Three-Year Undergraduate Programme

Diploma Engineering

Civil Engineering

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Faculty of Engineering & Technology
Diploma Engineering in Civil Engineering

1. Vision of the Department

The vision of the Civil Engineering Program is to "Achieve Excellence in Civil Engineering for sustainable and comprehensive growth of industry & society"

2. Mission of the Department

- **M1:** To develop core competency in civil engineering.
- **M2:** To promote learning through innovative approach for sustainable development.
- **M3:** To inculcate professional knowledge & entrepreneurship skill with moral, ethical & professional value for industry & society.

3. Program Educational Objectives

The statements below indicate the career and professional achievements that the Diploma Engineering in Civil Engineering curriculum enables graduates to attain.

PEO 1	**Preparation**	To prepare students to succeed in employment/profession and/or to pursue under graduate educations in civil Engineering discipline in particular and allied Engineering discipline in general.
PEO 2	**Core Competence**	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to formulate, analyse and solve engineering problems requiring knowledge of civil Engineering.
PEO 3	**Breadth**	To prepare students with engineering breadth to innovate, design, and develop products and to contribute in providing solutions related to multidisciplinary real-life problems.
PEO 4	**Professionalism**	To inculcate in students professional and ethical attitude, effective communication skills and team work to become a successful professional.
PEO 5	**Learning Environment**	To provide students with an academic environment that makes them aware of excellence and lifelong learning in emerging Civil Engineering technologies.

4. Program Learning Outcomes

Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Basic and Discipline specific knowledge**	Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
PLO 2	**Problem analysis:**	Identify and analyse well-defined engineering problems using codified standard methods.

PLO 3	**Design/ development of solutions:**	Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
PLO 4	**Engineering Tools, Experimentation and Testing:**	Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
PLO 5	**Engineering practices for society, sustainability and environment:**	Apply appropriate technology in context of society, sustainability, environment and ethical practices.
PLO 6	**Project Management:**	Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
PLO 7	**Life-long learning:**	Ability to analyse individual needs and engage in updating in the context of technological changes.

5. Program Specific Learning Outcomes

PSO 1	An ability to design, develop, supervise and implement solutions in the areas related to construction industry.
PSO 2	An ability to apply standard practices and strategies in identifying quality of material focusing quality output.

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	15
Semester-2	18
Semester-3	20
Semester-4	20
Semester-5	29
Semester-6	25
Total Credits:	**127**

Category wise Credit distribution of the programme	
Category	**Credit**
Major Core	58
Minor Stream	25
Multidisciplinary	22
Ability Enhancement Course	3
Skill Enhancement Courses	4
Value added Courses	0
Summer Internship	2
Project	13
Total Credits:	**127**

7. Program Curriculum

Semester 1						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
1	03605101	Environmental Science	0	2	-	-
2	03606102	Introduction to IT Systems Lab	2	-	4	-
3	03609101	Engineering Graphics	1	1	-	-
4	03609102	Engineering Graphics Lab	2	-	4	-
5	03609154	Engineering Workshop Practice	2	-	4	-
6	03691101	Mathematics – I	3	2	-	1
7	03692103	Applied Physics	3	3	-	-
8	03692104	Applied Physics Lab	1	-	2	-
9	03693103	Communication Skills – I	1	1	-	-
		Total	**15**	**9**	**14**	**1**
Semester 2						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
10	03602107	Applied Chemistry	3	3	-	-
11	03602108	Applied Chemistry Lab	1	-	2	-
12	03605151	Engineering Mechanics	3	3	-	-
13	03605152	Engineering Mechanics Lab	1	-	2	-
14	03605153	Building Planning and Drawing	1	1	-	-
15	03605154	Building Planning and Drawing Lab	2	-	4	-
16	03605156	Computer Aided Drawing Lab	2	-	4	-
17	03691151	Mathematics-II	4	3	-	1
18	03693153	Communication Skills – II	1	1	-	-
		Total	**18**	**11**	**12**	**1**
Semester 3						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
19	03600201	Entrepreneurship and Start-ups	1	1	-	-
20	03605201	Construction Materials	3	3	-	-
21	03605202	Construction Materials Lab	1	-	2	-
22	03605203	Concrete Technology	3	3	-	-
23	03605204	Concrete Technology Lab	1	-	2	-
24	03605205	Hydraulics	2	2	-	-
25	03605206	Hydraulics Lab	1	-	2	-
26	03605213	Fundamentals of Civil Engineering	2	2	-	-

27	03605214	Fundamentals of Civil Engineering Lab	1	-	2	-
28	03605215	Mechanics of Materials	3	3	-	-
29	03605216	Mechanics of Materials Lab	1	-	2	-
30	03693203	Professional Communication and Critical Thinking	1	1	-	-
		Total	**20**	**15**	**10**	**-**
Semester 4						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
31	03600251	Essence of Indian Knowledge and Tradition	0	2	-	-
32	03605251	Theory of Structure	4	3	-	1
33	03605253	Surveying	2	2	-	-
34	03605254	Surveying Lab	1	-	2	-
35	03605255	Transportation Engineering	3	3	-	-
36	03605256	Transportation Engineering Lab	1	-	2	-
37	03605259	Geotechnical Engineering	3	3	-	-
38	03605260	Geotechnical Engineering Lab	1	-	2	-
39	03605261	Water Resource Engineering	3	3	-	-
40	03605264	Minor Project	1	-	2	-
41	03693251	Employability Skills	1	1	-	-
		Total	**20**	**17**	**8**	**1**
Semester 5 (43)						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
42	03605301	Design of Concrete Structure	3	3	-	-
43	03605302	Design of Concrete Structure Lab	2	-	4	-
44	03605303	Public Health Engineering	3	3	-	-
45	03605304	Public Health Engineering Lab	1	-	2	-
46	03605305	Estimating, Costing and Valuation	5	3	-	2
47	03605307	Advance Construction Technology	3	3	-	-
48	03605308	Advance Construction Technology Lab	1	-	2	-
49	03605310	Summer Internship	2	-	-	-
50	03605314	Major Project – I	6	-	12	-
51		Program Elective - I (Compulsory Subjects :1)	3	3	-	-
		Total	**29**	**15**	**20**	**2**
Program Elective – I						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**

1	03605331	Highway Engineering	3	3	-	-
2	03605333	Precast and Prestressed Concrete	3	3	-	-
3	03605335	Rural Construction Technology	3	3	-	-
4	03605337	Solid Waste Management	3	3	-	-
Semester 6						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
52	03600351	Indian Constitution	0	2	-	-
53	03605351	Design of Steel Structure	3	3	-	-
54	03605352	Design of Steel Structure Lab	2	-	4	-
55	03605353	Construction Management	4	3	-	1
56	03605355	Repair and Maintenance of Structures	3	3	-	-
57	03605356	Repair and Maintenance of Structures Lab	1	-	2	-
58	03605360	Major Project – II	6	-	12	-
59		Program Elective - I (Compulsory Subjects :1)	3	3	-	-
60		Program Elective - II (Compulsory Subjects :1)	3	3	-	-
		Total	**25**	**17**	**18**	**1**
Program Elective – I						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
1	03605381	Railway, Harbour and Tunnel Engineering	3	3	-	-
2	03605383	Tendering Accounts	3	3	-	-
3	03605385	Construction Quality Control & Monitoring	3	3	-	-
4	03605387	Green Building and Energy Conservation	3	3	-	-
Program Elective – II						
Sr. No.	**Subject Code**	**Subject Name**	**Credit**	**Lect.**	**Lab**	**Tut**
1	03605389	Pavement Design and Maintenance	3	3	-	-
2	03605391	Building Services and Maintenance	3	3	-	-
3	03605393	Disaster Management	3	3	-	-

8. Detailed Syllabus

Semester 1

a. **Course Name:** Environmental Science
b. **Course Code:** 303106201
c. **Prerequisite:** Zeal to learn the subject
d. **Rationale:** The course is designed to give developers a general awareness of these and related issues so that every student will start acting as a responsible citizen to make the country and the world a better place to live in.
e. **Course Learning Objective:**

CLOBJ 1	Student able to understanding Ecosystem Structure and Describe the components of an ecosystem, including both biotic and abiotic factors and understand the significance of these cycles in maintaining ecosystem balance.
CLOBJ 2	Evaluate air and noise pollution sources, effects, and control measures, considering both natural and anthropogenic factors. Studying Air and Noise Pollution and Identify common air pollutants and their sources. Evaluate noise pollution sources, measurement techniques, and regulatory measures
CLOBJ 3	Analyse characteristics such as turbidity, pH, BOD, and COD in water. Examine primary, secondary, and tertiary methods of wastewater treatment. Investigate causes, effects, and preventive measures of soil pollution.
CLOBJ 4	Explore the basics of solar energy and different solar technologies and Evaluate biomass as an energy source, including its thermal characteristics and biogas production. Investigate new energy sources like hydrogen, ocean energy, tidal energy, and geothermal energy.
CLOBJ 5	Understand the principles of the 3Rs (Reduce, Reuse, Recycle) in solid waste management. Evaluate methods of energy recovery and disposal, including sanitary landfill for municipal solid waste.

f. **Course Learning Outcomes:**

CLO 1	Understand the ecosystem and terminology and solve various engineering problems applying
CLO 2	Ecosystem knowledge to produce eco – friendly products.
CLO 3	Understand the suitable air, the extent of noise pollution, and control measures and acts.
CLO 4	Understand the water and soil pollution, and control measures and acts.
CLO 5	Understand different renewable energy resources and efficient process of harvesting.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Ecosystem:** Structure of ecosystem, Biotic & Abiotic components, Food chain and food web Carbon, Nitrogen, Sulphur, Phosphorus cycle. Global warming -Causes, effects, process, Green House Effect, Ozone depletion.	**15%**	**3**
2	**Air and Noise Pollution:** Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler, Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.	**22%**	**6**
3	**Water and Soil Pollution:** Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.	**24%**	**8**
4	**Renewable Sources of energy:** Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.	**24%**	**8**
5	**Solid Waste management:** Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.	**15%**	**3**

i. Text Book and Reference Book:

1. "Principles of Solar Engineering" By Yogi Goswami D., Frank Kreith, Jan F. Kreider | Taylor & Francis, 2003 | Second.
2. "Environmental Studies" By M.P. Poonia, S.C. Sharma | Khanna Publishing House, NewDelhi | 2017.
3. "Renewable Energy Sources" By Twidell J.W. and Weir. A | EFN Spon Ltd"Linear Systems and Signals" by B.P. Lathi.
4. "Environmental Sciences", By Daniel B Botkin & Edward A Keller, | John Wiley & Sons
5. "Air Pollution", By M. N. Rao and H. V. N. Rao | Tata McGraw-Hill Publishing Company
6. "Environmental Pollution Control Engineering", By Rao C.S | 2nd edition
7. "Solid Waste Treatment and Disposal", By G. Tchabanoglous | McGraw Hill Pub.

a) Course Name: Introduction to IT Systems Lab

b) Course Code: 03606102

c) Prerequisite: Basic knowledge of Computer such as Newton's laws of motion.

d) Rationale: This course aims to teach students basics of computer including hardware and software.

e) Course Learning Objective:

CLOBJ 1	Gain knowledge about various computer components, including CPU, motherboard, RAM, storage devices, peripherals, etc., and understand their functions and interactions. Understand the different types of memory used in computers, such as RAM, ROM, cache memory, and their respective roles in system performance and data storage.
CLOBJ 2	Develop proficiency in using Microsoft Office Suite applications, including Excel for creating worksheets, PowerPoint for preparing presentations, Word for writing documents, and Access for creating databases.
CLOBJ 3	Learn effective internet research techniques, including search engine usage, website evaluation, and information retrieval.
CLOBJ 4	Acquire skills in creating dynamic webpages using HTML, CSS, and other relevant tools, with an emphasis on incorporating style sheets for enhanced design and functionality.
CLOBJ 5	Develop proficiency in general computer usage, including navigating the operating system, installing and configuring software, assembling a PC, and connecting it to external devices. Master the creation of documents, worksheets, and presentations while adhering to best practices for information protection and security measures.

f) Course Learning Outcomes:

CLO 1	Know about different computer components& different types of memory
CLO 2	Create excel sheet, power point, word, access database etc.
CLO 3	Use internet effectively
CLO 4	Create dynamic webpages including style sheet
CLO 5	Comfortably work on computer, install and configure OS, assemble a PC and connect it to external devices, write documents, create worksheets, prepare presentations, protect information and computers from basic abuses/attacks

g) Teaching & Examination Scheme:

a) Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**0**	**4**	**2**	**0**	**0**	**100**	**0**	**0**	**100**

h) Text Book and Reference Book:

1. "Basic Computer Course Made Simple", by Satish Jain | BPB Publication
2. "Basic Computer Engineering" By Sanjay Silakari and Rajesh K Shukla | Wiley India Pvt. Limited, Pub. Year 2011
3. "Computer Fundamentals", By P.K. Sinha | BPB Publications.
4. "HTML & CSS: The Complete Reference", By Thomas A. Powell | McGraw Hill

a. **Course Name:** Engineering Graphics
b. **Course Code:** 03609101
c. **Prerequisite:** Drawing basic knowledge
d. **Rationale:** Engineering drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. It is the transmitting link between ideas and realization. It is an attempt to develop fundamental Understanding and application of engineering drawing. It covers knowledge & application of drawing instruments & also familiarizes the learner about Bureau of Indian standards.
e. **Course Learning Objective:**

CLOBJ 1	Understand the specifications and proper usage methods of drawing equipment and instruments.
CLOBJ 2	Understand standard practices for planning and layout in engineering graphics and apply orthographic projection techniques to convert pictorial views into orthographic views.
CLOBJ 3	Understand various dimensioning methods and their applications.

CLOBJ 4	Understand the process of constructing polygons and apply isometric projection techniques to create isometric drawings of objects containing lines, circles, and arcs.
CLOBJ 5	Understand the concepts of conic sections and their construction methods.

f. Course Learning Outcomes:

CLO 1	Students should be able to demonstrate a solid understanding of the fundamental principles of engineering drawing, including line types, dimensioning, scale, and projection methods.
CLO 2	Students should be proficient in manual drafting techniques as well as computer-aided drafting (CAD) software, such as AutoCAD or SolidWorks, to create accurate and detailed engineering drawings.
CLO 3	Develop the ability to visualize three-dimensional objects from two-dimensional representations and vice versa, enabling students to interpret engineering drawings effectively.
CLO 4	Students should be able to interpret complex engineering drawings, including orthographic projections, isometric drawings, sectional views, and assembly drawings, to understand the design intent and manufacturing specifications.
CLO 5	Gain proficiency in geometric construction techniques, such as creating polygons, circles, and tangents, as well as understanding geometric relationships and constraints in engineering design.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	**-**	**0**	**1**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Drawing equipment's, instruments and materials.** Equipment's-types, specifications, method to use them, applications. Instruments-types, specifications, methods to use them and applications. Pencils-grades, applications,	**4**	**1**

	types of points and applications. Other materials-types and applications.		
2	**Planning, Layout And Scaling Of Drawing** Follow and apply standard practice as per bureau of I.S. for planning and layout, Choose appropriate scale factor for the drawing as per given situation	**4**	**0**
3	**Lines, Lettering and dimensioning:** Different types of lines. Vertical capital and lower-case letters. Inclined capital and lower-case letters. Numerals and Greek alphabets. Dimensioning methods. Aligned method. Unilateral with chain, parallel, progressive and combined dimensioning.	**4**	**0**
4	**Geometric Construction:** Geometric construction related with line like bisecting a line, to draw perpendicular with a given line, divide a line, etc. Geometric construction related with angle like bisect an angle, trisect an angle, etc. To construct polygon. Triangle, Square / Rectangle, Pentagon with special method. d: Hexagon with special method. To draw tangents. Geometric construction related with circle & arc.	**7**	**2**
5	**Engineering Curves:** Conic sections: Concept and understanding of focus, directory, vertex and eccentricity and drawing of conic sections. Using various methods, understand construction of: Ellipse. Parabola. Hyperbola. Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid) Involutes. Involutes of a circle, Involutes of a polygon, Spiral (Archimedean spiral only).	**22**	**3**
6	Projection Of Points, Lines and Planes Reference planes, orthographic projections. Concept of quadrant.1st angle and 3rd angle projection and their symbols. Projection of points. Projection of lines – determination of true length and inclinations for following cases. Line parallel to one or both the plane. Line perpendicular to one of the planes. Line inclined to one plane and parallel to another. Line inclined to both the planes. Projection of Planes: Types of planes, Projection of planes parallel to one of the reference planes, Projection of plane inclined to one reference plane and perpendicular to another, Projection of planes inclined to both reference planes.	**25**	**2**
7	**Orthographic Projections:** Types of projections-orthographic, perspective, isometric and oblique: concept and applications. Various term associated with orthographic projections. Theory of projection, Methods of projection, Orthographic projection, Planes of projection. Conversion of simple pictorial views into Orthographic	**22**	**3**

	views. Illustrative problems on orthographic projection B.I.S. code of practice		
8	**Isometric Projections:** Isometric axis, lines and planes. Isometric scales. Isometric view and isometric drawing. Difference between isometric projection and isometric drawing. Illustrative problems limited to objects containing lines, circles and arcs shape only.	**12**	**3**

i. Text Book and Reference Book:

1. "ENGINEERING GRAPHICS" By P. J. Shah | S. Chand & Co., New Delhi Publications.
2. "A Text Book of Engineering Graphics" By P.J.Shah | S.Chand & Company Ltd., New Delhi
3. "Engineering Drawing" By P.J.Shah. | S.Chand, New Delhi

a. Course Name: Engineering Graphics Lab
b. Course Code: 03609102
c. Prerequisite: Zeal to learn the subject
d. Rationale: Engineering Drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization.
e. Course Learning Objective:

CLOBJ 1	Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
CLOBJ 2	Train the usage of 2D and 3D modelling.
CLOBJ 3	Instruct graphical representation of machine components.

f. Course Learning Outcomes:

CLO 1	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing.
CLO 2	Draw views of given object and components.
CLO 3	Sketch orthographic projections into isometric projections and vice versa.
CLO 4	Apply computer aided drafting tools to create 2D engineering drawings.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**-**	**4**	**2**	**-**	**-**	**100**	**-**	**0**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Name of Experiment to be conducted

1. USE OF DRAWING INSTRUMENTS
2. GEOMETRIC CONSTRUCTION
3. ENGINEERING CURVES – I
4. ENGINEERING CURVES – II
5. PROJECTIONS OF POINTS AND LINE
6. PROJECTIONS OF PLANE
7. ORTHOGRAPHIC PROJECTIONS
8. ISOMETRIC DRAWINGS

I Text Book and Reference Book:

1. Engineering Drawing Practice for Schools and Colleges By Bureau of Indian Standards | Government of India, Pub. Year 1998
2. Engineering Drawing By N. D. Bhatt | Charotar Publishing House, Pub. Year 2010
3. Engineering Graphics & Design By Jain & Gautam | Khanna Publishing House
4. Engineering Drawing By D. A. Jolhe | Tata McGraw Hill Edu
5. Engineering Drawing By R. K. Dhawan | S. Chand and Company

a. Course Name: Engineering Workshop Practice

b. Course Code: 03609154

c. Prerequisite: Learn about fundamental of mechanical and electrical engineering

d. Rationale: Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems. The workshop experiences would help to build the understanding of the complexity of the industrial job, along with time and skills requirements of the job. Workshop curricula build the hands on experiences which would help to learn manufacturing processes and production technology courses in successive semesters. Workshop practice is also important since only practice can make the man perfect

e. Course Learning Objective:

CLOBJ 1	To develop general machining skills in the students.
CLOBJ 2	To develop a skill in dignity of labour, precision, safety at work place, team working and development of right attitude.
CLOBJ 3	The Engineering Workshop Practice for engineers is a training lab course spread over entire semester. The modules include training on different trades like Fitting, Carpentry, Black smithy etc… which makes the students to learn how various joints are made using wood and other metal pieces

f. Course Learning Outcomes:

CLO 1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines.

