

LIST OF PRACTICALS:

1. Identify different switches used in instrumentation system.
2. Measure linear displacement by L.V.D.T.
3. Measure the strain with the help of strain gauge
4. Measure temperature by PT-100, thermistor, thermocouple along with simple resistance bridge.
5. Use Thermocouple to control the temperature of a furnace/machine.
6. Measure pressure using pressure sensor kit.
7. Measure angular speed using stroboscope and tachometer.
8. Measure the flow using flow meter.
9. Use op-amp as inverter, non-inverting mode, adder, differentiator and integrator.
10. Convert digital data into analog data by using analog to digital converters and analog data into digital data by digital to analog converter.

Visit to testing center of electrical testing lab for tan delta and diagnostic tests and determine polarization index

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN ELECTRICAL ENGINEERING	
Course code: EEPR 202	Course Title: Electrical Workshop – III
Semester: 4th	Credits: 3
Hours per week: 6 (L:0 T:0 P:6)	

COURSE OBJECTIVE:

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

LIST OF PRACTICALS

- Contactor control operations
- Wiring estimates for a residential building
- Wiring estimates for a polytechnic
- Contactor Control Circuits along with Schematic and wiring diagram DOL Starter of 3-phase induction Motor.
- Forwarding/reversing of 3-phase induction motor
- Limit switch control of a 3-phase induction motor
- Sequence operation of two motors using T.D.R.
- Two speed motor control.
- Automatic star-delta starter for 3-phase induction motor
- Crimping of CAT 6/ LAN cable along with accessories (RJ 45 connector/ switch etc).
- Crimping of 2/4 pair telephone wire along with accessories (RJ 45 connector/ switch etc).
- Assemble and dismantle a 1KWP Solar Power Plant
- Assemble and dismantle a small wind energy Power Plant

INDUSTRIAL TRAINING OF STUDENTS
(During summer vacation after IV Semester)

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organized during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students, understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. Theformative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry

CURRICULUM
FOR

FOURTH SEMESTER

DIPLOMA IN

ELECTRONICS AND COMMUNICATION ENGINEERING

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN ELECTRONICS & COMM.ENGG.

FOURTH SEMESTER

Code	Subjects	Study Scheme Hours			Total Hours L+T+P	Credits			Total credit
		L	T	P		L	T	P	
PC401	Electrical Machines	3	0	0	3	3	0	0	3
PC402	Electrical Machines Lab	0	0	2	2	0	0	1	1
PC403	Digital and Data Communication	3	0	0	3	3	0	0	3
PC404	Digital and Data Communication Lab	0	0	2	2	0	0	1	1
PC405	Microcontrollers and Embedded Systems	3	0	0	3	3	0	0	3
PC406	Microcontrollers and Embedded Systems Lab	0	0	2	2	0	0	1	1
PC407	Power Electronics	3	0	0	3	3	0	0	3
PC408	Power Electronics Lab	0	0	2	2	0	0	1	1
PE409	PE-1(Branch Specific Elective)	3	0	0	3	3	0	0	3
PE410	PE-1(Branch Specific Elective)Lab	0	0	2	2	0	0	1	1
SI/PR411	Fundamentals of Electronic Equipment Maintenance Lab	0	0	4	4	0	0	2	2
Total		**15**	**0**	**14**	**29**	**15**	**0**	**07**	**22**

PE- I (Branch specific elective):- Principles of Instrumentation/Linear Integrated Circuits

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC401**	**Course Title**: **ELECTRICAL MACHINES**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

This subject shall enable student to study the fundamental concepts of electrical machines, their operating principle and working. Such machines form a basis for understanding machines based on similar concepts as employed in industries, power stations, domestic and commercial appliances,etc.

DETAILED CONTENTS

1. Single phase and Three Phase Supply: (04 hrs)

1.1 Advantage of three-phase system over single-phase system.

1.2 Star Delta connections.

1.3 Relation between phase and line voltage and current in a three-phase system.

1.4 Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.

2. Transformers: (10 hrs)

2.1 Principle of operation and constructional details of single phase and three-phase transformer, core type and shell type transformers.

2.2 Difference between single phase and three phase transformers and their applications.

2.3 Voltage Regulation of a transformer (No Derivation).

2.4 Losses in a transformer.

2.5 Efficiency, condition for maximum efficiency and all day efficiency.

2.6 Auto transformers.

2.7 Brief introduction of CTs and PTs (Current transformer and potential transformer) and CVT (Constant Voltage Transformer)

3. Introduction to Rotating Electrical Machines: (04hrs)

3.1Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction).

3.2 Definition of motor and generator.

3.3 Basic principle of a generator and a motor.

3.4 Torque due to alignment of two magnetic fields and the concept of Torque angle.

4. DC Machines: (10 hrs)

4.1 Principle of working of D.C motors and D.C generator, their constructional details.

4.2 Function of the commutator for motoring and generating action.

4.3 Factors determining the speed of a DC motor.

4.4 Different types of excitations.

4.5 Characteristics of different types of DC machines.

4.6 Starting of DC motors and starters.

4.7 Application of DC machines.

5. A.C. Motors: (10 hrs)

5.1 Revolving magnetic field produced by poly phase supply.

5.2 Brief introduction about three phase induction motors, its principle of operation.

5.3 Types of induction motors and constructional features of squirrel cage and slip-ring motors.

5.4 Starting and speed control. Star Delta and DOL (Direct-on-line) starters.

5.5 Reversal of direction of rotation of 3-phase induction motors.

5.6 Applications of induction motors.

6. Single Phase Fractional Kilowatt Motors: (10 hrs)

6.1 Introduction to Single Phase Fractional Kilowatt Motors.

6.2 Principle of operation of single-phase motors

6.3 Types of single-phase induction motors and their constructional details (i.e., Split phase, capacitor start, capacitor start and run, shaded pole and reluctance start).

6.4 Introduction to servo- motors and stepper motors.

6.5 Concept of micro-motors.

COURSE OUTCOME:

After completing the course , a student is expected to :

1. Understand various electrical machines and their practical applications in the field of electrical and electronics engineering.
2. Acquire knowledge about working principles of various electrical machines.

3. Gain basic idea of construction, maintenance and testing of electrical machines.

BOOKS RECOMMENDED:

1. Electrical Machines by SK Bhattacharya, Tata McGraw Hill, Education Pvt Ltd. New Delhi.

2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar.

3. Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi.

4. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi.

5. Electrical Machines by SmarajitGhosh-Pearson Publishers, Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Single phase and Three Phase Supply	04	10
2	Transformers	10	20
3	Introduction to Rotating Electrical Machines	04	10
4	DC Machines	10	20
5	A.C. Motors	10	20
6	Single Phase Fractional Kilowatt Motors	10	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC402**	**Course Title :ELECTRICAL MACHINES LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course supplementing the theory subject of Electrical Machines. The practicals will reinforce the concepts treated in the theory subject.

LIST OF PRACTICALS:

1.To measure power and power factors in three phase load by two wattmeter method.

2.To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test.

3.To connect the primary and secondary windings of a three phase transformer in a suitable circuit and to verify line and phase current and voltage relationship respectively.

4. Study of dc series motor with starter (to operate the motor on load/no load)

5.Speed control of dc shunt motor (i) Armature control method (ii) Field control method

6. To connect a dc shunt motor with supply through a 3 point starter and to run the motor at different speeds with the help of a field regulator.

7. To run a 3 phase squirrel cage induction motor with the help of a star-delta starter. and to change the direction of rotation of the motor.

8.To measure power and power factor of a single phase induction motor.

9.To run a synchronous motor with a.c supply and to measure speed.

10.To make connections of starting and running winding of a single phase capacitor motor and to run it with the help a DOL starter and to measure its speed.

11.Study construction of a stepper motor and servomotor.

COURSE OUTCOME:

Students will be able to get practical understanding about the working of three phase system, transformers and different types of motors etc.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC403**	**Course Title**: **DIGITAL AND DATA COMMUNICATION**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES:

This course is designed to develop an understanding of basic concepts in digital and data communication. This course examines the important techniques related to digital and data communication and enable students to have an insight into the theoretical concepts.

DETAILED CONTENTS:

1. Introduction to Digital Communication (04 hrs)

1.1 Basic block diagram of a digital communication system.

1.2 Advantages of digital communication system over analog communication system

1.3 Definition of the terms :Bit rate, baud rate, information capacity, bandwidth, Nyquist frequency, bandwidth efficiency

2. Digital modulation techniques (10 hrs)

2.1 Definition of digital modulation.

2.2 Amplitude shift keying (ASK): basic principles ,waveforms and block diagram explanation of transmitter and receiver.

2.3 Frequency Shift keying (FSK): basic principles ,waveforms and block diagram explanation of transmitter and receiver.

2.4 Phase shift keying (PSK): BPSK, basic principles ,waveforms and block diagram explanation of transmitter and receiver

2.5 Other forms of PSK:QPSK,8-PSK and 16-PSK,(basic description only).

2.6 Basic principles of Quadrature Amplitude Modulation (QAM).

3. Pulse modulation (04 hrs)

Types of pulse modulation-PAM, PPM, PWM (Generation & Detection) and their comparison.

4. Pulse code modulation (08 hrs)

4.1 Statement of sampling theorem and elementary idea of sampling frequency for pulse code modulation.

4.2 Basic concepts of time division multiplexing (TDM) and frequency division multiplexing (FDM).

4.3 Pulse code Modulation (PCM) : Basic scheme of PCM system, Quantization, quantization error, block diagram of PCM communication system and function of each block. Advantages of PCM systems.

4.4 Brief idea of delta modulation and adaptive delta modulation.

5. Data Communication basics (14 hrs)

5.1 Block diagram description of a basic data communication model and its components consisting of transmitter ,receiver, medium ,message and protocol.

5.2 a) Modes of communication:simplex,half-duplex,duplex

b)Transmission modes: parallel, serial, asynchronous and synchronous

5.3 Communication media.

a)Guided transmission media: twisted pair cable, co-axial cable, fibre-optic cable

b)Unguided transmission media: radio waves, microwaves ,infrared, satellite.

c)Line of sight transmission: Point-to-point, broadcast.

5.4 Data communication codes

a) Basic codes

i)Baudot code ii)BCD code iii)ASCII code iv) EBCDIC code

b) Line codes

i)NRZ ii)RZ iii)Manchester

5.5 Error detection

a)Redundancy checking

i)VRC ii)Checksum iii)LRC iv)CRC

b)Error detection using parity

5.6 Error correction

a)Re-transmission/Automatic repeat request(ARQ)

b)Forward error correction(FEC) using Hamming code

5.7 Character synchronization

a)Asynchronous serial data b) Synchronous serial data

6. Data Communication hardware (04 hrs)

Brief description of the following:-

a)Data terminal equipment (DTE) and Data Communication Equipment(DCE)

b)UART and USRT

c)Serial data interface RS-232.

d)Modems

7. Data Networks (04 hrs)

7.1 Description of public switched data networks.

7.2 Difference between circuit switching , message switching and packet switching

7.3 Concept of ISDN and Broadband ISDN

7.4 Brief idea of Asynchronous transfer mode (ATM)

7.5 Local area networks(LAN) and ethernet.

COURSE OUTCOME:

After the completion of the course the student will be able to:

1. Understand the fundamental concepts related to the data communication systems. Distinguish between analog, digital signals and the transmission thereof.
2. Interpret how and why the errors occur during the transit of signal or data and what are the remedial techniques to correct the same.

3. Understand the behavior of data communication devices and the underlying technologies involved in manufacturing of those devices.

RECOMMENDED BOOKS:

1. Dr. Sanjay Sharma, Data Communication and Computer Networks, Kataria Publications.
2. William Stallings, Data Communication and Networks, Prentice Hall India
3. Behrouz A. Forouzan, Data Communications and Networking , McGraw Hill Edn.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Introduction to Digital Communication	04	10
2	Digital Modulation Techniques	10	20
3	Pulse modulation	04	10
4	Pulse code modulation	08	15
5	Data communication basics	14	25
6	Data communication hardware	04	10
7	Data communication networks	04	10
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC404**	**Course Title :DIGITAL AND DATA COMMUNICATION LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Digital and Data communication and aims to reinforce the concepts taught in the theory with practical observations.

LIST OF PRACTICALS:

1. Observe Pulse Amplitude Modulation (PAM)signal.
2. Observe Pulse Width Modulation (PWM)signal.
3. Observe Pulse Position Modulation (PPM)Signal.
4. Observe wave forms at input and output of ASK modulator and demodulator.
5. Observe wave forms at input and output of FSK modulator and demodulator.
6. Observe wave forms at input and output of BPSK modulator and demodulator
7. To feed signal to the input of a PCM transmitter and compare the signal at the output of PCM receiver with it.
8. To transmit parallel data on a serial link using USART.
9. Transmission of Hamming code on a serial link and its reconversion at the receiving end.
10. Perform the transfer of a file from PC to another PC using serial port RS-232.

COURSE OUTCOME:

After the completion of the course the student will be able to understand the basics of types of signals, network devices, modulators etc. Students will be able to work on practical projects related to networking of computers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC405**	**Course Title**: **MICROCONTROLLERS AND EMBEDDED SYSTEMS**
Semester: 4TH	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES:

Micro-controllers and Embedded systems have also assumed a great significance in the electronic and consumer goods industry and are a very vital field in modern era. The subject aims to expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

DETAILED CONTENTS:

1. Introduction to the Architecture of 8051 Microcontroller. (12 hrs)

1.1. Comparison of a microprocessor and a microcontroller

1.2. Overview of 8051 family and their comparison.

1.3. Study of architecture of 8051 using its block diagram.

1.4. Pin details ;function of each pin of an 8051 microcontroler.

1.5. I/O Port structure.

1.6. Memory Organization(Concept of internal and external memory).

1.7. Various registers and Special Function Registers (SFRs) in an 8051.

2. 8051 Instruction Set And Programs.

2.1 Overview of 8051 instruction set.

2.2 Various addressing modes.

2.3 Classification of instructions(brief explanation and one or two examples of each type).

Data transfer instructions
Arithmetic instructions
Logical instructions
Branching instructions
Bit manipulation instructions

Stack, subroutine and interrupt related instructions

2.4 Simple Programs based on above instructions.

3.Assembly/C programming for Micro controller: (12 hrs)

3.1 Use of software development tools like Editor, Assembler, Linker, Loader and Hex- converters for writing and executing programs for the microcontroller.

3.2 Various directives of Assembly language programming for 8051 programming.

3.3 Brief idea of use of compiler, debugger and simulator in running microcontroller programs.

3.4 Simple programs in assembly and C for 8051.

4. Microcontroller Operations: (08 hrs)

4.1 I/O ports in 8051: their function and use with related SFRs.

4.2 Timers/counters in 8051:their function, programming modes, operations and use with related SFRs

4.2 Serial communication in 8051.

4.3 Description of interrupts in 8051.

5. Application of Micro controllers and Embedded systems. (05 hrs)

5.1Brief description of an embedded system.

5.2Application of Micro controllers and Embedded systems in consumer electronics.

6. Design of embedded systems using Arduino

6.1 Arduino board layout and description of onboard components

6.2 Pin details of Arduino.

6.3Concept of interfacing LEDs, IR sensors, LCD module, buzzer, push button, motor with Arduino.

6.4 Familiarisation with Arduino IDE and simple programming examples (sketches) with Arduino.

6.5 Design example of a simple embedded system using an Arduino.

COURSE OUTCOMES

On completing the course a student is expected to :

1. Gain substantial knowledge of microcontrollers, their architecture ,working and their programming.
2. Understand embedded systems and their practical applications.
3. Design simple programs for 8051 microcontroller.
4. Fabricate a small electronics circuit using Arduino boards.

RECOMMENDED BOOKS

1. Microcontrollers by Deshmukh, Tata McGraw Hill Education Pvt Ltd, New Delhi.

2. Microcontrollers by Ayala.

3. Microcontrollers by Mazidi, Pearson Education, Delhi.

4. Microcontrollers by Neil Makanzi, Pearson Education, Delhi.

5. Embedded GSM Applications.

6. Microcontrollers and Embedded Systems by Sangar and Sahdev, Unique Publications, Jalandhar.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	**Time Allotted (Hrs)**	**Marks Allotted (%)**
1	Introduction to the Architecture of 8051 Microcontroller	10	20
2	8051 Instruction Set And Programs	10	20
3	Assembly/C programming for Micro controller	06	15
4	Microcontroller Operations	08	15
5	Application of Micro controllers and Embedded system	04	10
6	Design of embedded system using Arduino	10	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC406**	**Course Title: MICROCONTROLLERS AND EMBEDDED SYSTEM LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Microcontrollers and Embedded System.There will be more emphasis on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini-projects based on microprocessor and micro-controller operations may be identified and given to students as assignments.

LIST OF PRACTICALS

1. Familiarization with 8051micro-controller Kit.

2. Assembly Language Programming (PC Based) for writing programs for 8051 using an assembler.

3. C Language Programming- (PC Based) for writing programs for 8051 using a C compiler.

4. Adding two 8 bit and 16 bit numbers.

5. Subtraction of two 8 bit and 16 bit numbers.

6.Multiplication of two 8 bit and 16 bit unsigned numbers.

7. Multiplication of two 8 bit and 16 bit signed numbers.

8.Dividing 16 bit unsigned number with an 8 bit unsigned numbers.

9.Program on placing contents of external memory in the accumulator.

10.Exchange of contents of memory locations

11.Program using ports in an 8051

Other programs can be devised by the teacher as per his choice.

12 .Blinking an LED using any Arduino.

13.Displaying Temperature on an LCD module using data from temperature sensor.

14.Increasing/decreasing the speed of motor using PWM pins of Arduino

COURSE OUTCOMES:

Students will be able to understand the basis of Assembly level programming and will be able to work on microcontroller kits. Knowledge of Assembly level programming will help them in programming Arduinos Microcontrollers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC407**	**Course Title**: **POWER ELECTRONICS**
Semester: 4th	**Credits:** 3
Periods Per Week : 3 (L: 3, T:0, P: 0)	

COURSE OBJECTIVES : Diploma holders in Electronics and related fields are required to handle a wide variety of power electronic equipment used in process control Industry. This subject will provide the student basic understanding of the principles of their working. The practical training will further re-inforce the knowledge and skill of the students.

COURSE CONTENTS

1. **Basics of Power Electronics Devices: (12hrs)**

   1.1. Construction, Working principles of SCR, two transistor analogy of SCR
   1.2. V-I characteristics of SCR.
   1.3. SCR specifications & ratings.
   1.4. Different methods of SCR triggering.
   1.5. Different commutation circuits for SCR.
   1.6. Series & parallel operation of SCR.

2. **DIAC,TRAIC& UJT and other Power Electronics Devices: (12 hrs)**

   2.1. Construction & working principle of DIAC and its V-I characteristics.
   2.2. Construction & working principle of TRAIC and its V-I characteristics.
   2.3. Construction, working principle of UJT and its V-I characteristics.
   2.4. UJT as relaxation oscillator.
   2.5. Basic idea about the selection of Heat sink for thyristors.
   2.6. Applications of SCR,DIAC and TRAIC.

3. Controlled Rectifiers (10hrs)

3.1. Single phase half wave controlled rectifier with load (R, R-L)

3.2. Fully controlled full wave bridge rectifier.

3.3. Single phase full wave center tap rectifier.

4. **Dual Converters and Cyclo converters:(12 hrs)**

4.1. Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel. Inverters & their applications.

4.2. Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step down choppers.

4.3. Brief Introduction of Dual Converters and cyclo converters.

5. **Applications:** (08 hrs)

5.1. Battery charger ,Emergency light system, Temperature controller using SCR .

5.2. Illumination control / fan speed control using TRIAC.

5.3. Thyristorized control of electric drives.

5.4. UPS: Offline and Online.

5.5. Concept of SMPS.

COURSE OUTCOME:

- Acquire knowledge about fundamental concepts and techniques used in power electronics.
- Understand the operation of power electronic devices and applications
- Ability to analyze various power converter circuits and understand their application.
- Ability to identify basic requirements for power electronics based design application.

Recommended Books:

1) Power Electronics by P.C. Sen, Tata McGraw Hill Education Pvt Ltd. New Delhi
2) Power Electronics by P.S. Bhimbhra, Khanna Publishers, New Delhi
3) Power Electronics – Principles and Applications by Vithayathi, Tata McGraw Hill Education Pvt Ltd. New Delhi
4) Power Electronics by M.S. Berde, Khanna Publishers, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Basics of Power Electronics Devices	10	20
2	DIAC,TRAIC & UJT and other Power Electronics	10	20
3	Controlled Rectifiers	10	20
4	Inverters, Choppers, Dual Converters and Cyclo-converters.	10	20
5	Applications	08	20
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PC408**	**Course Title: POWER ELECTRONICS LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Power Electronics Subject.

LIST OF PRACTICALS:

1) To plot VI characteristic of an SCR.
2) To plot VI characteristics of DIAC.
3) To plot VI characteristics of TRIAC.
4) To plot VI characteristics of UJT.
5) Observation of wave shapes of voltage and relevant points of single Phase full wave controlled rectifier and effect of change of firing angle.
6) Study of UJT relaxation oscillator. And observe I/P and O/P wave forms
7) Observation of wave shape of voltage at relevant point of single-phase half wave controlled rectifier and effect of change of firing angle.
8) Observation of wave shapes of voltage at relevant point of single phase full wave controlled rectifier and effect of change of firing angle.
9) Observation of wave shapes and measurement of voltage at relevant points in TRIAC based AC phase control circuit for varying lamp intensity and AC fan speed control.
10) Installation of UPS system and routine maintenance of batteries.

Course Outcome:

The student shall be able to:

1)Understand various Power Electronic Devices and Equipment's which are used in the Electrical and Electronics Industry.

2) Able to know the characteristics of Power Electronic Devices like SCR, DIAC,TRAIC etc.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code:**PE409**	Course Title: **ELECTIVE** **a) PRINCIPLES OF INSTRUMENTATION**
Semester: 4th	Credits: 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

In the real world of work the technician is required to handle wide variety of instruments while testing, trouble shooting, calibration etc. the study of this subject will help students to gain the knowledge of working principles and operation of different instruments. During practical sessions, he will acquire the requisite skills.

1. Basics of Instrumentation and Measurements: **(06hrs)**

1.1 Measurement, method of measurement, types of instruments.

1.2 Basic Measurement System, functions of its elements namely the transducer, signal conditioner, display or read-out and power supply.

1.3 Specifications of instruments: Accuracy, precision, sensitivity, resolution, range.

1.4 Errors in measurement, loading effect.

2. Digital Instruments **(10hrs)**

2.1 Comparison of analog and digital instruments.

2.2 Brief overview of analog instruments.

2.3 Working principles of digital instruments.

2.4 Block diagram and working of digital voltmeters (DVMs).

2.5 Block diagram and working of digital multimeter.

2.5 Measurement of time interval, time period and frequency using frequency counter

2.6 Working principle of logic probe, logic pulser, logic analyzer.

2.7 Working of a digital LCR meter and a digital Q-meter.

3. Oscilloscopes (08hrs)

3.1 Working principle of an oscilloscope and measurement of voltage, frequency, time period and phase difference using CRO.

3.2 Brief idea of working of Cathode Ray Tube(CRT) oscilloscopes, single and dual trace.

3.3 Digital storage oscilloscope (DSO) : block diagram and working principle.

3.4 Brief definition of other types of CRO:

i) Mixed-domain oscilloscopes ii) mixed-signal oscilloscopes iii) Handheld oscilloscopes iv) PC-based oscilloscopes.

3.5 CRO probes, their types and features

4. Signal Generators and Analytical Instruments (06 hrs)

4.1 Block diagram explanation and working of a function generator.

4.2 Block diagram explanation and working of a wave analyzer and spectrum analyzer and their working principle.

5. Transducers (12 hrs)

5.1 Distinction between active and passive transducers with examples.

5.2 Basic requirements of a transducer.

5.3 Variable Resistance Type:

Principle of operation of Potentiometer, Strain gauge and Thermistor.

5.4 Variable capacitance type:

Principle of operation of dielectric guage, capacitor microphone and capacitive touchscreens.

5.5 Variable inductance type:

Principle of operation of Linear Variable differential transformer (LVDT).

5.6 Knowledge of **applications** of other different types of transducers**(definitions only**)

i)Electromagnetic(Antenna, disk read/write heads,Hall effect sensors)

ii)Electrochemical (PH probes, gas sensors)

iii)Electromechanical(accelerometers ,air flow sensors, load cells, gyroscope)

iv)Electro-acoustic (Loudspeakers, microphone ,vibrators or buzzers, hydrophone, ultrasonic sensors)

v)Electro-optical(Lamps , LEDs, laser diodes ,photodiode, phototransistor, LDRs)

vi)Thermoelectric(thermistors, thermocouple)

vii)Tactile sensors(touch screens)

viii)Humidity sensors(hygroscopes)

6.Telemetry and smart meters

6.1 Definition of telemetry or remote measurement; Block diagram working of a telemetry system.

6.2 Applications of telemetry in modern world.

6.3 Brief description of advanced metering infrastructure(AMI) or smart meters.

COURSE OUTCOME:

1. The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.
2. Students will be able to understand the basic uses and applications of Cathode ray oscilloscope,DSO,different types of transducers.

RECOMMENDED BOOKS:

1. Electronics Measurement and Instrumentation by AK Sawhney, DhanpatRai and Sons, New Delhi.

2. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi.

3. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi.

4.. Electronics Instrumentation by JB Gupta, SatyaPrakashan, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Basics of Instrumentation and Measurements	06	10
2	Digital Instruments	10	20
3	Oscilloscopes	08	15
4	Signal Generators and Analytical Instruments	06	15
5	Transducers	12	25
6	Telemetry and smart meters	06	10
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PE410(a)**	**Course Title :ELECTIVE LAB** **PRINCIPLES OF INSTRUMENTATION LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Principles of Instrumentation. There will be more emphasis on practical aspects along with the theory input.

LIST OF PRACTICALS

1. Measurement of voltage, frequency, time period and phase using CRO.
3. Measurement of voltage, frequency, time and phase using DSO.
4. Measurement of Q of a coil and its dependence on frequency using a digital Q-meter.
5. Measurement of capacitance and inductance using digital LRC meter
6. Use of logic pulser and logic probe.
7. Measurement of time period, frequency, average period using universal counter/ frequency counter.
8. Measurement of strain using strain gauge.
9. Measurement of temperature using thermistor and thermocouple.
10. To assemble and test instrumentation amplifier measure its gain, input and output Impedance.
11. Study of remote metering and smart meters for electrical consumption.

COURSE OUTCOMES:

Students will be able to understand the basic uses and applications of Cathode ray oscilloscope, DSO, different types of transducers etc which will be of great importance considering their practical applications in the Engineering field.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code:**PE409(b)**	Course Title: **ELECTIVE** **b) LINEAR INTEGTRATED CIRCUITS**
Semester: 4th	Credits: 3
Periods Per Week : 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

The student should be made to: To expose the students to linear and integrated circuits. To understand the basics of linear integrated circuits and available IC's.To understand characteristics of operational amplifier.To apply operational amplifiers in linear and nonlinear applications. To acquire the basic knowledge of special function IC.

PRIOR LEARNING REQUIREMENT: NIL

1. CHARACTERISTICS OF OP-AMP: (16 hrs)

1.1 Introduction to operational amplifier, Ideal OP-AMP characteristics, DC and AC characteristics.

1.2 Differential amplifier, Balanced and unbalanced Input/output configuration, frequency response of OP-AMP.

1.3 Brief introduction of instrumentation amplifier and isolation amplifier.

2. APPLICATIONS OF OP-AMP: (18 hrs)

2.1 Use of op-amp as Sign Changer, Scale Changer.

2.2 Use of op-amp as Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor.

2.3 Use of op-amp as Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier.

2.4 Use of op-amp as Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper.

2.5 Use of op-amp as Low-pass, high-pass and band-pass Butterworth filters

3. WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs (10 hrs)

3.1 Sine-wave generators, Multivibrators and Triangular wave generator.

3.2 Saw-tooth wave generator, ICL8038 function generator.

3.3 IC 723 general purpose regulator monolithic switching regulator.

3.4 Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters.

3.5 Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-coupler ICs.

3.6 IC-566 voltage-controlled oscillator & IC 565-phase locked loop.

3.4 IC AD633 Analog multiplier.

3. APPLICATION INTEGRATED CIRCUITS(IC'S) (10 hrs)

4.1 AD623 Instrumentation Amplifier and its application as load cell weight measurement .

4.2 IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply .

4.3 LM317, 723 Variable voltage regulators.

4.4 Switching regulator- SMPS — ICL 8038 function generator IC.

COURSE OUTCOME:

The student should be able to:

1. Design oscillators and amplifiers using operational amplifiers
2. Design filters using Op-amp and perform experiment on frequency response
3. Design DC power supply using ICs.

BOOKS RECOMMENDED:

1.Ramakant A. Gayakwad, "Op-Amps and Linear integrated circuits", PHI, 4th Edition, 2000.

2. Donald.E. Neaman, "Electronic Circuit, Analysis and Design", Tata McGraw Hill Publishing Company Limited, Second Edition, 2002.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Topic Name	Time Allotted (Hrs)	Marks Allotted (%)
1	Characteristics of OP-AMP	10	20
2	Applications of OP-AMP	10	20
3	Waveform Generators And Special Function ICs	14	30
4	Application Integrated Circuits	14	30
Total		**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **PE410(b)**	**Course Title : ELECTIVE LAB** **b)LINEAR INTEGRATED CIRCUITS LAB**
Semester: 4th	**Credits:** 1
Periods Per Week : 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES:

This course is a lab course related to the theory subject of Linear Integrated Circuits. There will be more emphasis on practical aspects along with the theory input.

PRIOR LEARNING REQUIREMENT: NIL

LIST OF PRACTICALS:

1. To demonstrate the use of op-amp as Integrator and Differentiator.

2. To obtain the output of voltage comparator and zero crossing detector.

3. To know the operation of clippers and clampers.

4. To study the application of IC565 as an PLL.

5. To demonstrate the use of op-amp as low pass and high pass filter.

6. To design a high current, low voltage and high voltage linear variable dc regulated power supply and test its line and load regulation.

7. To study the operations of at least four analog ICs currently being used .

COURSE OUTCOMES:

Students will be able to understand and perform practicals using OP-Amp and will be able to know the various applications of Operational amplifiers.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN ELECTRONICS AND COMMUNICATION ENGINEERING	
Course Code: **FI/PR411**	**Course Title**: **FUNDAMENTALS OF ELECTRONIC EQUIPMENT MAINTENANCE LAB**
Semester: 4th	**Credits:** 2
Periods Per Week : 4 (L:0 , T:0, P: 4)	

COURSE OBJECTIVES:

This course aims at making the students introduced to the working of electronic products used in daily life and to the repair and maintenance of these products.

COURSE CONTENTS:

UNIT 1 Basic concepts in repair, servicing and maintenance (10 hrs)

1.1 Role and scope of maintenance and repair in modern electronic equipment.
1.2 Concept of terms like Mean time between failures (MTBF), Mean time to repair (MTR),preventive maintenance, corrective maintenance.
1.3 Circuit tracing techniques-Divergent, convergent and feedback path circuit analysis
1.4 Fault location techniques like functional Areas approach, split half method, measurements of parameters at different points in a circuit ,signal injection etc.

UNIT 2 Fault finding aids and tools (10 hrs)

2.1 Interpretation of data sheets of various electronic components
2.2 Utility of information available in service / operation manuals of various electronic gadgets.
2.3 Proficiency in the use of test and measuring instruments in fault finding like multimeter, oscilloscope ,signal generator, fixed and dc power supplies, logic probes ,IC testers etc.

UNIT 3 Installation of different electronic equipment (30 hrs)

Most of the installations can be demonstrated either practically, through industrial visit or through video resources available on the internet.

3.1 Study of installation of CCTV equipment.

3.2 Study of installation of DTH receiver/set top box and satellite dish antenna.

3.3 Study of installation of computer LAN network .

3.4 Study of installation of solar power plant(domestic or commercial).

3.5 Study of installation of IFPDs (interactive flat panel device), smart classrooms, digital and audio podiums.

3.6 Study of installation of public address system .

3.7 Study of installation of audio system in a conference setting.

3.8 Study of installation of video conferencing system.

3.9 Study of installation of home automation system.

3.10 Study of installation of fire alarms, gas leakage alarms, burglar alarms.

More studies can be added by the teacher as per his choice so as to expose a student to the ubiquitous world of Electronics.

UNIT 4 Repair and Maintenance of Electronic equipment/gadgets (14 hrs)

1. Fault finding and repair of simple household gadgets like electric iron, electric kettle, electric geyser, electric heaters , electric rice cookers/milk boilers, electric fans, electric water pumps ,mixers cum grinders etc.
2. Fault finding and repair of simple electronics circuits like power supply, timer circuit ,op-amp circuit, amplifier circuit, oscillator circuit etc.

3. Demonstration of repair and maintenance using learning resources/videos/practical demonstrations of electronic systems covered in chapter 3.

COURSE OUTCOME:

At the end of the course, the participant shall be able to identify the fault, repair &carry out the installation and maintenance of simple electronic products.

THREE YEAR DIPLOMA

PROGRAMME

IN

FOOD

TECHNOLOGY

(FOURTH SEMESTER)

S.No	Code	Subjects	Th Hr	Tut Hr	Pr Hr	Total Hr	Cr Th	Cr Tut	Cr Pr	Total CR
1	FTPC-401	Dairy Technology -II	2	0	0	2	2	0	0	2
2	FTPC-402	Dairy Technology –II-Lab	0	0	2	2	0	0	1	1
3	FTPC-403	Technology Of FoodBeverages	2	0	0	2	2	0	0	2
4	FTPC-404	Technology Of FoodBeverage – Lab	0	0	2	2	0	0	1	1
5	FTES-405	Principles Of Food Engineering	2	0	0	2	2	0	0	2
6	FTES-406	Principles Of Food Engineering-Lab	0	0	2	2	0	0	1	1
7	FTOE-407	Open Elective-II	2	0	0	2	2	0	0	2
8	FTPC-408	Health & Functional Foods	2	0	0	2	2	0	0	2
9	FTPC-409	Health & Functional Foods-Lab	0	0	2	2	0	0	1	1
10	FTSI-410	Internship/ IndustrialTraining	0	0	4	4	0	0	2	2
11	FTPC-411	Food Additives	2	0	0	2	2	0	0	2
12	FTPC-412	Food Additives –Lab	0	0	2	2	0	0	1	1
13	FTPC-413	Food Biochemistry	2	0	0	2	2	0	0	2
14	FTPC-414	Food Biochemistry- Lab	0	0	2	2	0	0	1	1
		TOTAL	**14**	**0**	**16**	**28**	**14**	**0**	**8**	**22**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code**: FTPC-401**	Course Title: **Dairy Technology-II**
Semester:**4th**	Credits:**2**
Hours Per Week:**2(L: 2, T: 0,P: 0)**	

COURSE OBJECTIVE:

This subject is aimed at developing an understanding of various process technologies and handling of equipment used in the processing and value addition of milk and milk products to the students.

COURSE CONTENT

1. **Coagulated Milk Products**
   Channa, Paneer, classification and manufacturing process of cheese.
2. **Cream/Butter/Ghee**
   Manufacture and storage of butter and ghee.
3. **Condensed Milk**
   Types and factors affecting the quality of condensed milk, storage of condensed milk
4. **Frozen Products**
   Manufacturing of ice creams; factors affecting the quality of frozen products.
5. **Dry milk products**
   Drying methods of milk (spray and drum drying), Factors affecting the quality of dry milk. Packaging of dry milk products. Concept of Instantization.
6. **Cleaning and sanitation**
   Cleaning and sanitation of dairy plant and equipments.
7. **Traditional milk products manufacturing.**
   kh
8. by- product utilization of milk processing industry (Skim milk, butter milk, casein and whey)

COURSE OUTCOME

After the completion of the course the student will beable:

- Prepare and analyse the manufacturing process of coagulated milk products
- Prepare and analyse the manufacturing process of butter and ghee and cream
- Prepare and analyse the manufacturing process of condensed milk
- Prepare and analyse the manufacturing process of ice cream
- Gain knowledge about drying of milk
- Gain knowledge about cleaning and sanitation of dairy plant and equipments
- Prepare and analyse the manufacturing process of traditional milk products
- Gain knowledge about by-product utilization of milk processing industry

INSTRUCTIONAL STRATEGY

This being one of the most important subjects, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National, BIS and international standards. Visits to the relevant industry for demonstrating various operations involved in the dairy technology, is a must. Experts from the industry may be invited to deliver lectures on the latest technology. Knowledge about pollution control and devices for the same may

be provided to the students. Wherever relevant, students may be made aware about safety aspects.

RECOMMENDED BOOKS:

1. Milk and Milk Products by Eckles and Eckles, Tata McGraw-Hill Education Pvt. Limited;
2. Outlines of Dairy Technology by Sukmar De, Oxford University Press, India
3. Dairy Plant System and Layout by Tufail Ashmed, McGraw-Hill Education (India) Pvt Ltd
4. Principles of Dairy Technology by Woarner, Oxford University Press, India
5. Dairy Engineering by Forvall.
6. Milk & Milk Products by CBSE, Oxford and IBH Publishing Co., New Delhi.
7. Chemistry & Testing of Dairy Products by Atherton Newlander, John Alvin Newlander Publisher: Westport

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	1	2
2	5	16
3	5	16
4	5	16
5	5	16
6	5	16
7	4	12
8	2	6
Total	**32**	**100**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY

Course Code:**FTPC-402**	Course Title: **Dairy Technology-II Lab**
Semester:**4th**	Credits:**01**
Hours Per Week:**2(L:0,T:0,P:2)**	

COURSE OBJECTIVE:

This subject is aimed at developing an understanding of various process technologies and handling of equipment used in the processing and value addition of milk and milk products in the students

LIST OF PRACTICALS:

1. Preparation of ice cream.
2. Preparation of Khoa.
3. Preparation of channa and paneer.
4. Preparation of condensed milk
5. Preparation of Ghee.
6. Preparation of butter.
7. Visits to different dairy plants.
8. Quality evaluation of dairy products.

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code:**FTPC-403**	Course Title: **Technology Of Food Beverages**
Semester:**4th**	Credits:**02**
Hours Per Week: **2(L: 2 T: 0 P: 0)**	

COURSE OBJECTIVE:

Non-alcoholic industries are one of the fast growing industries in India. Therefore, this subject is introduced with the basic objective to Impart knowledge and skills of process techniques and equipment used for the production of these beverages, to the students.

COURSE CONTENT

1. **Introduction**
   Definition, scope and status of beverage industry in India

2. **Water:** -
   Sources, quality, treatment.

3. Ingredients of food beverages; sweeteners, emulsifiers, colouring agents, flavouring agents, stabilizers, water and their quality.
4. Processing of carbonated beverages (cold drinks)
5. Processing of non-carbonated beverages (coffee, tea, synthetic beverages).

6. Preparation and processing of Juice, squash, cordiale, sharbat, fruit drinks.

COURSE OUTCOME

After the completion of the course the student will be able:

- Develop a clear understanding of the beverage industry in India, including its definition, scope, and current status.
- Gain comprehensive knowledge of water sources, quality assessment, and treatment methods crucial for beverage production.
- Acquire in-depth insights into the various ingredients used in food beverages, including sweeteners, emulsifiers, colouring agents, flavouring agents, stabilizers, and water. Understand the quality standards associated with each ingredient.
- Master the processing techniques for carbonated beverages (cold drinks) and non-carbonated beverages such as coffee, tea, and synthetic beverages.
- Demonstrate proficiency in the preparation and processing of a variety of beverages, including juices, squashes, cordials, sharbats, and fruit drinks, understanding the nuances involved in each category.

INSTRUCTIONAL STRATEGY

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Suitable tutorial exercises may be designed by the teachers, which require students visit to various industries. Students may also be exposed to various National and international standards. Visits to the relevant industry for demonstrating various operations involved in the food beverage, is a must. Experts from the industry may be invited to deliver lectures on

the latest technology. Knowledge from pollution control and devices for the same may be provided to the students. Wherever relevant, students may be made aware about safety aspects.

RECOMMENDED BOOKS:

1. Technology of Carbonated Beverage AVI Publications
2. Formulation and Production of Carbonated Soft Drinks by AJ Mitchel (Blackie Publishers)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	2	08
2	4	12
3	4	12
4	8	24
5	8	24
6	6	20
Total	**32**	**100**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code: **FTPC-404**	Course Title: **Technology Of Food Beverages - Lab**
Semester**:4th**	Credits:**01**
Hours Per Week: **2(L: 0 T: 0 P:2)**	

COURSE OBJECTIVE:

Non-alcoholic industries are one of the fast growing industries in India. Therefore, this subject is introduced with the basic objective to impart knowledge and skills of process techniques and equipment used for the production of these beverages, to the students

LIST OF PRACTICALS:

1. Preparation of concentrate juices
2. Preparation of instant coffee.
3. Processing of apple, lemon, mango, watermelon juices
4. Preparation of Ready to serve beverages (RTS beverages)
5. Preparation of squash.
6. Determination of water quality parameters; hardness, pH, turbidity, E-coli Test, DO, BOD, COD
7. Preparation of flavored milk.
8. Preparation of soy- based beverages
9. Visit to beverage industry

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code: **FTPC-405**	Course Title: **Principles Of Food Engineering**
Semester:**4th**	Credits:**02**
Hours Per Week:**2(L: 2, T: 0,P: 0)**	

COURSE OBJECTIVE:

This subject is aimed to develop in the students the knowledge and skills related to various operations of process equipment used in food processing industry

COURSE CONTENT

1. **Introduction**:
   Units of measurement and their conversion ,Physical properties like colour, size, shape, density, specific gravity, thousand grain weight/bulk density, porosity, Rheological properties of food materials and their importance , Thermal conductivity, specific heat, thermal diffusivity and other physical properties of foods

2. **Materials and energy Balance: -**
   Basic principles, total mass & component mass balance, system boundaries

3. **Fluid Mechanics:**
   Manometers, Reynolds number, fluid flow characteristics, pumps – principles, types, and working of most common pumps used in food industry

4. **Heat and Mass Transfer during food processing:-**
   Modes of heat transfer i.e. conduction, convection and radiation. Different heat exchangers. Principle of mass transfer, diffusion.

5. **Thermal Processing of Foods:**
   Selection, operation and periodical maintenance of equipments used in food industry viz. pasteurizer, autoclave, heat exchangers, evaporators, driers, boilers.

COURSE OUTCOME

After the completion of the course the student will be able:

- Master units of measurement, conversion, and understand key physical properties of food materials such as color, size, density, and rheological properties.
- Apply material and energy balance principles, including total mass and component mass balance, in food processing, establishing clear system boundaries.
- Grasp fluid mechanics concepts, including manometers, Reynolds number, and the principles of common pumps used in the food industry.
- Understand heat and mass transfer during food processing, covering conduction, convection, radiation, and principles of mass transfer, including diffusion. Gain familiarity with different heat exchangers.
- Acquire practical knowledge in thermal processing of foods, including equipment selection, operation, and periodic maintenance of pasteurizers, autoclaves, heat exchangers, evaporators, driers, and boilers used in the food industry.

INSTRUCTIONAL STRATEGY

This being one of the most basic subjects for the students of food technology, the teachers should lay a lot of emphasis on explaining the facts, concepts, principles and procedures involved in various topics. The students should be given appropriate tutorial exercises. Teachers should made use of chart and other appropriate media to support classroom instruction. Emphasis during the practical session should be on performance by individual students and teacher should develop instructional manual for various exercises to facilitate the students. Visits to some of the local industries may be arranged to demonstrate various equipment used in food processing Industries and cold stores to the students. Experts may be invited to deliver lecturers on latest developments in the field.

RECOMMENDED BOOKS:

1. Post Harvest Technology of Cereal, Pulse and Oil Seeds by Chakraborty, AC, CBS Publishers, Delhi
2. Unit Operations in Agriculture Processing by Singh and Sahay, Vikas Publishing House (P) Ltd, New Delhi
3. Fundamentals of Food Engineering by Brennen, AVI Publishing Co., Westport
4. Fundamentals of Food Processing Engineering by Romeo T Toledo, AVI Publishing Co., Westport
5. Agricultural Process Engineering by Henderson and Perry, John Wiley and Sons, Inc., New York
6. Transfer Processes and Unit Operation by CJ GeanKoplis, McGraw-Hill Book Co., New York.
7. Physical Properties of Plants and Animal Materials by NK Mohsenin, Gordon and Breach Science Publishers, New York, USA
8. Principles of Food Engineering by TE Charm, McGraw-Hill Book Co., New York.
9. Introduction to Food Engineering by Singh RP and DR Heldmann, McGraw Hill Book Co., New York.
10. Unit Observation in Chemical Engineering by McCabe, Smith and others, McMillan publishing compony, Newyor
11. Unit Operation in Food Processing by Earlle, oodhead Publishing Limited, Cambridge, England

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	8	28
2	6	18
3	6	18
4	6	18
5	6	18
Total	**32**	**100**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code:**FTPC-406**	Course Title: **Principles Of Food Engineering- Lab**
Semester:**4th**	Credits:**01**
Hours Per Week:**2(L: 0, T: 0,P:2)**	

COURSE OBJECTIVE:

This subject is aimed to develop in the students the knowledge and skills related to various operations of process equipment used in food processing industry.

LIST OF PRACTICALS:

1. Determination of physical properties like size, shape, roundness, sphericity of the food products.
2. Determination of angle of repose of grains
3. Demonstration of thermal processing equipment a) Pasteurizer b) Heat Exchanger c) Evaporator d) Drier
4. Constructional and working details of different types of a) Pumps for liquid transportation b) Blower and fan for transportation for gases/air
5. Determination of viscosity, Specific gravity and density of foods

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN FOOD TECHNOLOGY	
Course Code: **FTOE-407**	Course Title: Renewable Energy Technologies(**Open Elective-II**)
Semester: **4th**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P:0)**	

COURSE OBJECTIVE:

This course aims to provide a comprehensive understanding of the energy scenario, encompassing various sources and their utilization. It explores society's current needs and anticipates future energy demands, delving into the principles of renewable energy conversion systems and exposing students to energy conservation methods.

COURSE CONTENT:

Unit-1 Introduction

Principles of renewable energy; energy and sustainable development, fundamentals and social implications worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

Unit -2 Solar Energy:

Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar Pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system

Unit-3

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

Unit- 4

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC.

Unit - 5

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy

COURSE OUTCOME:

At the end of the course the student will be able to:

- Understand global renewable energy principles and availability.
- Gain knowledge of solar energy, including radiation estimation and photovoltaic power.
- Explore wind energy components, turbine classification, and associated challenges.
- Acquire insights into biomass energy and its conversion technologies.
- Learn about tidal power, ocean thermal energy, and green energy concepts, including fuel cells and hydrogen applications.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	20
2	6	20
3	7	20
4	7	20
5	6	20
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA IN FOOD TECHNOLOGY	
Course Code: **FTOE-407**	Course Title: **Introduction to E-Governance(Open Elective-II)**
Semester: **4th**	Credits:**2**
Periods Per Week: **2(L:2, T:0, P:0)**	

COURSE OBJECTIVE:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency. To develop the basic understanding on the topic of E-Governance and learn the fundamentals involved in the subject.

COURSE CONTENT:

1. **Introduction:**
   - 1.1. Definition,
   - 1.2. Needs of E-Governance,
   - 1.3. Evolution of E-Governance,
   - 1.4. Its scope and content,
   - 1.5. Basic Structure of e- Governance,
   - 1.6. Advantages of e-governance

2. **E-governance approaches in India-The National e-Governance plan:**
   - 2.1. Introduction to NeGP (National e-Governance Plan)
   - 2.2. NeGP Vision
   - 2.3. The framework for e-Governance
   - 2.4. Infrastructure pillars of NeGP
   - 2.5. Capacity Building initiatives under NeGP

3. **E-Governance Project Development And Management**
   - 3.1. Introduction to e-Government Project Development
   - 3.2. Conceptualization Phase
   - 3.3. Architect Phase, Define Phase, Support Phase
   - 3.4. e-Government Project Management Phase.
   - 3.5. Public Private Partnership for e-Government.

4. **Government Process Re-Engineering**
   - 4.1. Process Reforms for e-Governance Projects,
   - 4.2. Tools and techniques for Government Process Re-engineering,
   - 4.3. Legal Reforms
   - 4.4. Technology Management and Enterprise Architecture for e-Governance,

5. **Capacity Building and change Management:**
   - 5.1. Capacity Building for e-Governance,
   - 5.2. Focusing on Indian initiatives and their impact on citizens
   - 5.3. Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context.
   - 5.4. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc)

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Understand e-Governance basics, its evolution, and recognize its advantages.
- Learn about India's National e-Governance Plan (NeGP), covering its vision, framework, infrastructure, and capacity-building initiatives.
- Gain proficiency in e-Government project development, management, and understand the role of Public Private Partnerships (PPP).
- Explore Government Process Re-engineering (GPR) principles for e-Governance projects, including process reforms, tools, legal considerations, and technology management.
- Grasp key aspects of capacity building and change management in e-Governance, with a focus on Indian initiatives, citizen impact, case studies, and practical site visits.

RECOMMENDED BOOKS:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning,2012.
2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
3. C.S.R.Prabhu : E-Governance: Concepts and Case Studies, Prentice Hall of India Pvt. Limited (2004).
4. Implementing and managing e-Government, Richard Heeks, 2006.
5. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time Allotted(Hrs)	Marks Allotted(%)
1	08	25
2	06	20
3	08	20
4	05	15
5	05	20
Total	**32**	**100**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOODTECHNOLOGY	
Course Code: **FTPC-408**	Course Title: **Health & Functional Foods**
Semester:**4TH**	Credits:**02**
Hours per Week: **2(L: 2, T: 0P: 0)**	

COURSE OBJECTIVE:

Health and functional foods are comparatively new concepts in the food industry. Some of the students may find employment in the industries engaged in processing of health and functional food. Understanding of different aspects related to health and function foods is essential to these diploma holders. Hence this subject is included in the curriculum.

COURSE CONTENT

1. **Introduction**
   Definition, Types of functional foods and their properties.
2. Definition types and importance of nutraceuticals.
3. **Various food constituents responsible for functional effects**
   3.1 Anti-carcinogenic, hypo-cholesterolemic and hypoglycemic foods
   3.2 Anti-oxidants
   3.3 probiotic foods, prebiotics
   3.4 High protein and high calorie foods and low calorie foods
   3.5 Artificial sweetness –
4. Importance and role of fibre in-Diabetes, Hypercholesterolemia, constipation and obesity.
5. Fortification and enrichment, definition and importance, fortified foods-salts, Atta and oil
6. **Advances in beverage sector;**
   Cereal based beverages, energy drinks, fortified beverages, soy based beverages

COURSE OUTCOME

After completion of course, the student will be able to:

- Understand functional foods, their types, and properties.
- Comprehend the definition, types, and importance of nutraceuticals.
- Gain knowledge of food constituents with functional effects, including anti-carcinogenic, hypo-cholesterolemic, and hypoglycemic foods, antioxidants, probiotic foods, prebiotics, and high/low-calorie foods.
- Recognize the significance of fiber in addressing conditions like diabetes, hypercholesterolemia, constipation, and obesity. Explore fortification and enrichment concepts, focusing on fortified foods (salts, atta, oil), and advancements in the beverage sector (cereal-based beverages, energy drinks, fortified beverages, soy-based beverages).

INSTRUCTIONAL STRATEGY

Experts from the industry may be invited to deliver lectures on various relevant themes. Students may be taken to industry to demonstrate processing of health and functional foods. Students should be given a thorough understanding about national, BIS and international standards related to health and functional foods.

RECOMMENDED BOOKS:

1. Geissler (2005) powers; Human Nutrition
2. Krause food, Nutrition and diet therapy (latest edition)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	5	15
2	5	15
3	5	15
4	7	21
5	5	15
6	5	15
Total	**32**	**100**

PROGRAM:THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code:**FTPC-409**	Course Title: **Health & Functional Foods Lab**
Semester:**4th**	Credits:**01**
Hours Per Week**: 2(L: 0, T: 0P: 2)**	

COURSE OBJECTIVE:

Health and functional foods are comparatively new concepts in the food industry. Some of the students may find employment in the industries engaged in processing of health and functional food. Understanding of different aspects related to health and function foods is essential to these diploma holders. Hence this subject is included in the curriculum.

LIST OF PRACTICALS:

1. Preparation of high fibre bread.
2. Preparation of high fibre biscuits.
3. Preparation of high fibre cake.
4. Preparation of cereal based beverages.
5. Preparation of soy based beverages.
6. Preparation of fortified beverages
7. Preparation of probiotic foods.
8. Preparation of fermented beverages (kanji, kefir).

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code :**FTPC-410**	Course Title: **Internship/ Industrial Training**
Semester : **4th**	Credits: **02**
Hours Per Week: **4 (L: 0 T: 0 P:4)**	

COURSE OBJECTIVE:

To provide students with a practical exposure of food industries so as to enable them to visualize the concepts learned and prepare them for the field.

- To learn about the operation and functioning of food industries. The Internship is to be completed in four phases as:
- Incubation in department
- Local industry
- Outside state industry
- Eminent Institutions

COURSE OUTCOME

Apply the expertise gained during the internship to deliver and demonstrate better skills

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code : **FTPC-411**	Course Title : **Food Additives**
Semester **: 4TH**	Credits: **2**
Hours Per Week:**2 (L:2,T:0 ,P: 0)**	

COURSE OBJECTIVE:

To develop the understanding of additives used in food products and the benefits thereof.

COURSE CONTENT

1. **Food additives-**
   Definitions, classification and functions, Nutritional and non-nutritional food additives. Naturally occurring food additives -vitamins, minerals and amino acids.
2. Preservatives, antioxidants, flavours (synthetic and natural), emulsifiers: and its role in emulsion, stabilization Stabilizers and their role, sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, ant caking agents, leavening agents, flour improvers, bleaching and antimicrobial agents, antioxidants, non-nutritional sweeteners. Etc.-chemistry, food uses and functions in formulations; indirect food additives; Codex Standards.
3. **Colours**
   Natural and synthetic, stability and applications, permitted colours. Flavours.
4. **Spices**
   Definition chemical composition ,uses and processing od different spices, pepper, cinnamon, turmeric fennel, chillies, cardamom, cumin, mint ginger cloves and fenugreek

COURSE OUTCOME

After completion of course, the student will be able to:

- Grasp the basics of food additives, including definitions, classification, and functions, covering both nutritional and non-nutritional additives.
- Understand the chemistry, uses, and functions of various additives like preservatives, antioxidants, flavors, emulsifiers, stabilizers, and sweeteners, adhering to Codex Standards.
- Explore the types, stability, and applications of natural and synthetic colors in foods, along with regulations on permitted colors.
- Acquire knowledge on spices, including definitions, uses, and processing of key spices such as pepper, cinnamon, turmeric, fennel, chilies, cardamom, cumin, mint, ginger, cloves, and fenugreek.

RECOMMENDED BOOKS:

1. Branen AL, Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed.Marcel Dekker.
2. Gerorge AB. 1996. Encyclopedia of Food and Color Additives. Vol. III.CRC Press.
3. Purseglove, j.w(1998). Spices vol.1 and 2, long man publicationers
4. Merory, j.(1978). Food flavourings, composition, manufacture and use,2 edition, ABI Publishing ,inc

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	18
2	10	32
3	8	25
4	8	25
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code : **FTPC-412**	Course Title : **Food Additives –lab**
Semester : **4th**	Credits: **01**
Hours Per Week:**2 (L:0,T:0,P: 2)**	

COURSE OBJECTIVE:

To develop the understanding of additives used in food products and the benefits thereof.

LIST OF PRACTICALS:

1. Determination of moisture in whole and ground spices
2. Determination of total Ash in spices.
3. Adultration tests for different spices.
4. Organoleptic evaluation of flavours.
5. Microscopic examination of spices.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code : **FTPC-413**	Course Title : **Food Bio-Chemistry**
Semester : **4th**	Credits: **2**
Hours Per Week:**2 (L:2,T:0,P: 0)**	

COURSE OBJECTIVE:

To develop the understanding about enzymes and their role in foods, digestion and food processing .

COURSE CONTENT

1. **Unit-I**
   Nomenclature, classification and specificity of enzymes and co factors. Enzyme kinetics. Factors affecting the rate of enzyme catalysed reactions , regulation and control of enzyme action.
2. **Unit-II**
   Metabolic path ways: carbohydrates , proteins and fats, catabolism and anabolism.
3. **Unit-III**
   Digestion, absorption, assimilation and transport of nutrients in human beings.
4. **Unit-IV**
   Post Harvest and post mortem biochemical changes in foods. Changes in composition, color, texture, flavour and its implications on quality of foods.
5. **Unit-V**
   Application of enzymes in food processing .Endogenous enzymes and their role in modification of foods, enzyme added to foods during processing, sources conversions and specific applications.

COURSE OUTCOME

- Master the nomenclature, classification, and specificity of enzymes and co-factors, understanding enzyme kinetics, and factors influencing the rate of enzyme-catalyzed reactions. Gain insights into the regulation and control of enzyme action.
- Understand metabolic pathways involving carbohydrates, proteins, and fats, comprehending both catabolism and anabolism.
- Acquire knowledge about digestion, absorption, assimilation, and nutrient transport in human beings.
- Grasp the post-harvest and post-mortem biochemical changes in foods, including alterations in composition, color, texture, flavor, and their implications for food quality.
- Explore the application of enzymes in food processing, including the role of endogenous enzymes in modifying foods, the addition of enzymes during processing, and their specific applications.

RECOMMENDED BOOKS:

1. a.l.lehninger, principles of biochemistry
2. lubertstryen biochemistry
3. fennema or 1996 food chemistry . marcel dekker
4. meyer. lh.1987.food chemistry. cbs publishers
5. sajoshi nutrition and dietetics
6. j.h.well.general biochemistry

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	24
2	5	16
3	5	16
4	7	22
5	7	22
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN FOOD TECHNOLOGY	
Course Code : **FTPC-414**	Course Title : **Food Bio-Chemistry-Lab**
Semester : **4TH**	Credits:0**1**
Hours Per Week:**2 (L:0,T:0,P: 2)**	

COURSE OBJECTIVE:

To develop the understanding about enzymes and their role in foods, digestion and food processing.

LIST OF PRACTICALS

1. Determination of enzyme activity and specific activity(enzyme assay)
2. Determination of temperature on enzyme activity
3. Determination of ph on enzyme activity
4. Estimation of enzymatic browning.
5. Detection of peroxidise activity.
6. Application of enzymes in various foods

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
GARMENT TECHNOLOGY

STUDY SCHEMEFOURTH SEMESTER

S.No	Code No.	Subjects	Study Scheme Hrs/Week			Credits (C)		Total Credits
			L	T	P	L	p	L+P+T
4.4	GTPC401	Apparel Production Management	4	-	-	4	-	4
4.1	GTPC402	Garment Design-II	-	1	4	-	2	3
4.2	GTPC403	Pattern Making	-	1	4	-	2	3
4.3	GTPC404	Garment Construction-IV	-	-	6	-	3	3
4.5	GTPC405	CAD in Garment Technology-II	-	1	4	-	2	3
4.6	GTPC406	Finishing and Packaging	3	-	-	3	-	3
4.7	GTPC407	Finishing and Packaging-Lab	-	-	2	-	1	1
		TOTAL	7	3	20	7	10	20

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC401**	Course Title : **APPAREL PRODUCTION MANAGEMENT**
Semester: **4TH**	Credits : **4**
Periods per week: **4(L: 4 T: 0 P: 0)**	

Course Objective:

Diploma holders in garment technology are required to assist for controlling production and quality of the garments on the shop floor. They are also required to supervise erection, installation and maintenance of equipment including material handling and undertake work-study for better utilization of resources. They are also required to lead a team of workers and motivate them towards realization of organizational objectives

COURSE CONTENT:

Unit 1 **Introduction to Basic Production Terms**
Production, productivity, work in process, time study, motion study, work study, ergonomics

Unit2 Stitches – Definition, properties, types and application
Seams - Definition, properties, types and application

Unit 3 **Pre-Production Planning**
a) Types of production processes, job, batch and mass production
b) Raw material planning and allocation
c) Process planning and process sheet
d) Methods of production control

Unit 4 Types of Production System

Unit 5 **Plant Layout and Material Handling**
a) Concept of plant layout
b) Types of layout (process, product and combination type) and their characteristics
c) Factors affecting plant layout
d) Methods of plant layout
e) Workstation design: Factors considered in designing a work station

Unit 6 Material Handling
a) Introduction and functions of material handling
b) Material handling equipment – their selection
c) Safety requirements while using material handling equipment

COURSE OUTCOME:
By the end of this course, students will be able to:

- Understand and apply basic production terminology, including concepts of production, productivity, work in process, time study, motion study, work study, and ergonomics.
- Define and differentiate various types of stitches, seams, and their properties, enabling them to make informed decisions about stitching techniques in different applications.
- Demonstrate proficiency in pre-production planning, encompassing knowledge of different production processes (job, batch, and mass production), raw material planning, allocation, process planning, process sheets, and methods of production control.
- Identify and comprehend different types of production systems, gaining insight into their characteristics and applications in various industrial contexts.
- Analyze and evaluate plant layout concepts, including an understanding of process, product, and combination type layouts, factors influencing plant layout, methods of layout design, and considerations for designing efficient workstations.
- Describe the importance of material handling, its functions, and the selection of appropriate material handling equipment, while also emphasizing safety requirements associated with the use of such equipment in a production environment.

RECOMMENDED BOOKS:

1. Managing Quality by SK Bhardwaj and PV Mehta; New Age Publisher, Delhi
2. Productivity by Rajesh Bheda, CBS Publishers, New Delhi
3. ISO 9000 –Textile Committee Manual

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	12	15
3	12	15
4	10	20
5	10	15
6	10	15
TOTAL	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC402**	Course Title : **GARMENT DESIGN-II**
Semester: **4TH**	Credits : **3**
Periods per week: **5(L: 0T: 1 P: 4)**	

Course Objective:

The students should be able to design garments for different age groups, and occasions with proper selection of fabrics textures with latest trends. After going through this subject, the students will be able to design garments appropriately to customer's satisfaction and need.

COURSE CONTENT:

Unit 1 **Sketch a 10 ½ head fashion figure of:**
Sari Blouse with all accessories (formal/casual) (2 sketches)

Unit 2 **Sketch a fashion figure of:**
Kameez and shalwar (formal/casual) (2 sketches)

Unit 3 Flat sketch of
a) Kali- Kurta with Churidar pyjama(formal/casual)(2 sketches)
b) Pheran- Kashmiri (formal/casual)(2 sketches)

Unit 4 Practice on different embroidery designs (Indian/Kashmiri Design)

Unit 5 Sketch a top with palazzo in different styles on a fashion figure (Casual/ Formal) (2 Sketches)

NOTE: - Make a separate drawing file for presentation

INSTRUCTIONAL STRATEGY:

The students should be encouraged to visit fashion shows, fairs and exhibitions so that they are aware of the latest trends in garment design and prepare a file

RECOMMENDED BOOKS

1. Fashion Drawing Designs; Magazine of Thailand, New Age Publisher, Delhi
2. Pattern Designs for Haute Couture Volume – I, New Age Publisher, Delhi
3. Fashion Drawing – The Basic Principles by Anne Allen and Julion Seaman, Haper and Row
4. Publishers, New York
5. Latest Fashion Style by Winter Hiver, New Age Publisher, Delhi

6. Jasmine's "New Look, On Indian Fashion Scene", Haper and Row Publishers, New York
7. Lifestyles: Fashion Styles by Katheryn Samuel, McGraw Hill Book Co. Inc. New York.

SUGGESTED DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	13	15
2	12	15
3	13	25
4	14	25
5	12	20
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code :**GTPC403**	Course Title : **PATTERN MAKING**
Semester :4TH	Credits: **3**
Periods per week: **5 (L: 0 T: 1 P: 4)**	

COURSE OBJECTIVES:

The students are supposed to know how to adapt basic blocks to various garment designs, and layouts. Thus the subject deals with variations of pattern and styling of garments. After going through this subject, the students will be able to draft various components of the garments and express design ideas by a three dimensional process of pattern making.

COURSE CONTENT:

Unit1 Designing andAdaptation of skirt variations (Adult wear)

Unit 2 Design, draft and adapt a top with skirt(Special feature:-collar, yoke to both torsos)

Unit 3 Design, Draft and adapt an adult Midi knee Length Dress (Special features: - Gathers, tucks,with different sleeve variation)

Unit 4 Design, Draft and adapt a one –Piece Princess Line dress (adult wear)

Unit 5 Design, draft and adapt Kameez with shalwar

Unit 6 Design, Draft and adapt a Dangree (Special features:-Pleats, Pockets and yokes)(Adult wear)

NOTE: Make an Industrial Pattern and consumption of:

a) Top and skirt
b) Dangree

RECOMMENDED BOOKS

1. Fashion Drawing Designs; Magazine of Thailand
2. Pattern Designs for Haute Couture Volume – I
3. Fashion Drawing – The Basic Principles by Anne Allen and Julion Seaman
4. Latest Fashion Style by Winter Hiver
5. Jasmine's "New Look, On Indian Fashion Scene"
6. Lifestyles: Fashion Styles by Katheryn Samuel
7. Spring and Summer Collection; Tokyo, New York
8. Draping for Fashion Design by Jaffe, Hilde
9. Fashion from Concept to Consumer by Stephens

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	10	15
3	10	15
4	12	20
5	10	15
6	10	15
TOTAL	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC404**	Course Title : **GARMENT CONSTRUCTION-IV**
Semester :**4TH**	Credits: **3**
Periods per week: **6 (L: 0 T: 0 P: 6)**	

COURSE OBJECTIVE:

The diploma holders in garment technology are supposed to fabricate the garments as per the layouts and specifications. Hence this subject has been included in the curriculum in order to develop such competencies.

COURSE CONTENT

Unit1 Fabricationof skirt variations (Adult wear)(2 Nos)

Unit 2 Construction of a top with skirt(Special feature:-collar, yoke to both torsos)

Unit 3 Fabrication of an adult Midi knee Length Dress (Special features: -Gathers,tucks, with different sleeve variation)

Unit 4 Fabrication of a one –Piece Princess Line dress (adult wear)

Unit 5 Fabricate a Kameez with shalwar

Unit 6 Fabrication of a Dangree (Special features:-Pleats, Pockets and yokes)(Adult wear)

RECOMMENDED BOOKS

1. Pattern Making for Fashion design by Amstrong, Vikas Publishing House Pvt. Ltd. Delhi
2. Clothing Construction by Doongaji, Raj Parkashan, Delhi.
3. System of Cutting by Zarapkar, Navneet Publications
4. Clothing Construction by Evelyn A Mansfield, Hougutan Miffin Co., Boston
5. Creative Sewing by Allynie Bane; McGraw Hill Book Co., Inc., New York
6. How You Look and Dress by Byrta Carson; McGraw Hill Book Co., Inc., New York

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	20
2	16	15
3	16	15
4	16	20
5	16	15
6	16	15
TOTAL	**96**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC405**	Course Title : **CAD IN GARMENT TECHNOLOGY-II**
Semester: **4TH**	Credits : **3**
Periods per week: **5(L: 0 T: 1 P:4)**	

COURSE OBJECTIVE:

The term CAD has found its way into all major disciplines that have got anything to do with designing or drafting techniques. The objective of the subject is to expose professionals and to meet the needs of the users by complementing their knowledge, skills and ability, creativity in the field of garment technology and their application in the industry.

COURSE CONTENT:

Unit 1 Introduction to Corel Draw and Adobe Photoshop

Unit 2 Draw 3 profiles of female flesh figures (front, back and side view)

Unit 3 Design an executive wear along with accessories

Unit 4 Pick up a costume worn by a famous fashion model. Scan his/her figure and redesign the texture and the color combination of the dress

Unit 5 Design a mood/story board according to the selected theme (both paper and computer assignment

Unit 6 Logo and Labels designing

Unit 7 Create a brochure for your own label

NOTE: Visit Design Studios in Export Houses and Industry to understand the use of these Software by designers.

RECOMMENDED BOOKS

1. Literature from the supplier of each software can be consulted
2. Corel Draw 12 – BPB Publication (latest version)
3. Adobe Photoshop 5.5 - BPB Publication (latest version)

SUGGESTED DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	25
2	20	30
3	16	25
4.	12	20
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC406**	Course Title : **Finishing and Packaging**
Semester: **4th**	Credits : **3**
Periods per week:**3(L: 3 T: 0 P: 0)**	

COURSE OBJECTIVE:

The final presentation of finished product matters a lot in garment trade and hence knowledge and skill regarding this subject is essential for the students of garment technology, so that they are able to perform finishing, pressing and folding, packing and sealing processes effectively.

COURSE CONTENT:

Unit 1 Stain removal methods and the Chemicals used in removing stains.

Unit 2 Ironing factors – heat, moisture, pressure.

Unit 3 Washing and dry cleaning – methods, equipment, stone washing, specialwashing and dry cleaning methods.

Unit 4 Various kinds of fusing for different fabrics, woven, non-woven and knitted

Unit 5 Labels

Unit 6 Pressing: - Purpose, categories of pressing, – conventional and vacuum system

Unit 7 Folding – flannel method mechanical suiting size of bag/ container

Unit 8 Methods and types of Packing and sealing

Unit 9 Planning, stocking, valuation, scheduling, transportation, insurance

ASSIGNMENT FOR THE STUDENTS

Prepare a practical file on stain removal

INSTRUCTIONAL STRATEGY

The teachers are supposed to take the students for industrial visit for showing the processes of finishing, pressing and folding, packaging and sealing, so that the students are able to appreciate the importance of such activities in the trade of garments' manufacturing

COURSE OUTCOME:

By the end of this course the students will be able to:

- Understand various stain removal methods and the chemicals employed in the process.
- Comprehend the factors influencing ironing, including heat, moisture, and pressure.
- Gain knowledge about washing and dry cleaning techniques, equipment, and specialized methods.
- Acquire an understanding of different fabric fusing methods based on fabric types.
- Learn about labels, pressing techniques, folding methods, and packing principles, along with their practical applications.

RECOMMENDED BOOKS

1. Household textiles and laundry work by Durga Deolkar, Oxford & IBH Publishing Co. Delhi
2 Textile fibres and their use by Hess , Oxford & IBH Publishing Co. Delhi
Care Labels – NITTRA publications by Mehta and Bhardwaj, New Age Publishders, Delhi
3 Volume production and Quality Control (vol.I) by AJ Chitter

SUGGESTED DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	15
2	6	15
3	5	10
4	5	10
5	5	10
6	5	10
7	5	10
8	5	10
9	6	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN GARMENT TECHNOLOGY	
Course Code : **GTPC407**	Course Title : **Finishing and Packaging (Practical)**
Semester: **4th**	Credits : **1**
Periods per week:**2(L: 0 T: 0 P: 2)**	

COURSE OBJECTIVE:

The final presentation of finished product matters a lot in garment trade and hence knowledge and skill regarding this subject is essential for the students of garment technology, so that they are able to perform finishing, pressing and folding, packing and sealing processes effectively.

COURSE CONTENT:

LIST OF PRACTICALS:

1. Exercises on removal of stains – oils, colour, chemicals, blood, tea, coffee etc
2. Practice on hand washing and mechanical washing of different garments
3. Practice on fusing
4. Collection of different types of Labels
5. Exercises on the processesof Pressing
6. Exercises on the processes of Folding
7. Exercises on the processes of Packing and sealing
8. Preparation of different types of charts and practical analysis of Planning, stocking, valuation, scheduling, transportation, insurance

ASSIGNMENT FOR THE STUDENTS

Prepare a practical file on stain removal

INSTRUCTIONAL STRATEGY

The teachers are supposed to take the students for industrial visit for showing the processes of finishing, pressing and folding, packaging and sealing, so that the students are able to appreciate the importance of such activities in the trade of garments' manufacturing

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
INSTRUMENTATION
AND
CONTROL ENGINEERING

SUBJECT STUDY SCHEME
(4th SEMESTER: INSTRUMENTATION AND CONTROL ENGINEERING)

Course code	Subjects	Time in Hours				Credits		
		Theory	Tutorial	Practical	Total	Theory	Practical	Total
ES401	Electrical Machines	3	--	--	3	3	--	3
ES402	Electrical Machines Lab	--	--	2	2	--	1	1
ICPC401	Installation and Maintenance of Industrial Equipment's	--	--	4	4	--	2	2
ICPC402	Bio-Medical Instrumentation	3	--	--	3	3	--	3
ICPC403	Bio-Medical Instrumentation Lab	--	--	2	2	--	1	1
ICPC404	Process Instrumentation	3	--	--	3	3	--	3
ICPC405	Process Instrumentation Lab	--	--	2	2	--	1	1
ICPC406	Microcontroller and Embedded systems	2	1	--	3	3	--	3
ICPC407	Microcontroller and Embedded systems Lab	--	--	2	2	--	1	1
	Multidisciplinary Elective MOOC	2	--	--	2	2	--	2
MP409	Minor project	--	--	4	4	--	2	2
	UNIVERSAL HUMAN VALUES / Indian Constitution / Employability skills (Mandatory course)	--	--	1	1	--	--	--
	Total	**13**	**1**	**17**	**31**	**14**	**8**	**22**

Prior learning/Extra learning/Online learning will comprise of co-curricular activities like extension lectures on Constitution of India, etc, Games, Yoga, Human Values & Ethics, Knowledge of Indian System, Hobby Clubs e.g. Photography etc., Seminars, Declamation Contests, Educational Field Visits, NCC, NSS, Cultural Activities and Self-study etc.

Relevant MOOC courses (8 – 12 weeks)

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ES401	COURSE TITLE: ELECTRICAL MACHINES
SEMESTER: 4th	CREDITS: 3
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

Electrical machines is a subject where a student will deal with various types of electrical machines which are employed in industries, power stations, domestic and commercial appliances etc. After studying this subject, diploma holder must be competent to repair and maintain these machines and give suggestions to improve their performance. Practical aspects of the subject will make the students capable of performing various tests on the machines as per latest BIS specifications.

COURSE CONTENT

1. Transformers

1.1 Principle of operation and constructional details of single phase transformer
1.2 Voltage Regulation of a transformer (No Derivation)
1.3 Losses in a transformer
1.4 Efficiency, condition for maximum efficiency and all day efficiency
1.5 CTs and PTs (Current transformer and potential transformer)
1.6 CVT (Constant Voltage Transformer)

2. Introduction to Rotating Electrical Machines

2.1 E.M.F induced in a coil rotating in a magnetic field.
2.2 Definition of motor and generator
2.3 Basic principle of a generator and a motor
2.4 Torque due to alignment of two magnetic fields and the concept of Torque angle
2.5 Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction)

3. DC Machines

3.1 Principle of working of DC motors and DC generator, their constructional details
3.2 Function of the Commutator for motoring and generating action
3.3 Factors determining the speed of a DC motor
3.4 Different types of excitation
3.5 Starting of DC motors and starters

4. AC Motors

4.1. Revolving magnetic field produced by poly phase supply
4.1. Construction and working principle of single phase induction motor
4.1. Brief introduction about three phase induction motors, its principle of operation
4.1. Construction, Working Principle and applications of Single phase Synchronous Motor
4.1. Brief introduction about three phase Synchronous motors, its principle of operation

5. Single Phase Fractional Kilowatt Motors

5.1. Concept of micro-motors
5.2. Servo- motors: AC and DC Servo Motors
5.3. Stepper Motor: Working Principle and application

COURSE OUTCOMES

After undergoing the subject, student will be able to:

- Describe star delta 3-phase connections
- Explain phase, line voltages and current relationships in 3-phase power supply.
- Demonstrate the concept of single phase transformers
- Measure the power and power factor in 3 phase load
- Determine the efficiency of a single phase transformer
- Apply the working principle of rotating electrical machines.
- Demonstrate the working of DC, AC and single phase fractional kilowatt motors.
  CO8: Connect and run a DC shunt motor with supply through a 3 point starter.

INSTRUCTIONAL STRATEGY

A visit to a small factory (Preferably Transformer Factory) must be organised to give live exposure to students. For this the teacher should visit first to understand the assembly line-up which could be followed by a visit of the students in groups of 10-20 (depending upon the size of the factory), where the instructor can give an idea of the working of the factory without much seeking assistance of the factory staff.

RECOMMENDED BOOKS

1) Electrical Machine by SK Bhattacharya, Tata McGraw Hill Education Pvt Ltd, New Delhi
2) Electrical Machines by Nagrath and Kothari, Tata McGraw Hill Education Pvt Ltd, New Delhi
3) Experiments in Basic Electrical Engineering: by S.K. Bhattacharya, KM Rastogi: New Age International (P) Ltd. Publishers, New Delhi
4) Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar
5) Electrical Engineering by JB Gupta, SK Kataria& Sons, New Delhi
6) Electrical Machines by DR Arora, Ishan Publications, Ambala city
7) Electrical Technology Vol. - I and II B.L. Thareja, S Chand and Co. New Delhi
8) E-books/e-tools/relevant software to be used as recommended by AICTE / HSBTE / NITTTR

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	08	20
2	10	20
3	12	25
4	10	20
5	08	15
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ES402	COURSE TITLE: ELECTRICAL MACHINES LAB
SEMESTER: 4th	CREDITS: 1
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

Demonstrate various instruments use viz Ammeter, Voltmeter, Wattmeter, P.F meter etc for their identification and connecting procedure in a circuit.

1. Familiarization of electrical machines laboratory apparatus.
2. To measure power and power factors in 3 phase load by two wattmeter method.
3. Determination of transformer equivalent circuit from open circuit and short circuit test.
4. Determine regulation and efficiency of single phase transformer by direct loading.
5. To verify Faradays laws of electromagnetic induction.
6. Identify the different parts (along with function and materials) for the given single phase and three phase induction motor
7. To determine the efficiency of a single phase transformer from the data obtained through open circuit and short circuit test.
8. To measure power and power factor of a single phase induction motor.
9. To run a synchronous motor with a.c. supply and to measure speed to verify the relation N=120f/p.
10. To make connections of starting and running winding of a single phase capacitor motor and to run it with the help of DOL starter and to measure its speed.
11. To perform speed control of stepper motor.
12. Measurement of speed control of motor with tachometric feedback.

- **Note: - A few experiments will be performed through Electrical Machines Virtual Laboratory hosted by Virtual Labs, an Initiative of the Ministry of Education under the National Mission on Education through ICT.**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: ICPC401	**COURSE TITLE:INSTALLATION AND MAINTENANCE OF INDUSTRIAL EQUIPMENT**
SEMESTER: 4th	**CREDITS: 2**
PERIODS PER WEEK: 4 (L: 00,T: 00, P: 04)	

COURSE OBJECTIVE

When the students reach the industries, they will be able to install various instruments, identify the various instrumentation devices, measure the current, voltage and power, solder and desolder the components, identify and remedy the electrical faults, test and wire the instrumentation loop and recognize the use of instrumentation tools. They will also be able to select right instruments and tools for the right work.

SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS

The exercises/practical/experiments should be properly designed and implemented with an attempt to develop different types of skills leading to the achievement of the competency. Following is the list for guidance for exercises/practical/experiments

1. Study the process to setup an NABL accredited instruments calibration lab.
2. Wire instrument panel with various accessories as per instrument hook-up diagram
3. Wire the MCB, ELCB to supply electrical power to instrument panel
4. Prepare specifications for instrumentation tools, wires, cables, switches, electronic components for a given application
5. Wire electrical circuit diagram using IEEE standard symbols for one instrument panel application
6. Wire instrumentation loop as per given diagram using ISA standard symbols for one instrument panel application controlling single loop
7. Troubleshoot instrument panel wiring for various parameters and faults
8. To perform the installation of electrical earthing for industrial purpose.
9. Dismantle & assemble recorder to identify it's components
10. Install any one instrument using screw type and hang type instrument
11. Test pressure/flow /level/temperature switch
12. Assemble and demonstrate the working of electromagnet.
13. Assemble and demonstrate the working of solenoid.
14. To calibrate an Ammeter and a voltmeter.
15. To calibrate temperature measuring devices like thermocouple, RTD, thermistor etc.
16. To measure the output of piezoelectric crystal and study its characteristics.
17. To install a Solar PV cell and make its connections.
18. To install 3 phase Star-Delta starter (with automatic switch) of motor.
19. Designing of single layer PCB for a given circuit.
20. Designing of two sides PCB for a given circuit.

Note: Students have to perform at least 15 practical's.

COURSE OUTCOME
After undergoing the subject, the students will be able to:

- Learn NABL process of accreditation and starting an instrumentation calibration lab.
- Assemble various rectifier circuits.
- Troubleshoot instrumentation panel wiring.
- Install any instrument using screw and hange type instruments.
- Select right tools for right work.
- Designing and developing of PCB.
- Develop technical knowledge for different instruments.

INSTRUCTIONAL STRATEGY

Students are required to prepare and submit a laboratory report on instruction/demonstration given by teacher and workshop activities done by students as a part of team work.

RECOMMENDED BOOKS

1. Murthy, D. V. S. Transducers and Instrumentation PHI Learning 2011
2. Kalsi, H.S.Measurement Systems Mcgraw hill Publishers 2011
3. Bell, D.A.Electronic Instrumentation and Measurements PHI Learning 2010
4. Carr, Joseph J.Elements of Electronic Instrumentation and Measurements Pearson Education, 2010
5. E-books / e-tools / relevant software to be used as recommended by AICTE / HSBTE / NITTTR.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC402**	**COURSE TITLE: BIO-MEDICAL INSTRUMENTATION**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

Instrumentation has brought a new revolution in the field of medical science. An insight into human body could become possible on account of introduction of various bioinstrumentations and cure of various impossible diseases could become possible.

This course will cover various systems of the human physiology signals of biological origin obtained from these systems, biosensors, transducers, bio-electrodes used to acquire such signals, and amplifiers for measuring bio-potentials.

COURSE CONTENT

1. **Introduction**
   - 1.1 Biomedical instruments biometrics
   - 1.2 Introduction and components of man instrument system, transducers of biomedical applications.
   - 1.3 Physiological Systems
   - 1.4 Introduction of physiological system of human body, cardio vascular system, Respiratory system, nervous system

2. **Bioelectric Signals and Electrodes**
   - 2.1 Study of bio-electric potentials, resting and action potentials.
   - 2.2 Bio-electrodes, electrode- tissue interface, contact impedance,
   - 2.3 Types of electrodes (microelectrodes, skin surface electrodes & needle electrodes)

3. **Diagnostic Instruments**
   - 3.1 Brief study of- Stethoscope, Electro cardiograph (ECG) - Electro encephalograph (EEG)
     Electromyography (EMG)
   - 3.2 Pacemakers, Defibrillators, pulse oxymeter SPO2,
   - 3.3 Electro-magnetic and optical blood flow meter, Glucometer, Spirometer

4. **Imaging system**
   - 4.1 X-ray system, properties of X-ray, X-ray machine
   - 4.2 Computed Tomography (CT) scan, Magnetic resonance imaging (MRI),
   - 4.3 Ultra sonography—properties of ultrasound, basic ultra sound system

5. **Patient care and monitoring**
   - 1.1 Introduction, element of intensive care monitoring
   - 5.2 Bio-telemetry

COURSE OUTCOME

After completion of this course, the students will be able to

- Explain the working of instruments in various department & laboratories of a hospital and there by recognize their limitations.
- Understand fundamental knowledge of Bio-medical instrumentation.
- Develop knowledge in various bio-chemical signal generated by the body and their significance.
- Illustrate the fundamental concept of heart, its internal structure and flow of blood through it.

RECOMMENDED BOOKS

1. R.S.Khandpur, Biomedical Instrumentation Technology and Application,McGraw-HillProfessional,2004
2. Leslie Cromwell,Fred.J.Weibell and Erich.A.Pfeiffer."Biomedical Instrumentation and Measurement,"2nd Edition,PHI2003
3. Fundamental of Biomedical instrumentation byDr.O.N.Pandey

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	4	10
2	10	20
3	08	15
4	12	25
5	08	20
6	06	10
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC403**	**COURSE TITLE: BIO-MEDICAL INSTRUMENTATION lab**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. To operate and familiarization with
   (a) BP Apparatus/Sphygmomanometer
   (b) Electronic BP meter
2. To measure the concentration of blood sugar with Glucometer(Fasting/Random)
3. Measurement of heart rate using Stethoscope.
4. Visit to an Intensive Care Unit (ICU) of a hospital and prepare a detailed report of this visit.
5. Study of various leads for monitoring of Electro cardiogram (ECG).
6. Monitoring of Electrocardiogram (ECG) for bipolar limb leads L1, L2 and L3.
7. Monitoring of Electrocardiogram (ECG) for augmented leads a VL, a VF and a VR.
8. Monitoring of Electrocardiogram (ECG) for chest leads V1-V6.
9. Study of various leads and electrode position for electroencephalogram (EEG).
10. Study of various leads for present in different lobes.
11. Monitoring of Electroencephalogram (EEG) signal for different lobes.
12. To record the electrical parameters of the heart using ECG machine.

Note: Experiment No. 5 to 11 will be done through Virtual Biomedical Instrumentation Lab hosted by Virtual Labs, an Initiative of the Ministry of Education under the National Mission on Education through ICT.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC404**	**COURSE TITLE: PROCESS INSTRUMENTATION**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 03,T: 00, P: 00)	

COURSE OBJECTIVE

Precision measurement of process parameters such as pressure, level density, speed, temperature, flow, moisture etc. is very essential for successful running of a process Industry. Various tele-metric and manual control circuits are to be handled by technicians employed in these industries. Therefore to equip the diploma student in instrumentation and control engineering with the knowledge and skill of principles and circuitry for measurement of these parameters will be useful in world of work.

COURSE CONTENT

1. **Measurement of Flow**

   Construction and working principle of measurement with orifices, venture meter, nozzle, pitot tube, ultrasonic, vortex flow meters, turbine flow meters, electromagnetic flow meters and rotameter.

2. **Measurement of Level**
   Construction, working principle and application of float, visual, purge, resistance probes, capacitance probes, ultrasonic.

3. **Measurement of Temperature**
   Concept of temperatures measurement devices, Constructional details, working principle and application of temperature sensors-thermocouple, RTDs, bimetallic, thermistors, radiation pyrometers.

4. **Measurement of Pressure**
   Concept of absolute, gauge and differential pressure. Construction, working principle and application of pressure sensors-Bourden tube, bellows, diaphragm, capsules, manometers, pirani gauge, dead weight tester.

5. **Measurement of density, pH, humidity, moisture and viscosity**.

COURSE OUTCOME

After completion of the course, the students should be able to:

- Enabling the students to acquire knowledge about various Pressure measuring instruments.
- Understanding the concept and working of Level Measurement in instrumentation and control.
- Enable the student to get familiarized with working of flow measurement systems.

- Enable the student to get familiarized with working of temperature measurement systems.
- Describe the basics of Moisture and Density Measurement Systems.
- Understand the working and installation of Instrumentation system.

RECOMMENDED BOOKS

1. Industrial Instrumentation by Donald Peckman
2. Industrial Instrumentation and Control by S K Singh

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	12	25
2	08	15
3	10	20
4	10	20
5	08	20
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC405**	**COURSE TITLE: PROCESS INSTRUMENTATION LAB**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 00,T: 00, P: 02)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. To measure pressure by various methods
   a) Pressure Gauge(Bourdon, Bellowand diaphragm type)
   b) Digital Pressure Indicator
   c) Vacuum pressure by any available vacuum gauge and compare.
2. To measure record pressure offline by graphic recorder and electronic pressure Recorder.
3. To measure level of a tank by
   a) Sight glass tube and flood method.
   b) Capacitive level detector
   c) resistive level detector.
4. To calibrate a pressure gauge using load weight tester and standard pressure Calibration.
5. To study the construction and operation of level limit switch and make an application circuit using
   level limit switch.
6. To measure speed of motor by
   a) Mechanical tachometer
   b) Optical tachometer
   c) Inductive reluctance type tachometer
7. To measure temperature of a furnace/object by various methods.
   a) Thermometer
   b) Thermocouple
   c) Pyrometer (Total radiation and optical pyrometer)
   d) RTD
   e) I.R. temperature sensor (Semiconductor type)
8. To record level/temperature using universal electronic meter.
9. To measure flow in a pipeline using
   a) Orifice meter
   b) Venturimeter
   c) Rota meter
   d) Electromagnetic flow meter
   e) Ultrasonic flow meter
10. To measure flow of air using anemometer.
11. To measure density of solution using hydrometer.
12. To measure moisture using Electronic moisture meter.

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC406**	**COURSE TITLE: MICROCONTROLLER AND EMBEDDED SYSTEMS**
SEMESTER: 4th	**CREDITS: 3**
PERIODS PER WEEK: 3 (L: 02,T: 01, P: 00)	

COURSE OBJECTIVE

The study of microcontrollers in terms of architecture, software and interfacing techniques leads to the understanding of working of microcontrollers and applications of microcontroller in Instrumentation Industries. The microcontroller is an area of specialization & microcontroller is the heart of the programmable devices. Students of Instrumentation and related engineering branches often use microcontroller to introduce programmable control in their projects, automation and fault finding in industry.

COURSE CONTENT

1. Introduction
- 1.1 Difference between microprocessor and microcontroller.
- 1.2 Microcontroller and their applications.
- 1.3 Microcontroller for embedded system.
- 1.4 Overview of the 8051 family

2. 8051 Architecture
- 2.1 Block Diagram and Pin Diagram of 8051 microcontroller.
- 2.2 The 8051 Oscillator & clock.
- 2.3 Program Counter and Data Pointer.
- 2.4 A & B CPU registers.
- 2.5 Flag and the program status word (PSW).
- 2.6 Internal Memory.
- 2.7 The stack and stack pointer.
- 2.8 Input/output ports.
- 2.9 Counters and timers.
- 2.10 Serial Data input/output.
- 2.11 Interrupts.

3. Addressing Modes & Instructions
- 3.1 Instructions set of 8051.
  - 3.1.1 Arithmetic instructions.
  - 3.1.2 Loops and jump instructions.
  - 3.1.3 Call instructions.
  - 3.1.4 Push and Pop Instructions.
- 3.2 Addressing modes of 8051**.**

4. Introduction to Embedded System
- 4.1 Definition of embedded system.
- 4.2 Embedded operating system, RTOS.
- 4.3 Embedded hardware units and devices in a system.

4.4 Design parameters of an embedded system and its importance.
4.5 Applications of embedded system.

5. Advanced Microcontroller

5.1 Only brief general architecture of AVR, PIC and ARM microcontroller
5.2 Introduction to Arduino IDE
5.3 Applications of advanced microcontroller in the Instrumentation and Control field

COURSE OUTCOME
After completion of the subject, the learner should be able to:

- Understand the application of microcontrollers in industries.
- Understand the working of microcontrollers.
- Familiar with the instruction set and addressing modes of microcontroller
- Understand basic knowledge of embedded systems.
- Explain the architecture of advanced microcontrollers.

INSTRUCTIONAL STRATEGY

Instruction should be given to students to get familiar with the microcontrollers in the class room so that they can develop the concept of controllers. Programming should be done by taking simple examples like interfacing of switch, LCD and relay, keypad etc.

RECOMMENDED BOOKS:-

1. Fundamentals of Microprocessor and Microcontroller by B. Ram, DhanpatRai Publications.
2. Microcontroller: Architecture, Programming & Applications by Ayala, Kenneth J., Penram
3. Microcontroller and Embedded Systems using Assembly And C by Muhammad Ali Mazidi, Rolin Mckinlay, Janice Gillespie Mazidi: Pearson
4. PIC Microcontroller and Embedded Systems : Using assembly and C by Muhammad Ali Mazidi, Rolin Mckinlay, Danny Causey; Pearson
5. The 8051 microcontroller by K.J. Ayala, Penram International.
6. J B Peatman, Design with PIC Microcontrollers, Prentice Hall.
7. E-books/e-tools/relevant software to be used as recommended by AICTE / HSBTE / NITTTR.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hours)	Marks Allotted (%)
1	06	10
2	14	30
3	10	20
4	10	20
5	08	20
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: **ICPC407**	**COURSE TITLE: MICROCONTROLLER AND EMBEDDED SYSTEMS LAB**
SEMESTER: 4th	**CREDITS: 1**
PERIODS PER WEEK: 2 (L: 0,T: 0, P: 2)	

COURSE OBJECTIVE:

This subject is a lab course to be supplemented by theory subject and aims to develop proficiency and understanding of practical outcomes of the subject taught in theory.

LIST OF PRACTICALS

1. Familiarization with Micro-controller Kit and its different sections.
2. Familiarization with Assembly Language Programming (PC Based).
3. Program to add two hexadecimal numbers.
4. Program to add two decimal numbers.
5. Program to check whether number is odd or even.
7. Programming to interface switches and LEDs.
8. Programming and interface of Seven Segment and LCD.
9. Programming to interface Keypad.
11. Programming for A/D converter, result on LCD.
12. Programming for D/A converter, result on LCD.
13. Programming and interfacing of RELAY and Buzzer.
15. Programming and interfacing of Stepper Motor**.**

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: OE401	**COURSE TITLE: MULTIDISCIPLINARY ELECTIVE (Preferably through MOOCs from Swayam / NPTEL)**
SEMESTER: 4th	**CREDITS: 2**
PERIODS PER WEEK: 2 (L: 2,T: 0, P: 0)	

• Introduction to Internet of Things, Introduction to Robotics, • Introduction to Embedded System Design, • Fundamentals of Artificial Intelligence, • Digital Image Processing, • Introduction to Machine Learning • IOT and Smart systems, • Introduction to Artificial Intelligence, • Fundamentals of Mechatronics,	• Fundamentals of Artificial Intelligence, • The Joy of Computing Using Python, • Cloud Computing, • Introduction to Industry 4.0 and Industrial Internet of Things, • Object Oriented System Development using UML, Java and Patterns, • Mobile Application Development using Android, • Linux system administration, • Big Data Computing

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: SI/PR401	COURSE TITLE: MINOR PROJECT
SEMESTER: 4th	CREDITS: 2
PERIODS PER WEEK: 4 (L: 0,T: 0, P: 4)	

NOTE: - The project may be identified at the end of 3rd semester

Realizing the great importance of students' exposure to world of work for his professional growth, two spells of industry oriented projects-minor and major have been included in the curriculum. It is necessary that teachers to play a pro -active role in planning and guidance of individual students for optimizing the benefits of the activity in stipulated time.

COURSE OUTCOME

After undergoing the subject, students will be able to:

- Apply concepts, principles and practices taught in the classroom in solving field / industrial problems.

GENERAL GUIDELINES

Minor project work aims at exposing the students to industrial/field practices so as to have an appreciation of size, scale and type of operations; and work culture in the industries. Also the students will be able to correlate concepts, principles and practices taught in the classroom with their application in solving field/industrial problems. The work done in minor project work will also prepare them in taking up problem solving at latter stage under major project work

Depending upon the interests of the students and location of the organization the student may be asked to visit:

1. Process industries like Petrochemical Units/Fertilizers /Paper etc.
2. Various instrumentation industries.
3. Thermal power stations.
4. Electronics and Microprocessor based control system industries.
5. Medical electronics industries.
6. Repair and maintenance workshops.
7. Pressure measuring systems.
8. Digital display systems.
9. Calibration of different types of indicating instruments, measurement of process variables in industry.
10. Repair of different instruments being used in various laboratories.
11. Case study of process industries using PLC or DCS

LIST OF MINOR PROJECTS

1. LPG leakage detector
2. Smoke detector

3. Mobile detector
4. Street light control
5. Power supply design
6. Clamp switch
7. Fire alarm
5. Metal detector
6. Rain Alarm
7. Fastest finger first
8. A Timer
9. Filters
10. Running Light Control
11. Message Display
12. Digital Alarm Clock
13. PCB Design
14. Temperature Controller
15. Power Supply for Mobile
16. Multiple O/P Power Supply
17. Lab Experimental Trainer Board
18. On-Off Control
19. Use of for controlling speed of motors.