CLO 2	Understand job drawing and complete jobs as per specifications in allotted time.
CLO 3	Inspect the job for the desired dimensions and shape.
CLO 4	Operate, control different machines and equipment's adopting safety practices.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
0	-	4	2	-	-	100	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiment**

1. To A Perform a Job in Carpentry Shop.
2. To A Perform a Job in Tim Smithy.
3. To Perform a Job on Fitting Practice.
4. To Perform a Job on Soldering.
5. To Perform a Job on Welding.
6. To Perform a Job on plumbing.
7. To Perform a Job on Sheet Metal Practice.
8. Identify Different symbol used in electrical installation and prepare sheet.
9. Identify the different tools used in electrical installation.
10. Demonstration of measuring instrument Voltmeter, Ammeter, Wattmeter.
11. Demonstration of testing instruments: Multi meter, Clip-on meter, Megger, Line tester.
12. Demonstration of different cables used in electrical installation.
13. Demonstration of different switches used in electrical installation.
14. Demonstration of protective devices: fuse, MCB, ELCB.
15. Identify different types of domestic wirings.

i. Text Book and Reference Book:

1. Mechanical workshop practice By K.C. John
2. A Textbook of Electrical Workshop Practices By Dr. Umesh Rathore | S.K. Kataria & Sons
3. A Course in Workshop Technology By Raghuwamsi B S | Dhanpat Rai and Sons, 1682 Nai Darak, New Delhi., Pub. Year 1982
4. Workshop Practice Manual By K. Venkat Reddy | BS Publications
5. Elements of Workshop Technology Vol. I By Hajra Chaudhary S.K. | Asia Publishing House
6. Comprehensive Workshop Techno By S.K. Garg | Laxmi publications

a. Course Name: Mathematics - I

b. Course Code: 03691101

c. Prerequisite: Knowledge of basic concept studied till 10th std.

d. Rationale: The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects

e. Course Learning Objective:

CLOBJ 1	Evaluate logarithms by converting between logarithmic and exponential forms. Find unknown bases or arguments in simple logarithmic equations, solve word problems involving evaluating logarithms, Differentiate types of partial fractions
CLOBJ 2	Understand the concept of angles, Calculate T-Ratios of Allied angles, utilize product formulae for transforming product to sum, difference, and vice versa, Calculate T-Ratios of multiple angles and sub-multiple angles, Graph all trigonometric functions
CLOBJ 3	Define complex numbers, represent complex numbers in Polar and Cartesian forms, Understand the geometric representation of complex numbers and their operations, Apply De Moivre's Theorem for roots of complex numbers and simplifying mathematical expressions
CLOBJ 4	Define functions and limits, calculate derivatives using the first principle and differentiation rules, differentiate standard functions including algebraic, trigonometric, exponential, logarithmic, implicit, and composite functions
CLOBJ 5	Calculate higher-order derivatives

f. Course Learning Outcomes

CLO 1	Use Logarithms in engineering calculations.
CLO 2	Represent Complex numbers in various forms like modulus-amplitude (polar) form, Exponential (Euler) form – illustrate with examples.
CLO 3	Resolve Rational Fraction into sum of Partial Fractions in engineering problems
CLO 4	Understand Trigonometric Ratios and solve problems using the formulae for Multiple and Sub multiple Angles
CLO 5	Use the concepts of Limit and Continuity for solving the problems, Appreciate Differentiation and its meaning in engineering situations

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	**1**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

Lect - Lecture, Tut - Tutorial, **Lab** - Lab, T - Theory, **P** - Practical, **CE** – Continuous Evaluation, **T** - Theory, **P** – Practical

Sr.	Topic	Weightage	Teaching Hrs.
1.	**Unit I:** **Logarithms:** Definition, Logarithm as a transformation, Antilogarithm, Rules of Logarithms and examples, Use logarithmic functions for simplifying arithmetic computations. **Partial fractions:** Definition of partial fractions. Types of partial fraction (Denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors).	17%	4
2.	**Unit II:** **Trigonometry:** Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Trigonometric identities, Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2). Graphs of all trigonometric functions	23%	7
3.	**Unit III:** **Complex Numbers:** Definition of a complex number, real and imaginary parts of a complex number, Polar and Cartesian representation of complex number, Conjugate of complex number**,** Geometric representation of complex numbers and their operations, Modules and Amplitude form, De Moivre's Theorem, Root of Complex Number, Use of De Moivre's Theorem to simplify mathematical expressions.	17%	4
4.	**Unit IV:** **Function and Limit** Definition and concept of function, Concept of limits and standard forms of limits $\lim_{x \to a} \frac{x^n - a^n}{x-a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to a} \left(\frac{a^x - 1}{x}\right)$ and $\lim_{x \to a} (1+x)^{\frac{1}{x}}$	9%	3
5.	**Unit V:** **Differentiation** Definition of derivative, differentiation of standard function by first principle, Rule of Differentiation, Differentiation of algebraic, trigonometric, Exponential, Logarithmic, Implicit functions and Composite functions, Higher order derivatives.	34%	10

REFERENCE BOOKS:

1. Advanced Mathematics for Polytechnic, Pandya N R , Macmillan Publishers India Ltd.

2. Engineering Mathematics (Diploma Stream), H.K. Dass, S. Chand Publishing

3. Mathematics for Polytechnic, S.P. Deshpande, Pune Vidyarthi Griha Prakashan

4. Polytechnic Mathematics (Made Easy)(Applied Mathematics) , Manjeet Singh, Dhanpat Rai & Co. (P) Ltd (Publisher)

a) **Course Name: Applied Physics**
b) **Course Code:03692103**
c) **Prerequisite:** Understanding of fundamental physics principles such as mechanics, thermodynamics, Knowledge of key physical laws and theories, such as Newton's laws of motion.
d) **Rationale:** It fuels technological advancements by providing the scientific foundation for the development of new materials, devices, and systems. Applied physics underpins innovations in areas such as electronics, renewable energy, telecommunications, and healthcare. Applied physics serves as a practical problem-solving tool by utilizing fundamental physical principles to address real-world issues encountered in engineering, technology, medicine, and other fields
e) **Course Learning Objective:**

f) CLOBJ 1	g) Understand the concept of physical quantities, distinguishing between fundamental and derived quantities. Learn about measurements, measuring instruments, errors in measurements, and the significance of significant figures.
CLOBJ 2	Differentiate between scalar and vector quantities, and perform operations like addition and subtraction of vectors. Understand force, momentum, and the principle of conservation of linear momentum.
CLOBJ 3	Define work and power and calculate them in numerical problems. Examine the conservation of mechanical energy and its applications. Study friction, including types, laws of limiting friction, and its engineering applications.
CLOBJ 4	Understand the concepts of elasticity, stress, and strain, including Hooke's law. Explore surface tension, viscosity, and their effects, including applications in hydraulic systems. Study fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and its applications.

CLOBJ 5	Learn about heat and temperature, modes of heat transfer, and specific heats. Explore various types of thermometers and their uses in temperature measurement.

i) Course Learning Outcomes:

CLO 1	Demonstrate understanding of fundamental physical principles.Apply units and measurements effectively.Utilize dimensional analysis for problem-solving.Analyze experimental data accurately.
CLO 2	Define force and Newton's laws. Apply Newton's laws to analyze motion. Calculate net force and predict motion. Understand concepts of inertia, momentum, and friction.
CLO 3	Define work, power, and energy. Calculate work, power, and energy transformations. Analyze simple machines and mechanical advantage. Apply conservation of energy principles.
CLO 4	Describe matter's atomic and molecular structure. Identify states of matter and explain properties. Investigate behaviour under different conditions. Explore properties like density, viscosity, and elasticity.
CLO 5	Define heat, temperature, and heat transfer methods. Measure temperature using thermometric scales. Apply laws of thermodynamics to analyze systems.

j) Teaching & Examination Scheme:

b) Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	**Total**
3	**-**		**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

Sr.	**Topic**	**Weightage**	**Teaching Hrs.**
1.	**Unit 1: Physical world, Units and Measurements** Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units),Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis.	**15 %**	**6**

	Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.		

2.	**Unit 2: Force and Motion** Scalar and Vector quantities – examples, representation of vector, types of vectors. Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product, Resolution of a Vector and its application to inclined plane and lawn roller. Force, Momentum, Statement and derivation of conservation of linear momentum, its applications such as recoil of gun, rockets, Impulse and its applications.	**20%**	**9**
3	**Unit 3: Work, Power and Energy** Work: Concept and units, examples of zero work, positive work and negative work Friction: concept, types, laws of limiting friction, coefficient of friction, reducing friction and its engineering applications, Work done in moving an object on horizontal and inclined plane for rough and plane surfaces and related applications. Energy and its units, kinetic energy, gravitational potential energy with examples and derivations, mechanical energy, conservation of mechanical energy for freely falling bodies, transformation of energy (examples). Power and its units, power and work relationship, calculation of power (numerical problems).	25%	9
4.	**Unit 4**: **Properties of Matter** Elasticity: definition of stress and strain, moduli of elasticity, Hooke's law, significance of stress-strain curve. Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications. Surface tension: concept, units, cohesive and adhesive forces, angle of contact, Ascent Formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension. Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.	25%	12

	Hydrodynamics: Fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula and numericals) and its applications. .		
5.	**Unit 5: Heat and Thermometry** Concept of heat and temperature, modes of heat transfer (conduction, convection and radiation with examples), specific heats, scales of temperature and their relationship, Types of Thermometer (Mercury thermometer, Bimetallic thermometer, Platinum resistance thermometer, Pyrometer) and their uses. Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them, Co-efficient of thermal conductivity, engineering applications.	15%	6

ReferencesReferences Book :-

1. Text Book of Physics for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi
2. Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi.
3. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
5. Engineering Physics by DK Bhhatacharya & PoonamTandan; Oxford University Press, New Delhi.
6. Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
7. Practical Physics by C. L. Arora, S. Chand Publication.
8. e-books/e-tools/ learning physics software/websites etc.

Applied Physics Lab

a) **Course Name: Applied Physics Lab**
b) **Course Code:03692104**
c) **Prerequisite:** The ability to think critically, identify potential sources of error, and troubleshoot experimental setups is crucial in a physics lab.
d) **Rationale:** Physics involves quantitative analysis and mathematical modeling to describe physical phenomena. Applied physics education helps students develop quantitative and analytical skills that are valuable in a wide range of academic and professional settings.
e) **Course Learning Objective:**

CLOBJ 1	Students will learn to make accurate measurements using precision instruments such as Vernier calipers and screw gauges, and apply mathematical concepts to calculate physical quantities such as volume and diameter.
CLOBJ 2	Students will develop practical laboratory skills through hands-on experimentation, including the use of equipment such as Fly wheel , Red wood Viscometer and Searl's appartus
CLOBJ 3	Students will gain an understanding of capillary rise method
CLOBJ 4	Students will apply physics principles to real-world situations, such as measuring spring constant and frequency of tunning fork of with a sonometer.
CLOBJ 5	Students will be able to determine Force constant with the help of periodic time of oscillations of spring and verify triangle and parallelogram law of forces.

f) Course Learning Outcomes:

CLO 1	Measure objects' dimensions accurately and calculate their volumes using Vernier calipers, enhancing precision in experimental techniques.
CLO 2	Determine diameters of various objects using a screw gauge, refining skills in measuring small dimensions.
CLO 3	Calculate the moment of inertia of a flywheel, demonstrating understanding of rotational dynamics principles.
CLO 4	Measure viscosity using a Redwood viscometer, developing proficiency in experimental methods for fluid mechanics.
CLO 5	Determine material properties such as the coefficient of linear expansion and Young's modulus, fostering understanding of material behavior under thermal and mechanical stress.

g) Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

Experiment List with Course

List of Practical/Activities: (To perform minimum 10 Practical)

1. To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier calliper and find
volume of each object.
2. To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3. To find the moment of inertia of a flywheel.
4. Measurement of Viscosity by Redwood Viscometer
5. To find the coefficient of linear expansion of the material of a rod.(Young's Modulus)
6. To find the co-efficient of friction between wood and glass using a horizontal board.
7. To find surface tension of a liquid using capillary rise method
8. To find frequency of given tuning fork with the help of a sonometer.
9. To determine radius of curvature of a convex and a concave mirror/surface using a spherometer.
10. To determine Force constant with the help of periodic time of oscillations of spring
11. To verify triangle and parallelogram law of forces.
12. To determine force constant of a spring using Hook's Law.

a) **Course Name:** COMMUNICATION SKILLS-I
b) **Course Code:** 03693103
c) **Prerequisite:** Basic Knowledge of English
d) **Rationale:** Communication confidence laced with knowledge of English grammar is essential for all engineers.

e. Course Learning Objective:

CLOBJ 1	Encourage students to analyze information, evaluate arguments, and develop reasoned conclusions.
CLOBJ 2	Foster the ability to identify and solve complex problems through logical reasoning and creativity.
CLOBJ 3	Develop effective written, verbal, and non-verbal communication skills to express ideas clearly and persuasively.
CLOBJ 4	Teach students to work effectively in teams, valuing diverse perspectives and contributing positively to group efforts.
CLOBJ 5	Cultivate imaginative thinking and the ability to generate original ideas and solutions.

f. Course Learning Outcomes:

CLO 1	Analyze complex issues, evaluate evidence, and develop reasoned arguments to support their conclusions.
CLO 2	Identify problems, explore potential solutions, and implement strategies to address challenges effectively.
CLO 3	Articulate ideas clearly and persuasively in written, verbal, and non-verbal forms, adapting their communication style to different audiences and purposes.

CLO 4	Locate and critically evaluate information from various sources, demonstrating information literacy skills to support their learning and decision-making.
CLO 5	Create coherent and persuasive written and oral messages.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect. Hrs / Week	Tut Hrs/ Week	Lab Hrs/		T	P	T	CE	P	
1	0	-	1	-	-	-	100	-	100

Lect. - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE – Continuous Evaluation

Note: 15 Hours of additional sessions will be taken (within the semester) to match up 30 hours content.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Ice breaker + Introducing your friend**: • This is one activity which will build the bond between the students i the class and work as a team in the task given tothem. The students will be asked to introduce their new best friend in the class. This will ensure that the bond being created here will stay strongand also breaks the ice between them.	05%	01
2	**Picture connector**: • In this class the students will be trained to form a logical connection between a set of pictures which will be shared withthem. • This geared towards building creativity and presentation skills.	05%	01
3	**Crazy Scientist**: • The students will be taught the importance of invention and innovation using some examples that changed the world theway it worked.	05%	01
4	**Shopping role play**: • This activity topic gears towards making students do role playbased on shopping scenarios. • It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on toenact it.	05%	01
5	**Grammar** • Parts of speech, Active and Passive voice, Tenses	20%	10
6	**Communication: Theory & Practice** Basics of communication: Introduction ,meaning, definition , Process ofcommunication		

	Types of communication: Formal, Informal , Verbal / Non verbal andWritten barriers to effective communication 7 Cs of effective communication: (considerate ,concrete concise , clear, complete , correct and courteous)Technical Communication :	12%	05
7	**Soft Skills** for Professional excellence I**ntroduction** :Soft skills and hard skills , Inportance of Soft Skills	12%	02
8	**Debate**: • Students are trained to let go of inhibitions and come forwardand speak openly on passionate topics. • The students will be divided into teams and made to share theirideas and views on the topics.	05%	01
9	**Extempore**: • To change the average speakers in the class to some of thebest Orator. • This will be done by making the students give variety ofimpromptu speeches in front of the class.	05%	01
10	**Letter Writing** • Types of letters-Inquiry letter, Order letter, Complaint letter,Adjustment, Request letter, Recommendation letter • Format of letters	12%	02
11	**Reading Comprehension**: • Dabbawalahs • A Snake in the grass • Internet – Dr. Jagdish Joshi	14%	05
	Total	**100**	**60**

***Continuous Evaluation:**

It consists of

1. Phase I Exam-35 Marks(Hybrid or Offline Mode)
2. Phase II Exam -35 Marks (Hybrid or Offline Mode)
3. Activities – (Listening and Speaking) -10+10=20 Marks
4. Attendance -10 Marks

The passing marks for Continous Evaluation will be 40 out of 100.There will not be any re-test.

i. Text Book and Reference Books:

1. Active English –Almas Juneja and Vaseem Qureshi-Macmillan Publishers India Ltd
2. English- Prof. Pradyuman Raj, Prof. Rakhi Moghe, Ms. Anisha Modi
3. Technical Communication –Principles & Practice-IInd Edition by Meenakshi Raman & Sangeeta Sharma.
4. Effective Technical Communication by Dr.Bharti Kukreja & Dr. Anupama Jain
5. J.D.O'Connor. Better English Pronunciation. Cambridge: Cambridge University Press, 1980.
6. Lindley Murray. An English Grammar: Comprehending Principles and Rules. London:Wilson & Sons, 1908.
7. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House,

New Delhi (Re-vised Edition 2018)
8. Margaret M. Maison. Examine your English. Orient Longman: New Delhi, 1964.
9. M.Ashraf Rizvi. Effective Communication. Mc-Graw Hill: Delhi, 2002.
10. A Ready Reckoner –Dineshbhai J. Shah, Dr.Janakbhai I. Shah,Bhartiben P. Shah.
11. Oxford Dictionary
12. Roget's Theasaurus of English Words and Phrases.

Semester 2

a. **Course Name:** Applied Chemistry
b. **Course Code:** 03602107
c. **Prerequisite:** Understanding of Basic knowledge of Science for the application.
d. **Rationale:** Science is fundamental to technician courses, aiming to cultivate scientific inquiry and cause-and-effect reasoning in students. Chemistry, as applied science, plays a crucial role. Studying chemical concepts like bonding, corrosion, and organic chemistry, along with engineering materials such as polymers and lubricants, enhances understanding of engineering subjects. Chemistry focuses on the changes in matter's structure and properties, forming the basis of engineering processes. Teaching should foster aptitude and predictive skills. A strong science foundation aids students' self-development and adaptability to evolving innovations.
e. **Course Learning Objective:**

CLOBJ 1	Understand the concept of existence of material in nature
CLOBJ 2	Acquaint with the various mechanisms of natural phenomena.
CLOBJ 3	Explain the characteristics of materials, substances, and compounds.
CLOBJ 4	Develop skills to conduct experiments.
CLOBJ 5	Apply analytical techniques to solve engineering problems and perform material performance analysis.

f) **Course Learning Outcomes:**

CLO 1	Understand the concept of Existence of material in nature.
CLO 2	Acquainted with the various Mechanism of natural phenomenon.
CLO 3	Explain the characteristic of Material, Substances and Compounds.
CLO 4	Develop skills to do experiments.
CLO 5	Apply analytical techniques to solve the engineering problem and performance analysis of material.

g) Teaching and Examination Scheme:

c) Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-		3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

Course Content:

Sr No	Topic	Weigh tage	Teaching Hrs.
1	**Chemical Bandings and Catalysis**: 1. Rutherford model of atom, Bohr's theory, Heisenberg uncertainty principle, Quantum numbers – orbital concept. 2. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration. 3. Theory Of Valency 4. Electronic Configuration 5. Types of chemical bonds i. Electrovalent bond, & its characteristics ii. Covalent bond & its characteristics iii. Co- ordinate bond iv. Hydrogen bond, its types and Significance v. Metallic bond, Explanation of Metallic properties. vi. Electron Sea Model 6. Intermolecular force of attraction 7. Vander Waals force of attraction 8. Catalysis, i. Types of catalysis ii. Theory ofCatalysis iii. Characteristics of Catalyst 9. Types of Catalyst i. Positive Catalyst ii. Negative Catalyst iii. Auto-catalyst Catalytic Promoter and Catalytic inhibitor	10	**6**

	Industrial Application of Catalyst		
2	**Concepts of ElectroChemistry**: 1. Introduction 2. Arrhenius theory of ionization. 3. Degree of ionization i. Factors affecting the degree of ionization 4. Definition of pH i. pH of acid, base and neutral solution ii. pH calculations of acid, base and salt solution at different concentration iii. Importance of pH in various fields. 5. Definition of buffer solution. i. Buffer Action & Types of buffer Solution. ii. Application of buffer solutions. 6. Electrolytes and Non-electrolytes i. Types of electrolytes Definition the term ` Electrode ' the Types of Electrodes Inert electrode, Working electrode & Reference electrode; with suitable Illustrations. Construction & Working of reference electrode: 1. Hydrogen electrode 2. Calomel electrode 3. Quinhydrone electrode 4. Glass electrode 5. Ag/ Agcl/ Kcl electrode • Kohlrausch Law of independent Migration of ions. 7. Construction and working of electrochemical cell 8. Standard conditions 9. Standard hydrogen electrodes 10. Nernst theory of single electrode potential & Nernstequation 11. Electrochemical series, galvanic series 12. Electrolysis, Faradays laws of electrolysis 13. Industrial application of Electrolysis 14. conductance of solution (a) Conductivity (b)Specific Conductivity (c) Equivalent conductivity (d) Molar conductivity	**20**	**8**
3	**Corrosion of metals & its prevention**: . Definition of corrosion 1. Types of corrosion	**10**	**5**

	i. Dry corrosion: Oxidation corrosion mechanism corrosion-mechanism , Nature of oxide film ii. Wet corrosion-mechanism iii. Concentration cell corrosion 2. Pitting corrosion 3. Waterline corrosion 4. Crevice corrosion 5. Stress Corrosion 6. Erosion Corrosion 7. Factors affecting the rate of corrosion,- Nature of film, Nature of Environment,PH of Solution, Area of cathode anode and, Temperature,Moisture,Purity of metal 8. Methods of prevention of corrosion- 9. Modification of environment, 10. Modification of the properties of metal, 11. Use of protective coatings. 12. Anodic and cathodic protection, Modification in design and choice of material		
4	**Water Treatment**: Graphical presentation of water distribution on Earth (pie or bar diagram) . Hard water and soft water. 1. Types of hardness of water i. Salts producing hardness of water. ii. Method to express the hardness of water. 2. Estimation of total hardness by EDTA Method i. Examples to calculate the hardness 3. Effect of hard water in Boiler operation i. Scale and sludge formation and it's Prevention ii. Priming and foaming and its prevention. 4.4.3. Caustic embrittlement and its prevention. Corrosion and its prevention. 1. Softening of Water i. Soda-Lime process ii. Permutit process iii. Ion Exchange process iv. Reverse Osmosis process 2. Treatment of Drinking water i. Sedimentation ii. Coagulation iii. Filtration	**20**	**7**

	iv. Sterilization of water by chlorination Break-point chlorination-Graph v. enlist Indian standard specification of drinking water		
5	**Lubricants**: 1. Introduction and definition of lubricants and lubrication 2. function of lubricants 3. Types of lubrication i. Fluid film lubrication. ii. Boundary lubrication 4. Classification of lubricants i. Solid lubricants ii. Semi-solid lubricants iii. Liquid lubricants iv. Synthetic oils 5. Physical Properties of lubricants and their significance like i. Viscosity and viscosity index ii. Flash point and fire point iii. Pour point and cloud point iv. oiliness 6. Chemical Properties of lubricants like i. Soaponification value ii. Neutralization number iii. Emulsification number 7. Selection of lubricants for i. Gears ii. Cutting tools iii. Steam turbine	**10**	**5**
6	**Polymer, Elastomers & Adhesives**: Introduction and Definition of Polymer and Monomer Classification of Polymer on basis of Molecular structure as Linear, Branch and Cross-linked polymers Classification on basis of monomers homopolymer and copolymer) ification of Polymers on of Thermal behavior(Thermoplastics& Thermosetting) Types polymerization Reaction i. Addition Polymerization ii. Condensation Polymerization Synthesis, properties and application of i. Polyethylene ii. Polypropylene iii. Polyvinyl chloride	**20**	**6**

	iv. iv. Teflon v. Polystyrene vi. Phenol formaldehyde vii. Acrylonitrile viii. Epoxy Resin Define the term:- elastomers Natural rubber and its properties vulcanization of rubber Synthetic rubber, Synthesis, properties and uses i. Buna-S Rubber ii. Buna-N Rubber iii. Neoprene Rubber Definition of adhesives and Examples i. Characteristics of adhesives and their uses.		
7	**Chemistry of Fuels :** 7.1 Definition of fuel and combustion of fuel, 7.2 classification of fuels, calorific values (HCV and LCV), Bomb Calorimeter 7.3 calculation of HCV and LCV using Dulong's formula. 7.4 Proximate analysis of coal and Ultimate Analysis of coal 7.5 solid fuel petrol and diesel - fuel rating (octane and cetin numbers), Chemical composition, calorific values and 7.6 applications of LPG, CNG, water gas, coal gas, producer gas and biogas.	**10**	**5**

Reference Books:

1. ENGINEERING CHEMISTRY by JAIN & JAIN; DHANPAT RAI
2. A Text Book of Polytechnic Chemistry V.P. Mehta; Jain Brothers
3. A Text Book of Applied Chemistry. J. Raja ram
4. Engineering Chemistry S S. Dara

Applied Chemistry Lab

a. **Course Name:** Applied Chemistry Lab
b. **Course Code:** 03602107
c. **Prerequisite:** Understanding of Basic knowledge of Science for the application.
d. **Rationale:** Science is fundamental to technician courses, aiming to cultivate scientific inquiry and cause-and-effect reasoning in students. Chemistry, as applied science, plays a crucial role. Studying chemical concepts like bonding, corrosion, and organic chemistry, along with engineering materials such as polymers and lubricants, enhances understanding of engineering subjects. Chemistry focuses on the changes in matter's structure and properties, forming the basis of engineering processes. Teaching should foster aptitude and predictive skills. A strong science foundation aids students' self-development and adaptability to evolving innovations.

e. Course Learning Objective:

CLOBJ 1	Understand the concept of Existence of material in nature.
CLOBJ 2	Acquainted with the various Mechanism of natural phenomenon.
CLOBJ 3	Explain the characteristic of Material, Substances and Compounds.
CLOBJ 4	Develop skills to do experiments.
CLOBJ 5	Apply analytical techniques to solve the engineering problem and performance analysis of material.

f. Course Learning Outcomes:

CLO 1	Discriminate knowledge of different Chemical reactions.
CLO 2	Understand the different types of titration.
CLO 3	Identify industrially important chemical reactions.
CLO 4	Explain the effects of temperature on lubricating oils.
CLO 5	Calculate the hardness in water.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

h. Text Book and Reference Book:

1. ENGINEERING CHEMISTRY by JAIN & JAIN; DHANPAT RAI
2. A Text Book of Polytechnic Chemistry V.P. Mehta; Jain Brothers
3. A Text Book of Applied Chemistry. J. Raja ram
4. Engineering Chemistry S S. Dara
5. A Lab guide for Applied chemistry – S Raghu ram

Experiment List with Course

List of Practical/Activities: (To perform minimum 10 Practical)

1. Determine the strength of given acidic solution using standard solution of base
2. Standardize KMnO4 solution by preparing standard oxalic acid and to estimate ferrous ions.