***(This list is only suggestive; however other problems may also be identified depending on local industries*)**

For effective planning and implementation of the above, it is suggested that polytechnics / institutes should:

a) Identify adequate number of industrial/field organizations and seek their approval for deputing students for exposure/visits.
b) Prepare a workbook (which can be used by students) for guiding students to perform definite task during the above mentioned exposure.
c) Identify teachers who would supervise the students' activities and provide guidance on continuous basis during the above project work.

The components of evaluation will include the following:

Unit No.	Component	Weigtage
a)	Punctuality and regularity	10%
b)	Initiative in learning new things	10%
c)	Relationship with others/workers	10%
d)	Project Report/ Technical report	50%
e)	Seminar based on Project	20%

PROGRAM: THREE YEAR DIPLOMA PROGRAM IN INSTRUMENTATION AND CONTROL ENGINEERING	
COURSE CODE: AU401	**COURSE TITLE: UNIVERSAL HUMAN VALUES / Indian Constitution / Employability skills (Mandatory course)**
SEMESTER: 4th	**CREDITS: 0**
PERIODS PER WEEK: 1 (L: 0,T: 0, P: 1)	

UNIVERSAL HUMAN VALUES

COURSE OBJECTIVE:

This introductory course input is intended to help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Thus, this course is intended to provide a much needed orientation input in value education to the young enquiring minds.

COURSE METHODOLOGY

The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.

It is free from any dogma or value prescriptions.

It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.

This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.

This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

COURSE CONTENT

1. Course Introduction –

Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education.

Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facilities-

the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations: understanding and living in harmony at various levels

2. Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient 'I' and the material the Body'
Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I'
Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensureSanyam and Swasthya
Practice Exercises and Case Studies will be taken up in Practice Sessions.

3. Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding Harmony in the family – the basic unit of human interaction
Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;Trust (Vishwas) and Respect (Samman) as the foundational values of relationship Understanding the meaning of Vishwas; Difference between intention and competence
Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human GoalsVisualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!
Practice Exercises and Case Studies will be taken up in Practice Sessions.

4. Understanding Harmony in the Nature and Existence

Whole existence as Co-existence Understanding the harmony in the Nature Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self- regulation in nature
Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence
Practice Exercises and Case Studies will be taken up in Practice Sessions.

5. Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values

Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: Ability to utilize the professional competence for augmenting universal human order Ability to identify the scope and characteristics of people-friendly and ecofriendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order:
At the level of individual: as socially and ecologically responsible engineers, technologists and managers
At the level of society: as mutually enriching institutions and organizations
To inculcate Human Values among Students: The Role of self, Parents and Teachers- Practice Exercises and Case Studies will be taken up in Practice Sessions. Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples.

MEANS OF ASSESSMENT

Assignments and quiz/class tests, Practical assessment.

Reference Material

The primary resource material for teaching this course consists of
a. The text book (Latest Edition)Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
b. The teacher's manual (Latest Edition)Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 4.
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkanta k. E. F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
8. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

Value Education websites, http://uhv.ac.in, http://www.aktu.ac.in Story of Stuff, http://www.storyofstuff.com

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
INFORMATION TECHNOLOGY

STUDY SCHEME 4TH SEMESTER

Code	Subjects	Study Scheme Periods Per Week			Total Hours L+T+P	CREDITS			Total Credits L+T+P
		L	T	P		L	T	P	
ITPC401	E-Commerce and Digital Marketing	3	0	0	3	3	0	0	3
COPC402	Object Oriented Programming using Java	3	0	0	3	3	0	0	3
COPC403	Object Oriented Programming using Java Lab	0	0	4	4	0	0	2	2
ITPC404	Software Project Management	4	0	0	4	4	0	0	4
COPC406	Full Stack Web Development	2	0	0	2	2	0	0	2
COPC407	Full Stack Web Development Lab	0	0	4	4	0	0	2	2
ITPC405	Computer Networks	3	0	0	3	3	0	0	3
ITPC406	Computer Networks Lab	0	0	2	2	0	0	1	1
HS410	Basics of Entrepreneurship Development	2	0	0	2	2	0	0	2
		17	**0**	**10**	**27**	**17**	**0**	**5**	**22**

PROGRAM: THREE YEAR DIPLOMA IN INFORMATION TECHNOLOGY	
Course Code: **ITPC401**	**Course Tittle: E-Commerce and Digital Marketing**
Semester: **4th**	Credit: **3**
Periods Per Week: **3 (L: 03, T: 0, P: 0)**	

COURSE OBJECTIVE:

This course aims to provide students with a comprehensive understanding of Electronic Commerce (e-commerce) and its applications, focusing on mobile commerce systems' theoretical background and practical implications. By exploring various e-commerce facets and ethical considerations, students will develop the knowledge and skills to navigate the dynamic digital business landscape with adaptability and responsible decision-making.

COURSE CONTENT:

1. **Introduction**

   What is E-Commerce, Forces behind E-Commerce Industry Framework, Brief history of E-Commerce, Inter Organizational E-Commerce, Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, benefits of e-Commerce?

2. **Mobile Commerce**

   Mobile Commerce systems-characteristics and functions, Mobile Computing technology-mobile clients, mobile client software, Wireless Application Protocols, payment issues, introduction to Ucommerce: the next step after m-commerce.

3. **Web Security**

   Introduction to Web security, Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, Network Security. Encryption, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPN), Implementation Management Issues.

4. **Electronic Payments & Net Commerce**

   Overview of Electronics payments, Digital Token based Electronics Payment System (EPS), Smart Cards, Credit Card/Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking, EDA, EDI Application in Business, Legal requirement in E -Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management.

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Define E-Commerce, recognize its various models, and understand its historical evolution and benefits.
- Describe characteristics and functions of Mobile Commerce (M-Commerce) systems, including mobile computing technologies and Wireless Application Protocols.
- Understand fundamentals of web security, covering firewalls, transaction security, network security, and encryption methods.
- Explore electronic payments, digital token-based systems, smart cards, credit/debit card-based systems, and emerging financial instruments.
- Highlight legal requirements in E-Commerce, introduce supply chain management concepts, and address issues related to Customer Relationship Management (CRM).

RECOMMENDED BOOKS:

1. Greenstein and Feinman, "E-Commerce", TMH
2. Ravi Kalakota, Andrew Whinston, "Frontiers of Electronic Commerce", Addision Wesley
3. Denieal Amor, "The E-Business Revolution", Addision Wesley
4. Diwan, Sharma, "E-Commerce" Excel
5. Bajaj & Nag, "E-Commerce: The Cutting Edge of Business", TMH

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	12	25
4	16	35
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC402**	Course Title: **OBJECT ORIENTED PROGRAMMING USING JAVA**
Semester: **4th**	Credit: **3**
Periods Per Week: **03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVES:

Object orientation is a new approach to understand the complexities of the real world. In contrast to the earlier approaches like procedural etc, object orientation helps to formulate the problems in a better way giving high reliability, adaptability and extensibility to the applications. This course offers the modern programming language JAVA that will help the students to implement the various concept of object orientation practically.

COURSE CONTENT:

1. Introduction to Java and Object Oriented Programming Concept
- 1.1. Concept of Procedure Oriented Language and Object-Oriented Language and the difference between the two.
- 1.2. Background of Java and Java Features
- 1.3. Java Virtual Machine, Byte code, JIT Compiler, Java IDE Tools, Introduction of NetBeans (IDE) for developing programs in Java.
- 1.4. Basics of OOP: Abstraction, Inheritance, Encapsulation and Polymorphism (Basic concept only)

2. Classes and Objects
- 2.1. Class fundamentals, declaring objects, creating and accessing variables and methods, static variables and methods.
- 2.2. Constructor (Default and Parameterized)

3. Language Constructs in Java
- 3.1. Primitive Data Types: Integers, Floating Point type, Characters, Booleans
- 3.2. User Defined Data Type, Declarations, Constants, Identifiers & Literals,
- 3.3. Type Casting,
- 3.4. Variables: Variable Definition and Assignment, Default Variable Initializations,
- 3.5. Operators: Arithmetic, Rational, Logical, Assignment, Conditional, Ternary, Auto Increment and Decrement
- 3.6. Control Statements: Selection Statement (If, Switch), Loops (While, Do-while, for), Jump statements (Break, Continue, Return)

4. Inheritance, Interfaces and Packages

4.1 Inheritance

4.1.1. Concepts of Inheritance, subclass, superclass.
4.1.2. Types of inheritance, single inheritance, multilevel inheritance, hierarchical inheritance, hybrid inheritance.
4.1.3. Using 'extends' keyword to demonstrate single and multilevel inheritances.
4.1.4. Abstract Classes and final Classes

4.2. Interfaces
4.2.1. Defining an interface, difference between classes and interface.
4.2.2. Implementation of multiple inheritances through interface.

4.3. Packages
4.3.1. Packages: Defining a package, Importing and using a package in-built.
4.3.2. packages, user defined packages.

4.4. Access modifiers
4.4.1 Public, protected, default, and private (visibility and scope)

5 Polymorphism
5.1 Constructor overloading
5.2 Method Overloading
5.3 Method Overriding
5.4 Use of Keyword "super"

6 Exception Handling
6.1 Basics of Exception and types: Checked and Unchecked
6.2 Handling Exceptions: try, catch, finally
6.3 Use of throw and throws for built-in exceptions

7 Multithreading
7.1 Threads, Difference between multi-threading and multi-tasking
7.2 Thread life cycle
7.3 Implementing Threads: extension of Thread Class and Implementation of Runnable Interface.

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Perform Java programming, understanding its background and key features, including the role of Java Virtual Machine and Byte code.
- Utilize the NetBeans IDE proficiently for Java development.
- Master manipulation of data by working with primitive and user-defined data types, variables, type casting, and operators.
- Apply Object-Oriented Programming (OOP) principles, including abstraction, inheritance, encapsulation, and polymorphism, to design efficient Java programs.
- Create Java applications by applying class fundamentals, object creation, and constructors.
- Utilize inheritance, interfaces, and packages to organize and structure Java code effectively.
- Implement access modifiers to control the visibility and accessibility of Java classes and members.
- Demonstrate polymorphism through constructor overloading and method overriding.
- Implement effective exception handling mechanisms for error management in Java programs.
- Apply multithreading concepts, understanding the thread life cycle to develop concurrent and responsive Java applications.

RECOMMENDED BOOKS:

1. Java: A Beginner's Guide by Herbert Schildt
2. Head First Java, O-REILLY, Kathy Sierra & Bert Bates.
3. Programming with Java: A Primer; E. Balagurusamy
4. Programmer's Guide to Java, Pearson, Khalid E Mughal
5. Java in a Nutshell" by Benjamin J. Evans and David Flanagan - Publisher: O'Reilly Media
6. "Java Programming 24-Hour Trainer" by Yakov Fain - Publisher: Wrox
7. "Java for Dummies" by Barry A. Burd - Publisher: For Dummies

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	10
2	10	20
3	07	15
4	10	25
5	02	5

6	05	10
7	09	15
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: COPC403	Course Title: **OBJECT ORIENTED PROGRAMMING USING JAVA LAB**
Semester: 4th	Credit: 2
Periods Per Week: 04 (L: 00, T: 00, P: 04)	

COURSE OBJECTIVES:

The objectives of the course is to determine the resultant of various forces and to compute support reactions using equilibrium conditions for various structures and to understand the significance of friction in equilibrium problems, basic machine rules and their application in different engineering problems

LIST OF PRACTICALS:

1. Install JDK and NetBeans, write a simple "Hello World" or similar java program, compilation, debugging, executing using java compiler and interpreter.
2. Develop minimum five (05) programs to explore java data types, operators, control structures and decision statements.
3. Develop minimum two (02) programs to explore labelled loop.
4. Develop minimum two (02) programs to explore arrays.
5. WAP to create a simple class to find out the area and perimeter of rectangle and box using super and this keyword.
6. WAP to design a class account using the inheritance and static that show all function of bank (withdrawal, deposit).
7. WAP to design a class using abstract methods and classes.
8. WAP to design a string class that perform string method (equal, reverse the string, change case).
9. Develop minimum four (04) programs based on overloading methods.
10. Modify created classes in during the previous practical sessions to provide constructor and retest all classes.
11. Develop minimum five (05) programs based on inheritance.
12. Develop minimum two (02) programs based on package and also test all the visibility modifiers.
13. Develop minimum two (02) programs to explore the multiple inheritance concept using interfaces.
14. Consider we have a Class of Cars under which Hyundai-i20, Alto-800, and Ignis represents individual Objects. In this context each Car Object will have its own, Model, Year of Manufacture, Colour, Top Speed, etc. which

form Properties of the Car class and the associated actions i.e., object functions like Create (), Sold (), display () form the Methods of Car Class.

15. In a software company Software Engineers, Sr. Software Engineers, Module Lead, Technical Lead, Project Lead, Project Manager, Program Manager, Directors all are the employees of the company but their work, perks, roles, responsibilities differ. Create the Employee base class would provide the common behaviours of all types of employees and also some behaviours properties that all employee must have for that company.

16. Using the concept of multiple inheritance create classes: Shape, Circle, Square, Cube, Sphere, Cylinder. Your classes may only have the class variable specified in the table below and the methods Area and/or Volume to output their area and/or volume.

Class	Class Variable	Constructor	Base class
Shape	String name	Shape ()	
Circle	double radius	Circle (double r, String n)	Shape
Square	double side	Square (doubles, String n)	Shape
Cylinder	double height	Cylinder (double h, double r, String n)	Circle
Sphere	None	Sphere (double r, String n)	Circle
Cube	None	Cube (doubles, String n)	Square

17. WAP that show the partial implementation of interface.

18. WAP to handle the exception using try and multiple catch block.

19. WAP that implement the Nested try statements besides usage of throw and throws.

20. Develop minimum two (02) programs using multiple thread concepts.

PROGRAM: THREE YEAR DIPLOMA IN INFORMATION TECHNOLOGY	
Course Code: **ITPC404**	**Course Title: Software Project Management**
Semester: **4th**	Credit: **4**
Periods Per Week: **4 (L: 04, T: 0, P: 0)**	

COURSE OBJECTIVE:

This course is designed to develop an understanding of basic software engineering techniques with the focus on requirements , design , planning and development of the software applications, with will be used by the students at industry level.

COURSE CONTENT

1. Introduction to Software S/W Engineering

1.1 Introduction, size factors. Quality and productivity factors.

1.2 Management issues, Models: waterfall, spiral, prototyping, fourth generation techniques, s/w process

1.3 Introduction to agile technologies

2. Planning

2.1 The development process

2.2 an organizational structure

2.3 other planning activities

3. Software Cost Estimations

3.1 Cost factors.

3.2 Estimations techniques. Staffing level estimation, estimating software maintenance costs.

3.3 Cost model.

3.4 COCOMO model.

4. Software Requirements Definitions

4.1 Problem analysis, requirement engineering.

4.2 The software requirements specifications (SRS).

4.3 Formal specifications techniques, characteristics of a good SRS

4.4 Characteristics of a good SRS

5. Verification and Validation Techniques

6.1 Symbolic execution unit testing, formal verifications

6.2 Black box and white box testing techniques

6.3 Documentation guidelines

6. Software Maintenance

7.1 Maintenance Overview.

7.2 Configuration Management

7.3 Software Quality

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
- Work in one or more significant application domains
- Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
- Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle

RECOMMENDED BOOKS:

1. Software Engineering by Rajib Mall, PHI Publishers, New Delhi
2. An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House Pvt Ltd, Darya Ganj, New Delhi 110002
3. Software Engineering, Sangeeta Sabharwal, New Age International, Delhi
4. Software Engineering by KK Aggarwal and Yogesh Singh
5. Software Engineering – A Practitioner's Approach by RS Pressman, Tata McGraw Hill Publishers, New Delhi
6. Eagles's Software Engineering By Gaurav Gupta, Dipika Goel

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	16
2	10	17
3	12	18
4	10	17
5	12	17
6	10	15
Total	**64**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC406**	Course Title: **Full Stack Web Development**
Semester: **4th**	Credit: **2**
Periods Per Week: **02 (L: 02, T: 00, P: 00)**	

COURSE OBJECTIVES:

To impart the basic knowledge of web development concepts this course makes the students to learn how to create responsive and visually appealing user interfaces. Also how to build dynamic and interactive web applications using component-based architecture and state management. Learn server-side programming languages like Node.js, Php, etc. It also gives students the skill to perform database operations.

COURSE CONTENT:

1. Introduction to Web Development

1.1 Overview of web technologies(Web Browsers, HTML, CSS and JavaScript)
1.2 Client-server architecture of web applications
1.3 Application development
  1.3.1 Frontend Development
  1.3.2 Backend Development
  1.3.3 Database
1.4 Basic concept of Responsive design

2. Front-end Design

2.1 HTML5
  2.1.1 Basic Structure of an HTML Document
  2.1.2 HTML Elements and Tags
  2.1.3 Headings and Paragraphs, Text Formatting
  2.1.4 Lists
  2.1.5 Links and Images
  2.1.6 HTML Forms and Tables
2.2 CSS Basics
  2.2.1 Introduction to CSS,
  2.2.2 Inline, Internal and External CSS
  2.2.3 CSS Selectors
  2.2.4 CSS Properties(color, font-size, background-color, and margin)
  2.2.5 Box Model(content, padding, border, margin).
  2.2.6 Borders and Backgrounds
  2.2.7 CSS Display and Positioning (display property :block, inline, inline-block)
2.3 JavaScript
  2.3.1 Introduction to JavaScript
  2.3.2 Variable , Operators , Conditions, loops

2.3.3 Functions
2.3.4 DOM manipulation
2.3.5 Popup Boxes (Alert ,Confirm)
2.3.6 Client side form validation

2.4 Bootstrap (Responsive design)
2.4.1 Introduction to bootstrap
2.4.2 Grid layout in Bootstrap (containers, rows, columns)
2.4.3 Bootstrap Buttons, Forms, Navbars

3. Back-end Development

3.1 PHP and MYSQL
3.1.1 Introduction to PHP, PHP variables, Data types, Operators, Control Statements, Embedding PHP in HTML, Embedding HTML in PHP,
3.1.2 PHP Session Management(Starting, Using, Unset and Destroy only)
3.1.3 Handling HTML form data using GET and POST
3.1.4 Introduction to MySQL Database. Connecting PHP with MySQL, Performing basic database operation(Select, Insert, Delete and Update)

3.2 Node js and MongoDB
3.3.1 Introduction to Node JS Platform
3.3.2 Environment Setup for Node js
3.3.3 Node Package Manager
3.3.4 Callbacks
3.3.5 Events And Event Loop
3.3.6 Introduction To MongoDb
3.3.7 Connecting Node.Js To Database

COURSE OUTCOME:

After the completion of the course the student will be able to:

- understand the foundational elements of web development, including web technologies, client-server architecture, and the distinction between frontend and backend development.
- Demonstrate proficiency in frontend design using HTML5, CSS, and JavaScript, covering essential concepts such as HTML structure, CSS styling, and basic JavaScript functionalities.
- Develop responsive web design skills using Bootstrap, encompassing grid layout, buttons, forms, and navigation components.
- Gain practical knowledge in backend development using PHP and MySQL, focusing on PHP fundamentals, session management, and basic database operations.
- Explore alternative backend development using Node.js and MongoDB, including environment setup, Node Package Manager, callbacks, events, and connecting Node.js to a MongoDB database.

RECOMMENDED BOOKS:

1. Learning Web Development with React and Bootstrap by Harmeet Singh, Mehul Bhatt, and Ravi Kant Son
2. Modern Full-Stack Development: Using Type Script, React, Node.js by Frank Zammetti, Apress, 1st Edition.
3. Full Stack Web Development For Beginners by Riaz Ahmad, Atlantic Publishers and Distributors
4. Web Design with HTML, CSS, JavaScript and jQuery Set by Duckett Jon, John Wiley & Sons Inc
5. Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Robbins (Publisher: O'Reilly Media)
6. JavaScript: The Good Parts" by Douglas Crockford (Publisher: O'Reilly Media)
7. Eloquent JavaScript" by Marijn Haverbeke (Publisher: No Starch Press)

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	14	45
3	14	45
Total	**32**	**100**

PROGRAM: THREE YEAR DIPLOMA IN COMPUTER ENGINEERING	
Course Code: **COPC407**	Course Title: **Full Stack Web Development Lab**
Semester: **4th**	Credit: **02**
Periods Per Week: **04 (L: 00, T: 00, P: 04)**	

COURSE OBJECTIVES:

The course objectives for full-stack development practical aim to provide students with hands-on experience and practical skills in various aspects of full-stack web development.

LIST OF PRACTICALS:

1. Create a HTML page and demonstrate use of all the tags which you have read in theory part.
2. Demonstrate the use of the CSS techniques read in theory part.
3. Build a static webpage using HTML and CSS, use different layout techniques, styling.
4. Create a HTML form with more than five different fields and validate them using Java script.
5. Develop a responsive web application using a Bootstrap front-end framework.
6. Test all data types and operators in PHP.
7. Build a server-side application using Node.js. Create routes, handle requests and responses, and integrate with a database.
8. Build a server-side application using php. Create routes, handle requests and responses, and integrate with a database.
9. Make a HTML form which accepts required inputs from a user. Perform all arithmetic operation using php then display the result on same page also connect to MySQL database and save all the inputs and results in table.
10. Implement user registration, login, and authentication using session management.
11. Work on a comprehensive full-stack project using PHP as Backend Scripting Language, applying the concepts and skills learned throughout the course. This project should include front-end and back-end development, database integration, and user authentication

PRACTICAL MARKS DISTRIBUTION

Topic	Time Allotted (Hrs)	Marks Allotted (%)
Front End Design	16 Hrs	50
Back End Design	16 Hrs	50
Total	**32Hrs**	**100**

PROGRAM: THREE YEAR DIPLOMA IN INFORMATION TECHNOLOGY	
Course Code: **ITPC405**	**Course Title: Computer Networks**
Semester: **4th**	Credit: **3**
Periods Per Week: **3 (L: 03, T: 0, P: 0)**	

COURSE OBJECTIVE:

The objective of the course is to understand the fundamental concepts and principles of computer networks: The primary objective of this course is to provide students with a comprehensive understanding of the basic concepts and principles underlying computer networks. Students will learn about network topologies, protocols, architectures, and the different layers of the TCP/IP model. Students will acquire hands-on experience in configuring and troubleshooting network hardware components, such as routers, switches, and wireless access points.

COURSE CONTENT:

1. Networks Basics
- 1.1. Concept and Uses of Computer Networks
- 1.2. Reference Model overview (OSI, TCP/IP)

2. Physical Layer
- 2.1. Types of networks (LAN, MAN and WAN)
- 2.2. Different network topologies like star, ring, hybrid, tree.
- 2.3. Transmission techniques(Simplex duplex and Half duplex)
- 2.4. Basics of Physical Media (Guided /Un Guided).
- 2.5. Concept of hub and Repeater

3. Data Link layer(DLL)
- 3.1. General Functions of DLL.
- 3.2. Concept of MAC Address.
- 3.3. Error detection(Parity Check and Checksum)
- 3.4. Correction techniques (Hamming Code)
- 3.5. Concept of Switch
- 3.6. Switching techniques(Circuit switching, Message switching and Packet switching)
- 3.7. Flow Control
  - 3.7.1. Stop and Wait
  - 3.7.2. Sliding window protocol(Go-Back-N)

4. Network Layer
- 4.1. General Functions of Network Layer
- 4.2. IP Addressing(Class A,B, C D & E)

4.3. IPv4 Packet format
4.4. Basics of Routing Protocols ARP and RARP.
4.5. Sub-netting
4.6. Basic concept of IPV6 (Need and importance only).
4.7. Concept of Router

5. Transport Layer

5.1. General Functions of Transport Layer
5.2. Transport layer protocols TCP, UDP
5.3. Multiplexing and de-multiplexing
5.4. Congestion Control
  5.4.1. Slow Start
  5.4.2. Congestion avoidance
  5.4.3. Fast Retransmit and fast recovery

6. Session and Presentation Layers

1.1 General functions of session layer
1.2 General functions of Presentation layer

7. Application Layer

7.1 General functions of Application Layer
7.2 Use of application layer protocols (HTTP, FTP,SMTP, POP ,IMAP)
7.3 Working of FTP and TELNET
7.4 Basic Concept of Gateways and comparison w.r.t Hub/Switch/Router.

COURSE OUTCOME:

After completing this course the students will be able to:

- Understand computer network concepts and reference models (OSI, TCP/IP).
- Differentiate between LAN, MAN, and WAN networks, grasp network topologies, transmission techniques, and physical media basics.
- Gain proficiency in Data Link Layer concepts, including MAC Address, error detection, and switching techniques.
- Acquire knowledge in Network Layer functions, IP addressing, routing protocols, and the basics of IPv6 and routers.

RECOMMENDED BOOKS:

1. W. Stallings, "Computer Communication Networks", PHI, 1999.
2. Computer Networks – Third Edition – Andrew S. Tanenbaum, Prentice Hall of India.
3. Data Communications and Networking – Behrouz A. Forouzan, Third Edition TMH.
4. TCP/IP Protocol Suite" by Behrouz A. Forouzan Publisher: McGraw-Hill.
5. Internetworking with TCP/IP" by Douglas E. Comer and David L. Stevens Publisher: Pearson.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	05	10
2	08	10
3	14	20
4	14	20
5	14	20
6	04	10
7	05	10
Total	**64**	**100**

PROGRAM: THREE YEAR DIPLOMA IN INFORMATION TECHNOLOGY	
Course Code: **ITPC406**	**Course Title: Computer Networks Lab**
Semester: **4th**	Credit: **01**
Periods Per Week: **2 (L:0, T: 0, P: 2)**	

COURSE OBJECTIVE:

Develop skills in network design and implementation: Students will learn how to design and implement computer networks based on specific requirements. They will be exposed to network design methodologies, sub-netting and IP addressing. Through practical exercises and projects, students will gain the ability to plan, configure, and troubleshoot network infrastructures.

LIST OF PRACTICALS:

1. Making of cross cable
2. Making of straight cable
3. Identify the IP address of a workstation and the class of the address and configure the IP Address on a workstation
4. Sharing the resources in wired and Wireless network.
5. To Connect two pcs using peer to peer communication/via switch/via router.
6. Study and Demonstration of sub netting of IP address. Concept of DHCP.
7. Connectivity troubleshooting using PING, IPCONFIG ,IFCONFIG etc
8. Demonstration of Packet Tracer /Wireshark or any other network software.
9. Demonstrate the use of router, switch and hub using cisco packet tracer.
10. Demonstrate the making of different topologies in any cisco packet tracer/ NS2 etc.
11. Subnet the given IP address (A, B, C) using ciaco packet tracer.
    Analysis of data in various forms(Packets, datagram, frames)at different layers of OSI model using any open source tool (cisco packet tracer, NS2/GNS3.
12. Identify the various parameters like (port number, IP address, subnet mask, MAC address, etc) when a message is send from source to destination

PROGRAM: THREE YEAR DIPLOMA IN INFORMATION TECHNOLOGY	
Course Code: **HS410**	**Course Title: BASICS OF ENTREPRENEURSHIP DEVELOPMENT**
Semester: **4th**	Credit: **2**
Periods Per Week: **2 (L: 02, T: 0, P: 0)**	

COURSE OBJECTIVE:

The course provides a comprehensive understanding of the concept of an entrepreneur and intricacies involved in managing entrepreneurial projects. The prime aim is to imbibe the necessary entrepreneurial competencies among students and motivate them to choose entrepreneurship as a feasible and desirable career option.

COURSE CONTENT:

1. Introduction to Entrepreneurship

1.1 Meaning and concept of entrepreneurship.
1.2 History of entrepreneurship development,
1.3 Entrepreneurs, Managers and Inrapreneurs
1.4 Barriers to entrepreneurship
1.5 Role of Entrepreneurship in economic development.
1.6 Types of Entrepreneurship.

2. Entrepreneurial process and Entrepreneurship Development

2.1 Entrepreneurial competencies.
2.2 Traits and characteristics, motives, attitude, achievement orientation, self-assessment required to be an entrepreneur.
2.3 Entrepreneurial decision process, Skill gap analysis,

3. Entrepreneurship as career

3.1 Identification and selection of business opportunities.
3.2 Market assessment, technology search, production capacity.
3.3 Assessment of infrastructure requirements and other resources.
3.4 Business plan and its importance

4. Institutional infrastructure to promote entrepreneurship

4.1 Overview, roles, promotional schemes.
4.2 Financial, regulatory and other support system institutions.

5. Emerging trends in Entrepreneurship

5.1 Technopreneurship
5.2 Webpreneurs , Agripreneurs
5.3 Women Entrepreneurship
5.4 Franchising

6 Legal and financial aids

6.1 Definition and purpose of legal aid
6.2 Legal Aid Providers
6.3 Challenges in Legal Aid
6.4 Financial Aid Programs
6.5 Student Financial Aid
6.6 Financial Aid for Small Businesses
6.7 Social Welfare Programs

COURSE OUTCOME:

After completion of the course the student will be able to

- Understand the meaning and concept of entrepreneurship, its historical development, and its role in economic development.
- Differentiate between entrepreneurs, managers, and entrepreneurs and identify the barriers to entrepreneurship.
- Identify the traits, characteristics, and attitudes required to be a successful entrepreneur and perform a self-assessment to evaluate one's potential in entrepreneurship.
- Analyze business opportunities, conduct market assessments, and assess resource requirements for entrepreneurial ventures.
- Recognize and explore emerging trends in entrepreneurship, such as technopreneurship, webpreneurs, agripreneurs, women entrepreneurship, and franchising.

RECOMMENDED BOOKS:

1. Desai Vasant, Fundamentals of entrepreneurship and small business management, Himalya publishing house.
2. Gupta C.B. Srinivasan N.P. Entrepreneurship development in India, Text and cases , Sultan Chand and Sons, New Delhi.
3. Charantimath, P.M. Entrepreneurship development and small business management, Pearson Education.
4. Generic skills and entrepreneurship development by Ishan Publishers, Ambala.
5. A handbook of entrepreneurship edited by B.S. Rathore and Dr. J.S. Saini.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Topic	Time (hrs)	Marks (%age)
1.	Introduction to Entrepreneurship	05	20
2.	Entrepreneurial process and Entrepreneurship Development	04	15
3	Entrepreneurship as career	05	20
4	Institutional infrastructure to promote entrepreneurship	05	18
5	Emerging trends in Entrepreneurship	04	15
6	Legal and financial aids	04	12
	Total	**32**	**100**

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
LEATHER TECHNOLOGY

STUDY SCHEME FOR 4TH SEMESTER LEATHER TECHNOLOGY

Code	Subjects	Periods Per Week			Total Hours L+P+T	Credits			Total Credits L+P+T
		L	T	P		L	P	T	
LTPC 401	Leather Process Technology-I	4	0	0	4	4	0	0	4
LTPC 402	Leather Goods andGarment Technology	4	0	0	4	4	0	0	4
LTPC 403	Material Testing &Analysis-I	4	0	0	4	4	0	0	4
LTPC 404	Leather ProcessDesign Engineering	3	0	0	3	3	0	0	3
LTPC 405	Leather Process Technology-I Lab	0	0	6	6	0	3	0	3
LTPC 406	Leather Goods andGarment Technology Lab	0	0	6	6	0	3	0	3
LTPC 407	Material Testing &Analysis-I Lab	0	0	4	4	0	2	0	2
LTPC 408	Leather ProcessDesign Engineering Lab	0	0	4	4	0	2	0	2
	Total	**15**	**0**	**20**	**35**	**15**	**10**	**0**	**25**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 401	Course Title: Leather Process Technology-I
Semester: 4th	Credits: 4
Periods Per Week: (L: 4, T: 0, P: 0)	

COURSE OBJECTIVE

The objective of this course is to enable the students to understand the manufacturing of various finished & heavy leather and processing of industrial & sports leather. Also students should understand the manufacturing of various light leather, of water proof leather and the uses of splits

COURSE CONTENT

Unit-I

Finished leathers and composition of finishes, tanned leathers semifinished leathers wet blue-wet white properties, general practices in vegetable and chrome tanning.

Unit -II

Heavy Leathers: Vegetable tanned sole leathers, Bag tanning, different types of finished leathers, Belting leathers, Harness and saddlery leathers, Chrome and waxed soles, picking band leathers. Picker and apron leathers, Hydraulic and pneumatic leather such as hand pump leathers- industrial gloving leather from splits/grains.

Unit-III

Leather for liquification plants for air, Oil seal, Gas, etc. Sports Goods leathers like Football.Rugby ball, Volley ball, Hockey ball, Cricket Ball etc. Gloves leathers for wicket keepers, Batting, Boxing etc).

Unit -IV

Light Leather: Full chrome retan, hunting suedes, softies, nappa, and burnishable Upper leathers, Printed, Shrunken grain and upholsteryleathers

Unit -V

Water proof and water repellent upper leather, Nubuk and white leather tanning, dressing of E.I. tanned leathers in to upper, lining, Bagleather,

Unit- VI

Split Processing and Up-gradation: Split Shoe suede, garment suede, grain finished leather and specialty finishes. Processing technologies and finishing techniques specially suited for the purpose. Up gradation of lower ends for better utilization. Transfer foil, lamination techniques etc. used in split finishing.

COURSE OUTCOME

After completion of this course, students will be able to:

- Demonstrate a comprehensive understanding of the composition of finished leathers, including tanned leathers like wet blue-wet white, and implement general practices in both vegetable and chrome tanning.
- Apply their knowledge to the production of heavy leathers, mastering techniques for manufacturing various types such as vegetable-tanned sole leathers, bag tanning, belting leathers, and specialized varieties like hydraulic and pneumatic leathers.
- Utilize acquired skills in leather production for specific applications, including the manufacturing of materials for liquification plants, sports goods leathers (e.g., football, rugby ball), and gloves leathers tailored for different sports.
- Showcase expertise in light leather production, covering full chrome retan, hunting suedes, nappa, burnishable upper leathers, and the understanding of printed, shrunken grain, and upholstery leathers.
- Implement specialized techniques in split processing and upgradation, applying knowledge to produce split shoe suede, garment suede, grain-finished leather, and employing advanced finishing techniques such as transfer foil and lamination for upgradation.

RECOMMENDED BOOKS

1. The Manufacture of Upper Leathers by Tuck, D.H.
2. Theory and Practice of Leather Manufacture By K.T. Sarkar.
3. An Introduction to Principles of Leather Manufacture by S SDutta.Indian Leather Technologists Association Kolkata.
4. Practical Leather Technology by T.C. Thorstensen, Robert E.Krieger Publishing Co., Florida
5. Lecture Notes on Dyeing and Finshing of Leathers by C.K. Rao& M.S. Olivannan
6. Lecture Notes on Leather by P.S. Venkatachalam, APO Publ.
7. Manufacture of Upper Leathers – D.H. Tuck, Tropical ProductsInstitute, UK
8. Glove & Garment Leathers - Tropical Products Institute, UK
9. Sole & Other Heavy Leathers - Tropical Products Institute, UK
10. CLRI Process Bulletins on Upper & Lining Leathers, Glove & Garment Leathers, Sole Leathers, Industrial Leathers, Sports Goods Leathers, Hair-on Skins etc.
11. Technical papers & seminar / workshop proceedings on cleaner leather processing
12. Technical Literatures from Various Leather Chemicals Companies

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted(%)
1	09	15
2	16	25
3	09	15
4	09	15
5	09	15
6	12	15
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 402	Course Title: Leather Goods and Garment Technology
Semester: 4th	Credits: 4
Periods Per Week: (L: 4, T: 0, P: 0)	

COURSE OBJECTIVE

The objective of this course is to enable the students to understand the Classification of leather Goods & Garments and to understand assembly techniques. Also to know about the working of the Machinery needs for Leather Goods Manufacture and also to understand the Classification of Leather Based Sports Goods.

COURSE CONTENT

Unit-I

Brief history of leather goods industry, its impact and importance in modern life-Classification of leather goods such as shopping bags, hand bags, patch bags, pouches and wallets, mobile cases, men's business satchels, executive accessories and petty articles etc. and their fabrication-Leather and other materials and their selection, characteristics, standardization of fittings and accessories-Tools, equipments and machinery used in leather goods manufacturing- Sketching and pattern cutting of components, their assembly and finishing -Modern methods of fabrication -

Unit- II

Overview: Classification of leather Goods & Garments. Selection of materials Grading and assorting of Leathers for Leather Goods & Garments. Property Requirement for Leather and Lining materials, Accessories for leather Goods and garments

Unit-III

Cutting: Hand and Machine Cutting, Pattern interlocking, various typesof assembly Techniques, Clicking, Splitting, Skiving, folding, embossing, folding, Sewing Quality Control measures in Leather products manufacture

Unit-IV

Organisation & Management: Project feasibility Reports, costing and pricing for leather goods& garments. Total Quality management. Analysis of International market trends.

COURSE OUTCOME

On completion of the course, students will be able to:

- Comprehend the historical context and significance of the leather goods industry in modern society.
- Classify and understand the fabrication processes of various leather goods, including shopping bags, handbags, pouches, wallets, mobile cases, and men's business satchels.
- Demonstrate proficiency in material selection, fittings, and accessory standardization, utilizing tools, equipment, and machinery for leather goods manufacturing.

- Master sketching, pattern cutting, assembly, and finishing of leather goods components using modern fabrication methods.
- Gain expertise in the classification of leather goods and garments, understand material selection, and implement cutting techniques with a focus on quality control.

RECOMMENDED BOOKS:

1. Clarks, "Manual on shoe Making"
2. CLRI, SATRA, FDDI, Publication

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted(%)
1	25	30
2	14	25
3	14	25
4	11	20
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 403	Course Title: Material Testing & Analysis-I
Semester: 4th	Credits: 4
Periods Per Week: (L: 4, T: 0, P: 0)	

COURSE OBJECTIVES

To study the various Leather chemicals to upgrade the quality of leather. To understand the characteristics of leather chemicals used in leather processing. To select the leather as per the end user's demand by knowing their chemical properties. To determine the quality of various chemicals used in leather processing.

COURSE CONTENT

UNIT-1 ANALYSIS OF WATER

Types of water- Principles of analytic methods employed in analysis ofwater.
Effect of hardness of water on various processes in leather manufacture-
Softening of water

UNIT-2 ANALYSIS OF PRETANNING CHEMICALS

Analysis of Lime, Total Bases - Analysis of Sodium Sulphide: Available Sulphide - Analysis of Ammonium Salts –- Determination of Sodium Bisulphite - Testing of Bates Preparation, Proteolytic Activity-Analysis of Salt-Analysis of Sodium sulphide- Analysis of fresh and used soak liquor, lime liquor, Pickle liquor-pH measurement ,indicators and their uses in the testing.

UNIT – 3 ANALYSIS OF CHROME TANNING AGENTS

Analysis of Basic Chromium Sulphate Powder: Moisture, Chromium, FreeSulphate & pH - Analysis of Chrome Liquor: Acidity, Chrome Content, Basicity - Proctor's & Schorlemmer's - Determination of Degree of Olation.

UNIT – 4 ANALYSIS OF VEGETABLE TANNING AGENTS

Analysis of Veg. Tanning Agents: 1. Qualitative Tests: Introduction, Preparation, Various Tests for Catechol &Pyrogallol 2. Quantitative Tests
– Introduction, Official Methods (Factors effecting Official Methods) – Hide Powder, Strength of Solution, Moisture Content of Hide Powder– Quantitative Analysis: Moisture & Total Solids, Total Solubles, Total In- solubles, Total Tannins, Total Non-tannins.

UNIT–5 ANALYSIS OF POST-TANNING CHEMICALS

Analysis of Oils/Fats - Theory of Saturation/ Un-saturation, Saponification - Determination of Free Fatty Acids, Acid Value, Saponification Value, Ester Value, Iodine Value, Unsaponificable Matterof Oils/Fats - Analysis of Fat Liquors: Sulphated

Oils-Sampling, Moisture Content, Ash, Acid Value, pH, Unsaponificable Matter, Degree of Sulphation,

COURSE OUTCOME

After completion of the course, the students will be able to:

- Understand water types and analytic methods, considering the impact of water hardness on leather processes and water softening techniques.
- Analyze pretanning chemicals, including lime, total bases, sodium sulphide, and ammonium salts. Conduct testing of bates preparation, assess proteolytic activity, and analyze various liquors with a focus on pH measurement.
- Conduct analyses of chrome tanning agents, covering parameters like moisture, chromium content, free sulphate, acidity, basicity, and degree of olation.
- Perform qualitative and quantitative analyses of vegetable tanning agents, including tests for catechol and pyrogallol, and quantitative measures of moisture, solubles, tannins, and non-tannins.
- Analyze post-tanning chemicals, covering saponification, determination of fatty acids, and analysis of fat liquors, emphasizing parameters like moisture, ash, acid value, pH, and degree of sulphation.

RECOMMENDED BOOKS:

1. Analytical Chemistry of leather manufacture – P.K.Sarkar
2. Technological controls in leather manufacture – S.Bangaraswamy- CLRI Publications
3. Methods of chemical testing of leathers –BIS-IS-582-1970
4. Standard methods -20th edition, British Publication
5. Official methods of analysis- Society of leather technologists/chemist-U.K.-1981
6. A Practical Guide for Chemical Analysis and Physical Testing of Leather, TSK Mahadevan

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted(%)
1	8	12
2	18	30
3	10	18
4	14	20
5	14	20
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 404	Course Title: LEATHER PROCESS DESIGN ENGINEERING
Semester: 4th	Credits: 3
Periods Per Week: (L: 3, T: 0, P: 0)	

COURSE OBJECTIVE:

This course aims at imparting knowledge on the technology of makingdifferent types of leathers with cleaner and greener approach.

COURSE CONTENT:

UNIT I SPECIALITY LEATHERS:

Different types of raw materials used, properties required, physical and chemical standards required and process details to achieve the specifications of different types of leathers such as upholstery, washable garment, water resistant leathers, chamois, glove and fashion leathers. Processing of exotic leathers such as reptiles, crocodiles, lizards, fish, ostrich etc.

UNIT II CLEANER PROCESSING – BEAMHOUSE:

Eco-friendly process technologies: Salt free curing options, sulphide free unhairing systems, ammonia - free deliming, salt freepickling systems, solvent free degreasing systems. Paradigm shift from chemical processing of hides and skins to bio beam house processing.

UNIT III CLEANER PROCESSING:

Tanning, post tanning and finishing less chrome and chrome-free tanning systems. Avoidance of eco sensitive substances viz., Formaldehyde, APE, Cr (VI), VOX, AOX free post tanning; solvent free finishing systems; Latest concepts and trends in leather processing. ECHA /REACH guidelines, Brand /Eco- labelling requirements and trend integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents;

UNIT IV ADVANCED FINISHING TECHNIQUES

Role of following finishing equipments; techniques for newer and novel finishing system viz., aqueous based patent finishing, cationic finishing, foam finishing. Shoe suede, garment suede, grain finished effect and specialty finishes at split leather - processing technologies and finishing techniques specially suited for the purpose. Upgradation of lower ends for better utilisation. New textures with enhanced properties; Transfer foil/coating, lamination techniques, etc., in split finishing. Latest trends.

UNIT V NEWER CONCEPTS IN LEATHER MANUFACTURE

Process controls and automation – productivity – quality consistency – Water management and Zero Discharge approaches Energy audit - Environmental footprints.

COURSE OUTCOME :

On the completion of the course, students will be able to:

- Understand specialty leathers, including raw materials, properties, and processes for upholstery, washable garment, water-resistant, chamois, glove, and fashion leathers. Learn processing of exotic leathers like reptiles, crocodiles, lizards, fish, and ostrich.
- Explore cleaner processing in the beamhouse, focusing on eco-friendly options such as salt-free curing, sulphide-free unhairing, ammonia-free deliming, and solvent-free degreasing. Embrace bio beamhouse processing to minimize chemical treatments.
- Master cleaner processing methods in tanning, post-tanning, and finishing, incorporating less chrome and chrome-free systems. Adhere to eco-friendly practices, avoiding substances like formaldehyde and adopting solvent-free finishing.
- Develop expertise in advanced finishing techniques, including aqueous-based patent finishing, cationic finishing, foam finishing, and specialty finishes for split leather. Learn technologies for upgrading lower-end materials and creating new textures.
- Explore newer concepts in leather manufacture, focusing on process controls, automation, productivity, quality consistency, water management, zero discharge approaches, energy audits, and environmental footprints in leather manufacturing.

RECOMMENDED BOOKS:

1. P.S.Briggs, "Gloving, Clothing and special leathers" products Institute, London 1981.
2. J.H.Sharphouse, "Leather Technicians Hand Book", Leather Producers Association, Northampton NN3 1JD, Reprinted 1995.
3. Exploration of GSK'S solvent selection guide in leather industry: A CSIR-CLRI tool for sustainable leather manufacturing. (2016) Green Chemistry.
4. Alternative carrier medium for sustainable leather manufacturing–A review and perspective. (2016) Journal of Cleaner Production, 112(1), 49-58

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted(%)
1	08	15
2	08	15
3	13	30
4	13	30
5	06	10
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 405	Course Title: Leather Process Technology-I LAB
Semester: 4th	Credits: 3
Periods Per Week: (L: 0, T: 0, P: 6)	

COURSE OBJECTIVES

Apply the theoretical knowledge to generate the specific type of leather. Understand the various types of leather formed & the propertiesdeveloped. Select the chemicals necessary to generate the specific typeof leather. Run a Crust process with the right quantity of chemicals atright stages. Recognize the various check points in the Crust operations. Decide the time duration of various stages of processes.

LIST OF THE PRACTICALS

1. Manufacture of some of the following industrial and sports good leathers Cricket and hockey ball, boxing gloves, wicket keeping gloves, industrial gloves, industrial belting from raw/wet blue/bag tanned hides & skin.
2. Manufacture of sole leather/insole / Harness & Saddlery leather

3. Practical exercises (in detail) involving dyeing, finishing and making of all varieties of leathers manufacturing. Students should undertake rigorous practical exercises on leather making involving some of the following type of processes from wet blue/E.I/Crust leathers and remaining should be studied during factory visit.

   i) Clothing Leathers
   ii) Antique Finish Leathers
   iv) Softy Upper Leather
   v) Corrected Grain Leathers
   vi) Burnish Upper
   vii) Split finishing
   viii) Ammunition leather / Mining Shoe Upper Leathers
   ix) Shrunken Grain Leathers
   x) Aniline/Semi Aniline Finished Leather
   xi) Two-tone Finished Leathers
   xii) Lining leather
   xiii) Suede Leathers
   xiv) Nu-buck Leathers
   xv) Upholstry Leathers

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 406	Course Title: Leather Goods and Garment Technology LAB
Semester: 4th	Credits: 3
Periods Per Week: (L: 0, T: 0, P: 6)	

COURSE OBJECTIVE

To provide practice on the principles, practices, tools and techniques of Total quality management in leather and allied sector. Students will be oriented on Quality control and Management practice requirements in leather manufacture for converting raw hides/skins into finished leather. To provide this practical orientation, any two types of leather (upper, garment etc.) will be used.

LIST OF PRACTICALS

1. Sketching, designing and Pattern cutting of various leather goods articles
2. Manufacturing of various articles of leather goods such as leather garments, shopping bags, hand bags, patch bags, pouches and wallets, suitcases, brief case, men's business satchels
3. Executive accessories, fur articles and other petty articles
4. Visits to different sections of leather goods manufacturing units

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 407	Course Title: Material Testing & Analysis-I LAB
Semester: 4th	Credits: 2
Periods Per Week: (L: 0, T: 0, P: 4)	

COURSE OBJECTIVE:

Apply the theoretical knowledge to upgrade the specific type of leather. Diploma holder in Leather Technology should have competency toanalyze water, curing and pretanning process. The knowledge of pHmeasurement, degree of tannange and mineral oxide content is helpfulin quality control of tanned leather for quality assurance.