3. Standardize Na2S2O3 solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4. Determine the viscosity of given lubricating oil by using Red-wood Viscometer
5. Determine PH-Values of given samples of Solution by using Universal Indicator and PH-meter
6. To Determine molecular weight of a polymer using Ostwald viscometer
7. Preparation of (any one) polystyrene, urea formaldehyde, phenol formaldehyde and its Characterisation.
8. To Determine Acid Value of given lubricating Oil
9. Determine of the percentage of moisture in a given sample of coal by proximate analysis
10. To Determine of saponification value of an lubricating oil
11. Study of corrosion of metals in medium of different Ph
12. To Determine the COD of given water sample
13. Determine Flash & Fire point of given lubricating oil.
14. Study of Corrosion of Metals in the different Mediums.

a. **Course Name:** Engineering Mechanics
b. **Course Code:** 03605151
c. **Prerequisite:** Knowledge of Applied science.
d. **Rationale:** Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.
e. **Course Learning Objective:**

CLOBJ 1	Identify force systems in diverse engineering scenarios through the application of fundamental mechanics principles.
CLOBJ 2	To impart knowledge about calculate the centroid and center of gravity for various components within engineering systems.
CLOBJ 3	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 4	Apply the principles of friction across various conditions to achieve practical objectives.
CLOBJ 5	Select appropriate eco-friendly lifting machines for specific purposes, considering relevant factors such as efficiency and sustainability.

f. **Course Learning Outcomes:**

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Find out the centroid and centre of gravity of various components in engineering systems.
CLO 3	Determine unknown force(s) of different engineering systems having Coplanar forces and non-coplanar forces.
CLO 4	Apply the principles of friction in various conditions for useful purposes

CLO 5	Select the eco-friendly relevant simple lifting machine(s) for given purposes

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Basics of Mechanics:** Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.	10%	2
2	**Centroid and Centre of Gravity:** Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) Centroid of composite figures composed of not more than three geometrical figures. Centre of Gravity of simple solids (Cube, cuboids, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids.	10%	6
3	**Coplanar Concurrent Forces:** Force – Unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Newton's first, second and third Law of motion Principle of transmissibility of force, Principle of superposition of force, Force system and its classification. Lami's Theorem – statement and explanation, Application for various engineering problems. Resolution of a force .Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.	25%	10
4	**Equilibrium and Coplanar Non Concurrent Forces:** Types of Equilibrium, Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium. Moment and couple, Varignon's Theorem. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported	25%	10

	beam with or without overhang – subjected to combination of Point load and uniformly distributed load. Beam reaction graphically for simply supported beam subjected to vertical point loads only		
5	**Friction:** Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Ladder Friction, Engineering Problems.	**10%**	**6**
6	**Simple Lifting Machine:** Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, Work – work done , force displacement diagram, Power , Engineering Problems Energy – Kinetic & Potential energy and Engineering Problems. Law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines.	**20%**	**8**

i. Text Book and Reference Book:

1. "Applied Mechanics" by H. J. Shah and S. B. Junarkar.
2. "A Text Book of Engineering Mechanics" by Bansal R K.
3. "Engineering Mechanics" by J.L. Meriam, and L.G.Kraige.
4. "Engineering Mechanics" by S.S. Bhavikatti and K. G. Rajashekarappa.

a. Course Name: Engineering Mechanics Lab

b. Course Code: 03605152

c. Prerequisite: Knowledge of Applied science

d. Rationale: Engineering mechanics is the main subject of mechanical engineering which gives a basic base to other subjects like strength of materials, manufacturing process. The goal of this Engineering Mechanics course is to expose students to problems in mechanics as applied to plausibly real-world scenarios.

e. Course Learning Objective:

CLOBJ 1	Identify force systems in diverse engineering scenarios through the application of fundamental mechanics principles.
CLOBJ 2	To impart knowledge about calculate the centroid and centre of gravity for various components within engineering systems.
CLOBJ 3	To impart knowledge about force systems and methods to determine resultant.
CLOBJ 4	To impart knowledge about force systems and methods to determine resultant.

CLOBJ 5	Apply the principles of friction across various conditions to achieve practical objectives.

f. Course Learning Outcomes:

CLO 1	Identify the force systems for given conditions by applying the basics of mechanics.
CLO 2	Find out the centroid and centre of gravity of various components in engineering systems.
CLO 3	Determine unknown force(s) of different engineering systems.
CLO 4	Determine unknown force(s) of different engineering systems.
CLO 5	Apply the principles of friction in various conditions for useful purposes and select the eco-friendly relevant simple lifting machine(s) for given purposes

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "Applied Mechanics" by H. J. Shah and S. B. Junarkar.
2. "A Text Book of Engineering Mechanics" by Bansal R K.
3. "Engineering Mechanics" by J.L. Meriam, and L.G.Kraige.
4. "Engineering Mechanics" by S.S. Bhavikatti and K. G. Rajashekarappa

i. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	**Name of the Experiment**
1	Law of Parallelogram: Verify and calculate resultant force through Law of Parallelogram.
2	Triangle Law of Forces: Verify and calculate resultant force through triangle Law of Forces.
3	Lami's Theorem: Verify and calculate resultant force through Lami's Theorem.
4	Polygon Law of Forces: Verify and calculate resultant force through Polygon Law of Forces.
5	Reactions in beam through Graphical & analytical method: Verify reactions in beam through Graphical & analytical method
6	Co efficient of Sliding Friction and angle of repose: Calculate Co efficient of Sliding Friction and angle of repose for different surfaces – Wood, Glass
7	Simple machines: To find out efficiency, velocity ratio and M.A for differential wheel and axle
8	Simple screw jack: To find out efficiency, velocity ratio and M.A for simple lifting machine using simple screw jack.

Exp. No.	Name of the Experiment
9	Centroid and Centre of Gravity: Solve numerical problems on Centroid and Centre of Gravity.

a. **Course Name:** Building Planning and Drawing
b. **Course Code:** 03605153
c. **Prerequisite:** Knowledge of Basic Engineering Drawing.
d. **Rationale:** The course is designed to give basic knowledge to produce more detailed Civil engineering Drawing related to construction of single storied, double storied residential buildings, public buildings and other simple civil engineering structures. Moreover, application of building regulation and by-laws as per local authorities will also be taught in this course, knowledge of which is must for planning buildings so that plan is approved by local civic authorities.
e. **Course Learning Objective:**

CLOBJ 1	To Interpret the symbols, signs and conventions from the given drawing.
CLOBJ 2	To Prepare line plans of residential and public buildings using principles of planning.
CLOBJ 3	To Prepare submission and working drawing for the given requirement of Load Bearing Structure.
CLOBJ 4	To Prepare submission and working drawing using CAD for the given requirement of Framed Structure.
CLOBJ 5	Draw two-point perspective drawing for given small objects.

f. **Course Learning Outcomes:**

CLO 1	To Interpret the symbols, signs and conventions from the given drawing.
CLO 2	To Prepare line plans of residential and public buildings using principles of planning.
CLO 3	To Prepare submission and working drawing for the given requirement of Load Bearing Structure.
CLO 4	To Prepare submission and working drawing using CAD for the given requirement of Framed Structure.
CLO 5	Draw two-point perspective drawing for given small objects.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
1	**-**	**-**	**1**	**20**	**20**	**-**	**60**	**-**	**100**

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Conventions and Symbols:** Conventions as per IS 962, symbols for different materials such as earthwork, brickwork, stonework, concrete, woodwork and glass. Graphical symbols for doors and windows, Abbreviations, symbols for sanitary and electrical installations. Types of lines-visible lines, center line, hidden line, section line, dimension line, extension line, pointers, arrow head or dots. Appropriate size of lettering and numerals for titles, sub-titles, notes and dimensions. Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing. Sizes of various standard papers/sheets. Reading and interpreting readymade Architectural building drawing (To be procured from Architect, Planning Consultants, Planning Engineer).	**15%**	**4**
2	**Planning of Building:** Principles of planning for Residential and Public building- Aspect, Prospect, Orientation, Grouping, Privacy, Elegance, Flexibility, Circulation, Furniture requirements, Sanitation, Economy. Space requirement and norms for minimum dimension of different units in the residential and public buildings as per IS 962. Rules and bye-laws of sanctioning authorities for construction work. Plot area, built up area, super built up area, plinth area, carpet area, floor area and FAR (Floor Area Ratio). Line plans for residential building of minimum three rooms including water closet (WC), bath and staircase as per principles of planning. Line plans for public building-school building, primary health center, restaurant, bank, post office, hostel, Function Hall and Library.	**22%**	**5**
3	**Drawing of Load Bearing Structure:** Drawing of Single story Load Bearing residential building (2 BHK) with staircase. Data drawing –plan, elevation,section, site plan, schedule of openings, construction noteswith specifications, area statement, Planning and design of staircase- Rise and Tread for residential and public building. Working drawing – developed plan, elevation, section passing through staircase or WC and bath. Foundation plan of Load bearing structure.	**28%**	**2**
4	**Drawing of Framed Structure:** Drawing of Two storeyed Framed Structure (G+1), residential building (2 BHK) with staircase. Data drawing developed plan, elevation, section, site plan, schedule of openings, construction notes with specifications, area statement. Planning and design of staircase- Rise and Tread for residential and public building. Working drawing of Framed	**20%**	**1**

	Structure – developed plan, elevation, section passing through staircase or WC and bath. Foundation plan of Framed Structure. Details of RCC footing, Column, Beam, Chajjas, Lintel, Staircase and slab. Drawing with CAD- Draw Commands, modify commands, layer commands.		
5	**Perspective Drawing:** Definition, Types of perspective, terms used in perspective drawing, principles used in perspective drawing, Two Point Perspective of small objects only such as steps, monuments, pedestals.	**15%**	**2**

i. Text Book and Reference Book:

1. Building Drawing By M. G. Shah, C. M. Kale and S. Y. Patki | Tata McGraw Hill, New Delhi
2. Civil Engineering Drawing By MalikR.S.,Meo,G.S
3. A Course in Civil Engineering Drawing By Sikka, V.B.
4. Civil Engineering Drawing By Subhash C Sharma & Gurucharan Singh

a. Course Name: Building Planning and Drawing Lab

b. Course Code: 03605154

c. Prerequisite: Knowledge of Basic Engineering Drawing

d. Rationale: The course is designed to give basic knowledge to produce more detailed Civil engineering Drawings related to the construction of single-storied, double-storied residential buildings, public buildings, and other simple civil engineering structures. Moreover, application of building regulation and by-laws as per local authorities will also be taught in this course, knowledge of which is a must for planning buildings so that plan is approved by local civic authorities.

e. Course Learning Objective:

CLOBJ 1	Students will be able Interpret the symbols, signs, and conventions from the given drawing.
CLOBJ 2	Students will acquire the skills to Prepare line plans of residential and public buildings using principles of planning.
CLOBJ 3	Students will develop the ability to Prepare submission and working drawing for the given requirement of Load Bearing Structure.
CLOBJ 4	Students will learn the procedures for Prepare working drawing using CAD for the given requirement of Framed Structure.
CLOBJ 5	Students shall be able to draw a two-point perspective drawing for given small objects.

f. Course Learning Outcomes:

CLO 1	Students will be able Interpret the symbols, signs, and conventions from the given drawing.

CLO 2	Students will acquire the skills to Prepare line plans of residential and public buildings using principles of planning.
CLO 3	Students will develop the ability to Prepare submission and working drawing for the given requirement of Load Bearing Structure.
CLO 4	Students will learn the procedures for Prepare working drawing using CAD for the given requirement of Framed Structure.
CLO 5	Students shall be able to draw a two-point perspective drawing for given small objects.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Building Drawing By M. G. Shah, C. M. Kale and S. Y. Patki | Tata McGraw Hill, New Delhi
2. Civil Engineering Drawing By MalikR.S.,Meo,G.S
3. B.C. Punmia By Building Construction | Laxmi Publications Limited
4. Building construction By S.C. Rangwala | Charotar Publishing House Pvt. Ltd. Anand

i. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Draw various types of lines, graphical symbols for materials, doors and windows, symbols for sanitary, water supply and electrical installations and write abbreviations as per IS 962.
2	Write summary of observations of all technical details from the given drawing (One/Two BHK)obtained from the professional architect or civil engineer (Group activity in four students)
3	Measure the units of existing building (Load Bearing / Frame structure). b) Draw line plan of measured existing building at serial no 3a to the suitable scale.
4	a) Draw line plan to suitable scale (Minimum 1BHK, staircase, WC and Bathroom) b) Residential Bunglows (Minimum three plans) c) Apartment (Minimum two plans)
5	Draw line plans to suitable scale for any Five Public Buildings from the following (School Building, Primary Health Centre, Bank, Post Office, Hostel, Restaurant, Community Hall and Library).
6	Draw the following plans for a Framed Structure (One/Two BHK) from given line plan. a) Developed plan, Elevation b) Section for above developed plan. c) Site plan for above drawings including area statement, schedule of opening and construction notes
7	Draw submission drawing to the scale 1:100 of a single storey load bearing residential building (2BHK) with flat Roof and staircase showing a) Developed plan and

Exp. No.	Name of the Experiment
	elevation b) Section passing through Stair or W.C. and Bath c) Foundation plan and schedule of openings. d) Site plan (1:200), area statement, construction notes
8	Draw submission drawing, to the scale of 1:100, of (G+1) Framed Structure Residential Building (2BHK) with Flat Roof and staircase showing: a) Developed plan b) Elevation c) Section passing through Staircase, WC and Bath d) Site plan (1:2000) and area statement
9	Draw the above-mentioned drawing at serial number (B-2) using CAD software and enclose the print out. a) Developed plan b) Elevation's) Section passing through Staircase, W.C. and Bath d) Foundation plan. e) Site plan (1:200), area statement, Schedule of openings and construction notes.
10	Draw working drawing for above mentioned drawing at serial number (B-2) showing: a) Foundation plan to the scale 1:50 b) Detailed enlarged section of RCC column and footing with plinth filling. c) Detailed enlarged section of RCC Beam, Lintel and Chajjas. d) Detailed enlarged section of RCC staircase and lab.
11	Draw two point perspective drawing of small objects - steps, monuments, pedestals (any one) scale 1:50 a) Draw plan, elevation, eye level, picture plane and vanishing points b) Draw perspective view.

a. **Course Name:** Computer Aided Drawing Lab
b. **Course Code:** 03605156
c. **Prerequisite:** Engineering Drawing
d. **Rationale:** The course is designed to give the detailed understanding of various 2D and 3D command, its measurement unit. Also the subject gives details about how to draw creative drawing.
e. **Course Learning Objective:**

CLOBJ 1	Understanding Basic AutoCAD Interface and Tools, to Creating and Modifying 2D Drawings
CLOBJ 2	Implementing Design Standards and Specifications Utilizing Advanced Drawing Techniques
CLOBJ 3	Able to create Models of various Residential building in 3D
CLOBJ 4	Applying AutoCAD Skills to Real-World Projects
CLOBJ 5	Capable of Making drawing less time by using short keys for every command.

f. **Course Learning Outcomes:**

CLO 1	Apply basic CAD command to develop 2D and 3D drawings of residential & commercial building using AutoCAD.
CLO 2	Prepare detailed engineering and construction drawings and designs required for civil engineering activities.
CLO 3	Use advanced CAD commands for edit/modification of existing drawings as per needs and suggestions and print the same.
CLO 4	Capable of applying various 3 D AutoCAD Command.
CLO 5	Able to create 3D Drawing of residential Building.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	4	2	-	-	100	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "AutoCAD 2016 For Beginners" By CAD Folks, | Create Space Independent Publishing Platform
2. "AutoCAD 2018 3D Drawing & Modelling Student Guide": Ascent Centre for Technical Knowledge, 2017

i. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Introduction to AutoCAD
2	Editing of AutoCAD Drawing
3	Advanced 2DCommands
4	3D Commands of AutoCAD
5	Plot of 2D & 3D Drawings

a. Course Name: Mathematics - II

b. Course Code: 03699151

c. Prerequisite: Knowledge of Basic concept of mathematics studied till first semester

d. Rationale: This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, Integral Calculus coordinate geometry, Basic elements of vector algebra and First Order Differential Equations.

e. Course Learning Objective:

CLOBJ 1	Understand elementary properties of determinants up to 3rd order, Apply Cramer's rule to solve equations, learn algebra of matrices and matrix inverse method for solving linear equations
CLOBJ 2	Define vectors and their notation, perform vector addition and subtraction, calculate scalar and vector products, solve problems related to work, moment, and angular velocity using vectors.
CLOBJ 3	Determine inclination and slope of a line, Express equations of a straight line in various forms, Understand the general equation of a straight line and

	conditions for concurrency of lines, Define and work with circles, including equations and properties.
CLOBJ 4	Learn integration as the inverse operation of differentiation, integrate simple functions using various methods, apply definite integrals and understand their properties. Solve problems related to area bounded by curves and volume of solids using integration.
CLOBJ 5	Solve first-order and first-degree differential equations using variable separation method, Work with exact and linear differential equations, gain a simple introduction to MATLAB for solving differential equations.

f.g.Course Learning Outcomes:

CLO 1	Students will be able to understand the elementary properties of determinants up to 3rd order, consistency of equations, and Cramer's rule. They will also learn the algebra of matrices, inverse of a matrix, and matrix inverse method for solving a system of linear equations in 3 variables.
CLO 2	Students will be able to define and notate vectors, resolve vectors in rectangular form, add and subtract vectors, and calculate scalar and vector products. They will also learn to apply vector algebra to simple problems related to work, moment, and angular velocity.
CLO 3	Students will be able to understand the properties of lines and circles, including slope, intercepts, equations, and conditions for concurrency. They will also learn to calculate equations of chords and tangents for circles
CLO 4	Students will be able to understand integration as the inverse operation of differentiation, integrate simple functions, and apply integration by substitution, by parts, and by partial fractions. They will also learn to solve problems related to area and volume using definite integrals.
CLO 5	Students will be able to solve first-order and first-degree differential equations using variable separation method, exact differential equations, and linear differential equations. They will also gain a simple introduction to MATLAB for solving differential equations.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	**1**	**-**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

Lect - Lecture, Tut - Tutorial, **Lab** - Lab, T - Theory, **P** - Practical, **CE** – Continuous Evaluation, **T** - Theory, **P** – Practical

Sr.	Topic	Weightage	Teaching Hrs.
1.	**Unit I:** **Determinants and Matrices** Elementary properties of determinants up to 3rd order, consistency of equations, Crammer's rule. Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.	22%	8
2.	**Unit II:** **Vector Algebra** Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.	13%	5
3	**Unit III:** **Co-Ordinate Geometry** Straight line Inclination and slope of a line, different forms of equations to a straight line (i) Slope-intercept form (ii) Point- slope form (iii) Two-point form (iv) Intercept form. General equation of a Straight line, Family of lines. Conditions for concurrency of lines. Circle Definition, Equation of a circle with given center and radius, General form of equation of circle, Equation of a circle when intercepts are given, circle passing through three points, Equation of chord, Equations of tangents and normal at a point on a circle.	15%	7
4	**Unit IV:** **Integral Calculus** Integration as inverse operation of differentiation, Integration of simple functions, Integration by substitution, by parts and by partial fractions (for linear factors only). Definite integral: Definition, Properties of Definite integral, Odd and Even functions, Use of formulas $\int_0^{\frac{\pi}{2}} \sin^n x\, dx$, and $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\, dx$ for solving problems Where m and n are positive integers. Applications of integration for i. Simple problem on evaluation of area bounded by a curve and axes. Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems).	37 %	14

5	**Unit V:** **Differential Equations** Solution of first order and first-degree differential equation by variable separation method (simple problems), Exact differential equations (simple problems), Linear differential equations (simple `problems), MATLAB – Simple Introduction.	13%	5

REFERNCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics (Diploma Stream), H.K. Dass, S. Chand Publishing
3. Mathematics for Polytechnic, S.P. Deshpande, Pune Vidyarthi Griha Prakashan.
4. Polytechnic Mathematics (Made Easy)(Applied Mathematics) , Manjeet Singh

a. **Course Name:** COMMUNICATION SKILLS-II
b. **Course Code:** 03693153
c. **Prerequisite:** Inclination to improve speaking & listening skills .Basic speaking & writing skills
d. **Rationale:** Communication skills are essential for all Diploma Engineers
e. **Course Learning Objective:**

CLOBJ 1	Develop learning & establish a platform for the students that they can easily learn through various life skills required in the organization for becoming an asset for the organization.
CLOBJ 2	Make them understand how new words are formed, role of syllable, vowel, consonant in pronunciation of word.
CLOBJ 3	Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce them to various international Language testing systems
CLOBJ 4	Co-relating of sentence through para jumble concepts.
CLOBJ 5	Encourage students to overcome stage fear through classroom activities.
CLOBJ 6	Make learning fun through the usage of comprehension units.

f. **Course Learning Outcomes:**

CLO 1	Develop basic speaking and writing skills including proper usage of language and vocabulary so that they can become highly confident and skilled speakers and writers.
CLO 2	Apply and analyses the right kind of pronunciation with regards to speech sounds and able to get different types of pronunciations.
CLO 3	Able to read, understand, and interpret a text intrinsically as well as extrinsically. The learner can browse a text quickly to come-up with a gist and personal interpretation. One is able to create a healthy work-environment and prove to be an asset or one of the most reliable resources to the Organization. As a professional, one is mature to bridge the gulf between the existing behaviour/ lifestyle and the expected corporate behaviour cum lifestyle with the help of learning life skills.
CLO 4	Apply the concepts of grammar, various strategies and the usage of formal language in written expression. By using synonyms rewrite the same text in the same format and meaning. Write the gist of the given text.

g. **Teaching & Examination Scheme:**

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect Hrs/ Week	Tut Hrs/ Week	Lab Hrs/ Week		T	P	T	CE	P	
1	0	-	1	-	-	-	100	-	100