LIST OF PRACTICALS

1. Water analysis-hardness of water (temporary & permanent), chloride content, sulphate content.
2. Analysis of common salt.
3. Analysis of lime-purity of lime, total bases.
4. Analysis of Sodium Sulphide.
5. Analysis of Deliming Agents-analysis of ammonium salts, analysisof organic acids.
6. Analysis of Pickle Liquor-acid and salt contents.
7. Analysis of Oils-moisture, acid value, iodine value, sponificationvalue.
8. Analysis of Sulphated oils, moisture, pH, acid value.
9. Qualitative analysis of Vegetable Tannins, moisture, total solid,total soluble, insoluble, non-tannins, pH.
10. Analysis of Chrome Tanning Agents-chrome powder, moisture,chrome contents, basicity, PH.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN LEATHER TECHNOLOGY	
Course Code: LTPC 408	Course Title: LEATHER PROCESS DESIGN ENGINEERING LAB
Semester: 4th	Credits: 4
Periods Per Week: (L: 4, T: 0, P: 0)	

COURSE OBJECTIVE:

To impart practical exposure in Designing and applying processes for making different types of leathers using cleaner, approaches. Advanced processing techniques with emphasis on eco friendly leather manufacture. Case studies for specific product mix (upper, garment, upholstery, glove) with details of chemical audit, energy audit, water consumption during processing.

LIST OF PRACTICALS:

1. Make different types of leather using cleaner methods.
2. Analyse process efficiencies.
3. Construct process strategy for speciality leathers.

CURRICULUM

FOR

FOURTH SEMESTER

DIPLOMA IN

MECHANICAL ENGINEERING

SUBJECT STUDY SCHEME (4TH Semester: Mechanical Engineering)

		Time in Hours				Credits			
Course Code	**Subjects**	**Theory**	**Tutorial**	**Practical**	**Total**	**Theory**	**Tutorial**	**Practical**	**Total**
MEPC401	Fluid Mechanics and Hydraulic Machinery	3	0	-	3	3	-	-	3
MEPC402	Thermal Engineering- II	3	0	-	3	3	-	-	3
HS401	Entrepreneurship and Start ups	3	0	-	3	3	-	-	3
Program Elective-1		3	0	-	3	3	-	-	3
PE401	Computer Integrated Manufacturing								
PE402	Tool Engineering								
PE403	Industrial Robotics and Automation								
MEPC403	Advance Manufacturing Processes	3	0	-	3	3	-	-	3
Open Elective-1		3	0	-	3	3	-	-	3
OE401	Safety Engineering								
OE402	Renewable Energy Technologies								
OE403	Sustainable Engineering								
MEPC404	Fluid Mechanic and Hydraulic Machinery Lab	0	0	2	2	0	0	1	1
MEPC405	Thermal Engineering- II Lab	0	0	2	2	0	0	1	1
MEPC406	Advance Manufacturing Processes Lab	0	0	4	4	0	0	2	2
		18	**0**	**8**	**26***	**18**	**0**	**4**	**22**

*** Note: the 4hrs in a week shall be utilized for sports and other activities like debates, seminars etc.**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC401**	Course Title: **FLUID MECHANICS AND HYDRAULIC MACHINERY**
Semester: **4TH**	Credits: **3**
Periods Per Week: 3 **(L: 3, T: 1, P: 0)**	

COURSE OBJECTIVE:

To understand fluid flow and related machinery for power generation, water supply and irrigation, to select and use appropriate flow measuring device, to select and use appropriate pressure measuring device, to understand and analyze the performance of pumps and turbines.

COURSE CONTENT

1. Fundamental Concept and Pressure Measurement

1.1. Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapor Pressure, Compressibility.
1.2. Fluid Pressure and Pressure Measurement: Fluid pressure, Pressure head, Pressure intensity, Concept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differential manometers, Bourdon pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.

2. Flow of Fluid and Losses

2.1. Fluid Flow: Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge and numerical problems.
2.2. Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Numerical problems to estimate major and minor losses.

3. Hydraulic Jets

3.1. Impact of jets: Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on curved vanes with special reference to turbines & pumps.
3.2. Simple Numerical problems on work done and efficiency.

4. Hydraulic Turbines

4.1. Hydraulic Turbines: Layout of hydroelectric power plant, Features of Hydroelectric power plant, Classification of hydraulic turbines, Selection of turbine on the basis of head and discharge available.
4.2. Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes – types and construction, Concept of cavitations in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities and simple numerical.

5. Hydraulic Pumps

5.1. Centrifugal Pumps: Principle of working and applications, Types of casings and impellers, Concept of multistage, Priming and its methods, Cavitations, Manometric head, Work done, Manometric

efficiency, Overall efficiency. Numerical on calculations of overall efficiency and power required to drive pumps.

5.2. Reciprocating Pumps: Construction, working principle and applications of single and double acting reciprocating pumps, Concept of Slip, Negative slip, Cavitations and separation.

COURSE OUTCOME

After the completion of the course, the student will be able to:

- Measure various properties such as pressure, velocity, flow rate using various instruments.
- Calculate different parameters such as co-efficient of friction, power, efficiency etc of various hydraulic systems.
- Describe the construction and working of turbines and pumps.
- Test the performance of turbines and pumps.

RECOMMENDED BOOK

1. Fluid Mechanics & Hydraulic Machines, S.S. Rattan, Khanna Publishing House, New Delhi.
2. Hydraulic, fluid mechanics & fluid machines – Ramamrutham S, Dhanpath Rai and Sons, New Delhi.
3. Hydraulics and fluid mechanics including Hydraulic machines – Modi P.N. and Seth S.M., Standard Book House. New Delhi.
4. One Thousand Solved Problems in Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
5. Hydraulic, fluid mechanics & fluid machines – S. Ramamrutham, Dhanpat Rai and Sons, New Delhi.
6. Fluid Mechanics and Hydraulic Machines – R. K. Bansal, Laxmi Publications, New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: MEPC402	Course Title: **THERMAL ENGINEERING-II**
Semester: **4TH**	Credits: **3**
Periods Per Week: 3 **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To provide the knowledge to the students on the internal combustion engine and fuel system ofPetrol and Diesel Engine. To help them comprehend the IC engine's cooling and lubrication systems, and to educate students on the testing of engines and provide knowledge about various types of turbines used in power plants.

COURSE CONTENT

1. Internal Combustion Engines

- **1.1** Introduction.
- **1.2** Working principle of two stroke and four stroke cycle, SI engines and CI engines,Otto Cycle, diesel cycle and dual cycle.
- **1.3** Location and functions of various parts of IC engines and materials used for them.

2. Fuel Supply and Ignition System

- **2.1** Concept of carburetor
- **2.2** Air fuel ratio
- **2.3** Simple carburettor and its application, MPFI, common rail system, Super chargingand turbo charger
- **2.1** Description of battery coil and magneto ignition system, Fault finding and remedial action in ignition system

3. Fuel system and Diesel Engine

- **3.1** Components of fuel system
- **3.2** Description and working of fuel feed pump
- **3.3** Fuel injection pump
- **3.4** Injectors

4. Cooling and Lubrication

- **4.1** Function of cooling system in IC engine.
- **4.2** Air cooling and water cooling system, use of thermostat, radiator and forcedcirculation in water cooling (description with diagram).
- **4.3** Function of lubrication.
- **4.4** Types and properties of lubricant.
- **4.5** Lubrication system of engine.
- **4.6** Fault finding in cooling and lubrication system and remedial action.

5. Testing of IC Engines

- **5.1** Engine power- indicated and brake power.
- **5.2** Efficiency- mechanical, thermal, relative and volumetric.
- **5.3** Methods of finding indicated and brake power.
- **5.4** Morse test for petrol engine.

5.5 Concept of pollutants in SI and CI engines, pollution control, norms for two orfour wheelers-EURO-1, EURO-2, methods for reducing pollution in IC engines.

6. Steam Turbines and Steam Condensers

6.1 Function and use of steam turbine.
6.2 Steam nozzles- types and application.
6.3 Steam turbines- impulse, reaction simple and compound, construction and working principle.
6.4 Governing of steam turbines.
6.5 Function of a steam condenser, elements of condensing plant
6.6 Classification- jet condenser, surface condenser.
6.7 Cooling pond and cooling towers.

7. Gas Turbines and Jet Propulsion

7.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine
7.2 Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine
7.3 Closed cycle gas turbines, PV and TS diagram and working
7.4 Principle of operation of ram-jet engine and turbo jet engine - application of jet engines
7.5 Rocket engine - its principle of working and applications

COURSE OUTCOME

After the completion of the course, the student will be able to:

- Explain the different types of IC engines and the functions and materials of various parts of the engine.
- Describe the workings of the diesel engine as well as the fuel supply and fuel system.
- Demonstrate the cooling and lubrication systems of the IC engine.
- Perform the testing of the IC engine.
- Describe different type of turbines and working of jet propulsion.

RECOMMENDED BOOKS

1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.
6. Thermodynamics: An engineering Approach YA Cengel and MA Boles TMH Publication.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	10
2	6	12
3	6	12
4	8	16
5	8	16
6	8	16
7	8	18
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **HS401**	Course Title: **ENTREPRENEURSHIP AND START UPS**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

Acquiring entrepreneurial spirit and resource fullness. Familiarization with various uses of human resource for earning dignified means of living. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation. Acquiring entrepreneurial quality, competency, and motivation, Learning the process and skills of creation and management of entrepreneurial venture.

COURSE CONTENT

1. **Introduction to Entrepreneurship and Start – Ups**
   - **1.1** Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation.
   - **1.2** Types of Business Structures, Similarities/differences between entrepreneurs andmanagers.
2. **Business Ideas and their implementation**
   - **2.1** Discovering ideas and visualizing the business
   - **2.2** Activity map
   - **2.3** Business Plan
3. **Idea to Start-up**
   - **3.1** Market Analysis – Identifying the target market
   - **3.2** Competition evaluation and Strategy Development
   - **3.3** Marketing and accounting
   - **3.4** Risk analysis
4. **Management**
   - **4.1** Company's Organization Structure
   - **4.2** Recruitment and management of talent.
   - **4.3** Financial organization and management

5 Financing and Protection of Ideas

- **5.1** Financing methods available for start-ups in India
- **5.2** Communication of Ideas to potential investors – Investor Pitch
- **5.3** Patenting and Licenses

6 Strategies

- **6.1** Exit strategies for entrepreneurs.
- **6.2** Bankruptcy, succession and harvesting strategy.

COURSE OUTCOME

After the completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Understanding the dynamic role of entrepreneurship and small businesses
- Organizing and Managing a Small Business
- Financial Planning and Control

- Forms of Ownership for Small Business
- Strategic Marketing Planning
- New Product or Service Development
- Business Plan Creation

RECOMMENDED BOOKS

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company Steve Blank and Bob Dorf K & S Ranch.
2. The Lean Startup: How today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses Eric Ries Penguin UK.
3. Demand: Creating What People Love Before They Know They Want It Adrian J. Slywotzky with Karl Weber Headline Book Publishing.
4. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business Clayton M. Christensen Harvard business

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted (%)
1	6	14
2	8	18
3	10	20
4	8	16
5	8	16
6	8	16
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE401**	Course Title: **Computer Integrated Manufacturing**
Semester: **4TH**	Credits: **3**
Hours Per Week: 3 **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The main objective of this course is to familiarize candidates with principles of Computer Integrated Manufacturing and Design in Mechanical Engineering. To get the knowledge about the flexible manufacturing and concept of Automation used in the manufacturing industries.

COURSE CONTENT

1. Computer Integrated Manufacturing

1.1 Concept of Computer Integrated Manufacturing (CIM); Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors.

2. Computer Aided Design

2.1 CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation; Group Technology Centre

3. Computer Aided Manufacturing

3.1 Computer assisted NC part programming; Computer assisted robot programming; computer aided process planning (CAPP); computer aided material requirementsplanning (MRP)

4. Flexible Manufacturing System

4.1 Computer aided production scheduling; computer aided inspection planning; computer aided inventory planning, Flexible manufacturing system (FMS); concept of flexible manufacturing.

5. Automation

5.1 Integrating NC machines, robots, AGVs, and other NC equipment; Computer aidedquality control; business functions, computer aided forecasting; office automation

COURSE OUTCOME

After completion of the course the student will be able to:

- Demonstrate the various components of CIM
- Describe the concept of Flexible manufacturing.
- Explain the working of NC machines
- Perform the NC part programing on machines.
- Highlight the various applications and parts of Robots in industries

RECOMMENDED BOOKS

1. CAD, CAM, CIM-P. Radhakrishnan and S. Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Robotics Technology and Flexible Automation – S.R. Deb, Tata McGraw Hill.
4. Computer Integrated Manufacturing Systems by Dr. V. Jaykumar, Lakshmi Publication
5. CIM by A.W Scheer, Springer-Verlag

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	22
2	8	18
3	10	22
4	10	20
5	10	18
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE401**	Course Title: **TOOL ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To understand metal cutting and forming process and factors affecting machinability, to develop knowledge of tools, dies and tool materials, to understand processes for increased productivity and quality.

COURSE CONTENT

1. Metal Cutting

1.1 Mechanics of Metal cutting; requirements of tools; cutting forces; types of chips; chip thickness ratio; shear angle; simple numerical only; types of metal cutting process; orthogonal; oblique and form cutting

1.2 Cutting fluids: types; characteristics and applications.

1.3 Tool wear: Types of tool wear; Tool life; Tool life equations.

2. Machinability

2.1 Definition: factors affecting machinability; machinability index.

2.2 Tool material: Types; characteristics; applications; Heat treatment of tool steels;specification of carbide tips; Types of ceramic coatings.

2.3 Cutting tool geometry: Single point cutting tool; drills; reamers; milling cutters.

3. Types of Die and construction

3.1 Simple Die; Compound Die; Progressive Die; Combination Die**.**

3.2 Punch & Die mountings: pilots; strippers; misfeed detectors; Pressure Pads; Knock outs; stock guide; Feed-Stop; guide bush; guide pins.

4. Die Design Fundamentals

4.1 Die Operations; blanking; piercing; shearing; cropping; notching; lancing; coining; embossing; stamping; curling; drawing; bending; forming; Die set; Die shoe; Die area; Calculation of clearances on die and punch for blanking and piercing dies; Strip layout; Calculation of material utilization factor.

5. Forming Dies

5.1 Bending methods; Bending Dies; bend allowance; spring back; spanking; bendingpressure; pressure pads; development of blank length.

5.2 Drawing: operations; Metal flow during drawing; Calculation of Drawing blank size; variables affecting metal flow during drawing; single action and double action dies; combination dies.

5.3 Fundamentals of other Tools: Constructional features of - Pressure Die casting dies; metal extrusion dies; injection molding dies; forging dies; plastic extrusion dies.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain the concepts, principles and procedures of tool engineering.
- Classify and explain various tools and tool operations.
- Select proper tool and a die for a given manufacturing operation to achieve highest productivity.
- Estimate tool wear and tool life.

RECOMMENDED BOOK

1. Tool Design - Donaldson Anglin, Tata McGraw Hill.
2. Production Technology- H.M.T.Jain, Tata McGraw Hill.
3. A Text Book of Production engineering – P.C. Sharma, S.Chand & Co.
4. Production Technology, R.K.Jain, Khanna Publishers.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	16
4	10	20
5	10	24
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **PE 401**	Course Title: **INDUSTRIAL ROBOTICS AND AUTOMATION**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To introduce the basic concepts, parts of robots and types of robots, to make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots, to select the robots according to its usage, to discuss about the various applications of robots, justification and implementation of robot, to conceptualize automation and understand applications of robots in various industries.

COURSE CONTENT

1. Fundamentals of Robotics

- **1.1** Introduction; Definition; Robots anatomy (parts) and its working:
- **1.2** Robots components; Manipulator, End effect; Construction of links, Types of joints; Classification of robots; Cartesian , Cylindrical, Spherical, Scara, Vertical Articulated;
- **1.3** Structural Characteristics of robots; Mechanical rigidity; effects of structure on control work envelope and work
- **1.4** Volume; Robot work volumes, Comparison; Advantages and disadvantages of robots

2. Robotic Drive System and controller

- **2.1** Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives; AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion.
- **2.2** Feedback devices; Potentiometers; Optical encoders; DC tachometer.
- **2.3** Robot controller; Level of Controller; Open loop and Closed loop controller; Microprocessor based control system; Robot path control; Point to point, Continuous path control and Sensor based path control; Controller programming.

3. Sensors

- **3.1** Requirements of a sensor; Principles and Applications of the following types of sensors.
- **3.2** Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach); Proximity sensing; Force and torque sensing.
- **3.3** Introduction to Machine Vision: Robot vision system (scanning and digitizing image data); Image processing and analysis; Cameras (Acquisition of images); Videoconcamera (Working principle & construction).
- **3.4** Applications of Robot vision system: Inspection, Identification, Navigation & serving.

4. Robot kinematics and Robot Programming

4.1 Forward Kinematics; Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems.

4.2 Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming; Motion Commands; Sensor Commands; End effecter commands; and Simple programs

5. Advanced Automation

5.1 Basic elements of automated system, advanced automation functions, levels ofautomation**.**

5.2 Industrial Applications: Application of robots in machining; welding; assembly andmaterial handling.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
- Explain the various robotic actuators on hydraulic, pneumatic and electrical drives.
- Explain about various types of sensors and concepts on robot vision system.
- Highlight the concepts of robot programming languages and various methods of robot programming.
- Explain the various applications of robot.

RECOMMENDED BOOK

1. Introduction to Robotics: Analysis, Systems, Applications – Saeed B. Niku, Pearson Education Inc. New Delhi 2006.

2. Industrial Robotics: Technology, Programming and Applications – M.P. Groover, Tata McGraw Hill Co, 2001.

3. Robotics Control, Sensing, Vision and Intelligence – Fu.K.S. Gonzalz.R.C and Lee C.S.G, McGraw Hill Book Co, 1987.

4. Robotics for Engineers – Yoram Koren, McGraw Hill Book Co, 1992.

5. A Text book on Industrial Robotics – Ganesh S. Hedge, Laxmi Publications Pvt. Ltd., New Delhi, 2008.

6. Robotics Technology and Flexible Automation – S.R. Deb & Sankha Deb, Tata McGraw-Hill, 2010.

7. Elements of Robotics Process Automation, Mukherjee, Khanna Publishing House, Delhi, 2018

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	8	18
3	10	22
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC403**	Course Title: **ADVANCE MANUFACTURING PROCESSES**
Semester: 4TH	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To distinguish between non-conventional machining and traditional machining processes. To know about the advancements in the area of manufacturing and production processes and impart knowledge & skills necessary for working in modern manufacturing environment. To get familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

COURSE CONTENT

1. Milling

- **1.1** Specification and working principle of milling machine
- **1.2** Classification, brief description and applications of milling machines
- **1.3** Details of column and knee type milling machine
- **1.4** Milling machine accessories and attachment – Arbors, adapters, collets, vices, circular table, indexing head and tail stock, vertical milling attachment
- **1.5** Milling methods - up milling and down milling
- **1.6** Identification of different milling cutters and work mandrels
- **1.7** Work holding devices
- **1.8** Milling operations – face milling, angular milling, form milling, straddle milling and gang milling.
- **1.9** Cutting speed and feed, simple numerical problems.
- **1.10** Indexing on dividing heads, plain and universal dividing heads.
- **1.11** Indexing methods: direct, Plain or simple, compound, differential and angularindexing, numerical problems on indexing.
- **1.12** Thread milling

2. Grinding

- **2.1** Purpose of grinding
- **2.2** Various elements of grinding wheel – Abrasive, Grade, structure, Bond
- **2.3** Common wheel shapes and types of wheel – built up wheels, mounted wheels anddiamond wheels. Specification of grinding wheels as per BIS.
- **2.4** Truing, dressing, balancing and mounting of wheel.
- **2.5** Grinding methods – Surface grinding, cylindrical grinding and centreless grinding.
- **2.6** Grinding machine – Cylindrical grinder, surface grinder, internal grinder, centre-lessgrinder, tool and cutter grinder.
- **2.7** Selection of grinding wheel.
- **2.8** Thread grinding.

3. Gear Manufacturing and Finishing Processes

- **3.1** Gear hobbing
- **3.2** Gear shaping

3.3 Gear finishing processes

4. Modern Machining Processes

4.1 Mechanical Process - Ultrasonic machining (USM): Introduction, principle, process, advantages and limitations, applications

4.2 Electro Chemical Processes - Electro chemical machining (ECM)– Fundamental principle, process, applications, Electro chemical Grinding (ECG)– Fundamental principle, process, application

4.3 Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications

4.4 Laser beam machining (LBM)–Introduction, machining process and applications

4.5 Electro beam machining (EBM)-Introduction, principle, process and applications

5. Metallic Coating Processes

5.1 Metal spraying – Wire process, powder process, applications

5.2 Electro plating, anodizing and galvanizing

5.3 Organic Coatings- oil base paint, rubber base coating

6. Metal Finishing Processes

6.1 Purpose of finishing surfaces.

6.2 Surface roughness-Definition and units

6.3 Honing Process, its applications

6.4 Description of hones.

6.5 Brief idea of honing machines.

6.6 Lapping process, its applications.

6.7 Description of lapping compounds and tools.

6.8 Brief idea of lapping machines.

6.9 Super finishing process, its applications.

6.10 Polishing

6.11 Buffing.

COURSE OUTCOME

After completion of the course the student will be able to:

- Know the Operation and control of different advanced machine tools and equipment.
- Produce jobs as per specified requirements by selecting the specific machining process.
- Develop the mind set for modern trends in manufacturing and automation.
- Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
- Know different non-traditional machining processes, CNC milling machines, special purpose machines.

RECOMMENDED BOOKS

1. Production Technology – HMT, Banglore, Tata Mc-Graw Hill

2. CNC machines – Pabla B. S. & M. Adithan, New Age international limited.

3. Non-conventional Machining – P. K. Mistra, Narvasa Publishining House

4. Manufacturing Processes – Begman & Amsted, John Willey and Sons.

5. Advanced manufacturing technology – David L. Goetsch

6. Exploring Advanced Manufacturing Technologies – Stephen F. Krar & Arthur Gil, Industrial Pres

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	12	26
2	10	20
3	5	10
4	6	14
5	5	10
6	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC404**	Course Title: **SAFETY ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To provide in-depth knowledge to students about the safety in engineering industry and its applications in various fields. To provide in-depth knowledge of various processes involved in engineering industry and the associated hazards. To familiarize the student with occupational hazards associated with various industrial Processes, to expose the students to the risk control process of identified hazards

COURSE CONTENT

1. **Introduction**
   - **1.1** Definitions- classification of industry- different processes in the engineering industry.
2. **Foundry Operations**
   - **2.1.** Furnace-health hazard - safe methods of operation. Forging operations - heat radiation -maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills.
3. **Safety in The Use Of Power Presses**
   - **3.1** Shearing -bending - rolling - drawing - turning - boring - milling - planning - grinding.
   - **3.2** Selection and care of tools - health hazards and prevention
4. **Safety In General Engineering Workshop**
   - **4.1.** Safety in handling and storage, disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.
5. **Care and Maintenance**
   - **5.1** Equipment like rope chains slings, hooks, clamps general safety consideration in material handling – manual and mechanical handling. Handling assessments- handling techniques – lifting.
   - **5.2** Occupational diseases due to physical and chemical agents.

COURSE OUTCOME

After completion of the course the student will be able to:

- Describe the various processes in engineering industries.
- Identify the various hazards associated with different operations.
- Formulate the methods of safe operations by effectively controlling the occupational health and safety hazards.
- Highlight the various safety requirements for material handling

RECOMMENDED BOOKS

1. Safety and Health for Engineers by Roger L. Breuer John Wiley & Sons, Inc.
2. Ronald P. Blake, Industrial Safety: Prentice Hall, New Delhi, Reference Books.
3. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago
4. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	8	18
2	10	20
3	8	18
4	10	20
5	12	24
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC 404**	Course Title: **RENEWABLE ENERGY TECHNOLOGIES**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To understand present and future scenario of world energy use, to understand fundamentals of solar energy systems. To understand basics of wind energy, to understand bio energy and its usage in different ways, to identify different available non-conventional energy sources

COURSE CONTENT

1. **Introduction**
   - **1.1** World Energy Use, Reserves of Energy Resources, Environmental Aspects of Energy Utilization.
   - **1.2** Renewable energy Scenario in India and World, Potentials Achievements/ Applications, Economics of renewable energy systems.
2. **Solar Energy**
   - **2.1** Solar Radiation, Measurements of Solar Radiation, Flat Plate and Concentrating Collectors.
   - **2.2** Solar direct Thermal applications, Solar Thermal Power Generation.
   - **2.3** Fundamentals of Solar Photovoltaic Conversion, Solar Cells, Solar PV Power Generation, Solar PV applications.
3. **Wind Energy**
   - **3.1** Wind Data and Energy Estimation, Types o f Wind Energy Systems, Performance.
   - **3.2** Site Selection, Details of Wind Turbine Generator, Safety and EnvironmentAspects.
4. **Bio-Energy**
   - **4.1** Biomass direct combustion, Biomass gasifiers, Biogas plants, Digesters.
   - **4.2** Ethanol production, Bio Diesel, Cogeneration, Biomass applications.
5. **Other Renewable Energy Sources**
   - **5.1** Tidal Energy, Wave Energy, Open and Closed OTEC Cycles.
   - **5.2** Small Hydro-Geothermal Energy, Hydrogen and Storage.
   - **5.3** Fuel Cell Systems, Hybrid Systems.

COURSE OUTCOME

After the completion of course, the student will be able to:

- Describe present and future energy scenario of the world
- Identify various methods of solar energy harvesting
- Identify various wind energy systems
- Evaluate appropriate methods for Bio energy generations from various Bio wastes
- Identify suitable energy sources for a location

RECOMMENDED BOOKS

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 200

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	9	20
2	10	20
3	9	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC 404**	Course Title: **SUSTAINABLE ENGINEERING**
Semester: **4TH**	Credits: **3**
Hours Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

To develop an increased awareness among students on issues in areas of sustainability, to make students understand the role of engineering and technology within sustainable development, to give students some familiarity with the methods and tools used for sustainable product-service system development, to establish in students an understanding of the role and impact of engineering activities and engineering decisions on environmental, societal, and economic well-being

COURSE CONTENT

1. Sustainable Energy

1.1 **Introduction to Sustainable Energy-** Sustainable development, concepts of sustainable development: three pillar model, engg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering threats for sustainability.

1.2 **Environment Ethics and Legislations-** Environment ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India- The Water Act, The Air Act, The Environment Act.

2. Environment Issues

2.1 **Local Environmental Issues-** Solid waste, impact of solid waste on natural recourses, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

2.2 **Global Environmental Issues-** Resource degradation: deterioration of water resources, land degradation air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

3. Tools for Sustainability

3.1 Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA) , environment auditing, bio mimicking, case studies.

4. Sustainable Habitat

4.1 **Sustainable Habitat-** Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment (GRIHA), leadership in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable transport system.

4.2 **Sustainable Industrialization and Urbanization-** Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

5. Energy Resources and Businesses

5.1 **Renewable energy resource**s- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydro plants, biogas systems, bio fuels, energy from ocean, geothermal energy, conservation of energy.

5.2 **Green technology and Green Business**: Sustainable business, green technology, green energy, green Construction, green transportation, green chemistry, green computing.

COURSE OUTCOME

After completion of the course the student will be able to:

- Explain sustainable development and different environmental agreements and protocols
- Explain local and global environmental issues.
- Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability.
- Discuss real time activities causing environmental issues and different methods to use renewable energy resources.
- Discuss different renewable energy resources and explain methods to implement green Technology.

RECOMMENDED BOOKS

1. R. L. Rag and Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2nd Edition, PHI Learning Pvt. Ltd., 2016.
2. Sustainable Development and Education by Dr. Nibedita Priyadarshini.
3. Environment and Sustainable Development by M.H. Fuleker, Bhawanr Pathak and R.K. Kele, Springer Publication.
4. Sustainable Energy for All by Ali Sayegh; Springer Publication.
5. Sustainable Development by Sondous Oressi/ Kate Drum.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20
3	8	20
4	10	20
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code: **MEPC405**	Course Title: **FLUID MECHANIC AND HYDRAULIC MACHINERY LAB**
Semester: **4TH**	Credits: **01**
Hours Per Week: **2 (L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

To understand fluid flow & related machinery for power generation, water supply and irrigation,to Select and use appropriate flow measuring device, to select and use appropriate pressure measuring device, to understand and analyze the performance of pumps and turbines.

LIST OF PRACTICALS TO BE PERFORMED

1. Measurement of pressure head by employing.
   - **1.1** Piezometer tube
   - **1.2** Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code:**MEPC406**	Course Title: **THERMAL ENGINEERING –II LAB**
Semester: **4TH**	Credits: **01**
Hours Per Week: **2 (L: 0, T: 0, P: 2)**	

COURSE OBJECTIVE:

To impart practical knowledge about the two-stroke engine and single-cylinder diesel engine along with this study of the cooling and lubrication systems of engines. Moreover, Perform testing different engines to calculate efficiency and performance at different parameters

LIST OF PRACTICALS

1. Dismantle a two stroke engine, note the function and material of each part, reassemble the engine.
2. Dismantle a single cylinder diesel engine. Note the function of each part, reassemble the engine.
3. Study of battery ignition system of a multi-cylinder petrol engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment.
4. Study of cooling of IC engine.
5. Study of lubricating system of IC engine.
6. Determination of BHP by dynamometer.
7. Morse test on multi-cylinder petrol engine.
8. Local visit to roadways or private automobile workshops.
9. Study of steam turbines through models and visit.
10. Study of steam condensers through model and visits.

PROGRAM: THREE YEARS DIPLOMA PRAGRAMME IN MECHANICAL ENGINEERING	
Course Code:**MEPC407**	Course Title: **ADVANCE MANUFACTURING PROCESSES LAB**
Semester: **4TH**	Credits: **02**
Hours Per Week: **4(L: 0, T: 0, P: 4)**	

PRACTICAL EXERCISES

Advance Turning Shop

1. Exercise of boring with the help of boring bar.
2. Exercises on internal turning on lathe machine.
3. Exercises on internal threading on lathe machine.
4. Exercises on external turning on lathe machine.
5. Re sharpening of single point cutting tool with given geometry.

Machine Shop

1. Produce a rectangular block by facing on a slotting machine.
2. Produce a rectangular slot on one face with a slotting cutter.
3. Produce a rectangular block using a milling machine with a side and face cutter.
4. Prepare a slot on one face using milling machine.
5. Job on grinding machine using a surface grinder.
6. Prepare a job on cylindrical grinding machine.
7. Exercise on milling machine with the help of a form cutter.
8. Exercise on milling machine to produce a spur gear.
9. Grinding a drill-bit on tool and cutter grinder.
10. Exercise on dressing a grinding wheel.

CURRICULUM FOR FOURTH SEMESTER OFTHREE-YEAR DIPLOMA COURSE IN MEDICAL ELECTRONICS

STUDY SCHEME FOURTH SEMESTER

		Study Scheme (HOURS)				Credits			
Code	**Subjects**	**L**	**T**	**P**	**Total Hours (L+T+P)**	**L**	**T**	**P**	**Total Credits (L+T+P)**
PC401	Basic Human Biology For Engineers	3	0	0	3	3	0	0	3
PC402	Microcontrollers	3	0	0	3	3	0	0	3
PC403	Microcontrollers Lab	0	0	2	2	0	0	1	1
PC404	Testing and Measuring Instruments	3	0	0	3	3	0	0	3
PC405	Testing and Measuring Instruments Lab	0	0	2	2	0	0	1	1
PC406	BioMedical Instrumentation – I	3	0	0	3	3	0	0	3
PC407	BioMedical Instrumentation – I Lab	0	0	2	2	0	0	1	1
PC408	Imaging Techniques and Equipment	3	0	0	3	3	0	0	3
PC409	Imaging Techniques and Equipment Lab	0	0	2	2	0	0	1	1
PC410	Basic Electrical Machines	2	0	0	2	2	0	0	2
PC411	Basic Electrical Machines Lab	0	0	2	2	0	0	1	1
Total		**17**	**0**	**10**	**27**	**17**	**0**	**5**	**22**

Program: THREE YEARS DIPLOMA PROGRAM IN MEDICAL ELECTRONICS	
Course Code: PC401	Course Title: Basic Human Biology For Engineers
Semester: 4th	Credits: 3
Periods Per Week: 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVE

In order to understand the interaction of medical equipment with the human body, students pursuing electronics and communication engineering should have a basic knowledge of various systems, related organs, secreted fluids, etc., in the human body. The emphasis of this course will be on the location and functionof organs and systems, electric signals produced in the body cells, and medical technology.

COURSE CONTENTS

1. CELL PHYSIOLOGY

1.1 Cell and its organelles: Structure and functions
1.2 Cell division: Resting and action potential
1.3 Types of tissues and tissue regeneration
1.4 Anatomical terms of the body
1.5 The skeleton: Types and functions
1.6 Disorders of cells and tissues

2. THE BODY ITS CONSTITUENTS

2.1 Survival needs of the body: Communication, transport system, intake of raw materials, and elimi-nation of waste
2.2 Protection and survival
2.3 Introduction to the study of illness

3. HEMATOLOGY

3.1 Blood composition and cellular content of blood
3.2 Functions of blood and different blood cells like RBC, WBC, and Platelets
3.3 Blood group determination
3.4 Various blood tests commonly performed: ESR, RBC, WBC, and Platelet count

4. CARDIOVASCULAR SYSTEM

4.1 Anatomy of the heart

4.2 Flow of blood through the heart

4.3 Blood supply to the heart

4.4 Conducting system of the heart

4.5 Cardiac cycle and cardiac output

4.6 Properties of cardiac muscle

4.7 Blood pressure

4.8 Cardiac failure, myocardial infarction, cardiac arrhythmias, and heart block

5. RESPIRATORY SYSTEM

5.1 The organs of respiration: Nose, pharynx, larynx, trachea, lungs, bronchi, and bronchioles

5.2 Process of respiration and breathing

5.3 Muscles of breathing and the cycle of breathing

5.4 Exchange of gases

5.5 Lung volumes and capacities

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

1 CO1: To understand the basic functioning of a human body.

2 CO2:To know about the basics of different systems in a human body and their working in tandem with each other.

3 CO3:To comprehend the details of working of cardiovascular system in a human body.

4 CO4: To understand the working of respiratory system in a human body.

RECOMMENDED BOOKS

1. ”Anatomy and Physiology in Health and Illness” by Waugh Grant.

2. ”Human Physiology Part I and II” by C.C. Chatterjee.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	10	15
2	7	10
3	9	15
4	13	20
5	9	15
Total	**48 hours**	**100**

Program: THREE YEARS DIPLOMA PROGRAM IN MEDICAL ELECTRONICS	
Course Code: PC402	Course Title: Microcontrollers
Semester: 4th	Credits: 3
Periods Per Week: 3 (L:3 , T:0, P: 0)	

COURSE CONTENT

In order to understand the interaction of medical equipment with the human body, students pursuing electronics and communication engineering should have a basic knowledge of various systems, related organs, secreted fluids, etc., in the human body. The emphasis of this course will be on the location and function of organs and systems, electric signals produced in the body cells, and medical technology.

COURSE CONTENTS

1 INTRODUCTION TO MICROCONTROLLERS

1.1 Evolution of Microcontrollers

1.2 Block diagram of Microcomputer, elements of Microcomputer, types of buses

1.3 Von Neuman and Harward Architecture

1.4 Compare Microprocessor and Microcontrollers

1.5 Need of Microcontroller

1.6 Family of Microcontrollers and their specifications

1.7 Versions of Microcontroller 8051,8951, 89C1051, 89C2051, 89C4051 with their specifications and comparison

2 ARCHITECTURE OF MICROCONTROLLER 8051

2.1 Block diagram of 8051, function of each block

2.2 Pin diagram, function of each pin

2.3 Concept of Internal memory and External memory (RAM and ROM)

2.4 Internal RAM structure

2.5 Reset and clock circuit

2.6 Various registers and SFRs of 8051

3 8051 INSTRUCTION SET AND PROGRAMS

3.1 Overview of 8051 instruction set

3.2 Various addressing modes

3.3 Classification of instructions

3.4 Data transfer instructions

3.5 Arithmetic instructions

3.6 Logical instructions

3.7 Branching instructions

3.8 Bit manipulation instructions

3.9 Stack, subroutine and interrupt related instructions

3.10 Programs based on above instructions.

4 ASSEMBLY LANGUAGE PROGRAMMING

4.1 Software development steps

4.2 Software development tools like Editor, Assembler, Linker, Loader and Hex converters.

4.3 Role of various files created at various levels in running an Assembly program using simulators like RIDE or KEIL.

4.4 Various directives of Assembly language programming

4.5 Programs using directives.

5 8051 INTERNAL PERIPHERALS AND RELATED PROGRAMS

5.1 I/O ports- List, diagram, read write operation, instructions and related SFRs

5.2 Timers/counters – list, related SFRs, programming modes, operations with diagram.

5.3 Serial communication- Basics of serial communication, baud rate, related SFRs, programming modes, operations with diagram.

5.4 Interrupts- related SFRs, types, operations with diagram.

5.5 Power saving operation- modes, related SFR.

6 EMBEDDED SYSTEM AND ITS APPLICATIONS

6.1 Brief block diagram explanation of a typical Embedded system.

6.2 Applications of Embedded systems in medical systems.

COURSE OUTCOMES

1. Interpret the salient features of the archetype of types microcontrollers IC 8051.
2. Maintain the program features of the Microcontroller-based application.
3. Develop assembly language programs.
4. Develop programs to interface 8051 microcontrollers with LED/SWITCH.

BOOK REFERENCES:

1. Kenneth, Ayala, "8051 Microcontroller Architecture Programming and Application," PHI Learning, New Delhi, ISBN: 978-1401861582
2. Mazidi, Mohmad Ali; Mazidi, Janice Gelispe; Mckinlay Roline D., "The 8051 Microcontroller and Embedded system," Pearson Education, Delhi, ISBN 978-8177589030
3. Pal, Ajit, "Microcontroller Principle and Application," PHI Learning, New Delhi, ISBN13: 978-81-203-4392-4
4. Deshmukh, Ajay, "Microcontroller Theory and Application," McGraw Hill., New Delhi, ISBN- 9780070585959

5. Kamal, Raj, ”Microcontroller Architecture Programming, Interfacing and System Design,” Pearson Education India, Delhi, ISBN: 9788131759905

6. Mathur; Panda, ”Microprocessors and Microcontrollers,” PHI Learning, New Delhi, ISBN: 978-81-203-5231-5

7. Krishna Kant, ”Microprocessors and Microcontrollers: Architecture programming and System Design,” PHI Learning, New Delhi, ISBN: 978-81-203-4853-0

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	7	15
2	7	15
3	10	20
5	10	20
6	4	10
Total	**48 hours**	**100**

Program: THREE YEARS DIPLOMA PROGRAM IN MEDICAL ELECTRONICS	
Course Code: PC403	Course Title: Microcontrollers Lab
Semester: 4th	Credits: 1
Periods Per Week: 2 (L:0 , T:0, P: 2)	

COURSE OBJECTIVE

The lab course is meant to supplement and reinforce the concepts in theory subjects by doing practical exercises.

COURSE CONTENTS

LIST OF PRACTICALS

1. Interpret details of Hardware kit for Microcontroller and practice to write and execute programs.
2. Identify different menus available in a simulator software RIDE/KEIL and demonstrate their use.
3. Develop and execute Assembly language programs using Arithmetic Instructions and demonstrate outcome for a given input data
4. Develop and execute Assembly language programs using Logical Instructions and demonstrate outcome for a given input
5. Develop and execute an Assembly language program for Addition of series of 8 bit nos, 16 bit result and demonstrate outcome for a given input data
6. Develop and execute Assembly language program for addition/subtraction of 16 bit no/multibyte nos. and demonstrate outcome for a given input data
7. Develop and execute Assembly language program for Block transfer from and to Internal/External memory using directives and demonstrate outcome for a given input data.
8. Develop and execute Assembly language program Largest/smallest of given series of no. from Internal/External memory and demonstrate outcome for a given input data.
9. Develop and execute Assembly language program arrange no in ascending/descending order from Internal/External memory and demonstrate outcome for a given input data.
10. Develop and execute Assembly language program for LED blinking/LED sequences using delay/timer mode.
11. Develop and execute Assembly language program to interface LED with Microcontroller.

Program: THREE YEARS DIPLOMA PROGRAM IN MEDICAL ELECTRONICS	
Course Code: PC404	Course Title: Testing and Measuring Instruments
Semester: 4th	Credits: 3
Periods per Week: 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

The course aims at imparting knowledge and skills to handle a wide variety of instruments while testing, troubleshooting, calibration, etc. The study of this subject will help students to gain knowledge of working principles and operation of different instruments.

COURSE CONTENTS

1. Basics of Measurements

1.1 Measurement, method of measurement, types of instruments.

1.2 Specifications of instruments: Accuracy, precision, sensitivity, resolution, range.

1.3 Errors in measurement, sources of errors, limiting errors.

1.4 Loading effect.

2. Voltage, Current and Resistance Measurement

2.1 Principles of operation and construction of permanent magnet moving coil (PMMC) instruments.

2.2 Moving iron type instruments,

2.3 Measurement of d.c voltage and current, milli-volt measurement.

2.4 Measurement of voltage, current and resistance using multimeter.

2.5 Limitations of meters with regard to frequency and input impedance.

3. Cathode Ray Oscilloscope

3.1 Construction and working of Cathode Ray Tube (CRT) oscilloscopes.

3.2 Measurement of voltage, current, frequency, time period and phase using CRO.

3.3 CRO probes, their types and features.

3.4 Working of dual beam and dual trace CRO.

3.5 Digital storage oscilloscope (DSO): block diagram and working principle.

3.6 Brief definition of other types of CRO: Mixed-domain oscilloscopes, mixed signal oscilloscopes, Handheld oscilloscopes, PC-based oscilloscopes.

4. **Signal Generators and Analytical Instruments** (08 hrs)

4.1 Explanation of Block diagram and working of low frequency and RF signal generators, pulse generator, function generator.

4.2 Block diagram and working of wave analyzer and spectrum analyzer.

5. Impedance Bridges and Q Meters

5.1 DC Bridge: Wheatstone bridge.

5.2 AC bridges: Maxwell's induction bridge, Hay's bridge, De-Sauty's bridge, Schering bridge and Anderson bridge.

5.3 Block diagram and working principle of Q meter.

6. Digital Instruments

6.1 Working principles of digital instruments.

6.2 Comparison of analog and digital instruments.

6.3 Block diagram and working of digital voltmeters (DVMs).

6.4 Block diagram and working of digital multimeter.

6.5 Measurement of time interval, time period and frequency using universal counter/frequency counter.

6.6 Working principle of logic probe, logic pulser, logic analyzer, logic comparator, signature analyzer.

COURSE OUTCOMES

After completion of the course, the student should be able to understand the fundamental concepts of main instruments used in the field of Electronics Engg.

RECOMMENDED BOOKS

1. Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Sons, New Delhi.
2. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt Ltd, New Delhi.
3. Electronics Instrumentation by Cooper, Prentice Hall of India, New Delhi.
4. Electronics Test and Instrumentation by Rajiv Sapra, Ishan Publications, Ambala.
5. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	06	10
2	06	10
3	10	25
4	08	20
5	08	20
6	08	15
Total	48	100

Program: THREE YEARS DIPLOMA PROGRAM IN MEDICAL ELECTRONICS	
Course Code: PC405	Course Title: TESTING AND MEASURING INSTRUMENT LAB
Semester: 4th	Credits: 1
Hours per Week: 2 (L: 0, T: 0, P: 2)	

COURSE OBJECTIVES

This subject is a lab course to be supplemented by the theory subject which aims to develop proficiency and understanding of practical outcomes of the subjects treated in theory.

COURSE CONTENTS

LIST OF PRACTICALS

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high-frequency voltage.
3. Measurement of voltage, frequency, time period, and phase using CRO.
4. Measurement of rise time and fall time using CRO.
5. Measurement of Q of a coil and its dependence on frequency.
6. Measurement of voltage, frequency, time, and phase using DSO.
7. Measurement of resistance and inductance of coil using AC bridges.
8. Measurement of time period, frequency, average period using universal counter/frequency counter.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC406	Course Title: Bio Medical Instrumentation-I
Semester: 4th	Credits: 3
Hours per Week: 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES

The course aims at imparting knowledge and skills to handle a wide variety of instruments while testing, troubleshooting, calibration, etc. The study of this subject will help students gain knowledge of the working principles and operation of different instruments.

COURSE CONTENTS

1. BIOELECTRIC SIGNALS, ELECTRODES SENSORS

1.1 Origin of Bioelectric signals, recording electrodes, electrode-tissue interface, polarization, skin con- tact impedance, motion artifacts, electrical conductivity of electrode jellies & creams, optical fiber sensors, biosensors.

2. CLINICAL LABORATORY INSTRUMENTS

2.1 Medical Diagnosis with chemical test, spectrophotometry, spectrophotometer type instruments, microprocessor-controlled spectrophotometer, colorimeters, automated biochemical analysis system, clinical flame photometers, computers in the clinical laboratory, sterilization & its agents.

3. BLOOD CELL COUNTERS

3.1 Types of blood cells, methods of cell counting-microscopic method, automatic optical method, electrical conductivity method, coulter counters-multiparameter coulter counter, picoscale, automatic recognition & differential counting of cells-block diagram of cell identification system.

4. PULMONARY FUNCTION ANALYZER

4.1 Pulmonary function measurements, respiratory volumes & capacities, spirometry & its types, pneumotachometers, measurement of volume-flow volume curve, area of the flow volume, nitrogen washout technique.

COURSE OUTCOMES

After completion of the course, the student should be able to understand the fundamental concepts of measurements used in the field of Medical Electronics.

RECOMMENDED BOOKS

1. Handbook of medical instruments by R.S. Khandpur
2. Biomedical instrumentation & measurements by Leslie Cromwell

3. Medical instrumentation by John Webster

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	12	25
2	12	25
3	12	25
4	12	25
Total	48	100

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC407	Course Title: Bio Medical Instrumentation –I Lab
Semester: 4th	Credits: 1
Hours per Week: 2 (L:0 , T:0, P: 2)	

COURSE OBJECTIVE

The lab course is meant to supplement and reinforce the concepts in theory subjects by doing practical exercises and can be done in a medical lab environment.

LIST OF PRACTICALS

1. Basic guidelines in the medical laboratory.
2. Rapid test for: a) Malaria b) Dengue etc.
3. Estimation of blood glucose using digital glucometer.
4. Hemoglobin test by using Sahli's hemoglobinometer and its automated version.
5. Blood pressure measurement by using analog and digital Sphygmomanometer.
6. Lung volume measurement by using analog and digital Spirometer.
7. Demonstration of the use of Colorimeter.
8. Demonstration of the use of sphectrophotometer.
9. Demonstration of automated bio-chemical analysers.
10. Demonstration of use of pneumotachometer.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC408	Course Title: Imaging Techniques and Equipment
Semester: 4th	Credits: 3
Periods per Week: 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES:

Medical Imaging refers to a number of techniques that can be used as non-invasive methods of looking inside the human body. It can be used to assist in the diagnosis or treatment of various medical conditions. By studying this course, students will be able to learn about different imaging techniques which will enable them to work as x-ray technicians, MRI technicians, etc.

COURSE CONTENTS:

1. X-RAY MACHINES & DIGITAL RADIOGRAPHY

1.1 Basis of Diagnostic Radiology, Nature and properties of x-rays, production of x-rays, stationary anode tube, Rotating Anode tube, x-ray machine, collimators & grids, x-ray films, fluorescent screens, x-ray Image intensifier, Dental x-ray machine, catheterization laboratory instrumentation.

2. X-RAY COMPUTED TOMOGRAPHY

2.1 Basic principle of computed tomography, system components of CT-All Generations in scanning system, Gantry Geometry, Patient Dose in CT scanners.

3. MAGNETIC RESONANCE IMAGING (MRI) & THERMAL IMAGING SYSTEM

3.1 Principles of MRI systems, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging system, Medical thermography, Infrared detectors, Thermographic equipment.

4. ULTRASONIC IMAGING SYSTEM

4.1 Diagnostic ultrasound, properties of ultrasound, Basic modes of transmission, ultrasonic imaging, different display modes in ultrasonic imaging, medical ultrasound, Echocardiography, Real-time ultrasonic imaging systems & its requirements.