Lect. - Lecture, **Tut.** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** – Continuous Evaluation

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Listening skills:** **Listening Process and Practice** : Introduction, importance of good Listening skills, difference between listening and hearing, types of listening, Barriers to effective listening, traits of a good listener.	10%	6
2	**Listening Skills – Questions**: With audio aids, students will be able to listen to dialogues, Improve in gathering information and to summarize the content. To listen and understand day-to-day conversations and to solvequestions based on audio files.	2%	1
3	**Building Vocabulary** Synonyms, Antonyms, Homophones, Homonyms, Homographs,Phrasal verbs, idioms & phrases, One word substitution	2%	1
4	**Introduction to Phonetics** **Sounds:** Consonant, Vowel, Diphthongs, transcription of words(IPA)weak forms, syllable division, word stress, intonation and voice	10%	6
5	**Speaking Skill Building Introduction**: To enable students to eliminate stage fright and engage in conversationwith others.	3%	2
6	**Speaking Skill Building Activity:** Enables students to engage in formal communication as well as to participate in events like debate, extempore etc, and to introduce themto various international Language testing systems	2%	1
7	**Tourism Pitch:** Classroom activity which helps students to express their feelings and experiences in English. Encouraging students to overcome stage fear.	2%	1
8	**Lifeboat:** Classroom Activity to encourage Communication and Convincing Skills	5%	1
9	**Reporter:** Classroom Activity to encourage Communication and ConvincingSkills.	5%	1
10	**Paragraph jumble:** Enhance the skill of writing by completing the paragraph in appropriateand sensible form	5%	4
11	**Life skills:** Self Awareness, Empathy, Sympathy, Emotional Intelligence	5%	4
12	**Reading Comprehension :** A Day's Wait – Ernest Hemingway, My Lost Dollar- Stephen Leacock	10%	2

i. Text Book and Reference Book:

1. Technical Communication –Principles & Practice-IInd Edition by Meenakshi Raman & SangeetaSharma.
2. Effective Technical Communication by Dr. Bharti Kukreja & Dr. Anupama Jain
3. Daniel Johns : The Pronunciation of English. Cambridge: Cambridge University Press, 1956
4. James Hartman & et al. Ed. English Pronouncing Dictionary .Cambridge University Press,2006.
5. Kulbhushan Kumar, Effective Communication Skills, Khanna Publishing House, New Delhi00(Revised Ed.2018)
6. Active English –Almas Juneja and Vaseem Qureshi-Macmillan Publishers India Ltd
7. English- Prof. Pradyuman Raj, Prof. Rakhi Moghe, Ms. Anisha Modi
8.J.D.O's Connor. Better English Pronunciation0 Cambridge University Press,1980
9. Lindley Murry .An English Grammar: Comprehending Principles and Rules. London: Wison andsons,1908.
10.Margaret M. Maison. Examine your English Orient Longman:New Delhi,1964
11. J.Sethi & et al.A Practice Course in English Pronunciation, New Delhi: Prentice Hall, 2004
12. Pfeiffer, William Sanborn and T.V.S. Padmaja. Technical Communication: A Practical Approach 6th ed Delhi: Pearson, 2007.

a. **Course Name:** Entrepreneurship and Start-ups
b. **Course Code:** 03600201
c. **Prerequisite:** Zeal to Learn the Subject.
d. **Rationale:** The main objective of this course is to understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation and learning the process and skills of creation. This subject provides detail information about Acquiring Entrepreneurial spirit and resourcefulness, Familiarization with various uses of human resource for earning dignified means of living, Acquiring entrepreneurial quality, competency, and motivation and management of entrepreneurial venture.
e. **Course Learning Objective:**

CLOBJ 1	Define entrepreneurship and startups, understand the traits of an entrepreneur, and explore the motivation behind starting a business. Identify different types of business structures and analyze the similarities and differences between entrepreneurs and managers.
CLOBJ 2	Discover business ideas, visualize business concepts, and create activity maps. Develop a comprehensive business plan that outlines the vision, goals, and strategies for the startup venture.
CLOBJ 3	Conduct market analysis to identify the target market and evaluate competition. Develop strategies for marketing, accounting, and risk management to ensure the success of the startup.
CLOBJ 4	Understand the importance of company organization structure in startup management. Learn techniques for recruitment and management of talent, as well as financial organization and management.
CLOBJ 5	Explore financing methods available for startups in India and learn to effectively communicate ideas to potential investors through investor pitches. Understand the process of patenting and obtaining licenses to protect intellectual property.

CLOBJ 6	Understand exit strategies for entrepreneurs, including bankruptcy, succession planning, and harvesting strategies. Explore the implications and considerations of each exit strategy.

f. Course Learning Outcomes:

CLO 1	Understanding the dynamic role of entrepreneurship and small businesses
CLO 2	Organizing and Managing a Small Business
CLO 3	Financial Planning and Control
CLO 4	Forms of Ownership for Small Business
CLO 5	Strategic Marketing Planning
CLO 6	New Product or Service Development
CLO 7	Business Plan Creation

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	0	0	1	20	20	0	60	0	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination.

a. Course Content:

Unit No.	**Topic**	**Weightage**	**Teaching Hrs.**
1.	**Introduction to Entrepreneurship and Start Ups** Definitions, Traits of an entrepreneur, Entrepreneurship, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers.	20%	06
2.	**Business Ideas and their implementation** Discovering ideas and visualizing the business, Activity map , Business Plan.	15%	04
3.	**Idea to Start-up** Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis	15%	04
4.	**Management** Company's Organization Structure,Recruitment and management of talent, Financial organization and management	20%	04
5.	**Financing and Protection of Ideas** Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses	15%	04

6.	**Exit strategies for entrepreneurs** Bankruptcy, and succession and harvesting strategy	15%	04

b. Text Book and Reference Book:

1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company by Steve Blank and Bob Dorf, K & S Ranch
2. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Busines by Eric Ries, Penguin UK
3. 3 Demand: Creating What People Love Before They Know They Want It by 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 by Clayton M. Christensen, Harvard business

Semester 3

a. Course Name: Construction Materials
b. Course Code: 03605201
c. Prerequisite: High School Science
d. Rationale: Construction Materials is a core subject in civil engineering. This subject is intended for gaining useful knowledge with respect to facts. Concepts, principles, and procedures related to building construction systems so that students can effectively able to execute building construction work and carry out repairs and maintenance of existing buildings with safety and quality in construction
e. Course Learning Objective:

CLOBJ 1	The student will be able to demonstrate the ability to recognize and classify various construction materials commonly used in engineering projects and understand the properties and characteristics of different construction materials.
CLOBJ 2	Identify and differentiate natural construction materials such as aggregates, stones, and timber. Evaluate the geological and physical properties of natural materials for construction purposes
CLOBJ 3	Assess the suitability of artificial construction materials like concrete, bricks, and metals for specific construction applications. Understand the manufacturing processes and properties of artificial construction materials.
CLOBJ 4	Recognize and analyse special construction materials, including composites, polymers, and advanced materials. Evaluate the advantages and limitations of special materials in various construction scenarios
CLOBJ 5	Learn to identify and select processed construction materials, including precast concrete, asphalt, and composite materials. Understand the benefits of using processed materials in construction projects.

f. Course Learning Outcomes:

CLO 1	Identify relevant construction materials.
CLO 2	Identify relevant natural construction materials.
CLO 3	Select relevant artificial construction materials.

CLO 4	Select relevant special types of construction materials.
CLO5	Identify and use processed construction materials.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Overview of Construction Materials** Scope of construction materials in Building Construction, Transportation Engineering, Environmental Engineering, Irrigation Engineering (applications only), Selection of materials for different civil engineering structures on the basis of strength, durability, Eco friendly and economy, Broad classification of materials –, Natural, Artificial, special, finishing and recycled	10%	5
2	**Natural Construction Materials** Requirements of good building stone; general characteristics of stone; quarrying and dressing methods and tools for stone, Structure of timber, general properties and uses of good timber, different methods of seasoning for preservation of timber, defects in timber, use of bamboo in construction, Asphalt, bitumen and tar used in construction, properties and uses, Properties of lime, its types and uses, Types of soil and its suitability in construction, Properties of sand and uses, Classification of coarse aggregate according to size	25%	10
3	**Artificial Construction Materials** Constituents of brick earth, Conventional / Traditional bricks, Modular and Standard bricks, Special bricks –fly ash bricks, Characteristics of good brick, Field tests on Bricks, Classification of burnt clay bricks and their suitability, Manufacturing process of burnt clay brick, fly ash bricks, Aerated concrete blocks, Flooring tiles – Types, uses, Manufacturing process of Cement - dry and wet (only flow chart), types of cement and its uses. Field tests on cement,	25%	10

	Pre-cast concrete blocks- hollow, solid, pavement blocks, and their uses, Plywood, particle board, Veneers, laminated board and their uses, Types of glass: soda lime glass, lead glass and borosilicate glass and their uses, Ferrous and non-ferrous metals and their uses.		
4	**Special Construction Materials** Types of material and suitability in construction works of following materials: Water proofing, Termite proofing; Thermal and sound insulating materials, Fibres – Types – Jute, Glass, Plastic Asbestos Fibres, (only uses), Geopolymer cement: Geo-cement: properties, uses.	**15%**	**7**
5	**Processed Construction Materials** Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses, Paints- whitewash, cement paint, Distempers, Oil Paints and Varnishes with their uses. (Situations where used), Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses, Agro waste materials - Rice husk, Biogases, coir fibres and their uses, Special processed construction materials; Geosynthetic, Ferro Crete, Artificial timber, Artificial sand and their uses.	**25%**	**10**

i. **Text Book and Reference Book:**
   1. " Building materials" By S. K. Duggal | New Age International
   2. "Construction Materials" By D.N. Ghose | TATA Mc Graw Hill
   3. "Engineering Materials" By S C Rangwala | Charotar

a. **Course Name:** Construction Materials Lab
b. **Course Code:** 03605202
c. **Prerequisite:** High School Science
d. **Rationale:** Construction Materials is a core subject in civil engineering. This subject is intended for gaining useful knowledge with respect to facts. Concepts, principles, and procedures related to building construction systems so that students can effectively able to execute building construction work and carry out repairs and maintenance of existing buildings with safety and quality in construction.
e. **Course Learning Objective:**

CLOBJ 1	Employ appropriate testing techniques to assess the basic properties of different construction materials.
CLOBJ 2	Recognize and differentiate natural construction materials, such as aggregates, stones, and timber, through hands-on laboratory exercises. Perform geological and physical tests to characterize the properties of natural materials used in construction.
CLOBJ 3	Apply laboratory techniques to assess and select artificial construction materials, including concrete, bricks, and metals, based on specific project

	requirements. Analyze the manufacturing processes of artificial materials and their impact on performance through practical experimentation.
CLOBJ 4	Investigate and identify special construction materials, such as composites and polymers, in a laboratory setting. Evaluate the unique properties and applications of special materials through hands-on experiments and analysis.
CLOBJ 5	Demonstrate proficiency in identifying and using processed construction materials, including precast concrete, asphalt, and composite materials, in various laboratory scenarios. Apply laboratory techniques to assess the structural and functional aspects of processed materials for construction applications.

f. Course Learning Outcomes:

CLO 1	Identify relevant construction materials
CLO 2	Identify relevant natural construction materials.
CLO 3	Select relevant artificial construction materials.
CLO 4	Select relevant special types of construction materials.
CLO 5	Identify and use processed construction materials.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**20**	**-**	**30**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "Building materials" By S. K. Duggal | New Age International
2. "Construction Materials" By D.N. Ghose | TATA Mc Graw Hill
3. "Engineering Materials" By S C Rangwala | Charotar

i. Experiment List

Exp. No.	**Name of the Experiment**
1	Prepare the lime putty by mixing lime (1 kg) with water in appropriate proportion and prepare a report on slaking of lime.
2	Select first class, second class, and third-class bricks from the stake of bricks and prepare a report on the basis of its properties. Determine Water Absorption on bricks per IS:3495 (part II), IS:1077 or tile IS:1237
3	Measure dimensions of 10 bricks and find average dimension and weight. Perform field tests - dropping, striking, and scratching by nail and correlate the results obtained.
4	Apply the relevant termite chemical on a given damaged sample of timber.

Exp. No.	Name of the Experiment
5	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part I
6	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 1m x 1m using suitable brush/rollers adopting safe practices. Part II
7	Prepare the cement mortar of proportion 1:3 or 1:6 using artificial sand as a specially processed construction material.
8	Prepare mortar using cement and Fly ash or Granite/marble polishing waste in the proportion 1:6 or 1

a. **Course Name:** Concrete Technology
b. **Course Code:** 03605203
c. **Prerequisite:** High School Science.
d. **Rationale:** Cement mortar and concrete are the most widely used and versatile construction materials. It is the material of choice where strength, impermeability, durability, performance, fire resistance and abrasion resistance is required. Concrete is generally a site-made material unlike other materials of construction and as such can vary to a great extent in its quality, properties and performance owing to use of natural materials except cement. The knowledge of concrete and its properties in the plastic condition and in hardened condition are highly important in order to make Civil Engineering Structures safe and serviceable. This course focuses on students' acquisition of knowledge, skills & practices in concrete works. The knowledge and application of such aspects is essential in developing a good technician who should be conversant with the tests of various components of concrete and site practices to maintain the quality of concrete works.
e. **Course Learning Objective:**

CLOBJ 1	Analyze the physical characteristics of cement, aggregates, and water used in concrete mixtures, including factors such as particle size distribution, specific gravity, fineness, and chemical composition.
CLOBJ 2	Conduct tests and measurements to determine key properties of both fresh and hardened concrete, such as slump, workability, compressive strength, flexural strength, and durability.
CLOBJ 3	Design concrete mixtures according to Indian Standard (IS) methods, incorporating Non-Destructive Testing (NDT) techniques to assess and optimize the mix design parameters for desired performance characteristics.
CLOBJ 4	Procedures for batching, mixing, transporting, placing, and curing concrete to meet specified requirements, while also understanding methods for quality control and assurance to maintain concrete quality under varying environmental conditions.
CLOBJ 5	Knowledge about the properties and functions of different types of admixtures used in concrete, including plasticizers, accelerators, retarders, air-entraining agents, and superplasticizers, and understand their respective roles in enhancing concrete performance and workability.

f. **Course Learning Outcomes:**

CLO 1	Evaluate physical properties of cement, aggregates and water.
CLO 2	Measure important properties of fresh and hardened cement concrete.
CLO 3	Design Concrete Mix as per IS method including NDT.

CLO 4	Prepare concrete of required specification and maintain quality of concrete under different conditions.
CLO 5	Explain properties of various types of Admixtures and their utility.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Cement, Aggregates and Water:** Physical properties of OPC and PPC: fineness, standard consistency, setting time, soundness, compressive strength. Different grades of OPC and relevant BIS codes Testing of cement: Laboratory tests- fineness, standard consistency, setting time, soundness, compressive strength. Storage of cement and effect of storage on properties of cement. BIS Specifications and field applications of different types of cements: Rapid hardening, Low heat, Portland pozzolana, Sulphate resisting, Blast furnace slag, High Alumina and White cement. Aggregates: Requirements of good aggregate, Classification according to size and shape. Fine aggregates: Properties, size, specific gravity, bulk density, water absorption and bulking, fineness modulus and grading zone of sand, silt content and their specification as per IS 383. Concept of crushed Sand. Coarse aggregates: Properties, size, shape, surface texture, water absorption, soundness, specific gravity and bulk density, fineness modulus of coarse aggregate, grading of coarse aggregates, crushing value, impact value and abrasion value of coarse aggregates with specifications. Water: Quality of water, impurities in mixing water and permissible limits for solids as per IS: 456.	25%	10
2	**Concrete:** Concrete: Different grades of concrete, provisions of IS 456. Duff Abraham water cement (w/c) ratio law, significance of w/c ratio, selection of w/c ratio for different grades, maximum w/c ratio for different grades of concrete for different expo- sure conditions as per IS 456. Properties of fresh concrete: Workability: Factors affecting workability of concrete. Determination of workability of concrete by slump cone, compaction factor, Vee-Bee Consist meter. Value of	25%	10

	workability requirement for different types of concrete works. Segregation, bleeding and preventive measures. Properties of Hardened concrete: Strength, Durability, Impermeability.		
3	**Concrete Mix Design and Testing of Concrete:** Concrete mix design: Objectives, methods of mix design, study of mix design as per IS 10262 (only procedural steps). Testing of concrete, determination of compressive strength of concrete cubes at different ages, interpretation and co-relation of test results. Non- destructive testing of concrete: Rebound hammer test, working principle of rebound hammer and factor affecting the rebound index, Ultrasonic pulse velocity test as per IS13311 (part 1 and 2), Importance of NDT tests.	**20%**	**8**
4	**Quality Control of Concrete:** Concreting Operations: Batching, Mixing, Transportation, Placing, Compaction, Curing and Finishing of concrete. Forms for concreting: Different types of form works for beams, slabs, columns, materials used for form work, requirement of good form work. Stripping time for removal of form works per IS 456. Waterproofing: Importance and need of waterproofing, methods of waterproofing and materials used for waterproofing. Joints in concrete construction: Types of joints, methods for joining old and new concrete, materials used for filling joints.	**10%**	**6**
5	Chemical Admixture, Special Concrete and Extreme Weather concreting: Admixtures in concrete: Purpose, properties and application for different types of admixture such as accelerating admixtures, retarding admixtures, water reducing admixtures, air end- training admixtures and super-plasticizers. Special Concrete: Properties, advantages and limitation of following types of Special concrete: Ready mix Concrete, fibre Reinforced Concrete, High performance Concrete Self-compacting concrete and light weight concrete. Cold weather concreting: effect of cold weather on concrete, precautions to be taken while concreting in cold weather condition. Hot weather concreting: effect of hot weather on concrete, precautions to be taken while concreting in hot weather condition.	**20%**	**8**

i. Text Book and Reference Book:

1. "Concrete Technology" by M.L.Gambhir.
2. "Concrete Technology" by M.S. Shetty.
3. "Concrete Technology" by A.R. Santhakumar.
4. "Properties of Concrete" by A.M. Neville.

a. Course Name: Concrete Technology Lab
b. Course Code: 03605204
c. Prerequisite: High School Science

d. Rationale: Cement mortar and concrete are the most widely used and versatile construction materials. It is the material of choice where strength, impermeability, durability, performance, fire resistance and abrasion resistance is required. Concrete is generally a site-made material unlike other materials of construction and as such can vary to a great extent in its quality, properties and performance owing to use of natural materials except cement. The knowledge of concrete and its properties in the plastic condition and in hardened condition are highly important in order to make Civil Engineering Structures safe and serviceable. This course focuses on students' acquisition of knowledge, skills & practices in concrete works. The knowledge and application of such aspects is essential in developing a good technician who should be conversant with the tests of various components of concrete and site practices to maintain the quality of concrete works.

e. Course Learning Objective:

CLOBJ 1	Students will be able to assess and analyse the physical characteristics of cement, aggregates, and water used in concrete mixtures, including factors such as particle size distribution, specific gravity, fineness, and chemical composition.
CLOBJ 2	Students will acquire the skills to conduct tests and measurements to determine key properties of both fresh and hardened concrete, such as slump, workability, compressive strength, flexural strength, and durability.
CLOBJ 3	Students will develop the ability to design concrete mixtures according to Indian Standard (IS) methods, incorporating Non-Destructive Testing (NDT) techniques to assess and optimize the mix design parameters for desired performance characteristics.
CLOBJ 4	Students will learn the procedures for batching, mixing, transporting, placing, and curing concrete to meet specified requirements, while also understanding methods for quality control and assurance to maintain concrete quality under varying environmental conditions.
CLOBJ 5	Students will gain knowledge about the properties and functions of different types of admixtures used in concrete, including plasticizers, accelerators, retarders, air-entraining agents, and superplasticizers, and understand their respective roles in enhancing concrete performance and workability.

f. Course Learning Outcomes:

CLO 1	Evaluate physical properties of cement, aggregates and water.
CLO 2	Measure important properties of fresh and hardened cement concrete.
CLO 3	Design Concrete Mix as per IS method including NDT.
CLO 4	Prepare concrete of required specification and maintain quality of concrete under different conditions.
CLO 5	Explain properties of various types of Admixtures and their utility.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "Concrete Technology" by M.L.Gambhir.
2. "Concrete Technology" by M.S. Shetty.
3. "Concrete Technology" by A.R. Santhakumar.
4. "Properties of Concrete" by A.M. Neville.

Exp. No.	Name of the Experiment
1	Determine fineness of cement by Blaine's air permeability apparatus Or by sieving.
2	Determine specific gravity, standard consistency, initial and final setting times of cement.
3	Determine compressive strength of cement.
4	Determine water absorption of fine and coarse aggregates.
5	Determine Fineness modulus of fine aggregate by sieve analysis.
6	Determine impact value of aggregate
7	Determine crushing value of aggregate.
8	Determine the abrasion value of aggregate.
9	Determine elongation and flakiness index of coarse aggregates
10	Determine workability of concrete by slump cone test.
11	Determine workability of concrete by compaction factor test.
12	To prepare a concrete mix of a particular grade and determine the compressive strength of concrete for 7 and 28 days.
13	Demonstration of NDT equipment.

a. Course Name: Hydraulics

b. Course Code: 03605205

c. Prerequisite: High School Science

d. Rationale: : It is necessary for civil, environmental, and transportation engineers to understand the behaviour of fluid flow in different conditions in pipes, channels, canals, notches, weirs, etc. In the field, these conditions are very common and diploma pass-outs have to solve problems related to water seepage and discharge. In this course, basics of hydraulics and its application oriented content has been kept with a focus that students should be able to solve practical problems.

The basic knowledge about hydraulics and fluid mechanics will be useful in subjects like Irrigation, Water Resources Management and Public Health Engineering. In this course, basics of hydraulics and its application oriented content has been kept with a focus that students should be able to solve practical problems. Competencies developed by this course would therefore be useful for students while performing his/her job in the field of Water resources / Irrigation/PHE and Environment Engineering.

e. Course Learning Objective:

CLOBJ 1	Understanding Technical Terms and Physical Properties of Fluids:.
CLOBJ 2	Understanding Pressure Concepts and Pascal's Law:
CLOBJ 3	Apply fluid mechanics principles to solve problems involving fluid flowing pipes.
CLOBJ 4	Applying various methods and techniques to calculate the hydraulic parameters of open channel flow, such as Manning's equation and the Chezy

	equation.
CLOBJ 5	Assess the validity of experimental results obtained from flow measurements and compare them with theoretical predictions.

f. Course Learning Outcomes:

CLO 1	To Measure pressure and determine total hydrostatic pressure for different conditions.
CLO 2	To acquire knowledge of different types of flow, different types of energy, and different types of equation & theory.
CLO 3	To determine head loss of fluid flow through pipes.
CLO 4	To compute discharge by various formulas in open channels
CLO 5	Select relevant hydraulic pumps for different applications.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
Lecture Hrs/ Week	**Tutorial Hrs/ Week Lab Hrs/ Week**	**Tutorial Hrs/ Week Lab Hrs/ Week**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
2	**-**	**0**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Pressure Measurement and Hydrostatic Pressure** Technical terms used in Hydraulics –fluid, fluid mechanics, hydraulics, hydrostatics and Hydrodynamics - ideal and real fluid, application of hydraulics, Physical properties of fluid – density-specific volume, specific gravity, surface tension, Capillarity, viscosity-Newton's law of viscosity, Various types of pressure – Atmospheric Pressure, Gauge Pressure, Absolute Pressure, Vacuum Pressure. Concept of Pressure head and its unit, Pascal's law of fluid pressure and its uses, Measurement of differential Pressure by different methods, Variation of pressure with depth, Pressure diagram, hydrostatic pressure and centre of Pressure on immersed surfaces and on tank walls, Determination of total pressure and centre of pressure on sides and bottom of water tanks, sides and bottom of tanks containing two liquids, vertical surface in contact with liquid on either side.	**25%**	**7**

2	**Fluid Flow Parameters** Types of flow – Gravity and pressure flow, Laminar, Turbulent, Uniform, Non-uniform, Steady, Unsteady flow. Reynolds number, Discharge and its unit, continuity equation of flow, Energy of flowing liquid: potential, kinetic and pressure energy, Bernoulli's theorem: statement, assumptions, equation.	**15%**	**4**
3	**Flow through Pipes** Major head loss in pipe: Frictional loss and its computation by Darcy's Weisbach equation, Use of Moody's Diagram and Nomograms, Minor losses in pipe: loss at entrance, exit, sudden contraction, sudden enlargement and fittings, Flow through pipes in series, pipes in parallel and Dupuit's equation for equivalent pipe, Hydraulic gradient line and total energy line, Water hammer in pipes: Causes and Remedial measures, Discharge measuring device for pipe flow: Venturi meter - construction and working, Discharge measurement using Orifice, Hydraulic Coefficients of Orifice	**30%**	**8**
4	**Flow through Open Channel** Geometrical properties of channel section: Wetted area, wetted perimeter, hydraulic radius for rectangular and trapezoidal channel section, Determination of discharge by Chezy's equation and Manning's equation, Conditions for most economical rectangular and trapezoidal channel section, Discharge measuring devices: Triangular and Rectangular Notches, Velocity measurement devices: current meter, floats and Pitot's tube, Specific energy diagram, Froude's' Number..	**20%**	**6**
5	**Hydraulic Pumps** Concept of pump, Types of pump - centrifugal, reciprocating, submersible, Centrifugal pump: components and working, Reciprocating pump: single acting and double acting, components and working, Suction head, delivery head, static head, Monomeric head, Power of centrifugal pump, Selection and choice of pump.	**10%**	**3**

i. Text Book and Reference Book:

1. "1. Fluid Mechanics & Hydraulic Machines By S.S. Rattan | Khanna Publishing House
2. Fluid Mechanics & Hydraulics Machines By Dr.R K Rajput | S Chand & Company Limited
3. Fluid mechanics& hydraulic Machines. (in S.I. units) By R.S.Khurmi | S.chand & Co.Ltd
4. Hydraulics and Fluid Mechanics Modi P.N, Seth S.M.; Standard Book House
5. Hydraulics, Fluid Mechanics and Hydraulic machine By S.Ramamrutham | Dhanpat Rai

a. Course Name: Hydraulics Lab
b. Course Code: 03605206
c. Prerequisite: High School Science

d. **Rationale:** It is necessary for civil, environmental, and transportation engineers to understand the behaviour of fluid flow in different conditions in pipes, channels, canals, notches, weirs, etc. In the field, these conditions are very common and diploma pass-outs have to solve problems related to water seepage and discharge. In this course, basics of hydraulics and its application oriented content has been kept with a focus that students should be able to solve practical problems

e. **Course Learning Objective:**

CLOBJ 1	Learn various methods of pressure measurement including Piezometer and U-tube differential manometer, understanding their principles and applications.
CLOBJ 2	Apply theoretical knowledge to analyse resultant pressure and its position within liquid-filled tanks through tutorial exercises.
CLOBJ 3	Explore fluid flow characteristics using Reynolds's apparatus to identify different flow types.
CLOBJ 4	Investigate energy distribution in closed conduits using Bernoulli's theorem with Bernoulli's apparatus and analyse flow behaviour.
CLOBJ 5	Gain practical experience in hydraulic measurements including discharge determination through various devices like Venturi meter, Orifice, Current meter, Pitot tube, triangular and rectangular notches, and efficiency assessment of centrifugal pumps.

f. **Course Learning Outcomes:**

CLO 1	To Measure pressure and determine total hydrostatic pressure for different conditions.
CLO 2	To acquire knowledge of different types of flow, different types of energy and different types of equation & theory.
CLO 3	To determine head loss of fluid flow through pipes.
CLO 4	To compute discharge by various formulas in open channels.
CLO 5	Select relevant hydraulic pumps for different applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**0**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. **Text Book and Reference Book:**

1. Fluid Mechanics & Hydraulic Machines By S.S. Rattan | Khanna Publishing House
2. Fluid Mechanics & Hydraulics Machines By Dr.R K Rajput | S Chand & Company Limited

3. Fluid mechanics& hydraulic Machines. (in S.I. units) By R.S.Khurmi | S.chand & Co.Ltd
4. Hydraulics and Fluid Mechanics Modi P.N, Seth S.M.; Standard Book House
5. Hydraulics, Fluid Mechanics and Hydraulic Machine By S. Ramammurtham

i. Experiment List

Exp. No.	Name of the Experiment
1	Use Piezometer to measure pressure at a given point.
2	Use U tube differential manometer to measure the pressure difference between two given points.
3	Tutorial: Find the resultant pressure and its position for given situation of liquid in a tank.
4	Use Reynolds's apparatus to determine the type of flow.
5	Use Bernoulli's apparatus to apply Bernoulli's theorem to get the total energy line for a flow in a closed conduit of varying cross-sections.
6	Use Friction factor Apparatus to determine friction factor for a given pipe.
7	Determine minor losses in pipe fittings due to sudden contraction and sudden enlargement.
8	Calibrate Venturi meter to find out the discharge in a pipe.
9	Calibrate the Orifice to find out the discharge through a tank.
10	Use the Current meter to measure the velocity of the flow of water in an open channel.
11	Use Pitot tube to measure the velocity of flow of water in an open channel.
12	Use a triangular notch to measure the discharge through the open channel.
13	Use Rectangular notch to measure the discharge through the open channel.
14	Determine the efficiency of centrifugal pump.

a. Course Name: Fundamentals of Civil Engineering

b. Course Code: 03605213

c. Prerequisite: Building Planning and Drawing

d. Rationale: Before the development and planning process for any civil engineering or mining project, a first field survey of that area is carried out and various types of survey maps are prepared. These maps and drawings are used for taking various decisions regarding the planning, designing, estimation, execution and construction process, etc. This course is therefore one of the core courses required for civil, mining, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey-related works. To identify different components of the building. To understand different types of foundation and their significance. To know different types of masonry and their construction. To highlight the importance of communications in building planning.

e. Course Learning Objective:

CLOBJ 1	Understand the pivotal role of field surveys and survey maps in civil engineering and mining projects' planning and development processes.
CLOBJ 2	Master the skills needed for proficient field surveys, including data collection, measurement, and mapping techniques.
CLOBJ 3	Identify and analyse building components, various foundation types, and masonry construction methods through surveying approaches.
CLOBJ 4	Recognize the importance of effective communication in building planning and executing projects.

CLOBJ 5	Apply surveying principles ethically and professionally, adapting methodologies to diverse project conditions for optimal resource allocation and decision-making.

f. Course Learning Outcomes:

CLO 1	Select the type of survey required for a given situation.
CLO 2	Carry out civil engineering survey using chain and tape, compass surveying
CLO 3	Carry out civil engineering survey using Plane Table Surveying.
CLO 4	Identify components of Building Structure and Propose a suitable type of foundation for building structures.
CLO5	Select suitable type of masonry and Scaffolding for building structures.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	**-**	**-**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Introduction:** Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, Units of measurement.	**7%**	**2**
2	**Surveying, Levelling and Mapping Linear Measurement:** Methods, Instruments used in chain surveying, Selection of stations, Chaining, Ranging, Offsetting, Errors in chaining and correction, Conventional symbols. Angular Measurement: Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing and correction of bearings for local attraction. Levelling: Aims and applications, Definition of various terms, Instruments for levelling, Methods of levelling, Recording observations in level-book, Computing reduced levels by HI and rise & fall method, Definition of contour, Characteristics of contours of different terrains and application of contour maps,. Introduction to plan meter.	**35%**	**10**

3	**Plane Table Surveying** Principles of plane table survey. Accessories of plane table and their use, Telescopic alidade. Setting of plane table; Orientation of plane table - Back sighting and Magnetic meridian method, True Meridian Method. Methods of plane table surveys- Radiation, Intersection and Traversing. Merits and demerits of plane table survey.	**16%**	**4**
4	**Overview of Building Components** Classification of Buildings as per National Building Code Group A to I, As per Types of Constructions- Load Bearing Structure, Framed Structure, Composite Structure. Building Components - Functions of Building Components, Substructure – Foundation, Plinth. Superstructure – Walls, Partition wall, Cavity wall.	**7%**	**2**
5	**Construction of Superstructure Stone Masonry:** Terms used in stone masonry- facing, backing, hearting, Through stone, corner stone, cornice. Types of stone **Masonry:** Rubble masonry, Ashlar Masonry and their types. Joints in stone masonry and their purpose. Selection of Stone Masonry, Precautions to be taken in Stone Masonry Construction. Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Junctions in brick masonry and their purpose and procedure. Precautions to be observed in Brick Masonry Construction. Comparison between stone and Brick Masonry. Tools and plants required for construction of stone and brick masonry. Hollow concrete block masonry and composite masonry. **Scaffolding and Shoring:** Purpose, Types of Scaffolding, Process of Erection and Dismantling. Purpose and Types of Shoring, Underpinning. Formwork: Definition of Formwork, Requirements of Formwork, Materials used in Formwork, Types of Formwork, Removal of formwork.	**35%**	**10**

i. Text Book and Reference Book:

1. Basics of Civil Engineering by S S Bhavikatti | New Age International Publishers.
2. Surveying and Levelling Vol. I by Arora K. R | Standard Publications, Delhi.
3. Building Construction by Sushil Kumar | Standard Publishers.
4. Building construction By S.C. Rangwala | Charotar Publishing House Pvt. Ltd. Anand.
5. Surveying and Levelling By N. N. Basak | Tata McGraw Hill Education, Pvt. Ltd. New Delhi.

a. Course Name: Fundamentals of Civil Engineering Lab

b. **Course Code:** 03605214
c. **Prerequisite:** Building Planning and Drawing
d. **Rationale:** Before the development and planning process for any civil engineering or mining project, a first field survey of that area is carried out and various types of survey maps are prepared. These maps and drawings are used for taking various decisions regarding the planning, designing, estimation, execution and construction process, etc. This course is therefore one of the core courses required for civil, mining, environmental and transportation engineers. Students are advised to master the desired skills which are expected from them for survey-related works. To identify different components of the building. To understand different types of foundation and their significance. To know different types of masonry and their construction. To highlight the importance of communications in building planning.
e. **Course Learning Objective:**

CLOBJ 1	Understand and interpret surveying signs and symbols on an A1 size imperial drawing sheet for effective communication of survey data.
CLOBJ 2	Gain practical skills in measuring distances between survey stations using chain, tape, and ranging rods, and accurately plotting measurements on an A1 size imperial drawing sheet.
CLOBJ 3	Develop proficiency in determining areas of open fields through chain and cross-staff survey techniques, ensuring accurate calculation and representation of land areas.
CLOBJ 4	Learn to measure fore and back bearings of survey lines in open and closed traverses using a prismatic compass, applying corrections for local attraction to ensure data accuracy.
CLOBJ 5	Acquire hands-on experience in undertaking various survey projects, including closed traverses around buildings, profile leveling for roads, and contour mapping using plane table survey methods, culminating in the accurate plotting of survey data on an A1 size imperial drawing sheet.

f. **Course Learning Outcomes:**

CLO 1	Select the type of survey required for a given situation.
CLO 2	Carry out civil engineering survey using chain and tape, compass surveying.
CLO 3	Carry out civil engineering survey using Plane Table Surveying.
CLO 4	Capable of conducting Contouring of various profile on earth surface.
CLO 5	Capable of conducting Levelling of various profile on earth surface.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**0**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Basics of Civil Engineering, By S S Bhavikatti | New Age International Publishers.
2. Surveying and Levelling Vol. I By Arora K. R | Standard Publications, Delhi
3. Building Construction by Shushil Kumar
4. Building construction by S.C. Rangwala | Charotar Publishing House Pvt. Ltd. Anand
5. Surveying and Leveling by N. N. Basak | Tata McGraw Hill Education, Pvt. Ltd. New Delhi

i. Experiment List

Exp. No.	Name of the Experiment
1	Plot Signs and symbols used for surveying on A1 size imperial drawing sheet.
2	Measure distance between two survey stations using chain, tape, and ranging rods when two stations are inevasible and plot on A1 size imperial drawing sheet.
3	Determine the area of open field using chain and cross-staff survey.
4	Measure Fore Bearing and Back Bearing of survey lines of open traverse and closed traverse using Prismatic Compass. Measure Fore Bearing and back bearing of a closed traverse of 5 or 6 sides and correct the bearings and included angles for the local attraction
5	Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides around a building. Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No.6.
6	Undertake simple leveling using dumpy level/ Auto level and leveling staff.
7	Undertake differential leveling and determine Reduced Levels by Height of instrument method and Rise and fall method using dumpy level/Auto Level and leveling staff.
8	Undertake fly leveling with double-check using dumpy level/ Auto level and leveling staff.
9	Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m intervals.
10	Plot the L-section with a minimum of 3 cross-sections on the A1 size imperial sheet for data collected in the Survey Project mentioned in practical No.11.
11	Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with a grid of 10m x 10m.
12	Plot the contours on the A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical No.13.
13	Use plane table survey to prepare plans, locate details by Intersection Method.
14	Use plane table survey to prepare plans, locate details by Traversing Method.

a. Course Name: Mechanics of Materials

b. Course Code: 03605215

c. Prerequisite: Engineering Mechanics

d. Rationale: After learning the Mechanics of rigid bodies in the second semester as a course in Engineering Mechanics, Mechanics of Structures mainly deals with the analysis of deformable structures. The primary purpose of the study of this course is to understand the behaviour of various structural elements like beams, columns, and truss members (struts/ties) under direct and transverse loads. The study of slope and deflection of beams will give insight to students about Stiffness an important property of the structure. This course enables the student to analyse the determinate structure, which will be helpful for safe and economical design of Steel & Concrete Structures used in Civil Engineering construction. Hence, this course is also a prerequisite for the design of the structure.

e. Course Learning Objective:

CLOBJ 1	Students will be able to calculate the moment of inertia for both symmetrical and asymmetrical sections about a specified axis, applying relevant mathematical formulas and principles of geometry.
CLOBJ 2	Students will analyse the behaviour of structural materials under different loading conditions, including tension, compression, bending, and torsion, to understand material properties and performance.
CLOBJ 3	Students will learn to draw and interpret shear force and bending moment diagrams for various types of structural elements subjected to different loading configurations, enhancing their ability to analyse structural responses.
CLOBJ 4	Students will determine bending and shear stresses in beams under different loading conditions, utilizing mechanics and material properties principles to assess structural integrity and safety.
CLOBJ 5	Students will analyse columns subjected to axial loads with different end conditions, considering factors such as buckling, stability, and material behavior to ensure structural stability and design efficiency.

f. Course Learning Outcomes:

CLO 1	Determine the moment of inertia of a symmetrical and asymmetrical section about a given axis.
CLO 2	Analyse the structural behaviour of materials in terms of stress and stress under various loading conditions.
CLO 3	Draw and Interpret shear force and bending moment diagrams various loading profile.
CLO 4	Able To determine Bending stress and shear stress at different location of beams
CLO 5	Analyse the column for axial load with various end conditions.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial Hrs/Week	Lab Hrs/Week	Hrs/Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Course Content:

Course Content

W - Weightage (%) , T - Teaching hours

Sr.	Topics	W	T
1	**Moment of Inertia** Moment of inertia (M.I.): Definition, M.I. of the plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations), M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroid axes and any other reference axis, Polar Moment of Inertia of solid circular sections.	**10**	**5**
2	**Simple Stresses and Strains** Definition of rigid, elastic and plastic bodies, deformation of elastic body under various forces, Definition of stress, strain, elasticity, Hook's law, Elastic limit, Modulus of elasticity, Type of Stresses-Normal, Direct, Bending and Shear and nature of stresses i.e. Tensile and Compressive stresses, Standard stress strain curve for tor steel bar under tension, Yield stress, Proof stress, Ultimate stress, Strain at various critical points, Percentage elongation and Factor of safety, Deformation of body due to axial force, forces applied at intermediate sections, Maximum and minimum stress induced, Composite section under axial loading, Concept of temperature stresses and strain, Stress and strain developed due to temperature variation in homogeneous simple bar (no composite section), Longitudinal and lateral strain, Modulus of Rigidity, Poisson's ratio, Biaxial and tri-axial stresses, volumetric strain, change in volume, Bulk modulus (Introduction only), Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation).	**20**	**8**
3	**Shear Force and Bending Moment** Types of supports, beams and loads, Concept and definition of shear force and bending moment, Relation between load, shear force and bending moment (without derivation), Shear force and bending moment diagram for cantilever and simply supported beams, subjected to point loads, uniformly distributed loads, and couple (combination of any two types of loading), point of contra flexure. Beam reaction graphically for supported beam subjected to vertical point loads only.	**25**	**10**
4	**Bending and Shear Stresses in Beams** Concept and theory of pure bending, assumptions, flexural equation (without derivation), bending stresses and their nature, bending stress distribution diagram, Concept of the moment of resistance and simple numerical problems using the flexural equation, Shear stress equation (without derivation), the relation between maximum and average shear stress for rectangular and circular section, shear stress distribution diagram, Shear stress distribution for square, rectangular, circle, hollow, square, rectangular, circular, angle sections, channel section, I-section, T section. Simple numerical problems based on a shear equation.	**20**	**8**
5	**Column** Concept of compression member, short and long column, Effective length, Radius of gyration, Slenderness ratio, Types of end condition for columns, buckling of axially loaded, Euler's theory, assumptions made in Euler's theory and its limitations, Application of Euler's equation to calculate buckling load, Rankine's formula and its application.	**15**	**6**

i. Text Book and Reference Book:

1. 1. Strength of Materials
   By R. S Khurmi, | S. Chand Publishing
2. A textbook Strength of Materials
   By R.K.Bansal | Laxmi Publications (P) LTD | 6th, Pub. The year 2018

3. Strength of Materials
   By Dr. B.C. Punmia | Laxmi Publications
4. Strength of Materials
   By Timoshenko

a. **Course Name:** Mechanics of Materials Lab
b. **Course Code:** 03605216
c. **Prerequisite:** Engineering Mechanics
d. **Rationale:** After learning Mechanics of rigid bodies in the second semester as a course Engineering Mechanics, Mechanics of Structures mainly deals with analysis of deformable structures. The primary purpose of the study of this course is to understand the behaviour of various structural elements like beams, columns and truss members (struts/ties) under direct and transverse loads. Study of slope and deflection of beams will give insight to students about 'Stiffness', a very important property of the structure. This course enables the student to analyse the determinate structure and this will be helpful for safe and economical design of Steel & Concrete Structures used in Civil Engineering construction. Hence, this course is also a prerequisite of design of structure.

e. **Course Learning Objective:**

CLOBJ 1	Students will develop the ability to calculate the moment of inertia of both symmetrical and asymmetrical structural sections about a specified axis, enabling them to analyse the section's resistance to bending and torsional loading.
CLOBJ 2	Students will acquire the skills to assess and predict the structural response of materials under different loading scenarios, including tension, compression, bending, and torsion, considering factors such as material properties, geometry, and support conditions.
CLOBJ 3	Students will learn to create accurate shear force and bending moment diagrams for statically determinate and indeterminate beams, and develop the ability to interpret these diagrams to analyse structural behaviour and determine critical points.
CLOBJ 4	Students will gain proficiency in calculating bending and shear stresses in beams subjected to different loading configurations, including point loads, distributed loads, and varying support conditions, allowing them to assess structural integrity and design safe and efficient structures.
CLOBJ 5	Students will be able to analyse columns subjected to axial loading with different end conditions, such as fixed, pinned, and free ends, to determine critical buckling loads and understand the behaviour of columns under compressive forces.

f. **Course Learning Outcomes:**

CLO 1	Determine moment of inertia of a symmetrical and asymmetrical section about a given axis.

CLO 2	Analyse the structural behaviour of materials under various loading conditions.
CLO 3	Draw and Interpret shear force and bending moment diagrams.
CLO 4	To determine the bending and shear stresses in beams for various types and loading conditions.
CLO 5	Analyse the column for axial load with various end conditions.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "Strength of Materials" by R. S Khurmi.
2. "A textbook Strength of Materials" by R.K.Bansal.
3. "Strength of Materials" by Dr. B.C. Punmia.
4. "Strength of Materials" by Timoshenko.

i. Experiment List

ExpNo.	Name of the Experiment
1	Study and understand the use and components of Universal Testing Machine (UTM). Perform Tension test on mild steel as per IS:432(1)
2	Conduct compression test on sample test piece using Compression Testing Machine.
3	Conduct Izod Impact test on three metals. E.g. mild steel/brass/aluminum/ copper /cast-iron etc. as per IS: 1598.
4	Conduct Charpy Impact test on three metals. E.g. mild steel/ brass/aluminum/ copper /cast iron etc. as per IS: 1757.
5	Determine Compressive strength of dry and wet bricks as per IS: 3495(part I), IS: 1077.
6	Conduct Abrasion Test on flooring tiles (any one) e.g. Mosaic tiles, Ceramic Tiles as per IS: 13630 (part7), Cement Tile as per IS: 1237.