COURSE OUTCOMES

After completion of the course, the student should be able to understand the fundamental concepts of imaging used in the field of Medical Electronics.

RECOMMENDED BOOKS

1. Handbook of medical instruments by R.S. Khandpur.
2. Biomedical Instrumentation & Measurements by Leslie Cromwell.
3. Medical instrumentation by John Webster.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allocation (%)
1	14	30
2	14	30
3	10	20
4	10	20
Total	48	100

Program: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC409	Course Title: Imaging Techniques and Equipment Lab
Semester: 4th	Credits: 1
Periods per Week: 2 (L:0 , T:0, P: 2)	

COURSE OBJECTIVE

The lab course is meant to supplement and reinforce the concepts in theory subjects by doing practical exercises and can be done in a medical lab environment.

LIST OF PRACTICALS

1. Study of digital x-ray machine.
2. Study of image intensifier.
3. Study of CT-scanner.
4. Study of MRI scanner.
5. Study of sonography machine.
6. Study of medical thermography.
7. Demonstration of working of medical thermographic equipment.

Program: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC410	Course Title: Basic Electrical Machines
Semester: 4th	Credits: 3
Periods per Week: 3 (L:3 , T:0, P: 0)	

COURSE OBJECTIVES

1. To study the fundamental concept of Electrical machines.
2. To understand the operating principle of transformers and motors.
3. To study different types of Electrical machines.

COURSE CONTENTS

1. Single phase and Three Phase Supply

1.1 Advantage of three-phase system over single-phase system.
1.2 Star Delta connections.
1.3 Relation between phase and line voltage and current in a three-phase system.
1.4 Power and power factor in three-phase system and their measurements by one, two and three wattmeter methods.

2. Transformers

2.1 Principle of operation and constructional details of single phase and three-phase transformer.
2.2 Core type and shell type transformers.
2.3 Difference between single phase and three phase transformers and their applications.
2.4 Voltage Regulation of a transformer (No Derivation).
2.5 Losses in a transformer.
2.6 Efficiency, condition for maximum efficiency and all day efficiency.
2.7 Auto transformers.
2.8 Brief introduction of CTs and PTs (Current transformer and potential transformer) and CVT (Constant Voltage Transformer).

3. **Introduction to Rotating Electrical Machines** (06 hrs)

3.1 Basic Electromagnetic laws (Faraday's laws of Electromagnetic Induction).
3.2 Definition of motor and generator.
3.3 Basic principle of a generator and a motor.
3.4 Torque due to alignment of two magnetic fields and the concept of Torque angle.

4. DC Machines

4.1 Principle of working of D.C motors and D.C generator, their constructional details.

4.2 Function of the commutator for motoring and generating action.

4.3 Factors determining the speed of a DC motor.

4.4 Different types of excitations.

4.5 Characteristics of different types of DC machines.

4.6 Starting of DC motors and starters.

4.7 Application of DC machines.

5. A.C. Motors

5.1 Revolving magnetic field produced by poly phase supply.

5.2 Brief introduction about three phase induction motors, its principle of operation.

5.3 Types of induction motors and constructional features of squirrel cage and slip-ring motors.

5.4 Starting and speed control.

5.5 Star Delta and DOL (Direct-on-line) starters.

5.6 Reversal of direction of rotation of 3-phase induction motors.

5.7 Applications of induction motors.

6. Single Phase Fractional Kilowatt Motors

6.1 Introduction to Single Phase Fractional Kilowatt Motors.

6.2 Principle of operation of single-phase motors.

6.3 Types of single-phase induction motors and their constructional details (i.e., Split phase, capacitor start, capacitor start and run, shaded pole and reluctance start).

6.4 Introduction to servo-motors and stepper motors.

6.5 Concept of micro-motors.

COURSE OUTCOMES

The student shall be able to understand various Electrical Machines and their practical application in Electrical Engineering and electronics. They shall have knowledge of how various electrical machines work and will have experience in maintenance and servicing of Electrical Machines.

RECOMMENDED BOOKS

1. Electrical Machines by SK Bhattacharya, Tata McGraw Hill, Education Pvt Ltd. New Delhi.
2. Electrical Machines by SK Sahdev, Uneek Publications, Jalandhar.
3. Electrical Machines by Nagrath and Kothari, Tata McGraw Hill, New Delhi.
4. Electrical Machines by JB Gupta, SK Kataria and Sons, New Delhi.
5. Electrical Machines by Smarajit Ghosh-Pearson Publishers, Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	08	15
3	06	15
4	10	20
5	10	20
6	10	20
Total	48	100

Program: THREE YEARS DIPLOMA PROGRAMME IN MEDICAL ELECTRONICS	
Course Code: PC411	Course Title: Electrical Machines Lab
Semester: 4th	Credits: 1
Periods per Week: 2 (L: 0, T:0, P: 2)	

COURSE OBJECTIVES

This course is a lab course related to the theory subject of Electrical Machines. There will be more emphasis on practical aspects along with the theory input.

LIST OF PRACTICALS

1. Measurement of the angular displacement of the rotor of a slip-ring induction motor on the application of DC to stator of motor winding in sequence and simultaneously to each phase of rotor winding.
2. Speed control of DC shunt motor
   (i) Armature control method
   (ii) Field control method
3. Study of DC series motor with starter (to operate the motor on no load for a moment).
4. Study of 3 point starter for starting D.C. shunt motor.
5. To perform open circuit and short circuit tests for determining:
   (i) Equivalent circuit
   (ii) The regulation
   (iii) Efficiency of a transformer from the data obtained from open circuit and short circuit tests at full load.
6. To find the efficiency and regulation of a single-phase transformer by actually loading it.
7. Checking the polarity of the windings of a three-phase transformer and connecting the windings in various configurations.
8. Finding the voltage and current relationships of the primary and secondary of a three-phase transformer under balanced load in various configurations conditions such as:
   (i) Star-star
   (ii) Star-delta

CURRICULUM FOR

FOURTH SEMESTER

DIPLOMA IN

MEDICAL LAB TECHNOLOGY

4th SEMESTER

SUBJECT SCHEME FOR MEDICAL LAB TECHNOLOGY

		Time in Hours				Credits			
Course code	**Subjects**	**Theory**	**Tutorial**	**Practical**	**Total**	**Theory**	**Tutorial**	**Practical**	**Total**
MLPC 401	Clinical Microbiology-IV	4			4	4	0		4
MLPC 402	Clinical Hematology-IV	3			3	3	0		3
MLPC 403	Clinical Bio-Chemistry IV	3			3	3	0		3
MLPC 404	Cytology-I	3			3	3			3
MLPC 405	Medical Laboratory Management	4			4	4	0		4
MLPC 406	Clinical Microbiology Lab-IV			2	2		----------	1	1
MLPC 407	Clinical Hematology Lab -IV			2	2			1	1
MLPC 408	Clinical Bio-Chemistry Lab- IV			2	**2**			**1**	1
MLPC 409	Cytology Lab -I			2	**2**			1	1
	Total	**17**		**8**	**25**	**17**		4	**21**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 401	Course Title : Clinical Microbiology- IV (Immunology and Mycology)
Semester : **4th**	Credits: 04
Periods per Week: 4 (L:4 T:0 P:0)	

Course objectives

The students undergoing training of medical laboratory technology learn the techniques of collection of samples, their processing and identification of various fungal infections and diagnosis of microbial infections by serological methods. In addition to the above, students are given training in the use of safety measures while handling infected materials. The training is aimed to make the students competent to isolate and identify fungi and do serological tests for various microbial infections.

DETAILED CONTENTS

1. Mycology (06 hrs)

   - General characteristics and classification of medically important fungi

2. Fungal Culture and Identification of :- (05 hrs)

   - Medically important fungi - Candida, Dermatophytes
   - Laboratory Contaminants – Penicillium, Rhizopus, Aspergillus

3. Fungal Culture media (04 hrs)

   - SDA (Sabouraud's dextrose agar) with and without antibiotics
   - CMA (Corn meal agar)
   - BHI (Brain Heart Infusion)

4. Collection and processing of sample for diagnosis of fungal infection in Skin, Nailand Hair (06 hrs)

   - KOH preparation
   - LCB (Lactophenol cotton blue) Tease Mount .
   - India ink Preparation.

5. Introduction to Immunology (03 hrs)

Immunity:
- Innate and
- Acquired

6. Antigens and Antibodies (05hrs)
- Definition, types and properties

7 Introduction to (02 hrs)
- Complement
- Hypersensitivity

8 Antigen – Antibody Reactions (08 hrs)
- Principle and applications of agglutination, precipitation and flocculation reactions

9 Serological tests (07 hrs)

Principle, procedure and interpretation of
- Widal Titre - Tube method/ Slide method.
- Anti streptolysin O (ASO)
- C-reactive protein (CRP)
- VDRL/RPR
- Rheumatoid factor (RF)

10 Principle and application of (02 hrs)
a) ELISA (direct and indirect)
b) Immunochromatography

Course outcome
On completion of Unit 1 students shall be able to;

Gain and understand the knowledge about the Medically important Fungi.
Unit II
Prepare the various culture media .
Unit III
collect various samples and their processing
Unit IV
perform the fungal culture and identify the fungal Isolates.
Unit V
Develop the knowledge and understanding of mechanism of Immunity and immune system.
Unit VI
Understanding and develop the knowledge about Antigen and Antibodies .
Unit VII
Gain the knowledge of compliment and hypersensitivity and their importance.
Unit VIII

Gain the knowledge of mechanism of antigen antibodies reaction .
Unit IX
Perform various serological Tests
Unit X
Explain the principal and application of ELISA and IC

RECOMMENDED BOOKS

1. Medical Laboratory Technology by Kanai Lal Mukherjee; Tata McGraw Hill Publishers, New Delhi

2. An introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinemann Oxford

3. Textbook of Microbiology by Ananthanarayan and Panikar; Orient Longman, Hyderabad

4. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi

5. Text Book of Medical Microbilogy by Satish Gupta; JP Brothers, New Delhi

6. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesberg; Cambridge University Press; UK

7. Text Book of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House; Mumbai

8. Medical Lab Science Theory and Practice by J Ochei and A Kolhatkar

9. Text Book of Medical Microbiology by Greenwood, ELB

DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	06	12
2	05	10
3	04	08
4	06	15
5	03	08
6	05	10
7	02	05
8	08	15
9	07	12
10	02	05
Total	**48**	**100**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 402	Course Title : Clinical Hematology- IV
Semester : **4th**	Credits: 03
Periods per Week: 3 (L:3 T:0 P:0)	

Course objective

This subject aims to enable the students to carry out routine clinical laboratory investigation (blood and other body fluids). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles. The training in laboratory safety is also provided.

DETAILED CONTENTS

1. Introduction to haemostasis (10 hrs)

   1.1 Theories of blood coagulation
   1.2 Platelets and their role in haemostasis
   1.3 Bleeding disorders and related diseases

(15hrs)

2. Laboratory Diagnosis of haemostatic disorder
   2.1 Principles, procedure and clinical importance with their reference value of: Prothrombin time, prothrombin time index (PTI) International normalized ratio (INR),
   2.2 Activated Partial Thromboplastin time (APTT)
   2.3 Bleeding time (BT), Hess test,
   2.4 Clotting time (CT), and clot retraction test (CRT)

3. Bone – marrow (11 hrs)

   3.1 Composition and function of bone-marrow
   3.2 Aspiration of bone-marrow techniques.
   3.3 Preparation, staining and examination of bone-marrow smears
   3.4 Iron staining (Perls' reaction)
   3.5 Significance of bone-marrow examination

4 Leukemia (12 hrs)

   4.1 Definition of leukemias

4.2 Classification (FAB)
4.3 Laboratory diagnosis of various leukemias

Course outcome

On completion of the course the students should be able to

Unit 1 Understand Haemostasis,and coagulation of blood ,role of platelets and related diseases

Unit-2 :
Understand the Haemostasis, Haemostatic disorders and complete coagulation Cascade .

Unit-3 :
Understand Bone marrow,its composition and function .
Perform the staining and examination of marrow smear

Unit-4 :
Explain leukemia and its diagnosis

.

RECOMMENDED BOOKS

- Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishing Company, New Delhi
- An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Heinenmann, Oxford
- Medical Laboratory Manual for Tropical Countries by Monica Cheesberg; Cambridge University Press; UK
- Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai
- Practical Haematology by J.V Decie; ELBS with Churchill Living Stone, UK
- Medical Laboratory Science Theory and Practical JO Chei and Kolhatkar, Tata McGraw Hill Publishing Company Ltd., New Delhi
- Haematology for Medical Technologists by Charles F. Seiverd 5th Ed. 1983, Lea & Febigue Philadalphiae

DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	10	25
2	15	30
3	11	20
4	12	25
Total	**48**	**100**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 403	Course Title : Clinical Biochemistry-IV
Semester : **4th**	Credits: 03
Periods per Week: 3 (L:3 T:0 P:0)	

Course objectives

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of different tests is obtained. The students are also given basic training in safety measures, quality control and automation

DETAILED CONTENTS

Theory

1. Electrophoresis and Chromatography (10 hrs)

   1.1 Principles and procedures of Gel Electrophoresis
   1.2 Principles and procedures of paper chromatography
   1.3 Clinical importance

2. Thyroid Hormone (T_3 , T_4 and TSH) (10 hrs)

   2.1 Introduction and clinical importance TFT

   2.2 Thyroid function Estimation by ELISA,CLIA

3. Introduction to Tumor markers (07 hrs)

   Clinical importance of :
   CA-125, CEA, Alfa feto Proteins,PSA and HCG.

4. Molecular Bio-Techniques (07 hrs)

   Introduction and application
   Electrophoresis
   PCR and its applications

5. Diagnostic Enzymes and Iso enzymes (06hrs)

Clinical importance and Reference range of

CK,CKMM,CKMB,CPK,CPK1,CPK2,CPK3,LDH,LDH1,LDH2,LDH3

6. Quality Assurance in Clinical Biochemistry (08 hrs)

Internal quality assessment
External quality assessment

Course outcome
On completion of the course the student should be able to

Unit -1: Perform Electrophoresis and chromatography.

Unit -2 : Perform TFT with better understanding of its clinical importance

Unit-3 : Perform Tumor markers and their diagnostic importance.

Unit-4 : Develop the importance of molecular techniques and their diagnostic use.

Unit-5 : Perform the estimation of various diagnostic enzyme with proper know how of their clinical importance.

Unit-6 : Perform quality assessment and maintain the Quality Assurance

RECOMMENDED BOOKS

- A Procedure Manual for Routine Diagnostic Tests, Vol. I, II and III by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
- Practical Clinical Biochemistry by Varley; Heinmann Publishers, Oxford
- A Text Book of Medical laboratory Technology by P Godkar; Bhalani Publishers, Mumbai
- Medical Laboratory Science Theory and Practice by J Ochaei and A Kolhatkar, Tata McGraw Hill

DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	10	20
2	10	20

3	07	15
4	07	20
5	06	13
6	08	12
Total	**48**	**100**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 404	Course Title : Cytology-I
Semester : **4th**	Credits: 03
Periods per Week: 3 (L:3 T:0 P:0)	

Course objectives

This part of the subject is aimed at introducing the students to the various types of tissue preparations and developing expertise in the students to cut very thin tissue sections from tissue blocks and facilitate visualization using various stains and dyes. Cytology part aims at exposing the students to the latest advancements in cytological investigations.

DETAILED CONTENTS

1. Cell (04 hrs)

   1.1 Definition and function
   1.2 Structure
   1.3 Multiplication (Mitosis and Meiosis)

2. Exfoliative Cytology (08 hrs)

   2.1 Introduction
   2.2 Preparation of vaginal & cervical smears
   2.3 Collection and Processing of specimen for cytology
   - Urine
   - Sputum
   - CSF (Cerebro Spinal Fluid)
   - Other fluids

3. Fixation (Cytological Specimen) (06 hrs)

3.1 Definition
3.2 Various types of Cytological fixatives
3.3 Advantages and Disadvantages

4. Cytological Staining (08 hrs)

Principle, Technique and interpretation of results in

- Papanicalaou staining
- May Grunwald & Giemsa staining
- Haematoxylin and Eosin staining

5. Malignant Cells (03 hrs)

5.1 Characteristics
5.2 Differences from normal cell

6. Hormonal Assessment (05 hrs)

6.1 Importance of HCG, ER, PR
6.2 Use of Hormonal Assessment

7. Aspiration Cytology (07 hrs)

7.1 Principle of FNAC (Fine Needle Aspiration Cytology)
7.2 Indications of FNAC

8. Cytological special stains (07 hrs)

Principle, Technique & Interpretation of :

10.1. PAS (Periodic Acid Schiffs reagent Stain)
10.2. Zeihl Neelson's(ZN) Stain (AFB)

Course outcome
On completion of
Unit 1 students shall be able to
Explain cell ,structure and multiplication .

Unit -2 : Process the various samples(Exfoliative) for cytological examination

Unit-3 : Perform the fixation of cytological specimens.
Unit-4 : Perform the various staining procedures in cytology

Unit-5 : Differentiate the various features of malignant cells.

Unit-6 : Explain the use and importance of hormonal assessment.

Unit-7 : understand the indications of FNAC.

Unit 8 : Perform the various special stains.

RECOMMENDED BOOKS

- An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Scientific, London
- Carleton's Histological Technique by RAB, Drury, MADM (OXON), FRC Path, Northwick Paru Hospital, Harrow, Middlesex
- Theory and Practice of Histological Technique by John D. Bancroft, Churchill Livingstone, London
- Cellular Pathology Techniques by CFA Culling, Butterworths, London
- Medical Lab Technology by Dr. Ramnik Sood, MD, Maulana Azad College, New Delhi
- Diagnostic Cytology and its Histopathology Basis by Leo Pold G.Koss; JB Lupein, Philladelphia

DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	04	06
2	08	17
3	06	12
4	08	15
5	03	06
6	05	09
7	07	21
8	07	14
Total	**48**	**100**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 405	Course Title : Medical Laboratory Management
Semester : **4th**	Credits: 04
Periods per Week: 4 (L:4 T:0 P:0)	

Course objectives

The students are taught techniques of planning a clinical laboratory. They are also supposed to be taught how to procure chemicals, reagents and equipment. The students are imparted special training in maintaining laboratory equipment, the preventive maintenance and daily up keeping. They are also given training for the maintenance of stocks and inventory. They are also given knowledge of recording results, interpretation, quality control and reproducibility. Students also learn how to communicate effectively.

DETAILED CONTENTS

1. **Laboratory Quality Management system** (08 hrs)

- Management .Principle,Planing of management
- Laboratory organization- Organizing, leading ,distribution of activities and Evaluation/Assessment
- Role of medical laboratory technology in total health care .

2. **Laboratory and Blood bank Lay out /Design** (08 hrs)

- Physical aspects/ Facilities of Premises

3. **Material Management** (06 hrs)

- Financial Management/ resources, Procurement and importing.
- Inventory, Inspection and storage .

4. **Quality Assurance and Source of errors in clinical laboratory** (10 hrs)

- Quality control (internal/external),
- Precision, Accuracy and SOP's (Standard operating Procedures)
- Pre analytical , Analytical , Post Analytical errors

- Standard deviation as per national standards

5. **Laboratory Safety Management/Measures** (05 hrs)

- Importance/Objectives of Safety in clinical laboratories
- Common hazards in laboratories
- Safe laboratory premises and personal safety measures in different laboratory sections .
- Waste management (Decontamination of infectious material and Disposal of Bio-medical waste)

6. **First Aid in Clinical Laboratory:** (09 hrs)

6.1 Laboratory First Aid kit
6.2 First Aid Measures in
- Contact with corrosive chemicals /reagents
- Cuts, Needle stick injuries
- Bleeding
- Electric Shock
- Heat Burns
- Gas/Toxic inhalation
- Swallowing of poisonous reagents/Chemicals

7. **Medical Ethics and Code of Conduct** (08 hrs)

Ethics and code of conduct - legal aspects – confidentiality / negligence; legal implications, consumer protection and insurance for professional health hazards

8 **Laboratory Equipment - Care and Maintenance** (05 hrs)

Preventive maintenance and care of various laboratory equipment

9 **Role of Computers in Lab** (03 hrs)

10 **Laboratory Accreditation – Introduction** (02 hrs)

Course outcome
On completion of
Unit 1 students shall be able to

Manage and organize clinical laboratory activities, describe the role of clinical laboratory in health care system.

Unit -2 : illustrate the Medical laboratory and blood bank Design/ layout with facilities of premises

Unit-3 : Manage the finance ,Procurement and inventory of clinical laboratory.
Unit-4 : Resolve the errors in clinical laboratory with proper application of QC , and SOPs

Unit-5 : Expalin the objectives of safety in clinical laboratory and rectify the common hazards.

Unit-6 : Take First Aid Measures for various clinical laboratory accident .

Unit-7 : Disseminate the Knowledge of legal aspects in clinical laboratory.

Unit 8 : Take care of various clnical laboratory equipments and their maintenance

Unit 9 : Explain the role of computers in clinical laboratory.

Unit-10 : Understand and explain **Accreditation, its role and importance .**

RECOMMENDED BOOKS

1. Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai (India)

2. Text Book of Medical Laboratory Technology by FJ Baker; Butterworths Heinmann Publishers, Oxford

3. Text Book of Medical Laboratory Technology by KL Mukherjee Vol I, II and III; Tata McGraw Hill Publishers, New Delhi

4. Medical Lab Technology by Ramnik Sood, Jay Pee Brothers, New Delhi

5. District Laboratory Practice in Tropical Countries by Monica Chesbrough, Churchill Livingstone.

6. Laboratory Management by Puthwilliams.

DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	08	12
2	08	12
3	06	10
4	10	14
5	05	08
6	09	16
7	08	14

8	05	07
9	03	05
10	02	02
Total	**64**	**100**

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 406	Course Title : Clinical Microbiology - IV LAB
Semester : **4th**	Credits: 01
Periods per Week: 2(L:0 T:0 P:2)	

LIST OF PRACTICALS

1. Preparation of different culture media used in mycology - Sabouraud's dextrose agar with and without antibiotics, Corn meal agar, BHI (Brain, Heart Infusion)

2. To perform wet mount techniques – KOH (LCB team mount)

3. To study characteristics of common laboratory fungal contaminants

4. Collection and processing of samples for diagnosis of fungal infections in skin, hair, nail scrapings

5. To perform serological tests

   - Widal test (Both slide and tube method)
   - ASO titre
   - CRP
   - Rheumatoid factor
   - VDRL Test
   - HIV Screening
   - HBsAg Screening

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 407	Course Title : Clinical Hematology - IV Lab
Semester : **4th**	Credits: 01
Periods per Week: 2(L:0 T:0 P:2)	

LIST OF PRACTICALS

1. Determination of bleeding time by Ivy's and Dukes method
2. Determination of clotting time by Lee and white and capillary method
3. Determination of prothrombin time, index and INR (International Normalised Ratio)
4. Determination of Activated Partial thrombo plastin time (APTT)
5. Demonstration of Hess test
6. Performance of Clot retraction time .

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 408	Course Title : Clinical Bio–Chemistry - IV LAB
Semester : **4th**	Credits: 01
Periods per Week: 2(L:0 T:0 P:2)	

LIST OF PRACTICALS

1. Demonstration of Gel Electrophoresis .
2. Demonstration of paper Chromatography
3. Demonstration of ELISA Technique.
4. Demonstration of CLIA Technique .
5. Demonstration of thermal cycler .
6. Preparation of standards to check the internal quality system by using pooled serum or plasma .

PROGRAM : THREE YEAR DIPLOMA PROGRAM IN MEDICAL LAB TECHNOLOGY	
Course code :MLPC 409	Course Title : Cytology - I LAB
Semester : **4th**	Credits: 01
Periods per Week: 2(L:0 T:0 P:2)	

LIST OF PRACTICALS

1. Demonstration of cell
2. Demonstration of malignant cell
3. Processing of sputum sample for malignant cells(M cells)
4. Processing of urine samples for malignant cells
5. To perform PAP stain on given smear
6. To perform MGG stain on given smear
7. To perform H&E on given smear
8. Preparation of dry smear and wet smear

CURRICULUM
FOR
FOURTH SEMESTER
DIPLOMA IN
OFFICE MANAGEMENT
AND
COMPUTER
APPLICATIONS

Credit Based Curriculum For Fourth Semester Of Three-Year Diploma Courses In Polytechnics Of UT Of J&K (OMCA)

SUBJECT SCHEME **SEMESTER: 4th**

Course Code	Subjects	Time in Hours				Credits			
		Lecture	Tutorial	Practical	Total	Lecture	Tutorial	Practical	Total
PC401	English and Communication Skill	3	-	-	3	3	-	-	3
PC402	English and Communication Skill Lab	-	-	2	2	-	-	1	1
PC403	Stenography-III	0	-	6	6	0	-	3	3
PC404	Organizational Behaviour and Personality Development	4	-	0	4	4	-	0	4
PC405	Book keeping-II	2	2	-	4	2	2	-	4
ES406	Computer Based Accounting-II	0	-	4	4	-	-	2	2
PE407	Web Designing/Internet and Networking	0	-	4	4	0	-	2	2
SE408	Seminar	2	-	-	2	2	-	-	2
409	Self-Learning and Self Skill	-	-	2	2	-	-	1	1
AU410	Indian Constitution (Audit Course)	3	-	0	3	0	-	0	0
	Total	**14**	**2**	**18**	**32**	**11**	**2**	**09**	**22**

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **PC401**	Course Title**: ENGLISH AND COMMUNICATION SKILLS**
Semester:**4Th**	Credits: **3**
Periods per week: **03(L: 03, T: 00, P:00)**	

COURSE OBJECTIVE:
The main objective of this course is to make the learner acquire the knowledge of oral and written communication skills.

COURSE CONTENT:

1. Literature (Facets of Literature)
1.1 Short Stories
1.1.1 I sell my dreams by Gabriel Marquez
1.1.2 The mark on the wall by Virginia Wolf
1.1.3 The Open Window by HH Munro (Saki)
1.2 Prose.
1.2.1 Of Studies by Francis Bacon
1.2.2 The Interview by Christopher Silvester.
1.2.3 The Grooming of a Boy by Abrahim Lincoln
1.3. Poems
1.3.1 If by Rudyard Kipling
1.3.2 The Nightingale and the Glow-worm by William Cowper
1.3.3 A thing of beauty by John Keats

2. Grammar
2.1 Modal verbs
2.2 Words often miss-pelt
2.3 Foreign words and phrases used in Communication
2.4 Punctuation

3. Translation:
3.1 Translation of sentences from English to Urdu/Hindi/Punjabi.

4. Communication.
4.1 Phonetics: Organs of speech; The study of pronunciation along with key to symbols which represent certain sounds
4.2 Voice modulation – quality, projection, volume, rate and high pitch etc.
4.3 Situational conversations
4.4 Listening skills
4.5 Expansion of headlines into paragraph

5. Comprehension.
5.1 Comprehension of Poetical Passages

COURSE OUTCOME:
After the completion of the course, the students will be able to:

- Make themselves proficient in literary contexts
- Comprehend a given text.
- Analyze the content words.
- Restate the vocabulary to express in verbal and written communication
- Use correct grammar
- Define foreign words and expressions
- Gain accuracy in pronunciation and restoring Standard English therebycrafting better command in English language.

RECOMMENDED BOOKS :

1. Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons
2. The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India
3. New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
4. Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill
5. English Conversation Practice by Grount Taylor; Tata McGraw Hill
6. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd.Delhi
7. Communication Skills by R Datta Roy and KK Dhir; Vishal Publication, Jalandhar.

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME (HOURS)	MARKS
1.	22	45
2.	08	15
3.	04	10
4.	10	20
5.	04	10
TOTAL	**48**	**100**

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **PC402**	Course Title: **ENGLISH AND COMMUNICATION SKILLS -LAB**
Semester:**4th**	Credits: **01**
Periods per week: **02 (L:00 T:00 P:02)**	

COURSE OBJECTIVE:

A student must have a fair knowledge of English language and skills to communicate effectively to handle future jobs in industry. The objective of this course is to develop effective communication skills among the students in professional and inter-personal communications facilitating their all-around development of personality.

LIST OF PRACTICALS:

1.Debate on given
topics
2. Recital of poetry
3.Situational
conversations
4.Speaking for one-minute on a given topics
5. Listening exercises (on the pattern of TOEFL/IELTS)
6. Appreciate reading passages or articles from various sources with correct pronunciation and voice modulation.
7. Errors in Pronunciation

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **PC403**	Course Title: **Stenography-III**
Semester:**4th**	Credits: **03**
Periods per week: **06 (L:00, T:00, P:06)**	

COURSE OBJECTIVE:

To make the students understand the concept of strokes so that secret message has limited unauthorized access.

COURSE CONTENT:

1. The Shun Hook

1.1The termination Shun
1.2 Shun following Circles S & NS
1.3 Shun hook
medially
1.4 Words ending in –uation and –uition

2. The Aspirate(H) & Upward and Downward R

2.1 Upward and Downward H 2.2 Tick H and Dot H
1.1 Upward and Downward R

2. Upward and Downward L & SH

3.1 Upward L
3.2 L preceding/following curve and circle
3.3 L after N &NG and vowel indication
3.4 Upward and Downward SH

4. Compund Consonants

4.1 Initial W and WH
4.2 Strokes L and R
4.3 Addition of P or B to M

5. The Halving principle (Section-1)

6. The Halving principle (Section-2)

7. The Doubling Principle

COURSE OUTCOME:

After the completion of the course, the students will be able to:

- **T**ake dictation, transcript and all types of correspondence, prepare report in less time.

RECOMMENDED BOOKS:

1.Pitman Shorthand Instructor and Key

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME (HOURS)	MARKS
1.	22	20
2.	08	10
3.	15	15
4.	06	10
5.	15	15
6.	15	15
7.	15	15
TOTAL	**96**	**100**

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **PC404**	Course Title**: Organizational Behaviour and Personality Development (OB & PD)**
Semester:**4th**	Credits: **04**
Periods per week: **04 (L:04, T:00, P:00)**	

COURSE OBJECTIVE:

The main objective of this course is to understand the human interaction in an organisation and inculcate positive qualities with organisation

COURSE CONTENT:

1. Organisational Behaviour

1.1Concept of Organisational behaviour(OB) and objectives
1.2 Management role, skill and discipline that contribute to Organisational Behaviour(OB)
1.3 Challenges of Organisational Behaviour(OB)
1.4 Opportunities of Organisational behaviour (OB)
1.4.1 Positive work environment
1.4.2 Ethics

2. Individual Behaviour

2.1 Learning
2.1.1 Concept of learning, conditioning, shaping and reinforcement
2.2 Perception
2.2.1 Meaning/ Features and importance of perception
2.2.2 Factors affecting perception
2.3 Attitude
2.3.1 Concept-Significance
2.3.2 Factor affecting attitudes-Positive attitude and Negative attitude
2.3.3 Way to develop positive attitude

3. Group behaviour

3.1 Meaning and importance of group
3.2 Types of group
3.3 Five stage model group development
3.4 Motivation

3.4.1 Concept of motivation
3.4.2 Significance
3.4.3 Internal and external motive
3.4.4 Importance of self motivation
3.4.5 Factors leading to de-motion

3. Introduction to Personality Development

4.1 Concept of Personality and features
4.2Determinant of Personality and techniques
4.3Cause of Stress and technique to handle stress

5. Human Resource Management

5.1 Meaning and importance of Human Resource Management
5.2 Objectives and functions of Human Resource Management

6. Time Management

6.1 Meaning ,importance of time management
6.2 Techniques for managing time

COURSE OUTCOME:

After the completion of the course, the students will be able to:

- To enhance communication skill, confidence , emotional intelligence , self awareness
- To inculcate leadership qualities, interpersonal skill
- To understand how individual, group and structure have impact on organization

RECOMMENDED BOOKS :

1.Organisational behaviour by StephenRoghin.
2. Organisational behaviour by Kanika, Sultan Chand and son.
3.Management concept and Organisational behaviour by Dr. NK. Sahni

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME (HOURS)	MARKS
1.	12	15
2.	12	15
3.	12	20
4.	12	20
5.	12	20
6.	04	10
TOTAL	**64**	**100**

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **PC405**	Course Title: **Book Keeping-II**
Semester: **4th**	Credits: **04**
Periods per week: **04 (L:02, T:02, P:00)**	

COURSE OBJECTIVE:

The main objective of this course is to acquaint Knowledge about the Book –keeping and Accountancy practices used in every organization and procedures, and also help the students in assisting the finance department of an organization

COURSE CONTENT:

1. Bank Reconciliation Statement

1.1. Concept, Need, Importance,
1.2. Reasons for Difference in Bank Balances,
1.3. Preparation of Bank Reconciliation Statement.

2. Trial balance

2.1. Meaning and Purpose
2.2. Preparation of Trial Balance from given Balances.

3.Errors and their rectification

3.1.Types of errors
3.2.Rectification of errors

4. Financial Statements of Proprietary Concerns

4.1.Preparation of trading account, preparation of Profit and Loss Account,
4.2. Preparation of Balance Sheet.
4.3. Effects of following Adjustments –
- 4.3.1 Bad and doubtful debts ,
- 4.3.2 Prepaid and outstanding expenses ,
- 4.3.3 Accrued and unaccrued income

5. Depreciation,Provisions , Reserves

5.1.Concept, Definition, Need and Factors Affecting Depreciation.

5.2. Methods, Straight line method and WDV method, difference between two methods, accounting treatment of depreciation

5.3.Reserves __Concept, objectives and difference between provisions and reserves, types of reserves.

6.Accounting of Non Business Concerns

6.1.Receipt and Payment account
6.2.Income and expenditure account
6.3.Balance sheet.

COURSE OUTCOME:

After the completion of the course, the students will be able to

- Reconcile bank statement.
- Acquire knowledge regarding trial balance and purpose of trial balance.
- Explain different errors that occur in books of accounting and their rectification.
- Acquire knowledge about final accounts and the adjustments in final accounts.
- Define depreciation, reserves and provisions.

- Prepare accounts of non-profits organizations.

RECOMMENDED BOOKS:

1. Elements of Book-keeping by Juneja, C.M. and Saksena, R.K.; Kalyani Publications.
2. Accountancy – Theory and Practice by Juneja, C.M. and Saksena, R.K; Kalyani Publications.
3. Introduction to Accountancy by Grewal, T.S; Sultan Chand & Sons, New Delhi.
4. Advanced Accounts (Complete) by Shukla, M.C.; Sultan Chand & Sons, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME (HOURS)	MARKS
1.	12	20
2.	08	10
3.	08	10
4.	15	25
5.	09	15
6.	12	20
TOTAL	**64**	**100**

PROGRAM THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: **ES406**	Course Title: **COMPUTER BASED ACCOUNTANCY-II**
Semester:4Th	Credits: **02**
Periods per week: **04 (L:00,T:00, P:04)**	

COURSE OBJECTIVE:

The main objective of this course is to acquaint the students with well-known accounting software i.e. Tally ERP. Students will learn about inventory, billing , purchase order, sales order etc.; reconcile bank statement; accrual adjustments, and also print financial statements, etc. in Tally ERP.9 software. Accounting with Tally is not just theoretical program, but it also includes continuous practice, to make students ready with required skill for employability in the job market.

COURSE CONTENT:

1. Masters : Inventory

1.1 Understanding Inventory
1.2 Integrating Accounts and Inventory
1.3 Practical on Stock Group
1.4 Practical on Go down and Locations
1.5Practical on Stock Category
1.6 Practical on Units of Measure
1.7 Practical on Stock Items

2. Billing Feature

2.1 Different Billing and Actual Quantity
2.2Additional Cost of Purchase
2.3Discount Column on Invoices

3. Purchase Order Processing

3.1 Purchase Order Process
3.2 Purchase Order Voucher with Examples
3.3 Receipt Note (Inventory) with Examples

4. Sales Order Processing

4.1 Sales Order Process
4.2 Sales Order Voucher with Examples
4.3 Delivery Note (Inventory) with Examples

5. Debit and Credit Notes

5.1 Debit Note Returns with Examples
5.2 Credit Note Returns with Examples

6.Bank Reconciliation

6.1Understanding BRS Process
6.2 Practical Examples

7. Batch Wise Details

7.1 Understanding Inventory Batches
7.2 Practical Examples

8.Goods and Services Tax (GST)

8.1 About Goods and Services Tax (GST)
8.2 Activating Tally in GST
8.3 Setting Up GST (Company Level, Ledger Level or Inventory Level)
8.4 GST Taxes & Invoices
8.5 Understanding SGST, CGST & IGST
8.6 Creating GST Masters in Tally

9. Purchase Voucher with GST

9.1Updating GST Number for Suppliers
9.2 Practical on Intra-State Purchase Entry in GST (SGST + CGST)
9.3 Practical on Inter-State Purchase Entry in GST (IGST)
9.4GST Purchase Entry for Unregistered Dealer in Tally

10. Sales Voucher with GST

10.1 Updating GST Number for Suppliers
10.2 Practical on Intra-State Sales Entry in GST (SGST + CGST)
10.3 Practical on Inter-State Sales Entry in GST (IGST)
10.4 Printing GST Sales Invoice from Tally ERP9 Software

11. GST Reports

11.1 GSTR 1 in Tally
11.2GSTR 2 in tally

COURSE OUTCOME:

After the completion of the course, the students will be able to

- Work with well-known accounting software i.e. Tally ERP.
- Define inventory; create bills etc.
- Reconcile bank statement, accrual adjustments, and also print financial statements, etc. in Tally ERP.9 software .

RECOMMENDED BOOKS:

1. Tally ERP.9 Training guide by Asok K. Nadhani
2. Tally ERP 9 course kit by Dr. Namrata Agrawal
3. Tally ERP 9 (with GST and E-Way bill) books by Rajesh Chheda

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	TIME (HOURS)	MARKS
1.	08	10
2.	04	08
3.	04	08
4.	04	08
5.	04	08
6.	04	08
7.	04	08
8.	08	10
9.	08	12
10.	08	10
11.	08	10
TOTAL	**64**	**100**

PROGRAM: THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTER APPLICATIONS	
Course Code: PC407	**Course Title: Web Designing**
Semester:4Th	**Credits: 02**
Periods per week: 04 (L:00,T:00, P:04)	

COURSE OBJECTIVE:

This module focuses upon the development of Web page design and publishing of websites. Various mark-up language and cascading should be known to develop web pages.

COURSE CONTENTS

1. WEB DESIGN PRINCIPLES

1.1 Basic principles involved in developing a web site
1.2 Planning process
1.3 Five Golden rules of web designing
1.4 Designing navigation bar
1.5 Page design
1.6 Home Page Layout
1.7 Design Concept

2. BASICS IN WEB DESIGN

2.1 Brief History of Internet
2.2 What is World Wide Web
2.3 Why create a web site
2.4 Web Standards
2.5 Audience requirement

3. INTRODUCTION TO HTML

3.1 What is HTML
3.2 HTML Documents
3.3 Basic structure of an HTML document
3.4 Creating an HTML document
3.5 Mark up Tags
3.6 Heading-Paragraphs
3.7 Line Breaks
3.8 HTML Tags

4. ELEMENTS OF HTML

4.1 Introduction to elements of HTML
4.2 Working with Text
4.3 Working with Lists, Tables and Frames
4.4 Working with Hyperlinks, Images and Multimedia
4.5 Working with Forms and controls

5. INTRODUCTION TO CASCADING STYLE SHEETS

5.1 Concept of CSS
5.2 Creating Style Sheet
5.3 CSS Properties
5.4 CSS Styling (Background, Text Format, Controlling Fonts)
5.5 Working with block elements and objects
5.6 Working with Lists and Tables
5.7 CSS Id and Class
5.8 Box Model (Introduction, Border properties, Padding Properties, Margin properties)
5.9 CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo

class, Navigation Bar, Image Sprites, Attribute sector)
5.10 CSS Color
5.11 Creating page Layout and Site Designs

6. INTRODUCTION TO WEB PUBLISHING OR HOSTING
6.1 Creating the Web Site
6.2 Saving the site
6.3 Working on the web site
6.4 Creating web site structure
6.5 Creating Titles for web pages
6.6 Themes-Publishing web sites.

RECOMMENDED BOOKS

1. Kogent Learning Solutions Inc. HTML 5 in simple steps Dreamtech Press
2. A beginner's guide to HTML NCSA,14th May,2003
3. Murray,Tom/Lynchburg Creating a Web Page
4. John Duckett Beginning HTML, XHTML, CSS, and JavaScript Wiley India Ian Pouncey,
5. Richard York Beginning CSS: Cascading Style Sheets for Web Design Wiley India
6. Kogent Learning Web Technologies: HTML, Javascript Wiley India
7. Kogent Learning Solutions Inc. HTML 5 in simple steps Dreamtech Press

PROGRAM:THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTE APPLICATIONS	
Course Code: PC407	**Course Title: Internet and Networking**
Semester:4Th	**Credits: 02**
Periods per week: 04 (L:00,T:00, P:04)	

COURSE OBJECTIVE:

Students shall identify network devices and hardware, learns the roles network devices. Use of ipconfig, ping and trace route commands, Check basic network connectivity

COURSE CONTENTS

1. Introduction to Computer Network.
2. Why do we need a computer network?
3. How to identify various network devices?
4. Commands you need: ipconfig, ping and traceroute
5. What is an IP address?
6. Network troubleshooting
7. Fix a home network - the Internet is down?
8. Identify wireless networks around you
9. How to Block and Unblock a Web Browser
10. Overview of network resources.
11. Latest IT technologies.

RECOMMENDED BOOKS

1. Computer Networking for Beginners and Beginners Guide (All in One) by Russell Scott
2. Computer Networking by Michael B White
3. Introduction to Networking: How the Internet by Dr. Charles R Severance
4. Networking Fundamentals by Crystal Panek, Sybex

PROGRAM:THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTE APPLICATIONS	
Course Code: SE408	**Course Title: Seminar**
Semester:4Th	**Credits: 02**
Periods per week: 02 (L:02,T:00, P:00)	

COURSE OBJECTIVE:

This two credit course is meant to give students practice speaking in front of a audience and to explore topics in detail. Students will research topics and organize presentations for faculty and other students. The topics may be any aspect of the management and must be approved by the instructor in advance.

COURSE OUTCOME:

After the completion of the course, the students will be able to

- Improve as speakers;
- Provide feedback to other students.

PROGRAM:THREE YEAR DIPLOMA IN OFFICE MANAGEMENT AND COMPUTE APPLICATIONS	
Course Code: 409	**Course Title: Self-Learning and Self Skill**
Semester:4Th	**Credits: 01**
Periods per week: 02 (L:00,T:00, P:02)	

Course Objective:-

Self Learning /Life skills :- The self-learning plays a very important role in the learning process and needs due credit Extra learning outside Institutional timing and online/digit al learning needs encouragement. Apart from this participation in debates, seminars, sports and Extra- co curricula activities shall be given due importance and credit. Participation by student in such activities needs to be given due importance and credit. Apart from knowledge and s kill, developing right attitude is of great significance in the real life situations. This can be better achieved by introducing the life skills and capability of handling the real life future challenges and situations. An activity in sports, Yoga and other activities plays a role in physical and psychological development and must form a part in the institutional processes. Prior learning of the student also needs to be given due credit.

The introduction of this course is to introduce these activities and award them on choice of student.

Contents of the Course:

- Concept and need of life skills
- Self-awareness
- Decision making
- Problem solving
- Effective communication
- Interpersonal relations
- Stress management
- Empathy
- Critical thinking

After completion of this course the student will be able to:

- Identify different skills required in personal and professional life.
- Develop Consciousness of self.
- Use critical thinking and decision-making skill to solve problems.
- Communicate effectively with others.
- Establish interpersonal relations
- Apply techniques to cope with emotions and stress.

Implementation: - At the start of the semester the HOD/Academic in-charge may register the student for course of life skill or may be given a choice to register for any online course activity. Such course and activity need to be monitored, evaluated, and shall be given credits as prescribed

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN OMCA/AUTOMOBILE ENGINEERING	
Course Code: **AU410**	Course Title: **Indian Constitution (IC)**
Semester: **4th**	Credits: **00**
Periods Per Week: 03**(L: 03, T: 00 P: 00)**	

COURSE OBJECTIVES:

This course aims to deepen students' awareness of the Indian Constitution's relevance across diverse backgrounds, facilitating comprehension of its core principles. Participants will recognize the significance of fundamental rights and duties and grasp the operations of India's federal structure involving Union, State, and Local Governments. The course further focuses on educating students about emergency procedures, the election commission's role, and the process of constitutional amendments, fostering a holistic understanding of India's governance and legal framework.

COURSE CONTENTS:

1. Introduction to Constitution

1.1. Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance.

2. Union Government

2.1. Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.

3. State and Local Governments

3.1. State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to74th Amendment.

4. Election provisions, Emergency provisions, Amendment of the constitution

4.1. Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.

RECOMMENDED BOOKS

1. M.V. Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication,2005
2. Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19th edition, Prentice-Hall EEE, 2008.
3. "Introduction to the Constitution of India" by Durga Das Basu Publisher: LexisNexis
4. "Our Constitution: An Introduction to India's Constitution and Constitutional Law" by Subhash C. Kashyap Publisher: National Book Trust, India
5. "Indian Polity" by M. Laxmikanth Publisher: McGraw-Hill Education
6. "The Framing of India's Constitution: Select Documents" by B. R. Ambedkar Publisher: Oxford University Press
7. "Constitutional Law of India" by Dr. J. N. Pandey Publisher: Central Law Agency

COURSE OUTCOMES:

At the end of the course the student should be able to:

- Understand and explain the significance of Indian Constitution as the fundamental law of the land
- Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building
- Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail
- Understand Electoral Process, Emergency provisions and Amendment procedure.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time (Hours)	Marks(%age)
1	17	25
2	13	24
3	14	25
4	20	26
Total	**64**	**100**

CURRICULUM

FOR

FOURTH SEMESTER

DIPLOMA

IN

PHE (CIVIL)

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME –PHE (CIVIL)

FOURTH SEMESTER

Code	Subjects	Study Scheme Periods Per Week			Total Hours L+T+P	Credits			Total Credits L+T+P
		L	T	P		L	T	P	
PC401	*Geotechnical Engineering	3	0	0	3	3	0	0	3
PC402	*Advanced Surveying	3	0	0	3	3	0	0	3
PC403	*Water Resource Engineering	3	0	0	3	3	0	0	3
PC404	Public Health Engineering - II	3	0	0	3	3	0	0	3
PC405	*Fluid Mechanics	3	0	0	3	3	0	0	3
PC406	*Geotechnical Engineering Practical	0	0	2	2	0	0	1	1
PC407	*Advanced Surveying Practical	0	0	2	2	0	0	1	1
PC408	*Fluid Mechanics Practical	0	0	2	2	0	0	1	1
PE409	*Elective- I	2	0	0	2	2	0	0	2
	Construction Quality Control								
	Rural Construction Technology								
OE410	*Open Elective - I	2	0	0	2	2	0	0	2
	Renewable Energy Technologies								
	Introduction to E-Governance								
	Artificial Intelligence								
		19	**0**	**6**	**25**	**19**	**0**	**3**	**22**

***Subjects common with Civil Engineering**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC401**	Course Title: **Geotechnical Engineering**
Semester:**4th**	Credits: **3**
Periods Per Week: **3 (L: 3, T: 0, P:0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

COURSE CONTENT

1. Overview of Geology and Geotechnical Engineering (06 Hours)

1.2 Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.

1.3 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures.

1.4 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.

2. Physical and Index Properties of Soil (08 Hours)

2.1 Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.

2.2 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index.

2.3 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.

3. Permeability and Shear Strength of Soil (08 Hours)

3.1 Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling head tests, simple problems to

determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net,(No numerical problems).

3.2 Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test –laboratory methods.

4. Bearing Capacity of Soil (10 Hours)

4.2 Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity.

4.3 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888&IS:2131.

4.4 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.

5. Compaction and stabilization of soil (12 Hours)

5.2 Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content (OMC), maximum dry density(MDD),Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumaticty red roller, Rammer and Vibrator, Difference between compaction and consolidation.