ExpNo.	Name of the Experiment
7	Perform Single Shear and double shear test on any two metals e.g. Mild steel/ brass/aluminum/copper / cast iron etc. as per IS:5242.
8	Conduct a Compression test on timber section along the grain and across the grain as per IS: 2408.
9	Plot Shear force and Bending Moment diagrams for cantilever and simply supported beams.
10	Plot Shear force and Bending Moment diagrams for overhanging beams for different types of loads including moment loading.
11	Conduct Flexural test on timber beam on a rectangular section in both orientation as per IS:1708, IS:2408
12	Conduct Flexure test on floor tiles IS:1237, IS:13630 or roofing tiles as per IS:654, IS:2690

a. **Course Name:** PROFESSIONAL COMUNICATION & CRITICAL THINKING
b. **Course Code:** 03693203
c. **Prerequisite:** Inclination to improve personality traits for development & basic communication
d. **Rationale:** Advance level of communication and personality development is crucial for and after placement.
e. **Course Learning Objective:**

CLOBJ 1	Develop basic speaking and writing skills including proper use of language & vocabulary so that they become highly confident & skilled speakers & writers
CLOBJ 2	Define the latest trends in basic verbal activities such as presentations, facing interviews & other forms of oral communication.
CLOBJ 3	Engage in professional Development Activities through presentation & enhance communication skills in team.
CLOBJ 4	Enhance non-verbal communication skills such as proper use of body language & gestures.
CLOBJ 5	Identify format & basic to write professionally through emails & reports

f. **Course Learning Outcomes:**

CLO 1	Develop their Personality
CLO 2	Analyze various concepts included in competitive exams.
CLO 3	Imply their knowledge for appearing in Interview
CLO 4	Writing & Communication is improved by their efforts.

CLO 5	Analyze the effectiveness of emails and reports in terms of clarity, conciseness, and tone.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect. Hrs/ Week	Tut Hrs / Week	Lab Hrs/ Week		T	P	T	CE	P	
1	0	-	1	-	-	-	100	-	100

Lect. - Lecture, Tut - Tutorial, Lab - Lab, T - Theory, P - Practical, CE – Continuous Evaluation

Note: 15 Hours of additional sessions will be taken (within the semester) to match up 30 hours content.

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Story Mason:** Classroom activity to encourage students to speak on topics they are good at, hence boosting confidence of students.	09%	5
2	**Determiners, Articles, and Interrogatives** This session will enable students to understand proper usage ofDeterminers and Articles. It will also enhance their daily speaking conversational/ communicationskills. Preparation of verbal section in company's aptitude exam	14%	8
3	**Subject-Verb Agreement:** This will enable students to understand the formation of sentencewith the usage of subject-verb agreement	05%	3
4	**Reading-Skill Building:** • **Types of Reading – reading for different purposes** • **An Astrologer's Day-Malgudi Days** Enhance reading skills by collecting information, know the importanceof reading	07%	4
5	**Reading Comprehension:** Learn to solve the reading comprehension questions in an easy manner and also in less amount of time • Introduction, Factual & Inferential comprehension, Reasons forPoor Comprehension • Able to solve reading comprehension in less amount of Time bypracticing	10%	6

6	**Mafia The art of observation and convincing**: • The interesting activity is targeted toward improving observation and convincing skills. A team activity in which every single • Individual is very important person of his team to win	10%	6
7	**Direct and Indirect Speech** • This session will enable students to understand proper usage ofnarration	09%	5
8	**Industry Expectation**: In this class the students will be made to understand what will be theworld after their college life will be, how they should prepare themselves from that competitive world with full of challenges for them	03%	2
9	**Mirror & Water Images** • Reflection of an object into a mirror and water • It is obtained by inverting an object laterally (mirror) & vertically(water).	05%	3
10	**Sentence Correction** • It will also enhance their daily speaking conversational/communication skills. • Preparation of verbal section in company's aptitude exam	03%	2
11	**Play Teacher:** Classroom activity to encourage students to speak on topics they aregood at, hence boosting confidence of students.	10%	6
12	**Professional Writing** • Email and report	05%	3
13	**Group Discussion** • It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members ofa *group* who share some common objectives.	10%	6
	Total	100	30

Continuous Evaluation:

It consists of

1. Phase I Exam-35 Marks(Hybrid or Offline Mode)
2. Phase II Exam -35 Marks (Hybrid or Offline Mode)
3. Activities – (Listening and Speaking) -10+10=20 Marks
4. Attendance -10 Marks

The passing marks for Continous Evaluation will be 40 out of 100.There will not be any re-test.

i. Text Book and Reference Book:

1. " Active English –Almas Juneja and Vaseem Qureshi-Macmillan Publishers India Ltd
2. English- Prof. Pradyuman Raj, Prof. Rakhi Moghe, Ms. Anisha Modi
3. Verbal and Non-Verbal Reasoning-B.S. Sijwali and Indu Sijwali
4. Competitive English- Azahar Siddiqui,Shaily Kavaiya,Amisha Pathak,Mayank Barot,Gautam Nayak,AnkitPandya
5.The Functional Aspects of Communication Skills-Dr. P. Prasad-S.K. Kataria and Sons.
6.Malgudi Days by R.K.Narayan

Semester 4

a. **Course Name:** Essence of Indian Knowledge and Tradition
b. **Course Code:** 03600251
c. **Prerequisite:** Zeal to learn Subject
d. **Rationale:** The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature is also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.
e. **Course Learning Objective:**

CLOBJ 1	Gain knowledge about the Vedas and Unvedas, including Ayurveda, Dhanurveda, Gandharvaveda, and Sthanya, and their significance in the Indian knowledge system.
CLOBJ 2	Learn about Vedangas such as Education, Kalpa, Nirukta, Grammar, and Jyotisha, and their importance in supporting and enriching the understanding of Vedic texts.
CLOBJ 3	Understand the purpose and relevance of Upangas such as Dharma Shastras, Itihasas, Puranas, and Tantras in providing supplementary knowledge and guidance in various aspects of life.
CLOBJ 4	Examine how modern scientific approaches are applied to ancient Indian practices like Yoga and Holistic Healthcare, exploring their effectiveness and potential benefits.
CLOBJ 5	Analyze real-world case studies demonstrating the practical implementation and outcomes of Yoga and Holistic Healthcare practices, including their effects on physical, mental, and emotional well-being.

f. **Course Learning Outcomes:**

CLO 1	Understanding the role of Modern Science
CLO 2	Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**		
				Internal Evaluation	**ESE**	**Total**

L	T	P	C	MSE	CE	P	Theory	P	
2	-	-	0	20	20	-	-	-	40

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- ContinuousEvaluation, **ESE-** End Semester Examination

h. Course Content:

Sr.	Topics	W	T
1	**Basic Structure of Indian Knowledge System:** i) Vedas, (ii) Unveda (Ayurveda, Dhanuveda, Gandhveda, Sthanya etc.) (iii) Vedanga (Education, Kalna, Nanrut, Grammar, Jyotish verses), (iv) Upaayaga (Dharma level, Vivamsa, Purana, Takma level)	60	12
2	**Modern Science and Indian Knowledge System:**	15	5
3	**Yoga and Holistic Health care:**	15	5
4	**Case Studies:**	10	4

a. Course Name: Theory of Structure
b. Course Code: 03605251
c. Prerequisite: Engineering Mechanics & Mechanics of Materials
d. Rationale: Knowledge and understanding of Mechanics of Materials is very important for engineers in order to make Civil Engineering Structures safe and serviceable. The Theory of Structure subject is taught in 4th sem. to develop the concept of analysis of determinate structures under various types of transverse &/or direct loading. Analysis of industrial trusses is also incorporated to give an idea of typical structure to the students. In this course, analysis of indeterminate structures under transverse loading, along with analysis of members under direct loading is to be studied.
e. Course Learning Objective:

CLOBJ 1	Analyze the impact of direct and eccentric axial loading on structures using principles of mechanics. Apply knowledge to assess structural stability and behaviour under various loading conditions. Demonstrate critical thinking by evaluating the effects and recommending solutions for loaded structures.
CLOBJ 2	Calculate slope and deflection in cantilever and simply supported beams using appropriate equations. Apply deformation analysis techniques to predict beam behavior under different loading scenarios. Demonstrate proficiency in quantifying structural deformations for design and analysis.
CLOBJ 3	Apply equilibrium and compatibility principles to analyze statically indeterminate beams. Demonstrate understanding of fixed and continuous beam behavior under various loading conditions. Utilize problem-solving skills to address challenges in analyzing complex structural systems.
CLOBJ 4	Apply the moment distribution method to analyze statically indeterminate beams. Demonstrate proficiency in distributing moments and determining support reactions. Solve complex problems involving indeterminate structures using moment distribution.
CLOBJ 5	Calculate axial forces in truss members using methods of joints and sections.

	Apply static equilibrium principles to analyze and solve problems in simple truss structures. Demonstrate competence in determining internal forces for efficient truss design.

f. Course Learning Outcomes:

CLO 1	Students will be able to analyze axial and eccentric loads, identifying and calculating maximum and minimum stresses in vertical members.
CLO 2	Learners will understand the concept of slope and deflection, establishing relationships among bending moment, slope, deflection, and radius of curvature.
CLO 3	They will apply the principle of superposition, calculate fixed end moments for different loading scenarios, and draw shear force and bending moment diagrams.
CLO 4	Participants will be able to analyze symmetrical and unsymmetrical portal frames, understanding the concepts of bays and stories.
CLO 5	Upon completion, students will demonstrate proficiency in analyzing trusses subjected to point loads and understand the practical applications of different truss types.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	**-**	**0**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	Direct and Bending Stresses in vertical members Introduction to axial and eccentric loads, eccentricity about one principal axis only, nature of stresses, Maximum and minimum stresses, resultant stresses and distribution diagram. Condition for no tension or zero stress at extreme fibre, Limit of eccentricity, core of section for rectangular and circular cross sections, Middle third rule. Chimneys of circular cross section subjected to wind pressure, Maximum and minimum stresses, resultant stresses and distribution diagram at base.	25	10

	Analysis of dams subjected to horizontal water pressure, condition of stability, maximum and minimum stresses, resultant stresses and distribution diagram at base.		
2	Slope and Deflection Concept of slope and deflection, stiffness of beams, Relation among bending moment, slope, deflection and radius of curvature, (no derivation).Double integration method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span. Macaulay's method for slope and deflection, application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span.	**15**	**8**
3	Fixed and Continuous Beam Concept of fixity, effect of fixity, advantages and disadvantages of fixed beam over simply supported beam. Principle of superposition, Fixed end moments from first principle for beam subjected to point load, UDL over entire span. Application of standard formulae in finding end moments, end reactions and drawing S.F. and B.M. diagrams for a fixed beam. Definition, effect of continuity, nature of moments induced due to continuity, concept of deflected shape, practical examples. Clapeyron's theorem of three moment (no derivation), Application of Clapeyron's theorem maximum up to three spans and two unknown support moment only, Support at same level spans having same and uniform moment of inertia subjected to concentrated loads and uniformly distributed loads over entire span. Drawing SF diagrams showing point of contra flexure, shear and BM diagrams showing net BM and point of contra flexure for continuous beams.	**20**	**8**
4	Moment distribution method Introduction to moment distribution method, sign convention, Carry over factor, stiffness factor, distribution factor. Application of moment distribution method to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same or different Moment of inertia, supports at same Level, up to three spans and two unknown support moments only. Introduction to portal frames – Symmetrical and unsymmetrical portal frames with the concept of Bays and stories.	**20**	**8**
5	Simple trusses	**20**	**8**

	Types of trusses (Simple, Fink, compound fink, French truss, pratt truss, Howe truss, North light truss, King post and Queen post truss); Calculate support reactions for trusses subjected to point loads at joints Calculate forces in members of truss using Method of joints and Method of sections.		

i. Text Book and Reference Book:

1. Theory of Structures By S.Ramamrutham | Dhanpat Rai Publishing Company
2. Theory of Structures By R S KHURMI
3. Analysis of Structure Vol. I By S S Bhavikatti
4. 'Mechanics of Structures – I & II'By S.B Junnarkar and H.J Shah | Charotar Publishing House

a. Course Name: Surveying

b. Course Code: 03605253

c. Prerequisite: Elements of Civil Engineering/Fundamentals of Civil Engineering

d. Rationale: Surveying is the basic and one of the most studied topics in civil engineering. Survey is used in the preparation of maps which help in the location of hills, valleys, rivers, boundaries, roads, canals and railways. It also helps in setting up plans for roads, railways and other important civil engineering structures. In addition to the instruments used for simple surveying, advanced surveying techniques such as Tachometric survey, Setting out of a curve, Total Station survey, use of G.P.S., D.G.P.S., U.A.V. etc. are essential as speed and accuracy are in high demand in recent time. Also, these modern equipment's use software which in turn encourages paperless work and use of green building materials.

e. Course Learning Objective:

CLOBJ 1	Fundamental Concepts: Develop a thorough understanding of basic surveying principles, including measurement techniques, coordinate systems, and mapping fundamentals.
CLOBJ 2	Application of Instruments: Gain proficiency in using traditional surveying instruments such as levels, theodolites, and compasses, as well as modern equipment like Total Stations, GPS, and UAVs for accurate data collection and analysis.
CLOBJ 3	Advanced Surveying Techniques: Learn advanced surveying techniques such as tachometric surveying, setting out of curves, and precision levelling using digital instruments to meet the demands of speed and accuracy in contemporary civil engineering projects.
CLOBJ 4	Integration of Software: Explore the integration of surveying software with modern instruments to enhance efficiency, accuracy, and productivity in data processing and analysis, thereby promoting paperless workflows and sustainability.
CLOBJ 5	Practical Applications: Apply surveying principles and techniques to real-world scenarios, including land development projects, infrastructure planning, and construction layout, to effectively plan, design, and execute civil

	engineering structures while considering environmental and social implications.

f. Course Learning Outcomes:

CLO 1	Use Theodolite for the measurement of horizontal and vertical angle.
CLO 2	Calculate the height of objects through a trigonometrical levelling
CLO 3	Explain the principles and various methodologies involved in tachometry.
CLO 4	Retrieving the data and generating the drawings using advanced surveying equipment & application software.
CLO5	Record and retrieve the data using a Hand-Held GPS and GIS.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	-	2	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Theodolite Surveying** Types and uses of Theodolite, Components of transit Theodolite and their functions, Reading the Vernier of transit Theodolite. Technical terms- Swinging, Transiting, Face left, Face right. Fundamental axes of transit Theodolite and their relationship Temporary adjustment of transit Theodolite. Measurement of horizontal angle- Direct and Repetition method, Errors eliminated by method of repetition. Measurement of magnetic bearing of a line, Prolonging and ranging a line, deflection angle. Measurement of vertical Angle. Theodolite traversing by Included angle method and Deflection angle method. Checks for open and closed traverse, Calculations of bearing from angles. Traverse computation-Latitude, Departure, Consecutive coordinates, Independent coordinates, balancing the traverse by Bowditch's rule and Transit rule, Gale's Traverse table computation.	35%	12

2	**Trigonometrical Levelling** Introduction, Methods of observations (Direct and Reciprocal), Methods of determining the elevation of a particular point, when base of the object is accessible, when base of the object is inaccessible, Related examples using all methods	20%	6
3	T**achometric surveying and Curve setting** Principles of Tachometry, tachometers, and its component parts, Anaclitic lens. Tachometric formula for horizontal distance with telescope horizontal and staff vertical. Field method for determining constants of tachometer, Determining horizontal and vertical distances with tachometers by fixed hair method and staff held vertical, Limitations of tachometry. Types of curves used in roads and railway alignments. Designation of curves. Setting simple circular curve by offsets from long chord and Rankine's method of deflection angles.	20%	6
4	**Advanced surveying equipment's** Principle of Electronic Distance Meter (EDM), its component parts and their Functions, use of EDM. Use of micro optic Theodolite and Electronic Digital Theodolite. Use of Total Station, Use of function keys. Measurements of Horizontal angles, vertical angles, distances and coordinates using Total Station, Traversing, Profile Survey and Contouring with Total Station.	15%	2
5	Remote sensing, GPS and GIS Remote Sensing – Overview, Remote sensing system, Applications of remote sensing in Civil engineering, land use / Land cover, mapping, disaster management. Use of Global Positioning System (G.P.S.) instruments. Geographic Information System (GIS): Over view, Components, Applications, Software for GIS. Introduction to Drone Surveying.	10%	2

i. Text Book and Reference Book:

1. **'Surveying and Levelling'**
   By R. Subramaniam | Oxford University Press Soil Mechanics and
2. **Dr. B. C.Punmia**
   By Surveying and Levelling Vol-I | Laxmi Publications Pvt. Ltd.
3. **Surveying and Levelling Vol. I**
   By Arora K. R | Standard Publications, Delhi
4. **Surveying and Levelling Vol.1&2**
   By T.P. Kanetkar and S.V. Kulkarni
5. **Surveying Vol. I**

By S. K. Duggal | Tata McGraw Hill Publication New Delhi

a. **Course Name:** Surveying Lab
b. **Course Code:** 03605254
c. **Prerequisite:** Elements of Civil Engineering/Fundamentals of Civil Engineering
d. **Rationale:** Surveying is the basic and one of the most studied topics in civil engineering. Survey is used in the preparation of maps which help in the location of hills, valleys, rivers, boundaries, roads, canals and railways. It also helps in setting up plans for roads, railways and other important civil engineering structures. In addition to the instruments used for simple surveying, advanced surveying techniques such as Tachometric survey, setting out of a curve, Total Station survey, use of G.P.S., D.G.P.S., U.A.V. etc. are essential as the speed and accuracy are in high demand in recent time. Also, these modern equipment's use software which in turn encourages paperless work and use of green building materials

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles and applications of surveying in civil engineering, including mapping and location of natural and man-made features.
CLOBJ 2	Learn about traditional surveying instruments and their functions, alongside advanced techniques such as Total Station survey and GPS.
CLOBJ 3	Recognize the importance of speed and accuracy in modern surveying practices for efficient project planning and design.
CLOBJ 4	Explore the role of software in modern surveying equipment, promoting paperless work and sustainability through the use of green building materials.
CLOBJ 5	Develop practical skills in using modern surveying instruments and software to collect and analyze data for civil engineering projects, emphasizing the incorporation of sustainable practices.

f. **Course Learning Outcomes**

CLO 1	Use Theodolite for the measurement of horizontal and vertical angle.
CLO 2	Calculate the height of objects through a trigonometrical levelling.
CLO 3	Explain the principles and various methodologies involved in tacheometry.
CLO 4	Retrieving the data and generate the drawings using advanced surveying equipment & application software.
CLO 5	Record and retrieve the data using a Hand-Held GPS and GIS.

g. **Teaching & Examination Scheme:**

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	

0	**-**	**2**	**1**	**-**	**-**	**50**	**-**	**-**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Dr. B. C. Punmia by Surveying and Levelling Vol-I | Laxmi Publications Pvt. Ltd.
2. Surveying and Levelling Vol. I By Arora K. R | Standard Publications, Delhi
3. Surveying and levelling Vol-I By T. P. Kanetkar & S. V. Kulkarni | Puna Vidyarthi Griha Prakashan
4. Surveying Vol. I By S. K. Duggal | Tata McGraw Hill Publication New Delhi

i. Experiment List

Exp. No.	**Name of the Experiment**
1	Use transit theodolite to measure Horizontal and Vertical angle by Direct Method.
2	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Theodolite Survey Project.
3	Use Theodolite as a Tachometer to compute reduced levels and horizontal distances.
4	Set out a circular curve by Rankine's Method of Deflection Angles.
5	Use micro-optic Theodolite to Measure Horizontal angle by Direct Method.
6	Use EDM to measure horizontal distance.
7	Use Total station instrument to measure horizontal distances and Vertical angle.
8	Use Total station instrument to carry out Survey Project for closed traverse for minimum five sides.
9	Plot the traverse on A1 size imperial drawing sheet for the collected data from preceding Total Station Survey Project
10	Use GPS to locate the coordinates of a station.

a. Course Name: Transportation Engineering
b. Course Code: 03605255
c. Prerequisite: Construction Materials & Fundamentals of Civil Engineering
d. Rationale: Economy of the nation is directly driven by movement of the people and goods effectively and efficiently. Moreover, In India population blast has made it mandatory to explore the quick and economical mode of transportation. Transportation is classified in general as Road transportation, Railway, Airway and Waterways. Out of all the available modes, water transportation is the cheapest one but it takes much more time; On the contrary, air ways provide quickest transport at costlier rates. Road transportation is easiest, flexible and most convenient mode of transportation for people and goods.
e. Course Learning Objective:

CLOBJ 1	Understand and compare different modes of transportation, focusing on their economic impacts, including costs, efficiency, and environmental considerations.
CLOBJ 2	Master the principles of geometric highway design, applying standards and guidelines to develop safe and efficient road layouts.

CLOBJ 3	Acquire skills in road construction techniques and material testing to ensure the durability and suitability of road infrastructure.
CLOBJ 4	Learn to maintain railway tracks by understanding their components and implementing regular inspection and maintenance practices.
CLOBJ 5	Grasp railway track geometrics, and the construction and maintenance processes, to ensure safe and efficient rail transport and can conduct road safety audits and implement safety measures to mitigate risks and enhance safety on highways.

f. Course Learning Outcomes:

CLO 1	Explain different modes of transportation and its effectiveness in terms of economy.
CLO 2	Implement the geometrical design features of different highways.
CLO 3	Implement various types of road construction work with different tests of road materials.
CLO 4	Maintain railway track and its components.
CLO 5	Identify the Track geometrics, Construction and Maintenance in railway engineering and capable of Explaining Road Safety Audit & Road Safety Measures in different highways.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial Hrs/ Week	Lab Hrs/Week	Hrs/Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Course Content:

Course Content

W - Weightage (%) , T - Teaching hours

Sr.	Topics	W	T
1	**Overview of Highway Engineering** Role of transportation in the development of nation, Scope and Importance of roads in India and its' Characteristics. Different modes of transportation – land way, waterway, airway. Merits and demerits of roadway and railway; General classification of roads. Selection and factors affecting road alignment.	10	5
2	**Geometric Design of Highway**	25	10

	Camber: Definition, purpose, types as per IRC – recommendations. Kerbs: Road margin, road formation, right of way. Design speed and various factors affecting design speed as per IRC – recommendations. Gradient: Definition, types as per IRC – Recommendations. Sight distance (SSD): Definition, types IRC – recommendations, simple numerical. Curves: Necessity, types: Horizontal, vertical curves. Extra widening of roads: numerical examples. Super elevation: Definition, formula for calculating minimum and maximum Super elevation and method of providing super-elevation. Standards cross-sections of national highway in embankment and cutting. Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and falling.		
3	**Construction of Road Pavements** Types of road materials and their Tests – Test on aggregates-Flakiness and Elongation Index tests, Angularity Number test, test on Bitumen- penetration, Ductility, Flash and Fire point test and Softening point test. Pavement – Definition, Types, Structural Components of pavement and their functions Construction of WBM road. Merits and demerits of WBM & WMM road. Construction of Flexible pavement / Bituminous Road, Types of Bitumen and its properties, Emulsion, Cutback, Tar, Terms used in BR-prime coat, tack coat, seal coat, Merits and Demerits of BR. Cement concrete road -methods of construction, Alternate and Continuous Bay Method, Types of joints. PAVEMENT EVALUATION General concept of pavement evaluation – Evaluation of pavement performance – Structural capacity – Distress – Safety elementary design .	**22**	**8**
4	**Basics of Railway Engineering** Classification of Indian Railways, zones of Indian Railways Permanent way: Ideal requirement, Components; Rail Gauge, types, factors affecting selection of a gauge. Rail, Rail Joints – requirements, types. Creep of rail: causes and prevention. Sleepers – functions and Requirement, types – concrete sleepers and their density Ballast – function and types, suitability. Rail fixtures and fastenings – fish plate, spikes, bolts, keys, bearing plates, chairs-types of anchors and anti-creepers.	**10**	**5**
5	**Track geometrics, Construction and Maintenance** Alignment- Factors governing rail alignment. Track Cross sections – standard cross section of single and double line in cutting and embankment. Important terms-permanent land, formation width, side drains, Railway Track Geometrics: Gradient, curves- types and factors affecting, grade compensation, super elevation, limits of Super elevation on curves, cant deficiency, negative cant, coning of wheel, tilting of rail. Branching of Tracks, Points and crossings, Turn out- types, components, functions and inspection. Track junctions: crossovers, scissor cross over, diamond crossing, track triangle. Station –Purpose, requirement of railway station, important technical terms, types of railway station, factors affecting site selection for railway station. Station yard: Classification- Passenger, goods, locomotive and marshalling yards. Function & drawbacks of marshalling yards. Track Maintenance- Necessity, Classification, Tools required for track maintenance with their functions, Organization of track maintenance, Duties of permanent way inspector, gangmate and key man. dilatancy test and toughness test	**25**	**10**
6	**Road Safety Audit & Road Safety Measures** Global & Local perspective – Road safety issues – Road safety programmes – Types of RSA, planning, design, construction & operation stage audits – Methodology – Road safety audit measures Ranking and Project Guidelines for accident prevention for better planning and design with crash counters.	**8**	**4**

i. Reference Books

1. Highway Engineering By Khanna & Justo
2. Highway Engineering By Dr. L.R. Kadiyali | Khanna Publishers, New Delhi
3. Principles, Practice and Design of Highway Engineering By Dr. S.K. Sharma | S. Chand & Co., New Delhi
4. Transportation Engineering Vol I By V.H. Vazirani & S.P. Chandola,

a. **Course Name:** Transportation Engineering Lab
b. **Course Code:** 03605256
c. **Prerequisite:** Construction Materials & Fundamentals of Civil Engineering
d. **Rationale:** Economy of the nation is directly driven by movement of the people and goods effectively and efficiently. Moreover, In India population blast has made it mandatory to explore the quick and economical mode of transportation. Transportation is classified in general as Road transportation, Railway, Airway and Waterways. Out of all the available modes, water transportation is the cheapest one but it takes much more time; On the contrary, air ways provide quickest transport at costlier rates. Road transportation is easiest, flexible and most convenient mode of transportation for people and goods.
e. **Course Learning Objective:**

CLOBJ 1	Gain practical understanding of transportation engineering principles through hands-on experiments and field visits.
CLOBJ 2	Learn to conduct tests on aggregates and bituminous materials to assess their suitability for road construction.
CLOBJ 3	Familiarize with equipment used in transportation engineering labs, such as sieves and penetrometers.
CLOBJ 4	Develop skills in visual inspection techniques for identifying defects and recommending remedial measures for roads and railway tracks.
CLOBJ 5	Apply theoretical knowledge to real-world scenarios encountered during experiments and site visits, fostering critical thinking and problem-solving abilities.

f. **Course Learning Outcomes:**

CLO 1	Explain different modes of transportation and its effectiveness in terms of economy.
CLO 2	Implement the geometrical design features of different highways.
CLO 3	Implement various types of road construction work with different tests of road materials.
CLO 4	Maintain railway track and its components.
CLO 5	Identify the Track geometrics, Construction and Maintenance in railway engineering and capable of Explaining Road Safety Audit & Road Safety Measures in different highways.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
0	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. Highway Engineering By Khanna & Justo
2. Highway Engineering, By Dr. L.R. Kadiyali | Khanna Publishers, New Delhi
3. Principles, Practice and Design of Highway Engineering, By Dr. S.K. Sharma | S. Chand & Co., New Delhi
4. Transportation Engineering Vol I By V.H. Vazirani & S.P. Chandola,

Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment
1	Draw the sketches showing standard cross sections of Expressways, Freeways, NH/SH, MDR/ODR.
2	Flakiness and Elongation Index of aggregates.
3	Angularity Number of aggregates.
4	Aggregate impact test.
5	Los Angeles Abrasion test.
6	Aggregate crushing test.
7	Softening point test of bitumen.
8	Penetration test of bitumen.
9	Flash and Fire Point test of bitumen.
10	Ductility test of Bitumen
11	Visit the constructed road for visual inspection to identify defects and suggest remedial measures. Prepare the photographic report containing details for experiment.
12	Visit the hill road constructed site to understand its components. Prepare the photographic report containing details for experiment

Exp. No.	Name of the Experiment
13	Visit the road of any one type (flexible or rigid) to know the drainage condition. Prepare the photographic report suggesting possible repairs and maintenance for experiment
14	Visit to the railway track for visual inspection of fixtures, fasteners and Yards. Prepare the photographic report containing details for experiment

a. Course Name: Geotechnical Engineering
b. Course Code: 03605259
c. Prerequisite: Hydraulics & Mechanics of Solids
d. Rationale: After learning Mechanics of deformable bodies and Hydraulics in 3rd semester, this subject Geotechnical Engineering means Soil Mechanics is introduced in 4th semester, as it deals with the natural material "Soil" whose behavior is somewhat intermediate between solids and fluids. Geotechnical Engineering means Soil Mechanics involves study of Soil, its behavior and application as an engineering material. Design of foundation of building, dams, towers, embankments, roads, railways, retaining wall, bridges is mainly governed by characteristics and behavior of Soil, hence this subject is very important for civil engineering students.
e. Course Learning Objective:

CLOBJ 1	Fundamental Understanding: Grasp the essential concepts of soil mechanics, including its properties, behavior, and classification systems.
CLOBJ 2	Site Investigation Techniques: Learn practical methods for soil exploration, including sampling, in-situ testing, and laboratory analysis, to assess soil properties effectively.
CLOBJ 3	Foundation Design Principles: Acquire skills in designing stable foundations for structures, considering factors such as soil bearing capacity, settlement, and load distribution.
CLOBJ 4	Slope Stability and Retaining Walls: Understand the principles of slope stability analysis and retaining wall design, including earth pressure theories and stabilization techniques.
CLOBJ 5	Geotechnical Hazards and Environmental Considerations: Identify geotechnical hazards, evaluate environmental impacts, and implement mitigation measures and sustainable practices in geotechnical engineering projects.

f. Course Learning Outcomes:

CLO 1	Identify types of rocks and subsoil strata of earth and types of Soil according to mode of deposition and mode of transportation.
CLO 2	Determine the physical and index properties of soil to estimate behaviour and other important engineering properties for given construction activities.
CLO 3	Determine Coefficient of permeability and shear parameters of soil and apply results in DAM analysis and other construction activities.
CLO 4	Able to calculate shear strength by using Mohr's Circle and Determine Shear parameters of soil by Direct Shear test.
CLO5	Able to differentiate between different Types of Foundation and demonstrate the purpose of foundation and Understand the concept of Compaction of soil and able to determine OMC & MDD of soil by proctor test.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Overview of Geology and Geotechnical Engineering** 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. Importance of soil as construction material in Civil engineering structures and as foundation bed for structures. Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.	20%	8
2	**Physical and Index Properties of Soil** 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,	30%	12

	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. Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index. Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification soil.		
3	**Permeability and Seepage** 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).	**15%**	**6**
4	**Shear Strength of Soil** Introduction, Theoretical Consideration- Mohr's Circle, 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. Measurement of Shear Strength by Direct shear and vane shear test –laboratorymethods.	**10%**	**5**
5	**Foundation** Introduction, purpose of foundation,Types of Foundation: Types of Shallow foundation: Spread foundation,Combined foundation,Raft foundation & Grillage foundationTypes of Deep foundation: Pile foundation: Classification of PilesEarthwork in foundation: Layouts/setting out for Foundation trenches, Excavation of Foundation trenches, Timbering of Foundation trenches& Dewatering of Trenches.	**15%**	**6**
6	**Compaction of soil** 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), and 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,	**10%**	**5**

	pneumatic tyred roller, Rammer and Vibrator, Difference between compaction and consolidation.		

i. Text Book and Reference Book:

1. Soil Mechanics and Foundation Engineering By B. C.Punmia
2. Soil Mechanics and Foundation Engineering By Arora .K.R | Standard Publication Distributors.
3. Soil Mechanics and Foundation Engineering By V. N.S.Murthy

a. Course Name: Geotechnical Engineering Lab

b. Course Code: 03605260

c. Prerequisite: Hydraulics & Mechanics of Solids

d. Rationale: After learning Mechanics of deformable bodies and Hydraulics in 3rd semester, this subject Geotechnical Engineering means Soil Mechanics is introduced in 4th semester, as it deals with the natural material "Soil" whose behaviour is somewhat intermediate between solids and fluids. Geotechnical Engineering means Soil Mechanics involves study of Soil, its behaviour and application as an engineering material. Design of foundation of building, dams, towers, embankments, roads, railways, retaining wall, bridges is mainly governed by characteristics and behaviour of Soil, hence this subject is very important for civil engineering students

e. Course Learning Objective:

CLOBJ 1	Identify various types of rocks and subsoil strata found within the Earth's crust.
CLOBJ 2	Demonstrate the ability to determine the physical and index properties of soil through appropriate laboratory and field testing methods.
CLOBJ 3	Determine the coefficient of permeability and shear parameters of soil through theoretical analysis, laboratory experiments, and field investigations.
CLOBJ 4	Upon completion of this course, students will be able to: Determine the shear parameters of soil through the application of Direct Shear test, including but not limited to understanding the experimental setup, conducting the test with precision, analyzing the obtained data, and interpreting the results effectively to characterize the shear behavior of soil samples.
CLOBJ 5	Identify and differentiate between various types of foundations, such as shallow foundations (including strip, pad, and raft foundations) and deep foundations (such as pile and drilled shaft foundations), considering their respective applications, advantages, and limitations and Determine the Optimum Moisture Content (OMC) and Maximum Dry Density (MDD) of soil through the Proctor Test method, demonstrating proficiency in soil compaction testing techniques and analysis.

f. Course Learning Outcomes:

CLO 1	After Learning the Course the students shall be able to: Identify types of rocks and sub soil strata of earth and types of Soil according to mode of deposition and mode of transportation.
CLO 2	Determine the physical and index properties of soil to estimate behaviour and other important engineering properties for given construction activities.
CLO 3	Determine Coefficient of permeability and shear parameters of soil and apply results in foundation analysis and other construction activities.
CLO 4	Determine Shear parameters of soil by Direct Shear test and Determine OMC & MDD of soil by proctor test.
CLO 5	Explain purpose of foundation and Types of Foundation:

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					**Examination Scheme**					**Total**
Lecture Hrs/Week	**Tutorial Hrs/ Week**	**Lab Hrs/Week**	**Hrs/Week**	**Credit**	**Internal Marks**			**External Marks**		
					T	**CE**	**P**	**T**	**P**	
-	-	2	-	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Text Book and Reference Book:

1. Soil Mechanics and Foundation EngineeringBy B. C.Punmia
2. Soil Mechanics and Foundation EngineeringBy V. N.S.Murthy
3. Soil Mechanics and Foundation EngineeringBy Arora .K.R | Standard Publication Distributors

i. Experiment List

Exp. No.	**Name of the Experiment**
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 in field by core cutter method as per IS 2720 (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 IS 2720 (Part- V

Exp. No.	Name of the Experiment
8	Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS 2720 (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 IS 2720 (Part- XVII)
11	Determine coefficient of permeability by falling head test as per IS 2720 (Part- XVII).
12	Determine shear strength of soil by direct shear test as per IS 2720 (Part-XIII) and Vane shear test as per IS 2720 (PartXXX).
13	Determine MDD and OMC by standard proctor test of given soil sample as per IS 2720 (Part-VII).

a. **Course Name:** Water Resource Engineering
b. **Course Code:** 0360561
c. **Prerequisite:** Hydraulics
d. **Rationale:** Knowing extremity of water crisis, we must appreciate water as "Nature's greatest gift". Our water requirement is rapidly increasing due to vast industrial development, population growth and changing life style. We are mostly dependent on rains as a predominant source of water. The other important source of water is the ground water which also depends to great extent on rainfall in previous years. We know that ground water table is declining rapidly due to its excessive use and misuse and also due to insufficient rainfall every year.
e. **Course Learning Objective:**

CLOBJ 1	Understand Fundamental Hydrological Concepts: Students will be able to define hydrology and explain the hydrological cycle. They will demonstrate knowledge of different methods of calculating average rainfall and comprehend factors affecting runoff and methods for computing runoff, including maximum flood discharge measurement.
CLOBJ 2	Analyze Groundwater Systems and Engineering Principles: Students will analyze the importance of groundwater, identify sources of water, and define terms related to groundwater engineering such as aquifer, porosity, and specific yield. They will evaluate various types of wells and artificial recharge methods, recognizing their significance in water resource management.
CLOBJ 3	Evaluate Storage Works and Hydraulic Structures: Students will evaluate the classification and storage zones of reservoirs, as well as factors affecting silting and control measures. They will analyze the components and construction methods of earthen and gravity dams, along with the design and function of spillways and energy dissipaters.
CLOBJ 4	Analyze Diversion Head Works and Canal Systems: Students will analyze the components and functions of weirs and diversion head works, distinguishing between different types of canals and understanding their classification and alignment within the canal network. They will evaluate canal cross-section design, lining materials, and the purpose and advantages of cross drainage works and canal regulators.

CLOBJ 5	Understand Watershed Management Principles: Students will understand the concept of a watershed and analyze its characteristics, including physiography, climate, and socio-economics. They will evaluate principles of watershed management and the role of people's participation, with a focus on cooperative societies in sustainable watershed management practices.

f. Course Learning Outcomes:

CLO 1	Estimate the surface runoff from given precipitation data. Estimate hydrological parameters.
CLO 2	Explain sources of water, Importance of ground water and present scenario.
CLO 3	Describe various types of survey investigations for reservoir planning.
CLO 4	Estimate crop water requirements of a command area and capacity of canals. Execute Minor and Micro Irrigation Schemes.
CLO 5	Select the relevant Cross Drainage works for the specific site conditions. Concept of 'watershed'.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
				Internal Evaluation			**ESE**		
Lecture Hrs/ Week	**Tutorial Hrs/ Week Lab Hrs/ Week**	**Tutorial Hrs/ Week Lab Hrs/ Week**	**C**	**T**	**CE**	**P**	**Theory**	**P**	**Total**
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Introduction to Hydrology** Hydrology: Definition and Hydrological cycle Rain Gauge: Symons rain gauge, automatic rain gauge, Methods of calculating average rainfall: Arithmetic mean, Isohyetal, and Theissen polygon method. Runoff, Factors affecting Run off, Computation of run–off Maximum Flood Discharge measurement: Rational and empirical methods, Simple numerical problems. Yield and Dependable yield of a catchment, determination of dependable yield.	**15%**	**8**

2	**Ground Water** Sources of water, Importance of ground water and present scenario, Terms related to groundwater engineering: Aquifer, Aquiclude, Aquifuge, Aquitard, porosity, Specific yield, Specific retention, storage coefficient, coefficient of permeability, coefficient of transmissibility, Yield, specific yield, Types of well :Open, Tube and flowing well - concept, location and importance, Necessity of recharging : Artificial recharging as today's need. Types of artificial recharge - Spreading method. - Pit method / khet-talavadi - Induced recharge method - Recharge well method. - Sub-surface dam. - Check dam series - Ponds - Unlined canals.	**25%**	**10**
3	**Storage Works – Dams, Reservoir and Spillways** Reservoir and its classification, Storage zones of reservoir, Silting of reservoir, factors affecting silting and control measures, Reservoir losses, Dams and its classification: Earthen dams and Gravity dams (masonry and concrete). Earthen Dams – Components with function, typical cross section, seepage through embankment and foundation and its control. Methods of construction of earthen dam, types of failure of earthen dam and preventive measures. Gravity Dams – Forces acting on dam, Theoretical and practical profile, typical cross section, drainage gallery, joints in gravity dam, concept of high dam and low dam.Spillways-Definition, function, location, types and components, Energy dissipaters.	**25%**	**10**
4	**Diversion Head Works & Canals** Weirs – components, parts, types, K.T. weir – components and construction Diversion head works – Layout, components and their function. Difference between weir and Barrage. Canals – Classification according to alignment and position in the canal network, Cross section of canal in embankment and cutting, partial embankment and cutting, balancing depth, most economical canal section. Canal lining - Purpose, material used and its properties, advantages Cross Drainage works- Aqueduct, siphon aqueduct, super passage and level crossing. Canal regulators- Head regulator, Cross regulator, Escape, Falls and Outlets.	**25%**	**10**
5	**Watershed Development** Concept of 'watershed',. Characteristic of watershed, size, shape, physiography, slope, climate, drainage, land use, vegetation, geology, hydrology, hydrogeology, socio-economics, Watershed management & people's participation. Role of co-operative society in watershed management.	**10%**	**4**

i. Text Book and Reference Book:

1. Engineering Hydrology, By K. Subramanya | Tata McGraw Hill Pub. Co. New Delhi

2. Fluid Mechanics & Hydraulics Dr.R. K. Bansal; Laxmi Publications
3. Fluid Mechanics & Hydraulics Machines, By Dr.R K Rajput | S Chand & Company Limited
4. Irrigation Engineering and Hydraulic Structures, By S K Garg

a. Course Name: Minor Project
b. Course Code: 03605264
c. Prerequisite: Zeal to learn the subject
d. Rationale: The main aim of the subject is to transform theoretical knowledge into practical.
e. Course Learning Objective:

CLOBJ 1	Students will develop the ability to identify and select a topic relevant to the civil engineering field, considering current trends, challenges, and emerging technologies, to demonstrate an understanding of the diverse areas within civil engineering practice.
CLOBJ 2	Students will learn to recognize and report on modern advancements, innovations, and breakthroughs in civil engineering, including new materials, construction techniques, sustainable practices, and infrastructure projects, fostering an awareness of contemporary industry developments.
CLOBJ 3	Students will become familiar with various ethical, legal, environmental, and societal issues relevant to professional engineering practice, including codes of conduct, sustainability considerations, regulatory requirements, and social responsibilities, to prepare for ethical decision-making in their careers.
CLOBJ 4	Students will acquire proficiency in communicating and presenting technical information using modern presentation tools and techniques, such as multimedia presentations, graphical representations, and digital platforms, to effectively convey ideas, analyses, and findings to diverse audiences in the civil engineering community.
CLOBJ 5	Students will acquire the quality of writing without plagiarism.

f. Course Learning Outcomes:

CLO 1	Identify and select any topic of interest to civil engineering community.
CLO 2	Identify and report modern developments in civil engineering.
CLO 3	Recognize various issues related to professional engineering practice.
CLO 4	Effectively present acquired information using a variety of modern presentation tools.
CLO 5	Gain the exposure to work in team.

g. Teaching & Examination Scheme:

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	50	-	-	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Text Book and Reference Book:

1. "Strength of Materials" by R. S Khurmi.
2. "A textbook Strength of Materials" by R.K.Bansal.
3. "Strength of Materials" by Dr. B.C. Punmia.
4. "Strength of Materials" by Timoshenko.

i. Mapping of Experiment List with Course Learning Outcomes:

Exp. No.	Name of the Experiment	CLO1	CLO2	CLO3	CLO4
1	Identification of problem and Framing of Problem Statement.	✓			
2	Problem Analysis		✓		
3	Feasibility of proposed solution		✓		
4	Adherence to Action plan			✓	
5	Content appropriateness			✓	
6	Technical knowledge and awareness related to the project				✓
7	Project Report and Presentation				✓

a. Course Name: Employability Skills
b. Course Code: 03693251
c. Prerequisite: Inclination to learn the importance of critical thinking & Interview Skills.
d. Rationale: Cracking aptitude is the first step towards cracking placements and competitive exams
e. Course Learning Objective:

CLOBJ 1	Inculcate critical thinking.
CLOBJ 2	Gear up them for Campus Placement & Competitive Exams.
CLOBJ 3	Builds up their confidence level
CLOBJ 4	Create ways to present the points in Group Discussions & how it plays an important role in cracking interviews.(selection process)
CLOBJ 5	Grasping the knowledge for preparing resume.

f. Course Learning Outcomes:

CLO 1	Application of the knowledge learnt in resume building
CLO 2	Building confidence & cracking interviews.
CLO 3	Improve competency in Competitive exams through various topics learnt
CLO 4	Selling skills are focused helping them to become an entrepreneur in future.
CLO 5	Apply appropriate formatting and language conventions to resume writing.

g. Teaching & Examination Scheme:

Teaching Scheme			Credit	Examination Scheme					Total
				External		Internal			
Lect. Hrs / Week	Tut Hrs/ Week	Lab Hrs/		T	P	T	CE	P	
2	0	-	0	-	-	-	100	-	100

Lect- Lecture, **Tut** - Tutorial, **Lab** - Lab, **T** - Theory, **P** - Practical, **CE** – Continuous Evaluation

Note: 15 Hours of additional sessions will be taken (within the semester) to match up 30 hours content.

h. Course Content:

Sr.	Topic	Weightage	Teaching Hrs.