5.3 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization. California bearing ratio(CBR)test-Meaning and Utilization in Pavement Construction

5.4 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.
- Interpret soil bearing capacity results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

INSTRUCTIONAL STRATEGY

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

RECOMMENDED BOOKS:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A textbook of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T. N. & Sitharam, T. G., Geotechnical Engineering (Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B.J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	20
4	10	25
5	12	25
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC402**	Course Title: **Advanced Surveying**
Semester: **4th**	Credits: **3**
Periods Per Week:**3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The objectives of this course are to introduce fundamental knowledge of land measurement and modern survey application. After completion of this course students will be able to implement modern survey techniques in map making and its applications in relevant to Civil Engineering projects.

COURSE CONTENT

1. Theodolite Surveying:

Working of a transit vernier theodolite axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

2. Tacho-metric surveying

Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problem

3. Curves:

3.1 Simple Circular Curve:

Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:

- Offsets from the tangent
- Successive bisection of arcs

- Offsets from the chord produced

b) By tangential angles using a theodolite

3.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

3.3 Vertical curve

Setting out of a vertical curve

4. Advanced Surveying Equipment's:

4.1 Principle of Electronic Distance Meter (EDM)

4.1.1 Its component parts and their functions

4.1.2 Use of EDM

4.2 Use of

4.2.1 Micro Optic Theodolite

4.2.2 Electronic Digital Theodolite

4.3 Use of Total Station

4.3.1 Use of function keys

4.3.2 Measurement of horizontal angles, vertical angles

4.3.3 Distances and coordinates using Total Station

4.3.4 Traversing, Profile survey and Contouring with Total station

5. Remote Sensing, GPS and GIS:

5.1 Remote Sensing

5.1.1 Overview

5.1.2 Remote Sensing System

5.1.3 Application of Remote Sensing in Civil Engineering

5.1.4 Land use/ Land Cover

5.1.5 Mapping, Disaster Management

5.2 Use of Global Positioning System (G.P.S.) instruments

5.3 Geographic Information system (GIS)

5.3.1 Overview

5.3.2 Components

5.3.3 Applications

5.3.4 Name of common software for GIS

COURSE OUTCOME

After completion of the course the student is able to:

Unit 1: To measure vertical and horizontal angles and finding level differences.

Unit 2: To prepare contoured maps or plans requiring both the horizontal as well as vertical control.
Unit 3: Setting out the curve by different methods.
Unit 4: Prepare plans by using Advanced Surveying Equipment
Unit 5: To know the concept of Remote Sensing, G.P.S. and G.I.S.

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS:

1. Hussain, SK and Nagraj, MS "Text Book of Surveying";, S Chand and Co Ltd., New Delhi
2. Deshpande, RS "A Text Book Surveying and Levelling"; United Book Corporation, Pune,
3. Kocher, CL; "A Text Book of Surveying"; Katson Publishing House Ludhiana,
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" AVG Prakashan, Pune
6. Punima, BC; "Surveying and Leveling ", Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"
9. Mahajan, Sanjay, "Surveying-II", Satya Prakashan, Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	6	15
3	10	25
4	6	20
5	6	20
Total	**38**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC403**	Course Title: **Water Resource Engineering**
Semester: **4th**	Credits: **3**
Periods Per Week:**3(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

- To learn estimation of hydrological parameters.
- To understand water demand of crops and provisions to meet the same.
- To know planning of reservoirs and dams.
- To design irrigation projects, canals and other diversion works.

COURSE CONTENT:

1. Introduction to Hydrology

1.1 Hydrology: Definition and Hydrological Cycle
1.2 Rain Gauge
  1.2.1 Symons Rain Gauge
  1.2.2 Automatic Rain Gauge
1.3 Methods of Calculating Average Rainfall
  1.3.1 Arithmetic Mean
  1.3.2 Isohyetal
1.4 Runoff
  1.4.1 Factors affecting run off
  1.4.2 Computation of Run off

2. Crop Water Requirement and Reservoir Planning

2.1 Irrigation and its Classification
2.2 Crop Water Requirement
  2.2.1 Cropping Seasons
  2.2.2 Crop Period
  2.2.3 Base Period
  2.2.4 Duty
  2.2.5 Delta
  2.2.6 CCA
  2.2.7 GCA
  2.2.8 Intensity of Irrigation

2.2.9 Factors Affecting Duty
2.2.10 Problems on Water Requirement and Capacity of Canal
2.3 Methods of Application of Irrigation Water and its Assessment

3. Dams and Spillways

3.1 Dams and its Classification
3.1.1 Earthen Dams
3.1.2 Gravity Dams (masonry and concrete)
3.2 Earthen Dams
3.3 Spillways
3.3.1 Definition
3.3.2 Energy Dissipaters

4. Minor and Micro Irrigation

4.1 Lift Irrigation Scheme
4.1.1 Components and their Functions
4.1.2 Lay Out
4.2 Drip and Sprinkler Irrigation
4.2.1 Need
4.2.2 Components and Layout
4.3 Well Irrigation
4.3.1 Types and Yield of Wells
4.3.2 Advantages and Disadvantages of Well Irrigation

5. Diversion Head Works & Canals

5.1 Weirs
5.1.1 Components
5.1.2 Parts
5.1.3 Types
5.1.4 K.T. Weir: Components and Construction
5.2 Diversion Head Works
5.2.1 Layout
5.2.2 Components and their functions
5.3 Barrages
5.3.1 Components and their functions
5.3.2 Difference between Weir and Barrage
5.4 Canals
5.4.1 Classification according to Alignment and Position in the Canal Network
5.4.2 Cross section of Canal in Embankment and Cutting
5.4.3 Partial Embankment and Cutting

5.5 Canal lining
- 5.5.1 Purpose
- 5.5.2 Material used and its properties
- 5.5.3 Advantages

5.6 Cross Drainage Works
- 5.6.1 Aqueduct
- 5.6.2 Siphon Aqueduct
- 5.6.3 Super Passage
- 5.6.4 Level Crossing

5.7 Canal Regulators
- 5.7.1 Head Regulator
- 5.7.2 Cross Regulator
- 5.7.3 Escape
- 5.7.4 Falls and Outlets

COURSE OUTCOMES

After completing this course, student will be able to:

- Estimate hydrological parameters.
- Estimate crop water requirements of a command area and capacity of canals.
- Execute Minor and Micro Irrigation Schemes.
- Select the relevant Cross Drainage works for the specific site conditions.
- Design, construct and maintain simple irrigation regulatory structures.

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare and interpret drawings of various irrigation works.

RECOMMENDED BOOKS:

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
2. Basak, N.N., Irrigation Engineering, McGraw Hill Education
3. Asawa, G.L., Irrigation and water resource Engineering, New Age

4. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
5. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
6. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	25
4	08	20
5	10	25
Total	**40**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC404**	Course Title: **Public Health Engineering - II**
Semester: **4th**	Credits: **3**
Periods per week: **3 (L:3, T:0, P:0)**	

COURSE OBJECTIVE:

1. It aims at enabling the student to understand the urban and rural sanitation.
2. Understand the need of sewage treatment and disposal of a city/town.

COURSE CONTENT:

1. INTRODUCTION:

Definition of sullage, sewage, sewerage, sewer, refuge, garbage. Aims and objectives of sewerage work, systems of refuge disposal and water carriage system.

2. QUANTITY OF SEWAGE:

Domestic and industrial sewage, volume of domestic sewage, variability of flow, limiting velocities-Self cleansing and Maximum velocities of sewer. Simple problems on design of sewers.

3. CHARACTERISTICS AND ANALYSIS OF SEWAGE:

Strength of Sewage, Sampling of Sewage to analyze for Physical, Chemical and Biological Parameters. Decomposition of sewage. Analysis of Sewage – Significance of the following Tests for

1. Solids
2. Dissolved Oxygen
3. B.O.D
4. C.O.D
5. pH value
6. Chlorides
7. Nitrate

4. SEWARAGE SYSTEMS:

Types of Sewerage System and their Suitability – Separate, Combined and Partially Separate Systems Brief Description and Suitability of the following Types of Sewers Stoneware, Cast Iron, Cement Concrete, AC Pipes, Pre-Cast Sewers, PVC sewer (SWR grade), and laying of sewers 08

5. SEWAGE TREATMENT:

Preliminary Treatment –

Brief Description and Functions of –

1. Screens
2. Skimming Tanks
3. Grit Chambers.

Primary Treatment –

Brief Description and Function of the Sedimentation and Septic Tanks
Secondary Treatment –
Brief Description of

1. Trickling Filters
2. Activated Sludge Process Oxidation Ponds, Oxidation Ditches, Aerobic Lagoons, Anaerobic Lagoons, Rotary Biological Disc.

Tertiary treatment –
Activated sand filter and chlorination.

6. SEWAGE & SLUDGE DISPOSAL:

Sewage Disposal-
Dilution, Self purification of streams, factors affecting self-purification. Disposal in Sea water, Disposal on Lands, Recycle of waste water(Grey water technology)
Sludge treatment & Disposal –
Sludge treatment & disposal methods. Sludge digestion tank, Sludge drying bed.

COURSE OUTCOME

After the completion of the course the student will be able to:

1. Ability to estimate sewage generation
2. Required understanding of characteristics and composition of sewage, self Purification of streams
3. Ability to understand unit operations and processes that are used in sewage treatment

INSTRUCTIONAL STRATEGY:

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students.

RECOMMENDED BOOKS:

1. Water Supply & Sanitary Engineering- by Rangwala
2. Sewage Disposal and Air pollution -by S.K.Garg.
3. Water Supply & Sanitary Engineering- by G.S.Birde
4. Environmental Science and Engg.- Vol-I – by Aloka Debi. (Universities Press)
5. Sanitary Engineering Vol-II -by Gurucharan Singh
6. Sewerage and Sewage Treatment Vol-II.-by Fair & Geir
7. Text Book of Environmental studies – Erach Bharucha (Universities Press)
8. Water Supply,Waste Disposal and Environmental Pollution Engineering-(khanna publication)a.k.chatterjee
9. Waste water Engineering by Dr B.C. Punmia, Jain & Jain

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT No.	Time Allotted(Hrs)	MarksAllotted(%)
1	4	05
2	8	16
3	8	18
4	8	18
5	12	25
6	8	18
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC405**	Course Title: **Fluid Mechanics**
Semester: **4th**	Credits: **3**
Periods per week: **3(L: 3, T:0, P:0)**	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses

COURSE CONTENT

1. Pressure Measurement and Hydrostatic Pressure

1.1. Technical terms used in Hydraulics:
- 1.1.1. Fluid, Fluid Mechanics
- 1.1.2. Hydraulics, Hydrostatics and Hydrodynamics
- 1.1.3. Ideal and Real Fluid
- 1.1.4. Application of Hydraulics

1.2. Physical Properties of Fluid:
- 1.2.1. Density-Specific Volume
- 1.2.2. Specific Gravity
- 1.2.3. Vapour pressure, Surface Tension, Capillarity
- 1.2.4. Viscosity - Newton's Law of Viscosity, Dynamic and Kinematic viscosity

1.3. Various Types of Pressure:
- 1.3.1. Atmospheric Pressure
- 1.3.2. Gauge Pressure
- 1.3.3. Absolute Pressure
- 1.3.4. Vacuum Pressure

1.4. Concept of Pressure Head and its unit

1.5. Pascal's law of fluid pressure and its uses

1.6. Measurement of Differential Pressure
- 1.6.1. Manometers
  - 1.6.1.1 Piezometer - its limitation
  - 1.6.1.2 U-tube - simple, differential, inverted
  - 1.6.1.3 Micro-manometers

1.7. Variation of Pressure with Depth:

1.7.1. Pressure Diagram
1.7.2. Hydrostatic Pressure
1.7.3. Center of Pressure on immersed surfaces and on tank walls

2. FLUID FLOW PARAMETERS

2.1 Types of flow
2.1.1 Gravity and Pressure Flow
2.1.2 Laminar, Turbulent
2.1.3 Uniform, Non-uniform
2.1.4 Steady, Unsteady flow
2.2 Reynolds Number
2.3 Discharge and its unit
2.4 Continuity Equation of Flow
2.5 Energy of flowing Liquid
2.5.1 Potential
2.5.2 Kinetic
2.5.3 Pressure Energy
2.6 Bernoulli's Theorem: Statement, Assumptions, Equation

3. FLOW THROUGH PIPES

3.1 Major Head Loss in Pipe
3.1.1 Frictional loss and its computation by Darcy's Weisbach Equation
3.2 Minor Losses in Pipe
3.2.1 Loss at Entrance, Exit
3.2.2 Sudden Contraction, Sudden Enlargement
3.2.3 Fittings
3.3 Flows through Pipes
3.3.1 Pipes in Series
3.3.2 Pipes in Parallel
3.4 Hydraulic Gradient Line and Total Energy Line
3.5 Water Hammer in Pipes: Causes and Remedial measures
3.6 Discharge measuring device for Pipe Flow: Venturimeter
3.7 Discharge measurement using Orifice.

4. FLOW THROUGH OPEN CHANNEL

4.1 Geometrical properties of channel section
4.1.1 Wetted Area
4.1.2 Wetted Perimeter
4.1.3 Hydraulic Radius for Rectangular and Trapezoidal Channel Section

4.2 Determination of discharge by Chezy's equation and Manning's equation
4.3 Conditions for Most Economical Rectangular and Trapezoidal Channel Section
4.4 Discharge measuring devices:
4.4.1 Triangular Notch
4.4.2 Rectangular Notch
4.5 Velocity measurement devices
4.5.1 Current Meter
4.5.2 Floats
4.5.3 Pitot's Tube
4.6 Froude Number

5. HYDRAULIC PUMPS

5.1 Concept of Pump
5.2 Types of Pump
5.2.1 Centrifugal
5.2.2 Reciprocating
5.2.3 Submersible
5.3 Suction Head, Delivery Head, Static Head, Manometric Head Selection and choice of pump

COURSE OUTCOMES

After completing this course, student will be able to:

- Measure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications

INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

SUGGESTED LEARNING RESOURCES

1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	10	20
3	10	20
4	12	25
5	06	10
Total	**50**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC406**	Course Title: **Geotechnical engineering Lab**
Semester: **4th**	Credits: **1**
Periods Per Week: **2(L: 0, T: 0, P: 2)**	

COURSEOBJECTIVE:

Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C. B. R test.
- To learn various compaction methods for soil stabilization.

LISTOFPRACTICALS:

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720(Part-II).
3. Determine specific gravity of soil by Pycnometer method as per IS2720 (Part-III).
4. Determine dryunit weight of soil in field by core cutter method as per IS2720 (Part-XXIX).
5. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part-XXVIII).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS2720 (Part-V).
7. Determine Shrinkage limit of given soil sample as per IS2720 (Part-V).
8. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS2720 (Part-IV).
9. Use different types of soil to identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
10. Determine coefficient of permeability by constant head test as per IS2720 (Part-XVII).
11. Determine coefficient of permeability by falling head test as per IS2720 (Part-XVII).
12. Determine shear strength of soil by direct shear test as per IS2720(Part-XIII).
13. Determine shear strength of soil by vane shear test as per IS2720 (Part-XXX).
14. Determine MDD and OMC by standard proctor test of given soil sample as per IS2720 (Part-VII).
15. Determination of CBR value on the field as per IS2720 (Part-XVI).

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PC407**	Course Title: **Advanced Surveying Lab**
Semester: **4th**	Credits: **1**
Periods Per Week: **(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVES:

The objective of the course is to determine horizontal and vertical angles by using theodolite, setting out the curves, measure horizontal distance by using EDM/Total Station and to locate coordinates of a station with the use of G.P.S.

LIST OF PRACTICALS:

1. Reading the vernier of transit Theodolite and working out the least count.

2. Use of Transit theodolite/ Digital theodolite measurement of horizontal angles by direct, repetition and reiteration methods

3. Use of Transit theodolite/Digital theodolite measurement of vertical angles.

4. Height of objects with and without accessible bases by using of theodolite.

5. Use Theodolite as a tacheometer to compute reduce level and horizontal distances.

6. Setting out of a simple circular curve with given data by the following methods

a) Offsets from the chords produced

b) One theodolite method

7. Use EDM to measure horizontal distances.

8. Use Total Station to measure horizontal distances.

9. Use Total Station to carry out survey projects for closed traverse for minimum5 sides.

10. Use GPS to locate the coordinates of a station.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code:**PC408**	Course Title: **Fluid Mechanic Lab**
Semester: **4th**	Credits: **1**
Periods per week: **2(L:0, T:0, P:2)**	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

LIST OF PRACTICALS

1. Use Piezometer to measure Pressure at a given point.
2. Use U tube Differential Manometer to measure Pressure Difference between two given points.
3. Use Reynold's Apparatus to determine type of flow.
4. Use Bernoulli's Apparatus to apply Bernoulli's Theorem to get Total Energy Line for a flow in a closed conduit of varying cross sections.
5. To find out venturimeter coefficient
6. To determine coefficient of velocity (Cv), Coefficient of discharge (Cd) Coefficient of contraction (Cc) of an orifice and verify the relation between them
7. To determine coefficient of discharge of a rectangular notch/triangular notch.
8. Use Current meter & Pitot Tube to measure the velocity of flow of water in Open Channel.
9. To verify loss of head in pipe flow due to
   a) Sudden enlargement
   b) Sudden contraction
   c) Sudden bend

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course code : **PE409**	Course Title: **Construction Quality Control (Elective-I)**
Semester: **4th**	Credits:**2**
Period Per Week : **2(L: 2,T: 0,P: 0)**	

COURSE OBJECTIVES

The theory should be taught and exercises should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. i. Apply total quality management in civil construction. ii. Check the quality in civil construction works. iii. Identify the variations in quality of civil works. iv. Use various standard codes in civil construction works. v. Design energy efficient buildings

COURSE CONTENT

Unit-I

Total Quality Management (TQM) in Construction. Concept of quality control, Quality assurance, Quality management. Aims of TQM. Development and design Concept of TQM. Accuracy and precision in observation, reading theodolite, digital theodolite, total station, calibration, etc. Accuracy in calculation, finding area, volume, etc.

Unit-II

Construction Quality Control Inspection Program. Duties, responsibilities, qualification of staff in organization. Checklists for - Quality of Materials - Masonry - Plastering, - Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing - Reinforcement Work - Formwork - Timber & steel construction, - Doors & windows, - Plumbing & drainage.

Unit-III

Quality standards in construction related to Building materials and other inputs for construction processes. Quality standards for Construction outputs, products and services. Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references. National Building code (NBC 2005) (a) Why to refer & How to refer (b) Methods of referring it & application. Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.

Unit-IV

Green building – Definition – Green Building, Green Construction, Sustainable building. Goals of Green building. Advantages and disadvantages. Strategies Certification

Agencies – GRIHA, LEED (Highlights & Criteria). Life cycle assessment (LCA). Siting and structure design efficiency. Energy efficiency Water efficiency. Materials efficiency. Indoor environmental quality enhancement. Operations and maintenance optimization. Waste reduction

COURSE OUTCOME

At the end of the course, the students will know the following:

- Overview of the of a construction quality control & assurance program.
- Understanding the organizational structure, functional responsibility, levels of authority and controls for a typical construction organization
- Job instructions governing quality control procedures and practices.
- Maintaining supervised controls on various quality aspects
- How to meet contractual requirements by conformance to applicable standards
- Maintain accurate records of inspections and test

INSTRUCTIONAL STRATEGY: -

i. Arrange site visit to a large construction project and discuss different quality control and monitoring measures being employed.
ii. Show video films on testing of different materials
iii. Arrange expert lectures of reputed contractors/builders/Engineers of Civil departments on quality control issues.
iv. Present case studies of failures in construction projects due to quality problems.

RECOMMENDED BOOKS:

1. Total Quality Management; G.Kanji; Springer Science &Business Media
2. Fundamentals of Quality Control and improvement:Amitva Mitra : Wiley India Private Limited.
3. Manual on Quality Control
4. Ambuja Technical Literature Series.
5. National Building Code.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time	Marks
1	8	25
2	7	25
3	6	25
4	6	25
Total	**27**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **PE409**	Course Title: **Rural Construction Technology (Elective-I)**
Semester: **4th**	Credits: **2**
Periods Per Week: **(L: 2, T: 0, P:0)**	

COURSEOBJECTIVE:

Following are the objectives of this course:

- To learn development and planning of low cost housing infrastructure.
- To know about different government schemes for rural development.
- To understand techniques for rural road construction as per IRC stipulations.
- To learn rural irrigation techniques and water shed management.

COURSECONTENT

1. Rural Development and Planning (04 Hours)

1.1 Scope; development plans; various approaches to rural development planning.

1.2 Significance of rural development.

1.3 Rural development programme/projects.

2. Rural Housing (12 Hours)

2.1 Low cost construction material for housing

2.2 Composite material-ferro-cement& flyash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.

2.3 Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rat-trap bond for walls; Panels for roof, ferro-cement flooring/roofing units.

2.4 Biomass-types of fuels such as firewood, agricultural residues, dung cakes.

2.5 Renewable energy and integrated rural energy program-Objectives, Key elements, Implementation, Financial provisions, sources of renewable energy.

2.6 Working of gobar gas and bio gas plants.

3. Water Supply and Sanitation for Rural Areas (12 Hours)

3.1 Sources of water: BIS & WHO water standards.

3.2 Quality, Storage and distribution for rural water supply works.

3.3 Hand pumps-types, installation, operation, and maintenance of hand pumps.

3.4 Conservation of water-rain water harvesting, drainage in rural areas.

3.5 Construction of low cost latrines: Two pit pour flush water seal, septic tank etc.

3.6 Low cost community and individual Garbage disposal systems, Ferro-cement storage tanks.

4. Low Cost Rural Roads (07 Hours)

4.1 Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases.

4.2 Guidelines for Surfacing of Rural Road as per relevant IRC codes.

4.3 Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.

5. Low Cost Irrigation (07 Hours)

5.1 Design consideration and construction of tube-well, drip & sprinkler irrigation systems.

5.2 Water shed and catchment area development–problems and features of water shed management.

5.3 Water shed management structures-K.T.weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Bandhara system.

Course outcomes:

After completing this course, student will be able to:

1. Plan low cost housing using rural materials.
2. Make use of relevant government schemes for construction of roads and housing.
3. Use guidelines for rural road construction.
4. Implement different irrigation systems for rural areas.
5. Identify the need of water shed management in rural areas.

INSTRUCTIONAL STRATEGY

Being an Elective subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to arrange site visits so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work being carried out by research institutes.

RECOMMENDED BOOKS:

1. Madhov Rao AG, and Ramachandra Murthy, DS, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt. Ltd.

2. CBRI, Roorkee, Advances in Building Materials and Constriction.

3. Desai, Vasant, Rural Development in India: Past,Present and Future: a Challenge in the Crisis, Himalaya Publishing House, Delhi.

4. Rastogi, A. K. Rural Development Strategy, Wide Vision, Jaipur.

5. Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications India Pvt Ltd.

6. Gaur, KeshavDev, Dynamics of Rural Development, Mittal Publications, Delhi.

7. Document Published by Ministry of Rural development, Govt. of India, Ministry of Rural development.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	12	25
3	12	25
4	07	20
5	07	20
Total	**42**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **OE410**	Course Title: **Renewable Energy Technologies (Open Elective- I)**
Semester: **4th**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P:0)**	

COURSE OBJECTIVES:

- To understand energy scenario, energy sources and their utilization.
- To explore society's present needs and future energy demands.
- To Study the principles of renewable energy conversion system.
- To exposed to energy conservation methods.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective 1. Use pie chart showing distribution of renewable energy sources 2. Use wind turbine models 3. Use sun path diagrams

COURSE CONTENTS

1. Introduction:

Principles of renewable energy; energy and sustainable development, fundamentals and social implications worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

2. Solar Energy:

Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar Pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system

3. Wind Energy:

Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind

energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Bio fuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

4. **Tidal Power**:

Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations.

Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC

5. **Green Energy**:

Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy

COURSE OUTCOME

At the end of the course the student will be able to:

Chapter-1 Describe the environmental aspects of renewable energy resources. In Comparison with various conventional energy systems, their prospects and limitations.

Chapter-2 Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.

Chapter-3 Understand the conversion principles of wind and tidal energy

Chapter-4 Understand the concept of biomass energy resources and green energy.

Chapter-5 Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy

INSTRUCTIONAL STRATEGY

Renewable energy is a complex and multidisciplinary topic that requires different types of learning methods to address different aspects and levels of understanding. Teacher can use a variety of methods, such as lectures, demonstrations, simulations, games, experiments, projects, case studies, debates, discussions, and field trips, to introduce, explain, apply, and evaluate renewable energy concepts and applications. Teacher can also use different media and formats, such as text, images, videos, audio, graphs, charts, maps, models, and online tools, to present and illustrate renewable energy information and data.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	20
2	6	20
3	6	20
4	6	20
5	6	20
Total	**29**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **OE 409**	Course Title**: Introduction to E-Governance (Open Elective-I)**
Semester: **4th**	Credits:**2**
Periods Per Week: **2(L: 2, T:0, P:0)**	

COURSE OBJECTIVE:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency. To develop the basic understanding on the topic of E-Governance and learn the fundamentals involved in the subject.

COURSE CONTENT

1. **Introduction:**
   - 1.1 Definition,
   - 1.2 Needs of E-Governance,
   - 1.3 Evolution of E-Governance,
   - 1.4 Its scope and content,
   - 1.5 Basic Structure of e- Governance,
   - 1.6 Advantages of e-governance
2. **E-governance approaches in India-The National e-Governance plan:**
   - 2.1 Introduction to NeGP (National e-Governance Plan)
   - 2.2 NeGP Vision
   - 2.3 The framework for e-Governance
   - 2.4 Infrastructure pillars of NeGP
   - 2.5 Capacity Building initiatives under NeGP
3. **E-Governance Project Development And Management**
   - 3.1 Introduction to e-Government Project Development
   - 3.2 Conceptualization Phase
   - 3.3 Architect Phase, Define Phase, Support Phase
   - 3.4 e-Government Project Management Phase.
   - 3.5 Public Private Partnership for e-Government.
4. **Government Process Re-Engineering**
   - 4.1 Process Reforms for e-Governance Projects,
   - 4.2 Tools and techniques for Government Process Re-engineering,
   - 4.3 Legal Reforms

4.4 Technology Management and Enterprise Architecture for e-Governance,

5 Capacity Building and change Management

5.1 Capacity Building for e-Governance,
5.2 Focusing on Indian initiatives and their impact on citizens
5.3 Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context.
5.4 Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc)

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Understand and appreciate the essence of e-Governance.
- Know the scope and basic structure of e-Governance
- Understand the National- Governance Plan
- Develop and manage e-Governance projects

INSTRUCTIONAL STRATEGY

The Teacher should familiarize students with practical aspects of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security, and data warehousing and data mining for e-governance. Teacher should work towards implementing e-governance models and systems using suitable platform.

RECOMMENDED BOOKS:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
3. C. S. R. Prabhu : E-Governance: Concepts and Case Studies, Prentice Hall of India Pvt. Limited (2004).
4. Implementing and managing e-Government, Richard Heeks, 2006.
5. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted (%)
1	10	25
2	8	20
3	10	20
4	8	15
5	8	20
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN PHE (CIVIL)	
Course Code: **OE410**	Course Title: **Artificial Intelligence (Open Elective-I)**
Semester: **4th**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P: 0)**	

COURSE OBJECTIVES:

Have a thorough understanding of classical and modern AI applications. Be able to implement a Wide range of AI concepts using Prolog. Understand non-classical AI approaches such as genetic Algorithms and neural networks. Be able to assess the potential of AI in research and real-world Environments.

COURSE CONTENT:

1. Introduction

1.1 History and foundations of AI, Problem solving: Uninformed and informed Search; Constraint Satisfaction Problems and Constrained Optimization problems (complete and incomplete techniques).

2. Adversarial Search

2.1 Two players' games, games with uncertainty; Decision support systems and technologies; Knowledge representation, Reasoning, Expert systems Contents (2/2), Planning (basics).

3. Machine learning Basics

3.1 Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation, Neural networks, Problems, data, and tools; Visualization;

4. Linear regression

4.1 SSE; gradient descent; closed form; normal equations; features, Over fitting and complexity; training, validation, test data, and introduction to Matlab.

COURSE OUTCOME

At the end of the course, the student will be able to:

- Identify problems that are amenable to solution by AI methods.
- Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- able to design and implement various machine learning algorithms in a range of real-world applications.

- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

INSTRUCTIONAL STRATEGY

When teaching Artificial Intelligence start with the basics: Introduce fundamental AI concepts and build upon them gradually. Use real-world examples: Connect AI to practical applications to demonstrate its relevance and capture students' interest with real-world problem solving practices with Artificial Intelligence. Make it fun: Incorporate interactive activities, games, and projects to engage students in Artificial Learning. Be patient: AI can be complex not only for students but for teachers as well, so provide clear explanations, encourage questions, and foster a supportive learning environment.

RECOMMENDED BOOKS:

1. Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/PrenticeHall.
2. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, New Delhi (2018)
3. V.K. Jain, Machine Learning, Khanna Publishing House, New Delhi (2018)
4. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, http://mitpress.mit.
5. edu/catalog/item/default.asp?ttype=2&tid=12012.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	10	25
3	10	25
4	10	25
Total	**40**	**100**

CURRICULUM

FOR

FOURTH SEMESTER

DIPLOMA

IN

Q S C M

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME - QSCM

FOURTH SEMESTER

Code	Subjects	Study Scheme Periods Per Week			Total Hours L+T+P	Credits			Total Credits L+T+P
		L	T	P		L	T	P	
PC401	*Geotechnical Engineering	3	0	0	3	3	0	0	3
PC402	*Advanced Surveying	3	0	0	3	3	0	0	3
PC403	*Water Resource Engineering	3	0	0	3	3	0	0	3
PC404	*Public Health Engineering	2	0	2	4	2	0	1	3
PC405	*Fluid Mechanics	3	0	0	3	3	0	0	3
PC406	*Geotechnical Engineering Practical	0	0	2	2	0	0	1	1
PC407	*Advanced Surveying Practical	0	0	2	2	0	0	1	1
PC408	*Fluid Mechanics Practical	0	0	2	2	0	0	1	1
PE409	*Elective- I	2	0	0	2	2	0	0	2
	Construction Quality Control								
	Rural Construction Technology								
OE410	*Open Elective - I	2	0	0	2	2	0	0	2
	Renewable Energy Technologies								
	Introduction to E-Governance								
	Artificial Intelligence								
		18	**0**	**8**	**26**	**18**	**0**	**4**	**22**

***Subjects Common with Civil Engineering**

PROGRAM:	THREE YEARS DIPLOMA PROGRAMME IN QSCM
Course Code: **PC401**	Course Title: **Geo technical Engineering**
Semester: **IV**	Credits: **3**
Periods Per Week: **3(L: 3, T: 0, P:0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

COURSE CONTENT

1. Overview of Geology and Geotechnical Engineering (06 Hours)

1.2 Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.

1.3 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures.

1.4 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.

2. Physical and Index Properties of Soil (08 Hours)

2.1 Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.

2.2 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index.

2.3 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.

3. Permeability and Shear Strength of Soil (08 Hours)

3.2 Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient

of permeability by constant head and falling head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net,(No numerical problems).

3.3 Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test –laboratory methods.

4. Bearing Capacity of Soil (10 Hours)

4.2 Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity.

4.3 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888&IS:2131.

4.4 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.

5. Compaction and stabilization of soil (12 Hours)

5.2 Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content(OMC), maximum dry density(MDD),Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ramming and vibration. Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumaticty red roller, Rammer and Vibrator, Difference between compaction and consolidation.

5.3 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabilization. California bearing ratio(CBR)test-Meaning and Utilization in Pavement Construction

5.4 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

COURSE OUTCOMES:

After completing this course, student will be able to:

- Identify types of rocks and sub soil strata of earth.
- Interpret the physical properties of soil related to given construction activities.
- Use the results of permeability and shear strength test for foundation analysis.

- Interpret soil bearing capacity results.
- Compute optimum values for moisture content for maximum dry density of soil through various tests.

INSTRUCTIONAL STRATEGY

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

RECOMMENDED BOOKS:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
2. Murthy, V.N.S., A textbook of soil mechanics and foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
3. Ramamurthy, T. N. & Sitharam, T. G., Geotechnical Engineering (Soil Mechanics), S Chand and Company LTD., New Delhi.
4. Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
5. Kasamalkar, B.J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
6. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	20
4	10	25
5	12	25
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC402**	Course Title: **Advanced Surveying**
Semester: **IV**	Credits: **3**
Periods Per Week: **3 (L: 3, T: 0, P: 0)**	

COURSE OBJECTIVE:

The objectives of this course are to introduce fundamental knowledge of land measurement and modern survey application. After completion of this course students will be able to implement modern survey techniques in map making and its applications in relevant to QSCM projects.

COURSE CONTENT

1. Theodolite Surveying: (10 hrs)

Working of a transit vernier theodolite axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

2. Tacho-metric surveying (06 hrs)

Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problem

3. Curves: (10 hrs)

3.1 Simple Circular Curve:

Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:

- Offsets from the tangent
- Successive bisection of arcs
- Offsets from the chord produced

b) By tangential angles using a theodolite

3.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

3.3 Vertical curve

Setting out of a vertical curve

4. Advanced Surveying Equipment's: (06 hrs)

4.1 Principle of Electronic Distance Meter (EDM)

4.1.1 Its component parts and their functions

4.1.2 Use of EDM

4.2 Use of

4.2.1 Micro Optic Theodolite

4.2.2 Electronic Digital Theodolite

4.3 Use of Total Station

4.3.1 Use of function keys

4.3.2 Measurement of horizontal angles, vertical angles

4.3.3 Distances and coordinates using Total Station

4.3.4 Traversing, Profile survey and Contouring with Total station

5. Remote Sensing, GPS and GIS: (08 hrs)

5.1 Remote Sensing

5.1.1 Overview

5.1.2 Remote Sensing System

5.1.3 Application of Remote Sensing in QSCM

5.1.4 Land use/ Land Cover

5.1.5 Mapping, Disaster Management

5.2 Use of Global Positioning System (G.P.S.) instruments

5.3 Geographic Information system (GIS)

5.3.1 Overview

5.3.2 Components

5.3.3 Applications

5.3.4 Name of common software for GIS

COURSE OUTCOME

After completion of the course the student is able to:

- To measure vertical and horizontal angles and finding level differences.
- To prepare contoured maps or plans requiring both the horizontal as well as vertical control.

- Setting out the curve by different methods.
- Prepare plans by using Advanced Surveying Equipment
- To know the concept of Remote Sensing, G.P.S. and G.I.S.

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS "Text Book of Surveying";, S Chand and Co Ltd., New Delhi
2. Deshpande, RS "A Text Book Surveying and Levelling"; United Book Corporation, Pune,
3. Kocher, CL; "A Text Book of Surveying"; Katson Publishing House Ludhiana,
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" AVG Prakashan, Pune
6. Punima, BC; "Surveying and Leveling ", Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"
9. Mahajan, Sanjay, "Surveying-II", SatyaPrakashan, Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	6	15
3	10	25
4	6	20
5	6	20
Total	**38**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC403**	Course Title: **Water Resource Engineering**
Semester: **IV**	Credits: **3**
Periods Per Week:**3(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

To learn estimation of hydrological parameters.
To understand water demand of crops and provisions to meet the same.
To know planning of reservoirs and dams.
To design irrigation projects, canals and other diversion works.

COURSE CONTENT:

1. Introduction to Hydrology (6 hours)

1.1 Hydrology: Definition and Hydrological Cycle
1.2 Rain Gauge
1.2.1 Symons Rain Gauge
1.2.2 Automatic Rain Gauge
1.3 Methods of Calculating Average Rainfall
1.3.1 Arithmetic Mean
1.3.2 Isohyetal
1.4 Runoff
1.4.1 Factors affecting run off
1.4.2 Computation of Run off

2. Crop Water Requirement and Reservoir Planning (8 hours)

2.1 Irrigation and its Classification
2.2 Crop Water Requirement
2.2.1 Cropping Seasons
2.2.2 Crop Period
2.2.3 Base Period
2.2.4 Duty
2.2.5 Delta
2.2.6 CCA
2.2.7 GCA
2.2.8 Intensity of Irrigation
2.2.9 Factors Affecting Duty
2.2.10 Problems on Water Requirement and Capacity of Canal
2.3 Methods of Application of Irrigation Water and its Assessment

3. Dams and Spillways **(8 hours)**

3.1 Dams and its Classification

3.1.1 Earthen Dams

3.1.2 Gravity Dams (masonry and concrete)

3.2 Earthen Dams

3.3 Spillways

3.3.1 Definition

3.3.2 Energy Dissipaters

4. Minor and Micro Irrigation **(8 hours)**

4.1 Lift Irrigation Scheme

4.1.1 Components and their Functions

4.1.2 Lay Out

4.2 Drip and Sprinkler Irrigation

4.2.1 Need

4.2.2 Components and Layout

4.3 Well Irrigation

4.3.1 Types and Yield of Wells

4.3.2 Advantages and Disadvantages of Well Irrigation

5. Diversion Head Works & Canals **(10 hours)**

5.1 Weirs

5.1.1 Components

5.1.2 Parts

5.1.3 Types

5.1.4 K.T. Weir: Components and Construction

5.2 Diversion Head Works

5.2.1 Layout

5.2.2 Components and their functions

5.3 Barrages

5.3.1 Components and their functions

5.3.2 Difference between Weir and Barrage

5.4 Canals

5.4.1 Classification according to Alignment and Position in the Canal Network

5.4.2 Cross section of Canal in Embankment and Cutting

5.4.3 Partial Embankment and Cutting

5.5 Canal lining

5.5.1 Purpose

5.5.2 Material used and its properties

5.5.3 Advantages

5.6 Cross Drainage Works

5.6.1 Aqueduct

5.6.2 Siphon Aqueduct

5.6.3 Super Passage
5.6.4 Level Crossing
5.7 Canal Regulators
5.7.1 Head Regulator
5.7.2 Cross Regulator
5.7.3 Escape
5.7.4 Falls and Outlets

COURSE OUTCOMES

After completing this course, student will be able to:

- Estimate hydrological parameters.
- Estimate crop water requirements of a command area and capacity of canals.
- Execute Minor and Micro Irrigation Schemes.
- Select the relevant Cross Drainage works for the specific site conditions.
- Design, construct and maintain simple irrigation regulatory structures.

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare and interpret drawings of various irrigation works.

RECOMMENDED BOOKS:

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
5. Basak, N.N., Irrigation Engineering, McGraw Hill Education
6. Asawa, G.L., Irrigation and water resource Engineering, New Age
7. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
8. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
9. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	25
4	08	20
5	10	25
Total	**40**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC404**	Course Title: **Public Health Engineering**
Semester: **IV**	Credits: **3**
Periods per week: 4 **(L:2, T:0, P:2)**	

COURSE OBJECTIVE:

The rationale of PHE Engineering revolves around safeguarding public health, meeting the basic human needs, conserving water resources, promoting sustainable development and complying with regulatory frameworks. The subject aims at providing the basic knowledge and skills in the field of waters supply and waste water engineering and thus contributing towards the sustainable management of water resources and the well-being of communities.

COURSE CONTENT:

(A) WATER SUPPLY ENGINEERING

UNIT 1: (12 Hours)

1.1 Introduction

1.1. Necessity and brief description of water supply system.

1.2 Quantity of Water

1.2.1 Water requirement
1.2.2 Rate of demand and variation in rate of demand
1.2.3 Per capita consumption for domestic, industrial, public and firefighting uses as per BIS standards (no numerical problems)
1.2.4 Population Forecasting

1.3 Quality of Water

1.3.1 Meaning of pure water and methods of analysis of water
1.3.2 Physical, Chemical and bacteriological tests and their significance
1.3.3 Standard of potable water as per Indian Standard
1.3.4 Maintenance of purity of water(small scale and large scale quantity)

UNIT 2: (18 Hours)

2.1 Water Treatment(brief introduction)

**2.1.1Sedimentation-purpose, types of sedimentation tanks
**2.1.2Coagulation flocculation –usual coagulation and their feeding
**2.1.3 Filtration -significance, types of filters, their suitability
2.1.4Necessityof disinfection of water, forms of chlorination, break

point chlorine, residual chlorine, application of chlorine. Flow diagram of different treatment units, functions of (i) Areation fountain (ii) mixer (iii) floculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

2.2 Conveyance of water

**2.2.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types Conveyance of Water of pipes.

2.2.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses

2.2.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes

2.2.4 Systems of water supply-Intermittent and continuous service reservoirs-types, necessity and accessories.

2.2.5. Wastage of water-preventive measures

2.2.6 Maintenance of distribution system

2.2.7 Leakage detection

2.3 Building Water Supply

2.3.1 Connections to water main (practical aspect only)

2.3.2 Water supply fixtures and installations and terminology related to plumbing

B. WASTEWATERENGINEERING

UNIT 3: (10 Hours)

3.1 Introduction

3.1.1 Purpose of sanitation

3.1.2 Necessity of systematic collection and disposal of waste

3.1.3 Definition of terms in sanitary engineering

3.1.4 Collection and conveyance of sewage

3.1.5 Conservancy and water carriage systems, their advantages and Disadvantages

3.1.6 (a) Surface drains (only sketches) : various types, suitability

(b)Types of sewage: Domestic, industrial, storm water and its seasonal variation

3.2 Sewerage System

3.2.1 Types of sewerage systems, materials for sewers, their sizes and joints
3.2.2 Appurtenance: Location, function and construction features. Manholes, drop man holes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts, Traps, seals, causes of breaking seals

UNIT 4: (09 Hours)

4.1 Sewage characteristics:

4.1.1 Properties of sewage and IS standards for analysis of sewage
4.1.2 Physical, chemical and bacteriological parameters

4.2 Natural Methods of Sewerage Disposal

4.2.1 General composition of sewage and disposal methods
4.2.2 Disposal by dilution
4.2.3 Self purification of stream
4.2.4 Disposal by land treatment
4.2.5 Nuisance due to disposal

UNIT 5: (08 Hours)

5. 1 Sewage Treatment

5.1.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifers, secondary clarifers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)

** Afield visit may be planned to explain and show the relevant things.

Student may also perform following Practical

1) To determine turbidity of water sample
2) To determine dissolved oxygen of given sample
3) To determine pH value of water
4) To perform jar test for coagulation
5) To determine BOD of given sample
6) To determine residual chlorine in water
7) To determine conductivity of water and total dissolved solids
8) Study of water purifying process by visiting a field lab.

INSTRUCTIONAL STRATEGY:

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students.

RECOMMENDED BOOKS:

1. Duggal,KN;"ElementsofPublicHealthEngineering";,S.ChandandCo.NewDelhi
2. Rangwala,SC;"WaterSupplyandSanitaryEngineering";AnandCharotarBookStall
3. Hussain, SK;"Text Book of Water Supply and Sanitary Engineering"; Oxford and IBH Publishing Co, NewDelhi,
4. Garg, Santosh Kumar; "Water Supply Engineering";Khanna Publishers,Delhi
5. Garg, Santosh Kumar;"Sewage and Waste Water Disposal Engineering"; Khanna Publishers, Delhi
6. Duggal, Ajay Kand Sharma, Sanjay," A Laboratory Manual in Public Health Engineering", Galgotra Publications,2006,New Delhi

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	12	21
2	18	32
3	10	15
4	09	16
5	08	16
Total	**57**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC405**	Course Title: **Fluid Mechanics**
Semester: **IV**	Credits: **3**
Periods per week**: 3(L:3, T:0, P:0)**	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses

COURSE CONTENT

1. Pressure Measurement and Hydrostatic Pressure (12 hours)

1.1. Technical terms used in Hydraulics:

1.1.1. Fluid, Fluid Mechanics

1.1.2. Hydraulics, Hydrostatics and Hydrodynamics

1.1.3. Ideal and Real Fluid 1.1.4. Application of Hydraulics

1.2. Physical Properties of Fluid:

1.2.1. Density-Specific Volume

1.2.2. Specific Gravity

1.2.3. Vapour pressure, Surface Tension, Capillarity

1.2.4. Viscosity - Newton's Law of Viscosity, Dynamic and Kinematic viscosity

1.3. Various Types of Pressure:

1.3.1. Atmospheric Pressure

1.3.2. Gauge Pressure

1.3.3. Absolute Pressure

1.3.4. Vacuum Pressure

1.4. Concept of Pressure Head and its unit

1.5. Pascal's law of fluid pressure and its uses

1.6. Measurement of Differential Pressure

1.6.1. Manometers

1.6.1.1 Piezometer - its limitation

1.6.1.2 U-tube - simple, differential, inverted

1.6.1.3 Micro-manometers

1.7. Variation of Pressure with Depth:

1.7.1. Pressure Diagram

1.7.2. Hydrostatic Pressure

1.7.3. Center of Pressure on immersed surfaces and on tank walls

2. FLUID FLOW PARAMETERS (10 hours)

2.1 Types of flow
- 2.1.1 Gravity and Pressure Flow
- 2.1.2 Laminar, Turbulent
- 2.1.3 Uniform, Non-uniform
- 2.1.4 Steady, Unsteady flow

2.2 Reynolds Number
2.3 Discharge and its unit
2.4 Continuity Equation of Flow
2.5 Energy of flowing Liquid
- 2.5.1 Potential
- 2.5.2 Kinetic
- 2.5.3 Pressure Energy

2.6 Bernoulli's Theorem: Statement, Assumptions, Equation

3. FLOW THROUGH PIPES (10 hours)

3.1 Major Head Loss in Pipe
- 3.1.1 Frictional loss and its computation by Darcy's Weisbach Equation

3.2 Minor Losses in Pipe
- 3.2.1 Loss at Entrance, Exit
- 3.2.2 Sudden Contraction, Sudden Enlargement
- 3.2.3 Fittings

3.3 Flow through Pipes
- 3.3.1 Pipes in Series
- 3.3.2 Pipes in Parallel

3.4 Hydraulic Gradient Line and Total Energy Line
3.5 Water Hammer in Pipes: Causes and Remedial measures
3.6 Discharge measuring device for Pipe Flow: Venturimeter
3.7 Discharge measurement using Orifice.

4. FLOW THROUGH OPEN CHANNEL (12 hours)

4.1 Geometrical properties of channel section
- 4.1.1 Wetted Area
- 4.1.2 Wetted Perimeter
- 4.1.3 Hydraulic Radius for Rectangular and Trapezoidal Channel Section

4.2 Determination of discharge by Chezy's equation and Manning's equation
4.3 Conditions for Most Economical Rectangular and Trapezoidal Channel Section
4.4 Discharge measuring devices:
- 4.4.1 Triangular Notch
- 4.4.2 Rectangular Notch

4.5 Velocity measurement devices
- 4.5.1 Current Meter
- 4.5.2 Floats
- 4.5.3 Pitot's Tube

4.6 Froude Number

5. HYDRAULIC PUMPS **(6 hours)**

5.1 Concept of Pump
5.2 Types of Pump
5.2.1 Centrifugal
5.2.2 Reciprocating
5.2.3 Submersible
5.3 Suction Head, Delivery Head, Static Head, Manometric Head
Selection and choice of pump

COURSE OUTCOME

After completing this course, student will be able to:

- Measure pressure and determine total hydrostatic pressure for different conditions.
- Understand various parameters associated with fluid flow
- Determine head loss of fluid flow through pipes.
- Find the fluid flow parameters in open channels.
- Select relevant hydraulic pumps for different applications

INSTRUCTIONAL STRATEGY

Hydraulics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

RECOMMENDED BOOKS:

1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines,DhanpatRai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	10	20
3	10	20
4	12	25
5	06	10
Total	**50**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC406**	Course Title: **Geotechnical engineering Practicals**
Semester: **IV**	Credits: **1**
Periods Per Week: **2(L: 0, T: 0, P: 2)**	

COURSEO BJECTIVE:

Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C. B. R test.
- To learn various compaction methods for soil stabilization.

LISTOFPRACTICALS

1. Identification of rocks from the given specimen.
2. Determine water content of given soil sample by oven drying method as per IS: 2720 (Part-II).
3. Determine specific gravity of soil by pycnometer method as per IS 2720 (Part-III).
4. Determine dry unit weight of soil infield by core cutter method as per IS2720 (Part-XXIX).
5. Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part-XXVIII).
6. Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS2720 (Part-V).
7. Determine Shrinkage limit of given soil sample as per IS2720 (Part-V).
8. Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS2720 (Part-IV).
9. Use different types of soil to identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
10. Determine coefficient of permeability by constant head test as per IS2720 (Part-XVII).
11. Determine coefficient of permeability by falling head test as per IS2720 (Part-XVII).
12. Determine shear strength of soil by direct shear test as per IS2720 (Part-XIII).
13. Determine shear strength of soil by vane shear test as per IS2720 (Part-XXX).
14. Determine M D D and O M C by standard proctor test of given soil sample as per IS2720 (Part-VII).
15. Determination of CBR value on the field as per IS2720 (Part-XVI).

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC407**	Course Title: **Advanced Surveying Practicals**
Semester: **IV**	Credits: **1**
Periods Per Week:**2(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVES:

The objective of the course is to determine horizontal and vertical angles by using theodolite, setting out the curves, measure horizontal distance by using EDM/Total Station and to locate coordinates of a station with the use of G.P.S.

LIST OF PRACTICAL:

1. Reading the vernier of transit Theodolite and working out the least count.
2. Use of Transit theodolite/ Digital theodolite measurement of horizontal angles by direct, repetition and reiteration methods
3. Use of Transit theodolite/Digital theodolite measurement of vertical angles.
4. Height of objects with and without accessible bases by using of theodolite.
5. Use Theodolite as a tacheometer to compute reduce level and horizontal distances.
6. Setting out of a simple circular curve with given data by the following methods
   a) Offsets from the chords produced
   b) One theodolite method
7. Use EDM to measure horizontal distances.
8. Use Total Station to measure horizontal distances.
9. Use Total Station to carry out survey projects for closed traverse for minimum 5 sides.
10. Use GPS to locate the coordinates of a station.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PC408**	Course Title: **Fluid Mechanic Practicals**
Semester: **IV**	Credits: **1**
Periods per week: **2(L:0, T:0, P:2)**	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

LIST OF PRACTICALS:

1. Use Piezometer to measure Pressure at a given point.

2. Use U tube Differential Manometer to measure Pressure Difference between two given points.

3. Use Reynold's Apparatus to determine type of flow.

4. Use Bernoulli's Apparatus to apply Bernoulli's Theorem to get Total Energy Line for a flow in a closed conduit of varying cross sections.

5. To find out venturimeter coefficient

6. To determine coefficient of velocity (Cv), Coefficient of discharge (Cd) Coefficient of contraction (Cc) of an orifice and verify the relation between them

7. To determine coefficient of discharge of a rectangular notch/triangular notch.

8. Use Current meter & Pitot Tube to measure the velocity of flow of water in Open Channel.

9. To verify loss of head in pipe flow due to
a) Sudden enlargement
b) Sudden contraction
c) Sudden bend

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course code :- **PE409**	Course Title: **Construction Quality Control (Elective-I)**
Semester:- **IV**	Credits:- **2**
Period Per Week:**2 (L:2,T:0,P:0)**	

COURSE OBJECTIVES:

The theory should be taught and exercises should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. i. Apply total quality management in civil construction. ii. Check the quality in civil construction works. iii. Identify the variations in quality of civil works. iv. Use various standard codes in civil construction works. v. Design energy efficient buildings

COURSE CONTENT

1. Unit-I (8 hours)

Total Quality Management (TQM) in Construction. Concept of quality control, Quality assurance, Quality management. Aims of TQM. Development and design Concept of TQM. Accuracy and precision in observation, reading theodolite, digital theodolite, total station, calibration, etc. Accuracy in calculation, finding area, volume, etc.

2. Unit-II (7 hours)

Construction Quality Control Inspection Program. Duties, responsibilities, qualification of staff in organization. Checklists for - Quality of Materials - Masonry - Plastering, - Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing - Reinforcement Work - Formwork - Timber & steel construction, - Doors & windows, - Plumbing & drainage.

3. Unit-III (6 hours)

Quality standards in construction related to Building materials and other inputs for construction processes. Quality standards for Construction outputs, products and services. Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references. National Building code (NBC 2005) (a) Why to refer & How to refer (b) Methods of referring it & application. Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.

4. Unit-IV (6 hours)

Green building – Definition – Green Building, Green Construction, Sustainable building. Goals of Green building. Advantages and disadvantages. Strategies Certification Agencies – GRIHA, LEED (Highlights & Criteria). Life cycle assessment (LCA). Siting and structure design efficiency. Energy efficiency Water

efficiency. Materials efficiency. Indoor environmental quality enhancement. Operations and maintenance optimization. Waste reduction

COURSE OUTCOMES:

At the end of the course, the students will know the following:

- Overview of the of a construction quality control & assurance program.
- Understanding the organizational structure, functional responsibility, levels of authority and controls for a typical construction organization
- Job instructions governing quality control procedures and practices.
- Maintaining supervised controls on various quality aspects
- How to meet contractual requirements by conformance to applicable standards
- Maintain accurate records of inspections and test

INSTRUCTIONAL STRATEGY: -

i. Arrange site visit to a large construction project and discuss different quality control and monitoring measures being employed.
ii. Show video films on testing of different materials
iii. Arrange expert lectures of reputed contractors/builders/Engineers of Civil departments on quality control issues.
iv. Present case studies of failures in construction projects due to quality problems.

RECOMMENDED BOOKS:

1. Total Quality Management; G.Kanji; Springer Science &Business Media
2. Fundamentals of Quality Control and improvement: Amitva Mitra : Wiley India Private Limited.
3. Manual on Quality Control
4. Ambuja Technical Literature Series.
5. National Building Code.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	25
2	08	25
3	08	25
4	08	25
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **PE409**	Course Title**: Rural Construction Technology (Elective-I)**
Semester: **IV**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P:0)**	

COURSEOBJECTIVE:

Following are the objectives of this course:

- To learn development and planning of low cost housing infrastructure.
- To know about different government schemes for rural development.
- To understand techniques for rural road construction as per IRC stipulations.
- To learn rural irrigation techniques and water shed management.

COURSECONTENT

1. Rural Development and Planning (04 Hours)

1.1 Scope; development plans; various approaches to rural development planning.

1.2 Significance of rural development.

1.3 Rural development programme/projects.

2. Rural Housing (12 Hours)

2.1 Low cost construction material for housing

2.2 Composite material-ferro-cement& flyash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.

2.3 Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rat-trap bond for walls; Panels for roof, ferro-cement flooring/roofing units.

2.4 Biomass-types of fuels such as firewood, agricultural residues, dung cakes.

2.5 Renewable energy and integrated rural energy program-Objectives, Key elements, Implementation, Financial provisions, sources of renewable energy.

2.6 Working of gobar gas and bio gas plants.

3. Water Supply and Sanitation for Rural Areas (12 Hours)

3.1 Sources of water: BIS & WHO water standards.

3.2 Quality, Storage and distribution for rural water supply works.

3.3 Hand pumps-types, installation, operation, and maintenance of hand pumps.

3.4 Conservation of water-rain water harvesting, drainage in rural areas.

3.5 Construction of low cost latrines: Two pit pour flush water seal, septic tank etc.

3.6 Low cost community and individual Garbage disposal systems, Ferro-cement storage tanks.

4. Low Cost Rural Roads (07 Hours)

4.1 Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases.

4.2 Guidelines for Surfacing of Rural Road as per relevant IRC codes.

4.3 Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.

5. Low Cost Irrigation (07 Hours)

5.1 Design consideration and construction of tube-well, drip & sprinkler irrigation systems.

5.2 Water shed and catchment area development–problems and features of water shed management.

5.3 Water shed management structures-K.T.weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Bandhara system.

Course outcomes:

After completing this course, student will be able to:

1. Plan low cost housing using rural materials.
2. Make use of relevant government schemes for construction of roads and housing.
3. Use guidelines for rural road construction.
4. Implement different irrigation systems for rural areas.
5. Identify the need of water shed management in rural areas.

INSTRUCTIONAL STRATEGY

Being an Elective subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to arrange site visits so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work being carried out by research institutes.

RECOMMENDED BOOKS:

1. Madhov Rao AG, and Ramachandra Murthy, DS, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt. Ltd.

2. CBRI, Roorkee, Advances in Building Materials and Constriction.

3. Desai, Vasant, Rural Development in India: Past,Present and Future: a Challenge in the Crisis, Himalaya Publishing House, Delhi.

4. Rastogi, A. K. Rural Development Strategy, Wide Vision, Jaipur.

5. Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications India Pvt Ltd.

6. Gaur, KeshavDev, Dynamics of Rural Development, Mittal Publications, Delhi.

7. Document Published by Ministry of Rural development, Govt. of India, Ministry of Rural development.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	12	25
3	12	25
4	07	20
5	07	20
Total	**42**	**100**

PROGRAM:	THREE YEARS DIPLOMA PROGRAMME IN QSCM
Course Code: **OE410**	Course Title: **Renewable Energy Technologies (Open Elective- I)**
Semester: **IV**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P:0)**	

COURSE OBJECTIVES

- To understand energy scenario, energy sources and their utilization.
- To explore society's present needs and future energy demands.
- To Study the principles of renewable energy conversion system.
- To exposed to energy conservation methods.

COURSE CONTENT

1. Introduction: **(5 hrs)**

Principles of renewable energy; energy and sustainable development, fundamentals and social implications worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

2. Solar Energy: **(6hrs)**

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation; Solar Pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system

3. Wind Energy: **(6hrs)**

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

4. Tidal Power: **(6hrs)**

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental

characteristics of tidal power, harnessing tidal energy, advantages and limitations.
Ocean Thermal Energy Conversion: Principle of working, OTEC power stations in the world, problems associated with OTEC

5. **Green Energy**: **(6hrs)**
Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy

COURSE OUTCOME:

At the end of the course the student will be able to:

- Describe the environmental aspects of renewable energy resources.
- In Comparison with various conventional energy systems, their prospects and limitations.
- Describe the use of solar energy and the various components used in the energy
- production with respect to applications like-heating, cooling, desalination, power generation.
- Understand the conversion principles of wind and tidal energy
- Understand the concept of biomass energy resources and green energy.
- Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy

INSTRUCTIONAL STRATEGY

Renewable energy is a complex and multidisciplinary topic that requires different types of learning methods to address different aspects and levels of understanding. Teacher can use a variety of methods, such as lectures, demonstrations, simulations, games, experiments, projects, case studies, debates, discussions, and field trips, to introduce, explain, apply, and evaluate renewable energy concepts and applications. Teacher can also use different media and formats, such as text, images, videos, audio, graphs, charts, maps, models, and online tools, to present and illustrate renewable energy information and data.

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	15
2	6	20
3	9	25
4	6	20
5	6	20
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **OE 409**	Course Title: **Introduction to E-Governance (Open Elective-I)**
Semester: **IV**	Credits:**2**
Periods Per Week: **2(L:2, T:0, P:0)**	

COURSE OBJECTIVE:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency. To develop the basic understanding on the topic of E-Governance and learn the fundamentals involved in the subject.

COURSE CONTENT:

1. Introduction: (10 Hours)

1.1 Definition,
1.2 Needs of E-Governance,
1.3 Evolution of E-Governance,
1.4 Its scope and content,
1.5 Basic Structure of e- Governance,
1.6 Advantages of e-governance

2. E-governance approaches in India-The National e-Governance plan (8 Hours)

2.1 Introduction to NeGP (National e-Governance Plan)
2.2 NeGP Vision
2.3 The framework for e-Governance
2.4 Infrastructure pillars of NeGP
2.5 Capacity Building initiatives under NeGP

3. E-Governance Project Development And Management (10 Hours)

3.1 Introduction to e-Government Project Development
3.2 Conceptualization Phase
3.3 Architect Phase, Define Phase, Support Phase
3.4 e-Government Project Management Phase.
3.5 Public Private Partnership for e-Government.

4. Government Process Re-Engineering (8 Hours)

4.1 Process Reforms for e-Governance Projects,
4.2 Tools and techniques for Government Process Re-engineering,
4.3 Legal Reforms
4.4 Technology Management and Enterprise Architecture for e-Governance,

5. Capacity Building and change Management: (8 Hours)

i. Capacity Building for e-Governance,
ii. Focusing on Indian initiatives and their impact on citizens
iii. Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context.
iv. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc)

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Understand and appreciate the essence of e-Governance.
- Know the scope and basic structure of e-Governance
- Understand the National- Governance Plan
- Develop and manage e-Governance projects

INSTRUCTIONAL STRATEGY

The Teacher should familiarize students with practical aspects of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security, and data warehousing and data mining for e-governance. Teacher should work towards implementing e-governance models and systems using suitable platform.

RECOMMENDED BOOKS:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
3. C.S.R.Prabhu : E-Governance: Concepts and Case Studies, Prentice Hall of India Pvt. Limited (2004).
4. Implementing and managing e-Government, Richard Heeks, 2006.
5. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	10	25
2	8	20
3	10	20
4	8	15
5	8	20
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN QSCM	
Course Code: **OE410**	Course Title: **Artificial Intelligence (Open Elective-I)**
Semester: **IV**	Credits: **2**
Periods Per Week: **2(L: 2, T: 0, P: 0)**	

COURSE OBJECTIVES:

Have a thorough understanding of classical and modern AI applications. Be able to implement a Wide range of AI concepts using Prolog. Understand non-classical AI approaches such as genetic Algorithms and neural networks. Be able to assess the potential of AI in research and real-world Environments.

COURSE CONTENT:

1. Introduction

1.1 History and foundations of AI, Problem solving: Uninformed and informed Search; Constraint Satisfaction Problems and Constrained Optimization problems (complete and incomplete techniques).

2. Adversarial Search

2.1 Two players' games, games with uncertainty; Decision support systems and technologies; Knowledge representation, Reasoning, Expert systems Contents (2/2), Planning (basics).

3. Machine learning Basics

3.1 Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation, Neural networks, Problems, data, and tools; Visualization;

4. Linear regression

4.1 SSE; gradient descent; closed form; normal equations; features, Over fitting and complexity; training, validation, test data, and introduction to Matlab.

COURSE OUTCOME

At the end of the course, the student will be able to:

1. Identify problems that are amenable to solution by AI methods.
2. Design and carry out an empirical evaluation of different algorithms on a problem

formalization, and state the conclusions that the evaluation supports.

3. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
4. able to design and implement various machine learning algorithms in a range of real-world applications.
5. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

INSTRUCTIONAL STRATEGY

When teaching Artificial Intelligence start with the basics: Introduce fundamental AI concepts and build upon them gradually. Use real-world examples: Connect AI to practical applications to demonstrate its relevance and capture students' interest with real-world problem solving practices with Artificial Intelligence. Make it fun: Incorporate interactive activities, games, and projects to engage students in Artificial Learning. Be patient: AI can be complex not only for students but for teachers as well, so provide clear explanations, encourage questions, and foster a supportive learning environment.

RECOMMENDED BOOKS:

1. Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/PrenticeHall.
2. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, New Delhi (2018)

3. V.K. Jain, Machine Learning, Khanna Publishing House, New Delhi (2018)

4. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, http://mitpress.mit.
5. edu/catalog/item/default.asp?ttype=2&tid=12012.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	10	25
3	10	25
4	10	25
Total	**40**	**100**

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
TEXTILE DESIGNING

Code	Subjects	Study Scheme			Total Hours L+T+P	Credits			Total Credits L+T+P
		Periods Per Week				L	T	P	
		L	T	P					
TDPC401	Dyeing Technology	4	0	0	4	4	0	0	4
TDPC402	Dyeing Technology Lab	0	0	2	2	0	0	1	1
TDPC403	Fabric Manufacture-II	3	0	0	3	3	0	0	3
TDPC404	Fabric Manufacture–II Lab	0	0	2	2	0	0	1	1
TDPC405	Textile Testing	3	0	0	3	3	0	0	3
TDPC406	Textile Testing Lab	0	0	2	2	0	0	1	1
TDPC407	Printing & Finishing	3	0	0	3	3	0	0	3
TDPC408	Printing & Finishing Lab	0	0	2	2	0	0	1	1
TDBS411	Essence of Indian Knowledge and Tradition	2	0	0	2	0	0	0	0
TDPC409	Computer Aided Textile Design	0	0	6	6	0	0	3	3
TDPC410	Industrial Lectures/Visits	2	0	0	2	2	0	0	2
TOTAL		**17**	**0**	**14**	**31**	**15**	**0**	**07**	**22**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 401	Course Title : Dyeing Technology
Semester: 4th	Credits:4
Hours per week:4(L: 4T: 0P: 0)	

COURSE OBJECTIVE:

A diploma holder in textile design must have sufficient knowledge and skills about principles of dyeing operation, equipment and processes. He should be able to execute various recipes for dyeing.

COURSE CONTENT

1. **Unit 1** **(02 Hours)**
   1.1 General terminologies and definitions used in technology of dyeing.

2. **Unit 2** **(22 Hours)**
   Principle, properties and methodology of application of
   - 2.1 Direct dyes.
   - 2.2 Reactive Dyes
   - 2.3 Azoic Dyes
   - 2.4 Vat Dye
   - 2.5 Solublized Vat Dyes
   - 2.6 Sulphur Dyes
   - 2.7 Acid Dyes
   - 2.8 Basic Dyes
   - 2.9 Disperse Dyes
   - 2.10 Metal Complex Dyes

3. **Unit 3** **(08 Hours)**
   - 3.1 Optical/ fluorescent brightening agents-method of application and importance.
   - 3.2 Water –Hardness of water, type, methods of removal.

4. **Unit 4** **(18 hours)**
   Description and working of different machines like:
   - 4.1 Loose stock dyeing machine
   - 4.2 Package dyeing-cone/cheese dyeing
   - 4.3 Hank dyeing machine
   - 4.4 Jet dyeing machine
   - 4.5 Jigger and Winch machine
   - 4.6 Beam dyeing machine
   - 4.7 Continuous dyeing range & Batch machine

COURSE OUTCOME

After completion of the course the student will be able to:

- Dye the textile with different dyes
- Produce shade by mixing of color
- Dye the textile as per requirement
- Control the process parameter of dyeing machines

BOOKS RECOMMENDED:

1. Technology of Dyeing- V A Shenai.
2. Chemical Tech of Fibrous Material-E R T rotman.
3. Chemistry of Dyes and Principal of Dyeing-V. A. Shenai.
4. Art of Dyeing–B S Chauhan.
5. The Dyeing of Textile Materials –Puente Cegarra.
6. Dyeing and chemical Technology of Textile Fibres- ERT rotman
7. Textile Fiber to Fabric –Bernard P. Corbman

UNITWISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	10
2	22	40
3	08	20
4	18	30
Total	**50**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 402	Course Title : Dyeing Technology Lab
Semester: 4th	Credits:1
Hours per week:2(L: 0T: 0P: 2)	

LIST OF PRACTICALS

1. Dyeing of the cotton sample with direct dyes.
2. To study the after treatment effect of direct dyed material using a cationic dye fixing agent and compare its washing and rubbing fastness with original sample.
3. Dyeing of cotton material with cold brand reactive dyes.
4. Dyeing of cotton material with vat dye.
5. Dyeing of cotton material with soluble vat dye.
6. Dyeing of cotton with sulphur dye.
7. To dye acrylic sample with basic dye
8. To dye acrylic sample with modified basic dye
9. To dye wool sample with basic dye
10. Dyeing of polyamide and polyester
11. Dyeing with disperse dyes
12. Dyeing of cot/wool blend
13. Dyeing of polyester/cotton blend

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 403	Course Title : Fabric Manufacture-II
Semester: 4th	Credits:3
Hours per week: 3(L: 3T: 0P: 0)	

COURSE OBJECTIVE:

The diploma holders in textile design are supposed to have knowledge and skills related to various looms and manufacturing of fabric. Thus in this subject, student will learn manufacturing techniques and mechanism employed to produce fabric.

COURSE CONTENT

1. **Box Motion** **(10 Hours)**
   - 1.1 Introduction to multiple box motion and its objectives,
   - 1.2 Classification of multiple box motion,
   - 1.3 Mechanism and working principle of cow burn/Eccles's box motion.
   - 1.4 Chain making for 4x4 box motion.
   - 1.5 Definition of pick-at-will motion, pick-and-pick-loom.

2. **Dobby Shedding-** **(12 Hours)**
   - 2.1 Single lift dobby
   - 2.2 Double lift dobby
   - 2.3 Construction and working of climax dobby and paper dobby

3. **Jacquard shedding** **(10 Hours)**

   Principle and working of following jacquards
   - 3.1 Single lift single cylinder jacquard
   - 3.2 Double lift single cylinder jacquard
   - 3.3 Double lift double cylinder jacquard
   - 3.4 Double lift single cylinder
   - 3.5 Cross-border jacquard

4. **Non-Conventional loom** **(08 Hours)**
   - 4.1 Introduction to unconventional weaving machines. Advantages against shuttle picking mechanism
   - 4.2 Type of unconventional picking
   - 4.3 Advantages of modern picking mechanisms
   - 4.4 Comparison with shuttle picking
   - 4.5 Types of selvedges–conventional, tucked, crossleno, selvedges
   - 4.6 Weft accumulator–principle and working

5. **Weft Insertion** **(10 Hours)**
   - 5.1 Weft Insertion by Projectile/Gripper
   - 5.2 Weft Insertion by Rapier

5.3 Weft Insertion by Air jet
5.4 Weft insertion by Water jet

COURSE OUTCOME

After completion of the course the student will be able to:

- Work on the Conventional loom
- Operate the Dobby and Jacquard System for Designing
- Work on the Shuttle less loom
- Construct the fabric on the loom

RECOMMENDED BOOKS:

1. Weaving mechanism Vol. I and Vol. II by N N Benerjee
2. Fancy weaving by K T Aswani
3. Principles of weaving by marks and Robinsons
4. Mechanism of weaving by T W Fox.
5. Jacquard-EK Saral Vidya by S. S. Satsangi(Bilingual)

SUGGESTEDWEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	12	25
3	10	20
4	08	15
5	10	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 404	Course Title : Fabric Manufacture-II Lab
Semester: 4th	Credits:1
Hours per week:2(L: 0T: 0P: 2)	

LIST OF PRACTICALS:

1. To study the principle and working of 4x1 drop box motion.
2. To study the principle and working automatic pirn change mechanism
3. To study the principle and working of the single lift dobby.
4. To study the principle and working of the double lift dobby(climax dobby)
5. To study the principle and working of the single lift single cylinder jacquard.
6. To study card cutting for a particular design for jacquard.
7. Demonstration and practice on Projectile loom through mill visit
8. Demonstration and practice on Rapier loom through mill visit
9. Demonstration and practice on Air-jet loom through mill visit
10. Demonstration and practice on Water-jet loom through mill visit

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 405	Course Title: Textile Testing
Semester: 4th	Credits:4
Hours per week:3(L: 3 T: 0 P: 0)	

COURSE OBJECTIVE:

The students of textile design are responsible for testing and quality control of yarn and fabric at the shop floor. Thus in this subject, student will be made fully aware of different quality standards and their maintenance during manufacturing processes for them total quality concept

COURSECONTENT

1. **Introduction:** **(03 hours)**
Aim and scope of testing, Sample and Population, Sampling techniques for fiber, yarn and fabrics.

2. **Testing of Fibers:** **(10 hours)**
Cotton fiber testing such as length, fineness, crimp, maturity, neps, strength, elongation, trash-content, grading of different cotton, fiber contamination measurement.

3. **Testing of Yarn** **(15 hours)**
Twist in continuous filament, spunand plied yarns, tensile properties, various type of measuring instruments and their working principles, factors affecting tensile properties, principles and methods of evenness testing evaluations Analysis of periodic variations in mass per unit length. Yarn hairiness, principle of measurement, measuring instruments.

4. **Testing of Fabric** **(16 hours)**
Measurement of fabric dimensions and other physical properties such asthickness,weight,yarncrimp,fabricshrinkage,air-permeability,thermalproperties,wettability, water proofness, and flame resistance Test related to fabric appearance such as pilling, crease and wrinkle recovery, fabric handle and factors influencing it, fabric comfort. Serviceability testing parameters such as abrasion resistance, fabric strength, tear strength, bursting strength.

5. **Chemical Testing of Textiles:** **(04 hours)**
Color fastness, rubbing fastness, laundering fastness.

COURSE OUTCOME

After completion of the course the student will be able to:

- Handle the various textile testing instruments
- Analyze the testing results

- Maintain the record of result obtained on instruments.

RECOMMENDEDBOOKS:

1. Textile Testing by JE Booth
2. Textile Testing by Grover and Hamley
3. Textile Testing by John H. Skinkle; DBTarapore wala and Sons, Bombay

SUGGESTEDWEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNITWISETIMEANDMARKSDISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
01	03	10
02	10	20
03	15	25
04	16	25
05	04	20
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 406	Course Title: Textile Testing Lab
Semester: 4th	Credits:1
Hours per week:2(L: 0T: 0P: 2)	

LIST OF PRACTICALS

1. To prepare and analyze Baer Sorter diagram.
2. Determine moisture content/regain of a fibre sample by hot air oven method.
3. Prepare yarns Appearance Boards and compare with ASTM standards.
4. Study the hairiness of a given yarns using Hairiness Tester.
5. Determine the percentage crimp with the help of crimp Tester.
6. Determine the tensile properties of yarn by single thread strength tester.
7. Determine twist of yarn using different principle of measurement.
8. Determine the tensile strength of a woven fabric
9. Determine the tear resistance of a fabric using Elmendorf Tear Tester.
10. Determine the bursting strength of a fabric on a bursting tester.
11. Determine the abrasion resistance and pilling resistance of a fabric.
12. Determine the Drape coefficient of a fabric sample.
13. Determine the thickness of fabric.
14. DeterminetheAirpermeability,waterpermeabilityandwaterrepellencyof a fabric

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 407	Course Title : Printing and Finishing
Semester: 4th	Credits:03
Hours per week: 3(L: 3 T: 0 P:0)	

COURSE OBJECTIVE:

Students of Textile Design must have enough knowledge about principles and practices employed for printing and finishing. He must be aware of various operation, materials, equipment and processes used for printing and finishing.

COURSE CONTENT

1. **Printing methods:** **(08 hours)**
   Hand block, roller and screen printing processes. Photo chemical method of screen preparation and enamel method. Draw backs and advantages of each method.

2. **Print Paste:** **(10 hours)**
   Constituent and characteristics of print paste, classification and mechanism of working of thickeners.
   Printing after treatments: Importance of steaming, curing, ageing of prints, Mechanism of each process.

3. **Printing Styles:** **(12 hours)**
   Direct, discharge and resist styles of printing on natural, manmade and blended textiles.
   Transfer Printing: Classification, mechanism of transfer in each type. Transfer printing of natural, man-made and blended textiles. Transfer printing machines.

4. **Mechanical Finishes:** **(08 hours)**
   Calendering: Influence of working parameters and function of various calendering machines. Physical and chemical softening processes, selection of chemical and evaluation of softening. Sanforizing: Method of sanforizing.

5. **Functional finishes:** **(10 hours)**
   Anti-crease finish on cotton, Choice of chemical, catalyst and process parameters. Drawback and advantages associated with use of various anti-crease chemicals. Water repellency and water repellent finishes on cotton, Evaluation of water repellency. Soil release finish: Classification of soil and mechanism of their adherence on cotton. Soil releases finishes. Flame retardant finish: Burning cycle and its importance to hypothesis for flame retardants. Limiting Oxygen Index (LOI).

COURSE OUTCOME

After completion of the course the student will be able to:

- Printing of fabric by various method
- Develop the printing screen
- Control the process parameter
- Finish the fabric with various finishes

RECOMMENDED BOOKS:

1. Miles L W C, "Textile Printing", Dyers Company Publication Trust, Bradford, England, 1981.
2. Shenai VA, "Technology of Printing", Sevak Publications, Mumbai, 1990.
3. Hall AJ, "Textile Finishing", Haywood Books, London, 1996.
4. Shenai VA and Saraf, NM, "Technology of Textile Finishing", Sevak Publications, Mumbai, 1990.
5. Nunn DM, "The Dyeing of Synthetic Polymer and Acetate Fibres", Dyers Company Publication Trust, London, 1979.

SUGGESTED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
01	08	20
02	10	25
03	12	25
04	08	15
05	10	15
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 408	Course Title : Printing and Finishing Lab
Semester: 4th	Credits:1
Hours per week: 2(L: 0T: 0P: 2)	

LIST OF PRACTICALS

1. To prepare thickening paste by using different thickeners like C.M.C, sodium alginate and guar gum.
2. To make different designs of flower on cotton fabric using a film stencil.
3. To make different designs of leaves on cotton fabric using a film stencil.
4. Printing of the cotton fabric by direct dyes using block printing method.
5. Printing of the cotton fabric by reactive dyes using block printing method.
6. Printing of the cotton fabric by direct dyes using screen printing method.
7. Printing of the cotton fabric by reactive dyes using screen printing method.
8. Printing of the cotton fabric by tie and dye technique in single and multi colour.
9. To print the cotton fabric by Batic printing in single and multi colour.
10. To print the silk fabric by tie and dye techniques in single and multi colour.

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 409	Course Title: CAD in Textile Designing
Semester: 4th	Credits:3
Hours per week:06(L: 0T: 0P: 6)	

COURSE OBJECTIVE:

The term CAD has found its way into all major discipline that has got anything to do with designing or drafting techniques. The major objective of this course is to expose the students to different software available in the field of textile design industry so that they are able to use those software in the design and construction of various textiles.

COURSE CONTENT (PRACTICAL PURPOSE)

1. Unit 1 **(02 hours)**
- 1.1 Introduction to latest coreldraw and Photoshop software

2. Unit 2 **(10 hours)**
- 2.1 Use of various tools in coreldraw and Photoshop.

3. Unit 3 **(08 hours)**
- 3.1 Formation of designs using different tools and application and selection of suitable colours for a particular design.

4. Unit 4 **(08 hours)**
- 4.1 Scan a design with the help of Photoshop and Change of colour scheme of the design.
- 4.2 Enlargement and reduction of design

5. Unit 5 **(08 hours)**
- 5.1 Understanding graphic representation, file conversion, drawing simple geo metric figures, capturing a picture using CCD/Scanner

6. Unit 6 **(10 hours)**
- 6.1 Use of computer to construct design on different bases with reference to various arrangements for woven designs

LIST OF PRACTICALS

Software packages like Textronics / Tex stylers / Wonder weave/ Scot weave /Ned Graphics Design systems may be adopted for doing following exercises (Anyone may be chosen or any other latest software):

1. Preparation of Woven/Knitted Fabric Construction and Design
   - Selection of a fabric.
   - Use of CAD for creating fabric structure by selecting drafting and lifting plan
   - Selection of colour scheme and colour ways
   - Selection of yarn count, twist and its direction, and type of yarn

- Presentation of simulated fabric design on computer screen and also on paper

2. Modify/editing fabric design from original fabric and looking at the effect of modification (modification could be on yarn count, colour, twist, and its direction; fabric drafting and lifting plan)
3. Preparation of printing and dyeing on fabric:
    - Selection of design either by selecting printed fabric or by generating figures based on ideas.
    - Selection of colour scheme
    - Finalizing the design on computer screen/paper.

COURSE OUTCOME

After completion of the course the student be able to:

- Work on the corel draw and photoshop
- Make design using various CAD application
- Construct 3-D modeling of the design

RECOMMENDED BOOKS

1. SAMS CorelDraw-II
2. SAMS Adobe Photoshop-I
3. CAD in clothing and textiles by W. Aldrich

SUGGESTEDWEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNITWISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
01	02	10
02	10	20
03	08	20
04	08	15
05	08	15
06	08	10
Total	**44**	**100**

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE DESIGNING	
Course Code: TDPC 410	Course Title: Industrial Lectures/ Visits
Semester: 4th	Credits:2
Hours per week: 2(L: 2T: 0P: 0)	

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for theirfuture role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. Itis suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students, understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behavior, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
TEXTILE TECHNOLOGY

STUDY SCHEME 4TH SEMESTER

Code	Subjects	Study Scheme			Total Hours L+T+P	Credits			Total Credits L+T+P
		Periods Per Week				L	T	P	
		L	T	P					
TTPC 401	Spinning Technology – II	4	0	0	4	4	0	0	4
TTPC 402	Spinning Technology – II Lab	0	0	2	2	0	0	1	1
TTPC 403	Weaving Technology – II	4	0	0	4	4	0	0	4
TTPC 404	Weaving Technology – II Lab	0	0	2	2	0	0	1	1
TTPC 405	Non-Woven Development and Technology	4	0	0	4	4	0	0	4
TTPC 406	Textile Chemical Processing – II	3	0	0	3	3	0	0	3
TTPC 407	Textile Chemical Processing – II Lab	0	0	2	2	0	0	1	1
TTPC 408	Textile Testing	3	0	0	3	3	0	0	3
TTPC 409	Textile Testing Lab	0	0	2	2	0	0	1	1
TTBS 410	Essence of Indian Knowledge and Tradition	2	0	0	2	0	0	0	0
TOTAL		**20**	**0**	**08**	**28**	**18**	**0**	**04**	**22**

PROGRAM:THREEYEARSDIPLOMAPROGRAMINTEXTILETECHNOLOGY	
Course Code: TTPC 401	Course Title: Spinning Technology-II
Semester:4th	Credits:**4**
Periodsperweek:**4(L:4T:0P:0)**	

COURSEOBJECTIVE:

The student of textile technology after completing diploma has to work in textile mills/textile houses/quality control, therefore should know the basic principles and objects of Ginning, Blow Room and Carding Machines, their working, quality and production and calculation.

COURSECONTENT

1. **Doubling and Drafting** **(12 hours)**

   Basic principles; drafting operation in the drafting arrangement; behavior of fibers in the drafting zone; fiber friction field, numerical problem.

2. **Combing process** **(12hours)**

   Objectives, combing for shorter and medium varieties of cotton, cottons suitable for combing, preparation of stock for combing, combing cycle, role of machine components and settings, noil extraction at backward feed and forward feed comber.

3. **Process related to roving formation** **(13hours)**

   Objectives, functions of different machine components and high drafting system, roving twist in speed frame, winding principles and equations related to bobbin leading and flyer leading, building motion.

4. **Ring spinning Process** **(13hours)**

   Function and mode of operation of ring frame, role of drafting system, yarn guiding devices, forces acting between ring and traveler, yarn tension variation, tasks of traveller, limiting speed, classification, form of traveler, traveler mass and material, different ring-traveller combinations, fiber lubrication, running on new-ring, winding process, copstructure, spinning geometry, causes of end breaks,

5. **Non-conventional spinning processes** **(13hours)**

   Principle of open-end spinning, rotor spinning, and their functions, yarn properties in comparison with ring-spun yarn, principle of friction spinning, function and yarn properties and comparison of Dref-II and Dref- III friction spinning machines, basic principle to air jet spun yarn, functions and yarn properties, numerical problems.

COURSE OUTCOME

After completion of the course the student will be able to:

- Construct different types of knitting design
- Control the Knitting parameters
- Operate the weft and warp knitting machine

RECOMMENDEDBOOKS:

1. Spun YarnTechnology,Vol.1Venkatasubramani
2. Cotton Opening and Picking-Gilbert Rmerril
3. Manual of Cotton Spinning. Vol.-II and part-I, Textile Institute.
4. Opening, Cleaning and Picking by Zoltan S Szaloki Essential Elements of Practical Cotton Spinning by T. K. Pattabhiram
5. Essential Elements of Practical Cotton Spinning by T. K. Pattabhiram
6. A practical Guide to Combing by W Klein
7. Cotton Spinning by WS Taggart
8. Spun Yarn Technology by Venkta subramani

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	13	20
2	12	15
3	13	25
4	13	20
5	13	20
Total	**64**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 402	Course Title: Spinning Technology–II Lab
Semester:4th	Credits:**1**
Periods per week: **2(L: 0T:0P:2)**	

LISTOFPRACTIALS

1. To estimate head-to-head difference in noil level (mill based study).
2. To study the effect of feed pernip on percentage in nep level during combing (mill based study).
3. To study the drafting, twisting and winding zone of speed frame.
4. To study the building motion in speed frame.
5. To study the differential motion of speed frame and calculation of bobbin speed.
6. Calculation of break draft constant, draft constant and twist constant and production of speed frame.
7. To study the influence of machine and process parameters on roving unevenness (mill based study).
8. To study the drafting, twisting and winding zone in ring frame.
9. To study the building motion in ring frame.
10. Calculation of draft constants, twist constant, coils perinchand production of ring frame.
11. To ascertain the effect of break draft and total draft on yarn unevenness and strength (mill based study).
12. Estimation of spinning tension as a function of traveler weight, yarn count and balloon height (mill based study).
13. Study the chief organs, mechanism and calculations of open end and friction spinning machines.

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 403	Course Title: Weaving Technology-II
Semester: 4th	Credits: 04
Hours per week: 4 (L: 4T:0P:0)	

COURSE OBJECTIVE:

The Subject weaving technology will impart awareness to the students about different weaving techniques to produce good quality of fabric.

COURSE CONTENT

1. Box Motion (12Hours)

1.1. Introduction to multiple box motion its objects
1.2. Classification of multiple box motion,
1.3. Mechanism and working principle of cowburn/Eccles's box motion.
1.4. Chain making for 4x4 box motion.
1.5. Definition of pick-at-will motion, pick-and-pick-loom.

2. Dobby Shedding (13Hours)

2.1. Single lift dobby
2.2. Double lift dobby
2.3. Construction and working of climax dobby and paper dobby

3. Jacquard shedding- Principle and working of following jacquards (13Hours)

3.1. Single lift single cylinder jacquard
3.2. Double lift single cylinder jacquard
3.3. Double lift double cylinder jacquard
3.4. Double lift single cylinder
3.5. Cross-border jacquard

4. Non-Conventional loom (13Hours)

4.1. Introduction to unconventional weaving machines. Advantages against shuttle picking mechanism
4.2. Type of unconventional picking
4.3. Advantages of modern picking mechanisms
4.4. Comparison with shuttle picking
4.5. Types of selvedges– conventional, tucked, crossleno, selvedges
4.6. Weft accumulator– principle and working

5. Weft Insertion (13 Hours)

5.1. Weft Insertion by Projectile/Gripper
5.2. Weft Insertion by Rapier
5.3. Weft Insertion by Air jet
5.4. Weft Insertion by Water jet

COURSEOUTCOME

After completion of the course the student will be able to:

- Work on the Conventional loom
- Operate the Dobby and Jacquard System for Designing
- Work on the Shuttleless loom
- Construct the fabric on the loom

RECOMMENDED BOOKS

1. Weaving mechanism Vol. I and Vol. II by NN Benerjee
2. Fancy weaving by K T Aswani
3. Principles of weaving by marks and Robinsons
4. Mechanism of weaving by T W Fox.
5. Jacquard-E K Saral Vidya by S.S. Satsangi(Bilingual)

SUGGESTED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
1	12	20
2	13	25
3	13	20
4	13	15
5	13	20
Total	**64**	**100**

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 404	Course Title: Weaving Technology–II Lab
Semester : 4th	Credits:01
Hours per week:2(L: 0T:0P:2)	

LISTOFPRACTICALS

1. To study the principle and working of 4x1 drop box motion.
2. To study the principle and working automatic pirn change mechanism
3. To study the principle and working of the single lift dobby.
4. To study the principle and working of the double lift dobby(climax dobby)
5. To study the principle and working of the single lift single cylinder jacquard.
6. To study card cutting for a particular design for jacquard.
7. Demonstration and practice on Projectile loom through mill visit
8. Demonstration and practice on Rapier loom through mill visit
9. Demonstration and practice on Air-jet loom through mill visit
10. Demonstration and practice on Water-jet loom through mill visit

PROGRAM:THREEYEARSDIPLOMAPROGRAMINTEXTILETECHNOLOGY	
Course Code: TTPC 405	Course Title: Non-Woven Development and Technology
Semester: 4th	Credits:4
Hours per week: 4(L:4 T: 0 P:0)	

COURSEOBJECTIVES

Skill regarding non-woven fabrics helps textile technology students to foray into technical textiles as the area offer vast opportunity in various aligned fields.

COURSECONTENT

1. Unit1 **(13hours)**

1.1 **Raw materials:** Natural and Synthetic fibres, Bonding agents, Types of bonding agents, Basic structure of bonding agent formulation, Characteristicpropertiesofpolymerdispersions,Adhesivefibres,Solublefibres.

2. Unit2 **(13hours)**

2.1 **Web formation techniques:** Fibre preparation, Dry laying, wet laying, Spun laying, Melt blowing, SM, SM fabrics.

3. Unit3 **(13hours)**

3.1 **Mechanical Bonding:** Needle punching technology, oblique needle punching, Hyper punch and H1 technology, Developments in needle punching technology, Factors affecting the tensile and bulk properties of needle punched fabrics, Spun lacing technology, factors affecting the properties of spun laced fabric.

3.2 **Chemical Bonding:** Adhesive Bonding, Methods of bonding agent application, Cohesive bonding.

3.3 **Thermal bonding:** Thermal bonding techniques, Area bonding, Point bonding and their properties.

3.4 **Spun bonding and Melt blowing**: Techniques, structure and properties of fabrics.

4. Unit4 **(13hours)**

4.1 **Finishing of nonwoven fabrics:** Shrinkage, Calendaring, Pressing, Splitting, Grinding Washing, Dyeing, Printing

5. Unit5 **(12hours)**

5.1 **Applications:** Medical and Hygiene, Apparel, Household and Home Textiles, Geo textiles, Filtration, automotive textiles.

COURSEOUTCOME

After completion of the course the student be able to:

- Improvise the nonwoven product.
- Make different types of non-woven product
- Improve the usability of the product

RECOMMENDED BOOKS:

1. Russell, SJ, "Handbook of Non woven", Wood head Publishing Limited, Cambridge, UK, 2007
2. Lunen schlossJ and Albrecht W," Non-Woven Bonded Fabric", Ellis and Horwood Ltd., UK, 1985
3. Albrecht W, Fuchs Hand Kittelmann, "Nonwoven Fabrics", Wiley-VCH Weinheim, 2003.
4. Mrstina V and Fejgal F," Needle punching textile technology",Elsevier,1990.
5. Krcma Radco ,"Manual of non wovens", Textile Trade Press,UK,1971

SUGGESTED WEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNITWISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted (%)
01	13	20
02	13	20
03	13	20
04	13	20
05	12	20
Total	**64**	**100**

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 406	Course Title: Textile Chemical Processing-II
Semester:4th	Credits:4
Hours per week: 4(L: 4 T: 0P:0)	

COURSE OBJECTIVE:

Students of Textile Technology must have enough knowledge about principles and practices employed for textile chemical processing. He must be aware of various operation, materials, equipment and processes used for dyeing, printing and finishing.

COURSECONTENT

1. Dyeing of blends **(02hours)**

Classification of blends and fancy shades, Methods for dyeing of blends. Suitability of each method for dyeing of specific blend.

2. Pretreatment and dyeing machineries: **(05hours)**

Working Principle, construction and functioning of loose fibre, yarn and package dyeing machines. Jigger, winch, jet and HTHP beam dyeing machines. Padding mangles.

3. Printing methods: **(07hours)**

Hand block, roller and screen printing processes. Photochemical method of screen preparation and enamel method. Drawbacks and advantages of each method.

4.Printing Process (**08hours)**

4.1. **Print Paste**: Constituent and characteristics of print paste, classification and mechanism of working of thickeners.

4.2. **Printing after treatments**: Importance of steaming, curing, ageing of prints, Mechanism of each process.

5. Printing styles **(10hours)**

5.1. **Printing Styles**: Direct, discharge and resist styles of printing on natural, manmade and blended textiles.

5.2. **Transfer Printing:** Classification, mechanism of transfer in each type. Transfer printing of natural, man-made and blended textiles. Transfer printing machines

6. Mechanical Finishes: **(08hours)**

Calendering: Influence of working parameters and function of various calendaring machines. Physical and chemical softening processes, selection of chemical and evaluation of softening. Sanforizing: Method of sanforizing.

7. Functional finishes **(08hours)**

Anti-crease finish on cotton, Choice of chemical, catalyst and process parameters. Drawback and advantages associated with use of various anti-crease chemicals. Water repellency and water repellent finishes on cotton, Evaluation of water repellency. Soil

release finish: Classification of soil and mechanism of their adherence on cotton. Soil releases finishes. Flame retardant finish: Burning cycle and its importance to hypothesis for flame retardants. Limiting Oxygen Index (LOI).

COURSEOUTCOME

After completion of the course the student will be able to:

- Printing off a bric by various method
- Develop the printing screen
- Control the process parameter
- Finish the fabric with various finishes

RECOMMENDED BOOKS:

1. Miles L W C, "Textile Printing", Dyers Company Publication Trust, Bradford, England, 1981.
2. Shenai VA, "Technology of Printing", Sevak Publications, Mumbai, 1990.
3. Hall AJ, "Textile Finishing", Haywood Books, London, 1996.
4. Shenai VA and Saraf, NM, "Technology of Textile Finishing", Sevak Publications, Mumbai, 1990.
5. Nunn DM, "The Dyeing of Synthetic Polymer and Acetate Fibres", Dyers Company Publication Trust, London, 1979.

SUGGESTEDWEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNITWISETIMEANDMARKSDISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
01	02	10
02	05	15
03	07	20
04	08	15
05	10	15
06	08	10
07	08	15
Total	**48**	**100**

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 407	Course Title: Textile Chemical Processing–II Lab
Semester:4th	Credits:1
Hours per week: 2(L:0T: 0P:2)	

LISTOFPRACTICALS

1. To prepare thickening paste by using different thickeners like C.M.C, sodium alginate and guar gum.
2. To make different designs of flower on cotton fabric using a film stencil.
3. To make different designs of leaves on cotton fabric using a film stencil.
4. Printing of the cotton fabric by direct dyes using block printing method.
5. Printing of the cotton fabric by reactive dyes using block printing method.
6. Printing of the cotton fabric by direct dyes using screen printing method.
7. Printing of the cotton fabric by reactive dyes using screen printing method.
8. Printing of the cotton fabric by tie and dye technique in single and multi colour.
9. To print the cotton fabric by Batic printing in single and multi colour.
10. To print the silk fabric by tie and dye techniques in single and multi colour.

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 408	Course Title: Textile Testing
Semester: 4th	Credits:03
Hours per week: 3(L: 3 T: 0 P: 0)	

COURSE OBJECTIVE:

The students of textile design are responsible for testing and quality control of yarn and fabric at the shop floor. Thus in this subject, student will be made fully aware of different quality standards and their maintenance during manufacturing processes for them total quality concept

COURSECONTENT

1. **Introduction:** **(03 hours)**
Aim and scope of testing, Sample and Population, Sampling techniques for fiber, yarn and fabrics.

2. **Testing of Fibers:** **(10 hours)**
Cotton fiber testing such as length, fineness, crimp, maturity, neps, strength, elongation, trash-content, grading of different cotton, fiber contamination measurement.

3. **Testing of Yarn** **(15 hours)**
Twist in continuous filament, spun and plied yarns, tensile properties, various type of measuring instruments and their working principles, factors affecting tensile properties, principles and methods of evenness testing evaluations Analysis of periodic variations in mass per unit length. Yarn hairiness, principle of measurement, measuring instruments.

4. **Testing of Fabric** **(16 hours)**
Measurement of fabric dimensions and other physical properties such asthickness,weight,yarncrimp,fabricshrinkage,air-permeability,thermalproperties,wettability, water proofness, and flame resistance Test related to fabric appearance such as pilling, crease and wrinkle recovery, fabric handle and factors influencing it, fabric comfort. Serviceability testing parameters such as abrasion resistance, fabric strength, tear strength, bursting strength.

5. **Chemical Testing of Textiles:** **(04 hours)**
Color fastness, rubbing fastness, laundering fastness.

COURSE OUTCOME

After completion of the course the student will be able to:

- Handle the various textile testing instruments
- Analyze the testing results
- Maintain the record of result obtained on instruments.

RECOMMENDED BOOKS:

1. Textile Testing by JE Booth
2. Textile Testing by Grover and Hamley
3. Textile Testing by John H. Skinkle; DBTarapore wala and Sons, Bombay

SUGGESTEDWEBSITES

1. https://onlinecourses.nptel.ac.in/
2. https://swayam.gov.in/

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hrs)	Marks Allotted(%)
01	03	10
02	10	20
03	15	25
04	16	25
05	04	20
TOTAL	**48**	**100**

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTPC 409	Course Title: Textile Testing
Semester: 4th	Credits:1
Hours per week: 2(L:3T: 0P: 0)	

LIST OF PRACTICALS

1. To prepare and analyze Baer Sorter diagram.
2. Determine moisture content/regain of a fibre sample by hot air oven method.
3. Prepare yarns Appearance Boards and compare with ASTM standards.
4. Study the hairiness of a given yarns using Hairiness Tester.
5. Determine the percentage crimp with the help of crimp Tester.
6. Determine the tensile properties of yarn by single thread strength tester.
7. Determine twist of yarn using different principle of measurement.
8. Determine the tensile strength of a woven fabric
9. Determine the tear resistance of a fabric using Elmendorf Tear Tester.
10. Determine the bursting strength of a fabric on a bursting tester.
11. Determine the abrasion resistance and pilling resistance of a fabric.
12. Determine the Drape coefficient of a fabric sample.
13. Determine the thickness of fabric.
14. Determine the Air permeability, water permeability and water repellencyof a fabric

PROGRAM:THREE YEARS DIPLOMA PROGRAM IN TEXTILE TECHNOLOGY	
Course Code: TTBS 410	Course Title: Essence of Indian Knowledge and Tradition.
Semester: 4th	Credits: 0
Hours per week: 2(L: 2T: 0P: 0)	

COURSE OBJECTIVES

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of Traditional Heritage of knowledge system.

COURSE CONTENT:

Unit I: Fine Arts in India (Art, Technology and Engineering), Art Galleries and Museums.

Unit II: Indian Painting, Indian Handicrafts, Indian Traditional Textiles like Woven, Printed and Embroidered

Unit III: Case Studies.

COURSE OUTCOME:

Ability to Understand, Connect up and explain Basics of Indian Traditional Knowledge, Modern Scientific Perspective.

CURRICULUM
FOR

FOURTH SEMESTER

DIPLOMA IN

TRAVEL AND TOURISM

TOURISM AND HOSPITALITY ADMINISTRATION
STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN TRAVEL & TOURISM
4th Semester

Course code	Subjects	Time In Hours				Credits		
		TH	TU	PR	TOTAL	TH	PR	TOTAL
TTRMPC401	Tour Guiding and Escorting	2	--	--	2	2	---	2
TTRMPC402	Tour Guiding and Escorting Lab	--	--	2	2	--	1	1
TTRMPC403	Adventure Tourism	2	--	--	2	2	--	2
TTRMPC404	Adventure tourism lab	--	--	2	2	--	1	1
TTRMPC405	Tourism planning	3	--	-	3	3		3
TTRMPC406	Tourism planning Lab	--	--	2	2	--		1
TTRMPC407	Travel Journalism	3	--	--	3	3		3
TTRMPC408	Travel Journalism Lab	--	--	2	2	--		1
TTRMPC409	Human Resource management	2	--	--	2	2		2
TTRMPC410	Human Resource management Lab	--	--	2	2	--		1
TTRMPC411	Aviation and cargo	3	--	--	3	3	--	3
TTRMPC412	Aviation Cargo lab	--	--	2	2	--	1	1
TTRMPC413	**Self-Learning in Travel and Tourism**	---	--	2	2	--	1	1
	Total	**15**	**--**	**14**	**29**	**15**	**7**	**22**

###specialization programme in mountaineering, skiing, photography, paragliding to be offered in self-learning.
MOU's to be signed with the concerned agencies.
Student centered activities will comprise of co-curricular activities like extension lectures, library studies, games, hobby clubs, seminars, educational field visits, NCC, NSS, cultural activities, civil defence, disaster management activities

PROGRAM: THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code**: TTRMPC401**	Course Title**: Tour Guiding And Escorting**
Semester**:4TH**	Credits**: 02**
Periods per Week**: 2(L: 2 T: 0 P:0)**	

COURSE OBJECTIVE:

Guiding and Escorting are an essential component of Tourism Industry that adds value to the tourism experience. This paper will help students to understand the fundamentals and practices of this field and this will also provide sufficient theoretical knowledge to take managerial decisions.

COURSE CONTENT

1. Tour Guiding

- **1.1** Defining Tour Guiding.
- **1.2** Role and Responsibilities of Tourist Guide.
- **1.3** Types of Guides- based on Licensing Authority, Specialisation, Employment contract.
- **1.5** Ethics of Tour Guiding
- **1.6** Qualities of an Effective Tourist Guide
- **1.7** Techniques for Tour Guiding.

2. Tour Escorting

- **2.1.** Defining Tour Escorts,
- **2.2** Role and Responsibilities of Tour Escorts.
- **2.3** Ethics of Escorting a Tour.
- **2.4** Qualities of an Effective Tour Escort.
- **2.5** Differentiate between Tour Guide and Tour Escort.

3. Tour Commentary and Interpretation

- **3.1** Tour Commentary- Meaning and Concept
- **1.2** Preparing tour commentary
- **3.3** Engaging storytelling techniques
- **3.4** Use of anecdotes and historical facts in Commentary

4. Customer Handling and Crisis Management

- **4.1** Customer satisfaction- Meaning and Importance
- **4.2** Time management and punctuality
- **4.4** Conflict resolution and problem-solving

4.4 Safety and emergency procedures
4.5 First aid and basic medical assistance

COURSE OUTCOME

After the completion of the course the student will be able to

- Define tour guiding and grasp the role, responsibilities, and ethical considerations for tourist guides, recognizing various guide types.
- Develop essential qualities for effective tour guiding and learn techniques for successful guidance.
- Differentiate between tour guides and tour escorts, understanding their roles, responsibilities, and ethical considerations.
- Explore the concept of tour commentary, preparing engaging narratives with anecdotes and historical facts.
- Acquire skills for customer handling, crisis management, time management, punctuality, conflict resolution, problem-solving, safety, emergency procedures, and basic first aid in the context of tour guiding and escorting.

RECOMMENDED BOOKS:

1. Jagmohan Neg (2004), Kanishka Publishers Distributors, Tourist Guide and Tour Operation.
2. Sampad Kumar Swain, Jitendra Mohan Mishra, Oxford Publication, Tourism Principles and Practices,
3. Suzanne Preston, The art and business of Tour Guiding.
4. Chowdhary, Nimit, Handbook for Tour Guides. New Delhi: Matrix Publishers
5. Mitchell, G.E., How to Start a Tour Guiding Business. Charleston: The GEMGroup Ltd.
6. Pond, K.L., The Professional Guide. New York: Van Nostrand Reinhold

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted(Hr)	Marks Allotted(%Age)
1	08	25
2	09	25
3	07	25
4	08	25
Total	**32**	**100**

PROGRAM: THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code: **TTRMPC402**	Course Title: **Tour Guiding And Escorting Lab**
Semester: **4TH**	Credits: **01**
Periods per Week: **2(L:0 T: 0 P:2)**	

COURSE OBJECTIVE:

Guiding and Escorting are an essential component of Tourism Industry that adds value to the tourism experience. This paper will help students to understand the fundamentals and practices of this field and this will also provide sufficient theoretical knowledge to take managerial decisions.

LIST OF PRACTICALS

1. Cultural Sensitivity Workshops: Discuss cultural norms, customs, and taboos, and have students share strategies for respecting diverse backgrounds.
2. Storytelling Workshops: Teach students to craft engaging narratives about landmarks, history, and local legends to captivate their tour groups.
3. Emergency Preparedness Drills i.e., Simulate emergency situations to teach students how to handle unexpected events, ensuring the safety of tour groups.
4. Group Management Exercises: Organize mock tour groups and guide them through various scenarios, teaching crowd control and management techniques.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC403**	Course Title: **Adventure Tourism**
Semester: 4TH	Credits:02
Periods per week**: 2 (L:2 T:0 P:0)**	

COURSE OBJECTIVE

Adventure tourism is considered as an essential part of tourism and an understanding of this type of tourism is required for any tourism professional. This course would provide a basic knowledge of technicalities in various adventure tourism related activities and an understanding of an approach in the management of adventure tourism.

COURSE CONTENT

1. **Basic Concept of Adventure Tourism**

   1.1 Meaning, Definition, Concept.
   1.2 Nature and scope of Adventure Tourism.
   1.3 Risks associated with Adventure Activities.
   1.4 Impacts of adventure tourism.
   1.5 Tools and equipment used in adventure tourism.

2. **Land based adventure activities**

   2.1 Mountaineering, Trekking, Rock Climbing, safaris, Motor rallies,
   2.2 Camping, zip lining, skiing, cycling, Bird watching, zorbing, hiking.
   2.3 Safety and security measures.
   2.4 Popular tourist destinations for land-based adventure activities in India.

3. **Water based adventure activities**

   3.1 Rafting, Kayaking, Canoeing, surfing, water skiing, scuba diving, snorkelling, sea walk, parasailing, sky boarding.
   3.3 Safety and security measures,
   3.4 Popular tourist destinations for water-based adventure activities in India

4. **Air based adventure activities**

   4.1 Paragliding, hot air ballooning, bungee jumping, sky diving, parachute, Air swing.
   4.2 Safety and security

5. **Adventure tourism organizations and Institutes**

   5.1 Indian Mountaineering federation (IMF)

5.2 Jawaharlal Nehru Institute of mountaineering and Winter sports (JIM&WS)
5.3 Atal Bihari Vajpayee Institute of Mountaineering and Allied sports (ABVIMAS)
5.4 Nehru Institute of mountaineering Uttarkashi.

COURSE OUTCOME

On completion of the course, the students will be able to:

- Grasp the fundamentals of adventure tourism, including risks, impacts, and tools used.
- Understand land-based activities with safety measures and popular destinations, covering mountaineering, trekking, camping, zip-lining, and more.
- Explore water-based activities, learning safety measures and popular destinations for activities like rafting, scuba diving, and parasailing.
- Gain insights into air-based activities, including paragliding and skydiving, with a focus on safety measures.
- Familiarize themselves with prominent adventure tourism organizations and institutes in India.

RECOMMENDED BOOKS

1. Swarbrooke J., C. Beard, S. Leckie and G. Pomfret. Adventure Tourism- New Frontier, Butterworth Heinemann: London
2. Buckley, Ralf, Adventure Tourism, CABI: Oxfordshire, UK
3. NegiJagmohan, Adventure Tourism and Sports: Risks and Challenges (a set of 2 volumes), Kaniskha, Delhi.

UNITWISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	7	22
2	7	22
3	7	22
4	6	18
5	5	16
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC404**	Course Title: **Adventure Tourism Lab**
Semester: **4TH**	Credits:**01**
Periods per week: **2 (L:2 T:0 P:2)**	

COURSE OBJECTIVE

Adventure tourism is considered as an essential part of tourism and an understanding of this type of tourism is required for any tourism professional. This course would provide a basic knowledge of technicalities in various adventure tourism related activities and an understanding of an approach in the management of adventure tourism.

LIST OF PRACTICALS

1. Visit to Rafting point Pahalgam.
2. Visit to Jawaharlal Nehru Institute of mountaineering and Winter sports Pahalgam (JIM&WS)
3. Visit to Dal Lake for Jet Skiing.
4. Visit To Gulmarg for Mountaineering.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC405**	Course Title: **Tourism planning**
Semester: **4TH**	Credits: **03**
Periods per week: 3 **(L:3 T:0 P:0)**	

COURSE OBJECTIVE

The course shall develop the student's understanding of tourism planning and its techniques, significant for rational decision making. It shall further enrich the understanding of the resource management and tourism development.

COURSE CONTENT

1. **Introduction to Tourism planning**

   1.1 Tourism Planning-Meaning Importance and Objectives.
   1.2 Tourism Planning approaches and Techniques
   1.3 Role of public and private sectors in Tourism Development

2. **Planning Process**

   2.1 Tourism Planning Process
   2.2 Factors influencing planning Process.
   2.3 Tourism Area Life Cycle (TALC),
   2.4 Destination Development Process

3. **Levels and Types of Tourism Planning**

   3.1 Types of Tourism planning, (Land use planning, Facility site planning, Facility design)
   3.2 Levels of Tourism Planning (International, National, Regional, State and Local level)
   3.3 Public Private Partnership model in Tourism (PPP).

4. **Consideration in Tourism Planning**

   4.1 Environmental, Socio- Cultural and Economic.
   4.2 Design considerations in the Tourism Development.
   4.3 Carrying Capacity in Tourism Development,

COURSE OUTCOME

On l completion of the course, the students will be able to:

- Understand tourism planning basics, including its meaning, importance, and objectives. Recognize planning approaches, techniques, and the roles of public and private sectors.
- Grasp the tourism planning process, including influencing factors, Tourism Area Life Cycle (TALC), and destination development.
- Learn about types of tourism planning (land use, facility site, and design) and different planning levels (international, national, regional, state, and local). Gain insight into Public-Private Partnership (PPP) models in tourism.
- Consider environmental, socio-cultural, and economic factors in tourism planning. Explore design considerations and understand carrying capacity in tourism development.

RECOMMENDED BOOKS

1. Bala, Usha, Tourism in India: Policy and Perspectives, (New Delhi, 1990).
2. Bhatia, A.K., Tourism Development: Principles and Practices, (New Delhi, 1995).
3. Burns, Peter, M et.al, Tourism: A New Perspective (London, 1993).
4. Cooper, Chris, et.al, Tourism: Principles and Practices (London: Pitman Publishing; 1993).
5. Dharmaraj an, S., Tourism in India: Trends and Issues (New Delhi, 1994).
6. Gill, Pushpinder, S., Dynamics of Tourism: vol. 11: Tourism- Planning and Management, (New Delhi, 1996).
7. Sharma, J.K., Tourism Planning and Development- A New Perspective.
8. National Action Plan
9. Tourism Policy of India

UNITWISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	12	25
2	12	25
3	12	25
4	12	15
Total	**48**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC406**	Course Title: **Tourism planning Lab**
Semester: 4TH	Credits: 01
Periods per week: 2 **(L:0 T:0 P:2)**	

COURSE OBJECTIVE

The course shall develop the student's understanding of tourism planning and its techniques, significant for rational decision making. It shall further enrich the understanding of the resource management and tourism development.

LIST OF PRACTICALS

1. To study the growth/decline of tourism in any state/region over a period of time.
2. To explore anyone potential tourist destination and prepare a report.
3. To study the environmental considerations in tourism planning in any local area.

PROGRAM THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code**: TTRMPC407**	Course Title**: Travel Journalism.**
Semester**:4TH**	Credits**: 03**
Periods per Week**: 3 (L: 3 T: 0 P:0)**	

COURSE OBJECTIVE

The students are expected to learn about the media landscape and communicative structure of travel Journalism, media and content. The course aspires to train up students in travel journalism skills and its allied parameters.

COURSE CONTENT

1. **Unit 1:Introduction To Travel Media and Journalism**

   1.1 Definition and concept of Travel Media;
   1.2 Functions of Media;
   1.3 Types of Media: Print, Audio-visual, New Media;
   1.4 Meaning, definition and nature of Journalism;

2. **Unit 2: Travel and New Media**

   2.1 Definition and characteristics of new media.
   2.2 The role of technology in transforming the travel industry.
   2.3 Impact of technology on travel planning, booking and navigation.
   2.4 Role of social media in shaping travel experiences.

3. **Unit 3: Travel Writing**

   3.1 Meaning and concept of travel writing.
   3.2 History of travel writing. (Travellers Accounts).
   3.3 Importance of travel writing.
   3.4 Prerequisites and tools for travel writing, Collection of material.
   3.5 Travel photography; Travel blogging, vlogging and Podcasting.
   3.6 Career in travel writing and publishing opportunities.

4. **Unit 4: Travel Writing Themes**

   4.1 Destinations; Culture; Customs; History.
   4.2 Social, economic and environmental concerns.
   4.3 Travel industry and Tourism organizations.
   4.4 Promotion; Tourist literature and video scripts.

COURSE OUTCOME

After course completion the students will be able to:

- Summarize the concept of Travel Journalism and its relevance to the travel industry.
- Relate various news media platforms and tools used in the travel context.
- Illustrate the role of social media in travel experiences, storytelling and destination marketing.
- Frame an engaging travel content for digital platforms.

RECOMMENDED BOOKS

1. Thompson Carl, Travel Writing, Routledge
2. Don George and Charlotte Hindle, Travel Writing, Lonely Planet
3. John F. Greenman, Introduction to Travel Journalism: On the Road with Serious Intent, Peter Lang Publishing Inc
4. Folker Hanusch, Travel Journalism: Exploring Production, Impact and Culture, Palgrave Macmillan
5. Jacqueline Harmon Butler, The Travel Writer's Handbook: How to Write — And Sell — Your Own Travel Experiences, Surrey Books

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs.)	Marks Allotted (%)
1	12	25
2	12	25
3	12	25
4	12	25
Total	**48**	**100**

PROGRAM THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code**: TTRMPC408**	Course Title**: Travel Journalism Lab**
Semester**:4TH**	Credits**: 01**
Periods per Week**: 2 (L: 0 T: 0 P:2)**	

COURSE OBJECTIVE

The students are expected to learn about the media landscape and communicative structure of travel Journalism, media and content. The course aspires to train up students in travel journalism skills and its allied parameters.

LIST OF PRACTICALS

1. Writing travel features.
2. Creating digital content. (Travel blogging, vlogging and Podcasting)
3. Photography projects and portfolio development.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC409**	Course Title: **Human Resource Management**
Semester:4TH	Credits: 02
Periods per week: 2**(L:2 T:0 P:0)**	

COURSE OBJECTIVE

The basic objective of this course is to help the students to acquire and develop decision making skills in relation to managing people in organizations and to create an understanding of the various policies and practices of human resource management

COURSE CONTENT

1. **Human Resource Management.:**
   Human Resource Management- Meaning, Nature and Significance,
   Evolution of HRM,
   Functions of the HRM,
   Challenges faced in HRM,

2. **Human Resource Planning:**
   2.1 Human Resource Planning- Concept and process.
   Job Analysis, methods and purpose of job analysis,
   Job description, job specification and job evaluation.
   Recruitment process-Sources and methods of recruitment.
   Selection Process, Induction, Placement.

3. **Performance Appraisal System (PAS):**
   Performance Appraisal System (PAS)- Concept and objectives,
   PAS Methods and sources.
   Discipline and grievance handling Mechanism.

4. **Employee Relations and Labor Laws**:
   Employee rights and responsibilities.
   Labor Laws,
   Work-life and Well-being programs,
   Managing diversity in the workplace

COURSE OUTCOME

After the completion of the course the student will be able to

- Describe the role and significance of Human Resource Management in an organisation.

- Identify the Legal and Ethical considerations in HRM practices.
- Evaluate the impact of HRM on employee performance and organisational effectiveness.

RECOMMENDED BOOKS

1. E. Schuster Human Resource Management, Concept, Cases And Readings ,PHI
2. GargDessler , Human Resource Management, Pearson Education.
3. Lata& Nair Personnel Management & Industrial Relations, S.Chand
4. M.S. Saiyadian , Human Resource Management, Tata Mac Graw Hill.
5. Shell/Bohlander , Human Resource Management, Cengage Learning.
6. UdaiPareek ,Training Instruments In Hrd And Od ,Tata Mac Graw Hill

UNITWISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	25
2	08	25
3	08	25
4	08	25
Total	**32**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC410**	Course Title: **Human Resource Management Lab**
Semester:**4TH**	Credits: **01**
Periods per week: **2(L:0 T:0 P:2)**	

COURSE OBJECTIVE

The basic objective of this course is to help the students to acquire and develop decision making skills in relation to managing people in organizations and to create an understanding of the various policies and practices of human resource management

LIST OF PRACTICALS:

1. Cases Studies and other assignments will be provided by the concerned faculty in the class.

PROGRAM THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code**: TTRMPC411**	Course Title**: Aviation and Cargo Operations**
Semester**:4TH**	Credits**: 03**
Periods per Week**: 3 (L: 3 T: 0 P:0)**	

COURSE OBJECTIVE:

The course aims at providing a systematic and extensive knowledge of Airline ticketing and related aspects. Beginning with a basic introduction to air transport it explains computers in ticketing. various codes of practice and procedures involved in the issuance of air tickets and use of computers in ticketing.

COURSE CONTENT

1. **Airline Operations**:
    1. Airlines- Meaning and Types,
    2. Working with airlines- Cabin crew, Ground Crew, Baggage Handlers, Air Traffic Controller,
    3. Air fare – Meaning and Types (Published and Un-published, Restricted and Unrestricted fare)
    4. Air Ticket- Meaning and Components, E-Ticket,
    5. Air Ticket types (One-way, Round, Circle, Open-Jaw)
    6. Cancellation and Re-issuance of Tickets,
    7. CRS- Introduction and Types,
2. **Airport Operations:**
    1. Airports- Meaning and Types,
    2. Airport Procedures- Boarding, Check-in, Security Check, Custom and Immigration,
    3. Baggage Handling- Meaning and Types,
    4. Baggage Allowances- Free Baggage Allowances, Excess Baggage,
3. **Airline Geography:**
    1. Aviation Organisations- IATA, ICAO, DGCA,
    2. IATA Traffic Conferences and Global Indicators,
    3. Aviation Agreements -Open sky Policy, Nine Freedoms of Air,
4. **Cargo Handling & Documentation**
    1. Cargo- Meaning and Types,
    2. Evolution and Growth of Cargo Industry,
    3. Dangerous goods and its types,

COURSE OUTCOMES:

After the completion of the course the student will be able

- Understand airline operations, covering types, roles (cabin crew, ground crew, etc.), airfare categories, air tickets (e-ticket, one-way, round, etc.), and processes like cancellation. Gain insight into Computer Reservation Systems (CRS).
- Grasp airport operations, including types, procedures (boarding, check-in, security check), baggage handling, and baggage allowances.
- Explore airline geography, recognizing key aviation organizations (IATA, ICAO, DGCA), IATA traffic conferences, and global indicators. Understand aviation agreements like open sky policy and the nine freedoms of air.
- Gain knowledge about cargo operations, covering types, industry evolution, and dangerous goods.

RECOMMENDED BOOKS:

1. Ratandeep Singh, Handbook of Global Aviation Industry and Hospitality services, Kanishka Publishers, New Delhi
2. Graham.A, Managing Airport an International Perspective, Butterworth Heinemann, Oxford
3. Doganis.R, The Airport Business, Routledge, London
4. P.S.Senguttuvan, Fundamentals of Airport Transport Management, McGraw Hill,
5. Air Cargo Tariff Manuals
6. IATA Live Animals Regulations Manuals

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time allotted(Hrs)	Marks allotted(%Age)
1	18	40
2	10	20
3	10	20
4	10	20
Total	**48**	**100**

PROGRAM THREE YEAR DIPLOMA IN TRAVEL AND TOURISM	
Course Code**: TTRMPC412**	Course Title**: Aviation and Cargo Operations Lab**
Semester**:4TH**	Credits**: 01**
Periods per Week**: 2 (L: 0 T: 0 P:2)**	

COURSE OBJECTIVE:

The course aims at providing a systematic and extensive knowledge of Airline ticketing and related aspects. Beginning with a basic introduction to air transport it explains computers in ticketing. various codes of practice and procedures involved in the issuance of air tickets and use of computers in ticketing.

LIST OF PRACTICALS:

1. Visit to an Airport,
2. Observation of Airport Procedures in an Airport,
3. Visit to the Cargo Section of an Airport,

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN TRAVEL AND TOURISM	
Course Code: **TTRMPC413**	Course Title: **Self Learning in Travel and Tourism**
Semester:**4th**	Credits: **01**
Periods Per Week: (L:0, T:0, P:2)	

COURSE OBJECTIVE:

This self-paced course aims to empower learners with a comprehensive understanding of the travel and tourism industry, fostering independent study and skill development.

COURSE CONTENT

1. **Introduction to Travel and Tourism**
   - 1.1. Definition and scope of the travel and tourism industry
   - 1.2. Key players and their roles
   - 1.3. Historical overview and evolution
2. **Geography and Destinations**
   - 2.1. Understanding global and regional geography
   - 2.2. Identification of popular tourist destinations
   - 2.3. Impact of geography on travel planning
3. **Travel Services and Products**
   - 3.1. Overview of travel services (transportation, accommodation, tour operators, etc.)
   - 3.2. Exploration of travel products and packages
   - 3.3. Importance of quality customer service
4. **Tourism Marketing and Promotion**
   - 4.1. Basics of tourism marketing
   - 4.2. Strategies and campaigns for promotion
   - 4.3. Utilizing social media for tourism marketing
5. **Cultural Awareness and Communication Skills**
   - 5.1. Cultural sensitivity in the travel industry
   - 5.2. Development of effective communication skills
   - 5.3. Interacting with diverse customers and culture
6. **Aviation and Cargo Operations**
   - 6.1. Overview of aviation industry.
   - 6.2. Understanding the airline geography i.e Air traffic Conference and Global Indicators.
   - 6.3. Key operations related to airport and cargo handling.
   - 6.4. Organizations associated with the industry and their role.

RESOURCES

- Recommended readings, articles, and online resources
- Virtual tours, webinars, and industry documentaries
- Discussion forums for learners to share insights and experiences

CURRICULUM
FOR
FOURTH SEMESTER
OF
THREE-YEAR DIPLOMA COURSE
IN
WOOD TECHNOLOGY

Course code	Subjects	Time in Hours				Credits			
		L	T	P	Total L+T+P	L	T	P	Total L+T+P
PC401	Timber Engineering	2	0	0	2	2	0	0	**2**
PC402	Timber Engineering Lab	0	0	2	2	0	0	1	**1**
PC403	Wood Composite & Adhesives	2	0	0	2	2	0	0	**2**
PC404	Wood Composite & Adhesives Lab	0	0	2	2	0	0	1	**1**
PC405	Timber Structure Mechanics	3	0	0	3	3	0	0	**3**
PC406	Timber Structure Mechanics Lab	0	0	2	2	0	0	1	**1**
PC407	Wood Working & Finishing	2	0	0	2	2	0	0	**2**
PC408	Wood Working & Finishing Lab	0	0	2	2	0	0	1	**1**
PC409	Wood preservation	2	1	0	3	2	1	0	**3**
PC410	Wood preservation Lab	0	0	2	2	0	0	1	**1**
PE411	**Program Elective –I** **a)** Commercial Wood Farming **b)** Timber Botany **c)** Pollution Control and Wood Waste Management	3	0	0	3	3	0	0	**3**
PR412	Minor Project	0	0	4	4	0	0	2	**2**
		14	**1**	**14**	**29**	**14**	**1**	7	**22**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code: **PC401**	Course Title: **Timber Engineering**
Semester: **4th**	Credit: **2**
Periods Per Week:**02 (L: 02, T: 00, P: 0)**	

COURSE OBJECTIVE:

It provides students with a fundamental understanding of structural engineering wood design principles. Students are expected to learn fundamentals of design aspects for structural timber components.

COURSE CONTENTS

1. Scope and significance of Engineering wood products in particular and associating concrete, steel and parallel products in general
2. Selecting timber species for structure and their rational classification. Use of small dimensional timber from silvicultural operations and plantations in structures, laminations and trusses Effect of defect on design and their codal limit.
3. Control of fire hazards in timber structures.
4. Prevention of termite attack in buildings by constructional methods.
5. Timber joints and mechanical fasteners
6. Design of linear structure timber components i.e. beam (solid and built-up), notched/ tapered and purlins, columns and trusses. Permissible stresses for short and long column.
7. Concept of glue laminated timber and their applications. Laminated wood bending and jointing in laminations.
8. Prefabrication techniques.
9. Wood and bamboo in earthquake resistance construction
10. Introduction to Indian standards.

INSTRUCTIONAL STRATEGY

Teacher should lay more emphasis on concept and principles. While imparting, instructions. During practical's work, individual student be given opportunities to perform practical.

RECOMMMENDED BOOKS

1. Timber Engineering without tears by NJ Masani; manager of Publication, government of India Publications, NEW DELHI
2. Indian Forest Utilization Vol. I and II, Government of India, NEW DELHI

COURSE OUTCOME

By the end of the course, students should be able to:

- Analyze the role and significance of engineering wood products in construction, with a focus on their application in comparison to concrete, steel, and parallel materials**.**
- Apply rational classification methods for timber, emphasizing the use of small dimensional timber from silvicultural operations and plantations.
- Identify potential fire hazards in timber structures and develop strategies for effective control.
- Comply with established standards and guidelines for termite-resistant construction.

UNIT WISE TIME AND MARKS DISTRIBUTION

UNIT NO.	Time Allotted (Hrs)	Marks Allotted (%)
1.	7	15
2	4	8
3	3	6
4	3	6
5	3	6
6	3	6
7	3	6
8	11	25
9	4	8
10	3	6
11	3	6
12	1	2
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code: **PC402**	Course Title: **Timber Engineering Lab**
Semester: **4th**	Credit: **1**
Periods Per Week:**02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

It provides students with a fundamental understanding of structural engineering wood design principles. Students are expected to learn fundamentals of design aspects for structural timber components.

LIST OF PRACTICALS

1. Blue print readings
2. Preparation and drawing of various kinds of joints and their testing.
3. Glue lamination technique for a small beam.
4. Design of linear components: beams, purlin and columns
5. Design and drawing of roof trusses
6. Testing of beams/ columns/ trusses.
7. Civil engineering sanitary fittings symbols.
8. Electrical fitting symbols for domestic interior installations.
9. Building plan drawing with mechanical and civil engineering symbols

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC403**	Course Title : **Wood Composite & Adhesives**
Semester: **4th**	Credit: **2**
Periods Per Week:**02 (L: 02, T: 00, P: 00)**	

COURSE OBJECTIVE:

The diploma holders in wood technology are supposed to have knowledge about the properties, types and classification of wood adhesives and composites

COURSE CONTENTS

1. Wood Adhesive: Definition, types and classification of adhesives, - Natural glues, synthetic resins.
2. Plywood manufacturing process solid core boards like block board and flush doors
3. Storage of logs, veneer production, lathe setting
4. Particle Board: Definition, types, raw material, manufacturing process, properties and uses
5. Fiber Board and MDF Board: definition, types, raw material, manufacturing process, properties and uses.
6. Modified woods: Definition, densified wood, impregnated, compregnated, wood polymer composites, their preparation, properties and uses.
7. Bamboo mat board- their preparation, properties and uses.

INSTRUCTIONAL STRATEGY

The teacher should lay stress in making the student s conversant with the concepts. Principles and procedures. Special emphasis should be laid in practice on various machines. It is also important to make use of audio-visual aids to show specific operations.

RECOMMMENDED BOOKS

1. Composite wood Research & Development by KS Shukla& SP Singh, ICFRE Publication, New Forest Delhi.
2. Principles of wood Science & Technology Vol. II Wood Based Materials by Kollman, F. PP, E W Kvenzi and AJ Stamn (1975) springer Verlag, Berlin
3. Wood Adhesives- Chemistry & Technology by Pizzi A (1983), Mareel Dekker Inc, New York
4. Principles of wood Science & Technology- wood based panels Vol. 2 by Kolmann& Cote Verlag, New York.

COURSE OUTCOME

By the end of the course, students should be able to:

- Classify different types of wood adhesives based on their properties and applications.
- Demonstrate proficiency in the selection and application of plywood and solid core boards for specific construction and woodworking purposes.
- Apply knowledge of log storage, veneer production, and lathe setting to optimize wood utilization in various woodworking applications.
- Analyze the properties of these engineered wood products and evaluate their uses in different applications.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	3	8
2	4	10
3	3	8
4	10	20
5	10	24
6	8	20
7	4	10
Total	**42**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC404**	Course Title : **Wood Composite & Adhesives Lab**
Semester: **4th**	Credit: **1**
Periods Per Week:**02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

The diploma holders in wood technology are supposed to have knowledge about the properties, types and classification of wood adhesives and composites

LIST OF PRACTICALS

1. Veneer production, peeling lathe, lathe setting.
2. Preparation and testing of plywood.
3. Preparation and testing of block board.
4. Preparation and testing of particle board.
5. Operation and testing of machinery for plywood and other panel products

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC405**	Course Title:**Timber Structure Mechanics**
Semester: **4th**	Credit: **3**
Periods Per Week:**03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

A diploma holder in wood technology should be well conversant with the physical and mechanical properties of wood. He should also appreciate the assessment of log quality through grading.

COURSE CONTENTS

1. Physical and mechanical properties – basics importance of Hooks law, Modulus of elasticity and Anistropicity; Different types of stresses and strain- Simple, shear stress, principle stresses, Mohr circle diagram: Effect of density, moisture content, temperature, grain angle, knots and notches, sap stain, elasticity properties of wood and standard tests on timber specimen; static bending, impact bending, compression parallel and perpendicular to grain, hardness, shear, tension perpendicular and parallel to grain, cleavage, torsion, nail and screw pulling, brittleness tests.

2. Structure of wood, water effects on the mechanical behavior of wood.

3. Defects in wood: defects in wood, their identification, measurement and evaluation.

4. Timber grading- principles and importance in assessment of quality of logs and sawn timber, commercial grading

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on concept and principles, while covering the subject contents in the practical work. Students should be given opportunities to do practical work individually.

RECOMMMENDED BOOKS

1. Indian Forest Utilization Vol. I: Manager of Publications, Delhi 1970

2. Textbook of wood technology Vol. 1 by HP Brown, AJ Panshin and CC Farsaith: McGraw Hill Book Company, INC , NEWYORK, 1949

3. Principles of wood science and technology-I solid wood by FPKollmann and WA COTE: Springer- Verlag Berlin- Heidelberg 1968

4. Timber-Its Structure and properties (Fifth Edition) by HE Desch. The MCMillan Press ltd. London.

COURSE OUTCOME

By the end of the course, students should be able to:

- Analyze the effects of factors such as density, moisture content, temperature, grain angle, knots, notches, sap stain, and elasticity properties on the mechanical behavior of wood.
- Analyze the effects of water on the mechanical properties of wood, considering aspects such as swelling, shrinkage, and changes in strength.
- Develop skills in measuring and evaluating defects in wood, considering their impact on structural integrity and quality.
- Apply commercial grading standards to evaluate and classify timber products based on their structural and aesthetic characteristics.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1.	20	40
2	10	20
3	8	20
4	10	20
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC406**	Course Title: **Timber Structure Mechanics Lab**
Semester: **4th**	Credit: **1**
Periods Per Week:**02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

A diploma holder in wood technology should be well conversant with the physical and mechanical properties of wood. He should also appreciate the assessment of log quality through grading.

LIST OF PRACTICALS

1. Mechanical test on timber.
2. Static bending, impact bending, compression parallel and perpendicular to grain, tension perpendicular and parallel to grain, hardness, shear torsion, nail and screw pulling test, and calculation of properties.
3. Identification and measurement of natural and processing defects in wood and their evaluation.
4. Grading of timber process.

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC407**	Course Title: **Wood Working & Finishing**
Semester: **4th**	Credit: **2**
Periods Per Week:02 **(L: 02, T: 00, P: 00)**	

COURSE OBJECTIVE:

A diploma holder in wood technology is supposed to have necessary knowledge and relevant skills in wood working and finishing operations.

COURSE CONTENTS

1. Introduction to various wood working operations, wood machining defects, working qualities of timber.
2. Wood carving, properties, carving tools. Important wood carving species.
3. Portable power tools
4. General features of wood working machines.
   Turning lathe, Thickness planner, Circular saw, Band saw, Advanced working Machines.
5. Introduction to various wood finishing operations, wood finishing defects.
6. Figure in wood and features of wood species. Finishing qualities, surface filling and staining treatments, precautions in using stains, special environment friendly surface improvement techniques.
7. Paints, lacquers, oils, varnishes and buffing equipment, PU Paint.

INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on concept and principles, while covering the subject contents. In the practical work. Students should be given opportunities to do practical work individually

RECOMMMENDED BOOKS

1. Wood Finish Handbook by Som Allan Sterling Publishing Co. INC NewYork
2. Machine wood working by John R Clayton, Mim Wood T. London Northwood Publication Limited.

COURSE OUTCOME

By the end of the course, students should be able to:

- Develop a comprehensive understanding of various woodworking operations, including cutting, shaping, and joining processes.
- Identify important wood carving species and assess their suitability for specific carving projects.
- Gain hands-on experience with a variety of portable power tools commonly used in woodworking.
- Evaluate the general features of essential woodworking machines such as the turning lathe, thickness planner, circular saw, and band saw.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	9	18
2	8	16
3	4	10
4	8	16
5	6	12
6	8	16
7	5	12
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC408**	Course Title:**Wood Working & Finishing Lab**
Semester: **4th**	Credit: **1**
Periods Per Week:02 **(L: 00, T: 00, P: 01)**	

COURSE OBJECTIVE:

A diploma holder in wood technology is supposed to have necessary knowledge and relevant skills in wood working and finishing operations.

LIST OF PRACTICALS

1. Practice of different wood working operations on soft wood & hardwood.
2. Fixing of planners knives 7 jointing
3. Practice on simple-complex wood working joints
4. Practice of finishing operations like sanding, filing & other operations.
5. Practical on surface improvement and staining.
6. Practical on stepwise coat system

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC409**	Course Title: **Wood preservation**
Semester: **4th**	Credit: **3**
Periods Per Week:**03 (L: 02, T: 01, P: 00)**	

COURSE OBJECTIVE:

Diploma holder in wood technology must have knowledge of various types of preservatives. Knowledge should also be imparted regarding preparation of timber for treatment, methods used to protect wood and wood products from decay and fire should also be covered.

COURSECONTENTS

1. Timber, bamboos and thatching grasses as structural material.

2. Natural durability of timbers.

3. Agencies responsible for the deterioration of timber

4. Types of preservatives: requirement of an ideal preservatives, composition and properties of various types of preservatives.
5. Protection during storage. Prophylactic treatment of timber.

6. Preparation of timber for treatment and methods of treatment timbers.
   a. Conditioning process of treatment- steaming and boulton, vapour drying
   b. Brushing, spraying, dipping, steeping and diffusion.
   c. Boucherie treatment and other methods in green condition
   d. Hot and cold bath process.
   e. Pressure process
   f. Post treatment of timber in situ.

7. Fire protection: fire protection of timber and other ligno cellulosic material and methods of testing the same

8. Preservation plant: specifications and operations of preservation plants, layout of preservation plant including storage yards.

9. Economic aspects of preservative treatment.

10. Safety measures in handling preservatives

INSTRUCTIONAL STRATEGY

Visit to preservative plants should be planned. While imparting instruction, teachers are expected to lay more emphasis on concept and principles.

RECOMMMENDED BOOKS

1. Wood Preservation in India by Satish Kumar and IndraDev: Indian Council of Forestry Research and Education, FRI, Dehradun
2. Wood Preservation by GM Hunt and G. A. Garrat: McGraw Hill Inc, New York.
3. Wood Preservation by Richardson B.A.: The construction Press Lancoster London.

COURSE OUTCOME

By the end of the course, students should be able to:

- Evaluate the structural properties and characteristics of timber, bamboos, and thatching grasses.
- Apply knowledge of natural durability in selecting timbers for specific applications.
- Identify and analyze agencies responsible for the deterioration of timber, including biological, environmental, and chemical factors.
- Have knowledge of preservation methods, including brushing, spraying, dipping, steeping, diffusion, pressure processes, and post-treatment in situ.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	2	4
2	2	4
3	2	4
4	8	16
5	4	8
6	10	20
7	6	12
8	6	12
9	4	10
10	4	10
Total	**48**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PC409**	Course Title: **Wood preservation Lab**
Semester: **4th**	Credit: **1**
Periods Per Week:**02 (L: 00, T: 00, P: 02)**	

COURSE OBJECTIVE:

Diploma holder in wood technology must have knowledge of various types of preservatives. Knowledge should also be imparted regarding preparation of timber for treatment, methods used to protect wood and wood products from decay and fire should also be covered.

LIST OF PRACTICALS

1. Laboratory method of chemical analysis and testing of preservatives like copper chromium, arsenic, zinc and boron
2. Operations of preservative plant.
3. Testing of the fire proofed materials.
4. Practical training in a commercial wood preservative plant and inspection of treated timber structures.

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PE411**	Course Title: **COMMERCIAL WOOD FARMING (ELECTIVE-II)**
Semester: **4th**	Credit: **3**
Periods Per Week:**03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

Knowledge of wood farming is essential to know about the raising of forests for timber purposes, and their commercial use.

COURSE CONTENTS

1. Wood farming. Introduction, importance
2. varieties of wood
3. The climatic requirement of wood production for different species like teak, fir, deodar etc.
4. Soil requirement for teak, deodar, wood farming.
5. Calcium importance in teak wood plantation.
6. Nursery rising of teak, deodar wood plantation and seed rate.
7. Sowing methods for different wood species
8. The spacing of teak wood plants.
9. Land preparation and planting care of teak wood
10. Weed control in wood plantation.
11. Intercropping in wood plantation, Harvesting techniques of wood, the yield of wood plantation

INSTRUCTIONAL STRATEGY

Experience should be provided to students to enable them to learn about characteristics of prominent tree species.

RECOMMMENDED BOOKS

1. Teak: A Global Overview by P. Suresh Kumar
2. Teak (Tectona grandis L.f.) Genetics and Breeding by Anniina Haatanen, et al
3. Soil Science Simplified by Helmut Kohnke and Keith Franz
4. Plant Nutrition and Soil Fertility Manual by J. Benton Jones Jr.

COURSE OUTCOME

By the end of the course, students should be able to:

- Explore the potential role of wood farming in addressing challenges such as deforestation and climate change.
- Assess the ecological impact of wood species selection and promote sustainable practices in wood farming.
- Apply knowledge of climatic and soil requirements to make informed decisions in planning and managing wood plantations.
- Examine the significance of calcium in teak wood plantation and implement strategies to ensure optimal calcium levels for plant growth.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No	Time Allotted (Hrs)	Marks Allotted (%)
1.	3	8
2	1	4
3	3	10
4	3	10
5	2	6
6	3	14
7	3	14
8	2	14
9	3	8
10	2	6
11	3	6
Total	**28**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code: **PE411**	Course Title: **TIMBER BOTANY (ELECTIVE-II)**
Semester: **4th**	Credit: **3**
Periods Per Week:**03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

Knowledge of timber botany is essential to know about the raising of forests for timber purposes, and their commercial use.

COURSE CONTENTS

1. Definition of forest farming, nursery raising, planting techniques, after care, management practices and different silviculture practices of commonly important timber species.
2. Characteristics of important timber producing families of India; distribution, characteristics and main uses of prominent tree species of these families.
3. Types of forests
4. Plant taxonomy and its relevance to wood science. Plant nomenclature
5. Gymnosperms, angiosperms, monocots Dicots, classification, characteristics.
6. Morphology of root, bark, stems, leaf, flower, fruit, seed, hard wood and soft wood

EXCURSION (2DAYS)

Excursion for showing the timber trees of tropical and temperature regions.

INSTRUCTIONAL STRATEGY

Experience should be provided to students to enable them to learn about characteristics of prominent tree species.

RECOMMMENDED BOOKS

1. University Botany by S.M. Read, New Age International Publications, Delhi

COURSE OUTCOME

By the end of the course, students should be able to:

- Define forest farming and demonstrate a comprehensive understanding of nursery raising, planting techniques, aftercare, and management practices in the context of silviculture.
- Analyze the characteristics of important timber-producing families in India, including their distribution and main uses.
- Formulate strategies for sustainable management and conservation of different forest types.
- Examine the morphology of key plant structures such as roots, bark, stems, leaves, flowers, fruits, seeds, hard wood, and soft wood, and relate their features to wood science and forestry practices.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time Allotted (Hrs)	Marks Allotted (%)
1.	6	25
2	2	10
3	2	10
4	4	10
5	4	20
6	6	25
Total	**24**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code: **PE411**	Course Title: **POLLUTION CONTROL & WOOD WASTE MANAGEMENT (ELECTIVE-II)**
Semester: **4th**	Credit: **3**
Periods Per Week:**03 (L: 03, T: 00, P: 00)**	

COURSE OBJECTIVE:

This course is designed to develop knowledge about various sources of pollution methods of controlling pollution and managing waste.

COURSE CONTENTS

1. **Environment and Ecology**
   Definition and understanding of their concept, ecosystem, energy flow in an ecosystem, important biochemical cycles (water, carbon and nitrogen)

2. **Protection of Environment.**
   Important of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural living resources. Environment education and awareness.

3. **Water Pollution**
   a) Importance of fresh water: Causes of water pollution is surface water and underground water; acid rain; excessive nitrate content in water. Water quality standards, remedial measures to control fresh water pollution.
   b) Waste Water adverse effects of domestic wastes on water industrial effluent, standards for industrial effluents, remedial measures to control industrial pollution.

4. **Air Pollution.**
   Definition, principal materials causing pollution, factors that contribute to air pollution, types of air contaminates, their of emission and ill effect on man, animals, vegetation and on non-living materials, permissible limits as per ISI and International Standards, remedial measures to control air pollution, global warming, ozone layer depletion.

5. **Noise Pollution.**
   Introduction, sources of noise, decibel until of sound, adverse effects on human beings and their environment, control of noise pollution.

6. **Deforestation and its Adverse Effects.**

Benefits from forests; environmental deterioration, blocking of land by refuse heaps, atmospheric pollution. Case studies on deforestation Forest policy and forest laws.

7. **Land Use, Pollution and Abuse**
   Land use and environmental quality, land use and natural disasters, soil degradation problems, corrosion, Stalinization and water logging, soil pollution management planning for land use and environmental improvement. Land reclamation waste land and wet land development case studies.

8. **Pollution Control in Wood Processing industry**
   Formal dehyde emission, fibre plant effluents, use of electrostatic precipitations for pollution control

9. **Solid Waste Management**.
   Sources and classification of solid wastes pollution, health hazards of land scape pollution, solid waste management – collection of solid wastes, disposal of solid wastes and waste utilization.

INSTRUCTIONAL STRATEGY

Efforts should be made to relate process of teaching with direct experiences in industry Experts from the industry can be invited to deliver lectures on specifics topics and share their experiences.

RECOMMENDED BOOKS

1. Environmental Engineering and Management by SK Dhameja, SK Kataria and Sons, New Delhi
2. A Text Book of Environment pollution and Control by HK Bhatia; Galgotia publications Pvt. Ltd; New Delhi.

COURSE OUTCOME

By the end of the course, students should be able to:

- Explore the importance of important biochemical cycles such as water, carbon, and nitrogen in maintaining ecological balance.
- Appreciate the importance of conserving natural living resources and engage in environmental education and awareness.
- Evaluate the adverse effects of domestic and industrial wastes on water quality and ecosystems.
- Understand permissible limits for air quality as per ISI and international standards, and propose remedial measures to control air pollution.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit No.	Time allotted (Hrs)	Marks Allotted (%)
1	06	10
2	10	16
3	10	16
4	08	12
5	04	06
6	06	10
7	06	09
8	06	09
9	08	12
Total	**64**	**100**

PROGRAM: THREE YEAR DIPLOMA IN WOOD TECHNOLOGY	
Course Code:**PR412**	Course Title: **Minor Project**
Semester: **4th**	Credit: **2**
Periods Per Week:**04 (L: 00, T: 00, P: 04)**	

The object of this training is to:

i) Expose the students to industrial/field procedures and practices so as to have an appreciation of the size and scale of operations.

ii) Develop comprehension regarding concept, principles and practices taught in the classroom in their application in solving field/ industrial tasks/problems.

For effective planning and implementation of this practical training, it is proposed to:

i) Identify adequate number of industrial/field organizations where students will be sent for practical training.

ii) Prepare a work book, which can be used by students to perform definite task during the practical training.

iii) Identification of teachers who would supervise the students and provide guidance during practical training.

The composition of evaluation will be including the following:

- Punctuality and regularity
- Initiative in learning
- Relationship at work
- Industrial training report