1	*Critical Thinking -Case Studies:* Critical thinking is based on pure logical thinking. Solving a critical reasoning question requires nothing but reasoning ability of the candidate. This session deals with the basic logic involved in critical reasoning questions and covers all the type of questions in CT. Worksheets would be provided to students for further practice.	10%	6
2	*Coding & decoding, Alphabetical Series* • Understand various types of questions which they can come across in the given topic. • Tips and tricks to solve questions on the above mentioned topics.	8%	4
3	*Analogy and odd man out* • Understand various types of questions which they can come across in the given topic. • Tips and tricks to solve questions on the above mentioned topics.	8%	4
4	*Direction sense :* • Able to solve all the direction sense question in competitive exams and aptitude exams of different companies	8%	4
5	*Blood relations:* • Able to solve all the Blood Relation questions in competitive exams and aptitude exams of different companies	8%	4
6	*Paper Folding* • In this section of non verbal reasoning a figure is obtained by folding a piece of paper containing same design along the dotted line.	4%	2
7	*Seating Arrangement* • Candidates are required to arrange the objects either in a row or circle on the basis of information given • Questions are presented in distorted form to create confusion and to taste the candidate's ability to analyze the information step by step in order to answer the question	3%	2
8	*Completion of Figure* • In each of the following figure, a part of figure is missing. Find out from the given options, the right figure to fit in the missing figure	3%	2
9	*Completion of Series* • In these questions a series of figures is given as problem figure & the candidate are asked to select one of the figurefrom the set of answer figure which will continue the given sequence.	8%	4
10	*Entrepreneurship skills (SELLING THE CONCEPT):* This topic will help students develop the skills necessary to develop into Self- Sufficient business leaders through Entrepreneurship studies.	4%	2
11	*Resume Building*		

	The students will have a proper understanding of the content and how it is to be presented in resume	8%	4
12	*Group Discussion* It is a systematic exchange of information, views and opinions about a topic, problem, issue or situation among the members of a group who share some common objectives.	14%	8
13	*Interview Skills* Students are prepared for their interviews, question and answers, how to react on some unique questions, body language & grooming is taken into account.	14%	8
	Total	100	60

Continuous Evaluation:

It consists of

1. Phase I Exam-35 Marks(Hybrid or Offline Mode)
2. Phase II Exam -35 Marks (Hybrid or Offline Mode)
3. Activities – (Listening and Speaking) -10+10=20 Marks
4. Attendance -10 Marks

The passing marks for Continuous Evaluation will be 40 out of 100.There will not be any re-test.

i. Text Book and Reference Book:

1. Verbal & Non-Verbal Reasoning, Indu Sijwali & B.S. Sijwali
2. Contributor Personality Development by i-become
3. Critical Thinking Skills for Engineers

a. Course Name: Design of Concrete Structure

b. Course Code: 03605301

c. Prerequisite: Engineering Mechanics, Concrete Technology, Mechanics of Materials & Geotechnical Engineering.

d. Rationale: Most of the civil Engineering structures are normally made up of either Steel Sections or of Reinforced Cement Concrete. In Fifth Semester, Design of Steel Structure has been covered and in this course Design of reinforced Concrete Structures will be taught as per IS 456 – 2000. Most of the residential buildings, Commercial and Public Buildings are designed using R. C. C. due to their long durability and flexibility in size and shape of structures and its members. So, Design of R.C.C. components like slab, beam, column and footing using Limit State Method are required to be understood. Also, precise and correct detailing of reinforcement in structure drawing is also required in order to execute smooth construction of RCC structures. Hence this course will provide a detailed knowledge of reinforcement as per IS 456-2000, SP 34 and SP 16.

e. Course Learning Objective:

CLOBJ 1	Develop proficiency in RCC design methodologies, integrating the properties of concrete and steel for structural design.
CLOBJ 2	Demonstrate competence in analyzing and designing Singly Reinforced Rectangular Sections (SRRS), Doubly Reinforced Rectangular Sections (DRRS), and flange beams under flexure.
CLOBJ 3	Acquire skills in designing various types of slabs, including one-way, two-way, and continuous slabs, considering structural requirements and load distributions.
CLOBJ 4	Gain expertise in determining the minimum shear reinforcement necessary to ensure structural integrity and safety.
CLOBJ 5	Verify the structural adequacy of slabs and beams by checking for deflection and cracking, ensuring compliance with design standards and specifications and Master the analysis and design processes for RCC columns and isolated footings, applying principles of structural engineering to ensure stability and load-bearing capacity.

f. Course Learning Outcomes:

CLO 1	Develop methods of RCC design using concrete and steel properties.
CLO 2	Analyze & Design Singly Reinforced Rectangular Section (SRRS) and Doubly Reinforced Rectangular Section (DRRS) and flange beam under Flexure.
CLO 3	Design of slabs (One way, Two way and continuous)
CLO 4	Determine minimum shear reinforcement.
CLO 5	Check: Deflection, Cracking for Slab & Beam and Perform analysis and design for R. C. C. Column and Isolated Footing.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme										
Teaching Scheme					**Examination Scheme**					**Total**
Lecture Hrs/Week	**Tutorial Hrs/ Week**	**Lab Hrs/Week**	**Hrs/ Week**	**Credit**	**Internal Marks**			**External Marks**		
					T	**CE**	**P**	**T**	**P**	
3	-	-	-	3	20	20	-	60		100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Course Content:

Course Content **W - Weightage (%) , T - Teaching hours**

Sr.	Topics	W	T
1	**Limit State Method** Reinforced Cement concrete, necessity of steel in concrete, normal location of Tension steel in beams, slabs &in footing, Limit State, Limit State of Collapse – Flexure, Shear, Compression, Torsion, Limit State of Serviceability, Deflection, Cracking., Characteristic Strength of Concrete and Steel, Partial Safety Factor for Concrete and Steel, Characteristic or Working Load, Partial Safety Factor for Load, Limit State or Factored Load.	10	3
2	**Limit State of Collapse: Flexure** Assumptions for Limit State of Collapse due to Flexure, Stress and Strain Diagram of SRRS, Equation (No Derivation) related to maximum depth of N.A- Xumax, Actual Depth of N.A- Xu , Limiting Moment of Resistance- Mulim , Actual Moment of Resistance- Mu , maximum % limiting steel – Ptlim as per IS 456-2000 & Design Aid SP-16,Balance Section, Under Reinforced Section, Over Reinforced Section, Minimum and Maximum steel in beam and in slab and clear cover as per IS 456- 2000(Clause 26.4, 26.5, Table 16), Design problem to find size of SRRS Beam and steel area for limit state Bending Moment, Numerical related to 1.6 to 1.9 using SP-16-Flexure Chart and Flexure Table., Condition for Doubly Reinforced Section, Equation stated in SP-16 for D.R.S., Conditions for the beam to act as Tee 2.11Beam.,Width of Flange as per IS 456- 2000 (Clause 23.1.2) 2.13Equation regarding Tee Beam from IS 456-2000 (Annexure G)., Numerical to find Limiting Moment of Resistance of Tee Beam using equation of IS 456-2000 and using Flexure Table of SP-16 regarding Tee beam.	30	16
3	**Design of Slab** Slab –Spanning in Shorter Span, Steel for Bending Moment, Distribution Steel, Depth of Slab as per Deflection, Effective span as per IS 456-2000 (Clause 22.2), Dead Load, Live Load on Slab, Shear and Cracking in Slab., Numerical to design and detail Simply Supported One Way Slab for Bending Moment , Shear , Deflection , Cracking for the assigned Floor Finish & Live Load., Numerical to design and detail One Way Continuous Slab for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M and S.F coefficients (Table 12 & 13),Numerical to design and detail Two Way Simply Supported Slab with and without Torsion Steel for Bending Moment, Shear, Deflection, Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M coefficients (Annexure D), *** Numerical in 2.1 to 2.4, use of SP-16 is permitted.	20	8
4	**Limit State of Collapse: Shear** Diagonal Tension Crack in Beam due to Shear, Equation related to Limit State of Collapse due to Shear as per IS 456-2000 (Clause 40)., IS 456-2000 clauses(26.5.1.5 & 1.6) related to Minimum and Maximum Spacing of Stirrups , minimum shear reinforcement, Clauses (40.2) related to Limit State of Collapse due to Shear for Slab in IS 456-2000,Numerical to check the slab for shear Introduction to serviceability limit state check.	10	4
5	**Limit State of Serviceability** Span to effective depth ratio, Modification factor for SRRS as per IS 456-2000(Clause 23.2.1, 24.1),Numerical to check Slab & Beam for Deflection, Maximum and Minimum spacing of Main steel and distribution steel in slab, Maximum and minimum spacing of bars in beam (Clause 26.3),Numerical to check spacing of steel in slab for cracking, Equation to find Development Length of IS 456 -2000(Clause 26.2.1,), Anchoring of	10	3

	reinforcing bars in Tension and in Compression (Clause 26.2.2) Clauses related to Lap Length of Is 456-2000 (Clause 26.2.5.1)		
6	**Axially Loaded Short Column and Isolated Footing** Column, slenderness Limit for Short & Long Column, Minimum Eccentricity in column, condition for axially loaded column, equation for axially loaded short column of IS 456-2000(Clause 25 & 39.3). Clauses (26.5.3.1, 26.5.3.2(C ,1-2)) of IS 456-2000 related to % compression steel , numbers of compression bars and its spacing, lateral ties – diameter and pitch. SBC of Soil, Types of Footing like Isolated foundation, combined footing, raft Foundation, pile foundation. Numerical to design & to detail Isolated Pad and Slope Foundation for assigned limit state compression load of column and SBC of soil for Bending Moment, One Way Shear, Punching or Double Shear, Load Transfer from Column to Footings (Clause 34)	**20**	**8**

i. Text Book and Reference Book:

1. Advanced Reinforced Concrete By P.C. Vargese | Prentice Hall of India
2. Illustrated Design of Reinforced Concrete Buildings By S. R. Karve and V. L. Shah | Structures Publishers
3. IS CODES: 456, 875, 1893, 4326, 13920, 3370, 4995(I & II)
4. Reinforced Concrete Vol 1By H J Shah | Charotar Publishers
5. S.P. – 16 Design Aids to IS 456' By BIS | New Delhi

a. Course Name: Design of Concrete Structure Lab

b. Course Code: 03605302

c. Prerequisite: Engineering Mechanics, Concrete Technology, Mechanics of Materials & Geotechnical Engineering

d. Rationale: Most of the civil Engineering structures are normally made up of either Steel Sections or of Reinforced Cement Concrete. In the Fifth Semester, the Design of Steel Structures has been covered, and in this course, the Design of reinforced Concrete Structures will be taught as per IS 456 – 2000. Most of the residential buildings, Commercial and Public Buildings, are designed using R. C. C. due to their long durability and flexibility in size and shape of structures and their members. So, the Design of R.C.C. components like slab, beam, column and footing using the Limit State Method is required to be understood. Also, precise and correct reinforcement detailing in structure drawings is required to execute the smooth construction of RCC structures. Hence, this course will provide a detailed knowledge of reinforcement as per IS 456-2000, SP 34 and SP 16.

e. Course Learning Objective:

CLOBJ 1	Develop methods for reinforced concrete (RCC) design utilizing concrete and steel properties effectively.
CLOBJ 2	Analyze and design singly reinforced rectangular sections (SRRS), doubly reinforced rectangular sections (DRRS), and flange beams under flexure.
CLOBJ 3	Design slabs, including one-way, two-way, and continuous systems, considering structural requirements and load distributions.
CLOBJ 4	Determine the minimum shear reinforcement required for reinforced concrete elements.

CLOBJ 5	Check deflection and cracking for slabs and beams to ensure structural integrity and serviceability and Perform analysis and design for reinforced concrete columns and isolated footings, meeting strength and stability criteria.

f. Course Learning Outcomes:

CLO 1	Develop methods of RCC design using concrete and steel properties.
CLO 2	Analyse & Design Singly Reinforced Rectangular Section (SRRS) and Doubly Reinforced Rectangular Section (DRRS) and flange beam under Flexure.
CLO 3	Design of slabs (One-way, Two-way and continuous).
CLO 4	Determine minimum shear reinforcement.
CLO 5	Check Deflection, Cracking for Slab & Beam and Perform analysis and design for R.C.C. Column and Isolated Footing.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					
					Internal Marks			External Marks		Total
Lecture Hrs/ Week	Tutorial Hrs/ Week	Lab Hrs/ Week	Hrs/ Week	Credit	T	CE	P	T	P	
-	-	4	-	2	-	-	60	-	40	100

h. Experiment List:

Exp. No.	Name of the Experiment
1	Draw One Way Simply Supported Slab in Plan and Longitudinal cross-section along a shorter span with reinforcement and its bent-up details in an A2 Size Drawing sheet. Draw One Way Simply Supported Slab in Plan and Longitudinal cross-section along shorter span with reinforcement and its bent-up details in A2 Size Drawing sheet
2	Draw One Way Continuous Slab in Plan and in Longitudinal cross section having five equal spans with reinforcement and its curtailment and its bent-up details in A2 Size Drawing Sheet Draw One Way Continuous Slab in Plan and in Longitudinal cross section having five equal spans with reinforcement and its curtailment and its bent-up details in A2 Size Drawing Sheet
3	Draw Two Way Simply Supported Slab with Torsion Steel in Plan having longitudinal cross sections along shorter and longer span with reinforcement , bent up bars details in A2 Size Drawing Sheet

Draw Two Way Simply Supported Slab with Torsion Steel in Plan having longitudinal cross sections along shorter and longer span with reinforcement, bent up bars details in A2 Size Drawing Sheet

4 A. Draw Plan and Cross Section Elevation of RCC Column having Isolated Slope Foundation with reinforcement details. B. Draw Longitudinal Cross Section Elevation and a Section along Length of Doubly Reinforced Beam with shear reinforcement (Above two in A2 Size Drawing Sheet)

Draw Plan and Cross Section Elevation of RCC Column having Isolated Slope Foundation with reinforcement details.

Draw Longitudinal Cross Section Elevation and a Section along Length of Doubly Reinforced Beam with shear reinforcement

(Above two in A2 Size Drawing Sheet)

5 Prepare following sketches in sketch book: A. Longitudinal and cross section elevation along Length of Singly Reinforced Supported Beam B. Longitudinal and cross section elevation along Length of Cantilever Beam C. Longitudinal and cross section elevation along Length of Simply Supported Tee Beam D. Plan & c/s elevation along shorter span of One Way Simply Supported Slab E. Plan & c/s elevation along shorter span& longer span of Two Way Simply Supported Slab without tors

Prepare following sketches in sketch book:

Longitudinal and cross section elevation along Length of Singly Reinforced Simply Supported Beam Longitudinal and cross section elevation along Length of Cantilever Beam Longitudinal and cross section elevation along Length of Supported Tee Beam

Plan & c/s elevation along shorter span of One Way Simply Supported Slab

Plan & c/s elevation along shorter span& Longer span of Two Way Simply Supported Slab without torsion steel

Plan of Circular Slab with reinforcement

Column and Beam ductile connection

Column to Column Connection when the size of the Upper column is reduced

Circular Water Tank with flexible joint

Cantilever Retaining Wall

Reinforcement details of Shear Wall

Reinforcement details of R C C Dome Dog Legged Stair Case

6 Prepare design report having designs of First, Second, Third, & Fourth Sheet.

Prepare design report having designs of First, Second, Third, & Fourth Sheet.

7 Visit nearby residential and commercial construction and prepare a brief with sketches/photographs of the site, including reinforcements, a structure drawing of the site, concrete work, etc.

Visit nearby residential and commercial construction and prepare brief having sketches/photographs of site including reinforcements, structure drawing of site, concrete work etc.

i. Text Book and Reference Book:

1. Advanced Reinforced Concrete By P.C. Vargese | Prentice Hall of India
2. Illustrated Design of Reinforced Concrete Buildings(GF+3 storeyed) By Shah V. L. &Karve S. R. | Structures Publications
3. IS CODES: 456, 875, 1893, 4326, 13920, 3370, 4995(I & II)
4. Reinforced Concrete Vol 1 By H J Shah | Charotar Publishers

a. **Course Name:** Public Health Engineering
b. **Course Code:** 03605303
c. **Prerequisite**: Hydraulics and Water Resource Engineering
d. **Rationale**: Water is very important element in civilization. Social life from the ancient times developed on the bank of water sources. If society wants to make remarkable growth, the mental as well as social health play vital role. For that purpose and to maintain the hygiene Pure, potable and palatable water needs to be supplied to the society. Water must be collected and disposed off in nature by giving proper treatment, so the natural flora and fauna will not get affected by sewage disposal.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of water supply systems, including the sources of water, demand estimation techniques, and quality assessment methods.
CLOBJ 2	Analyze the various purification processes involved in treating water, such as aeration, coagulation, sedimentation, filtration, and disinfection, to ensure safe drinking water standards are met.
CLOBJ 3	Evaluate the design and operation of water conveyance and distribution systems, including pipe materials, joint types, valve selection, and distribution methods, to ensure efficient water supply to communities
CLOBJ 4	Examine the principles of building sanitation and sewerage systems, including plumbing design, sewer layouts, and sewage treatment processes, to mitigate environmental pollution and safeguard public health
CLOBJ 5	Explore advanced techniques in sewage treatment and waste management, including biological processes, sludge management, and recycling methods, to promote sustainable practices and minimize the environmental impact of wastewater disposal.

f. **Course Learning Outcomes:**

CLO 1	Select appropriate treatment to raw water useful for domestic as well as construction purpose.
CLO 2	Calculate and Estimate the impurities present in water used for domestic as well as construction works.
CLO 3	Maintain the pipe-network for water supply and Sewage disposal effectively.
CLO 4	Prepare lay out plan and maintain water distribution and sewer-networks.

CLO 5	Test raw water as per the standard practices and Evaluate the characteristics and suggest treatment of sewage.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Sources, Demand and Quality of water** Water supply schemes - Objectives, components, Sources of water: Surface and Subsurface sources of water, Intake Structures, Definition and types, Factors governing the location of an intake structure, Types of intakes. Demand of water: Factors affecting rate of demand, Variations of water demands, Forecast- ing of population, Methods of forecasting of population, (Simple problems on forecasting of population), Design period, Estimating of quantity of water supply required for city or town.Quality of water: Need for analysis of water, Characteristics of waterPhysical, Chemical and Biological, Testing of water for Total solids, hardness, chlorides, dissolved Oxygen, pH, Fluoride, Nitrogen and its compounds, Bacteriological tests, E coli, B coli index, MPN, Sampling of water, Water quality standards as per IS 10500.	25%	10
2	**Purification of water** Purification of Water: Objectives of water treatment, Aeration- objects and methods of aeration, Plain sedimentation, Sedimentation with coagulation, principles of coagulation, types of coagulants, Jar Test, process of coagulation, types of sedimentation tanks, Clariflocculator. Filtration mechanization of filtration, classification of filters: slow sand filter, rapid sand filter, pressure filter. Construction and working of slow sand filter and rapid	20%	8

	sand filter, operational problems in filtration. Disinfection: Objects, methods of disinfection, Chlorination- Application of chlorine, forms of chlorination, types of chlorination practices, residual chlorine and its importance, Flow diagram of water treatment plants. Miscellaneous water Treatments: Introduction to water softening, Defluoridation techniques.		
3	**Conveyance and Distribution of water** Conveyance: Types of Pipes used for conveyance of water, choice of pipe material, Types of joints & Types of valvestheir use, location and function on a pipeline. Distribution of water: Methods of distribution of water-Gravity, pumping, and combined system, Service reservoirs - functions and types, Layouts of distribution of Water-Dead end system, grid iron system, circular system, radial system; their suitability, advantages and disadvantages.	**20%**	**8**
4	**Domestic sewage and System of Sewerages** Building Sanitation: Necessity of sanitation, Necessity to treat domestic sewage, Definitions - Sewage, sullage, types of sewage. Definition of the terms related to Building Sanitation- Water pipe, Rain water pipe, Soil pipe, Sullage pipe, Vent pipe. Building Sanitary fittings-Wa- ter closet – Indian and European type, flushing cistern, wash basin, sinks, Urinals. Traps- types, qualities of good trap. Systems of plumbing - one pipe, two pipe, single stack, choice of system. Principles regarding design of building drainage, inspection and junction chambers, their necessity, location, size and shape Systems of Sewerage and Sewer Appurtenances: Types of Sewers, Systems of sewerage, selfcleansing velocity and non- scouring velocity, Laying, Testing and maintenance of seers, Manholes and Drop Manhole-component parts, location, spacing, construction details, Sewer Inlets, Street Inlets.	**25%**	**10**
5	**Characteristics and treatment of Sewage** Analysis of sewage: Characteristics of sewage, B.O.D., C.O.D. and its significance. Central Pollution Control Board Norms for discharge of treated sewage, Objects of sewage treatment and flow diagram of conventional sewage treatment plant. Treatment of Sewage: Screening, Types of screens, Grit removal, Skimming, Sedimentation of sewage, Aerobic and anaerobic process, Sludge digestion, trickling filters, Activated sludge process, Disposal of sewage, Oxidation pond, Oxidation ditch. Septic tank, Recycling and Reuse of domestic waste.	**10%**	**6**

i. Text Book and Reference Book:

1. Environmental engineering volume 1 and 2 By B.C.Punamia | laxmi publication

2. Water Supply and Sanitary Engineering By G.S. Birdie and J.S. Birdie | Dhanpat Rai,Publishing Co.

3. Environmental Pollution Control Engineering, By Rao C.S. | New Age International

4. Water supply and sanitary engineering By G.S.Birdie and J.S.Birdie

5. 10. Environmental Engineering By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous | McGraw-Hill

a. Course Name: Public Health Engineering Lab

b. Course Code: 03605304

c. Prerequisite: Hydraulics and Water Resource Engineering

d. Rationale: Water is very important element in civilization. Social life from the ancient times developed on the bank of water sources. If society wants to make remarkable growth, the mental as well as social health play vital role. For that purpose and to maintain the hygiene Pure, potable and palatable water needs to be supplied to the society. Water must be collected and disposed off in nature by giving proper treatment, so the natural flora and fauna will not get affected by sewage disposal.

e. Course Learning Objective:

CLOBJ 1	Water Quality Assessment: Develop proficiency in assessing key water quality parameters such as pH, turbidity, residual chlorine, suspended solids, dissolved solids, and dissolved oxygen in both potable water and sewage samples.
CLOBJ 2	Practical Laboratory Skills: Acquire hands-on experience in conducting laboratory tests and field measurements to analyze water samples, including techniques for pH measurement, turbidity analysis, residual chlorine titration, and determination of suspended and dissolved solids.
CLOBJ 3	Understanding Water Treatment Processes: Gain insight into the principles and operation of water treatment processes by participating in field visits to water treatment plants. Evaluate the efficiency and effectiveness of various treatment methods in ensuring safe and clean drinking water supply.
CLOBJ 4	Coagulation Optimization: Learn to perform jar tests to determine the optimal dosage of coagulants for raw water samples, emphasizing the importance of coagulation in removing suspended particles and impurities from water.
CLOBJ 5	Sewage Characterization and Treatment: Develop skills in analyzing sewage samples to assess biochemical oxygen demand (B.O.D), chemical oxygen demand (C.O.D), pH, suspended solids, dissolved solids, and dissolved oxygen levels. Understand the significance of these parameters in evaluating sewage quality and treatment efficiency.

f. Course Learning Outcomes:

CLO 1	Select appropriate treatment to raw water useful for domestic as well as construction purpose.
CLO 2	Calculate and Estimate the impurities present in water used for domestic as well as construction works.
CLO 3	Maintain the pipe-network for water supply and Sewage disposal effectively.
CLO 4	Prepare lay out plan and maintain water distribution and sewer-networks.
CLO5	Test raw water as per the standard practices and Evaluate the characteristics and suggest treatment of sewage.

j. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	30	-	20	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

k. Text Book and Reference Book:

1. Environmental engineering volume 1 and 2 By B.C.Punamia | laxmi publication
2. Water Supply and Sanitary Engineering By G.S. Birdie and J.S. Birdie | Dhanpat Rai,Publishing Co.
3. Environmental Pollution Control Engineering, By Rao C.S. | New Age International
4. Water supply and sanitary engineering By G.S.Birdie and J.S.Birdie
5. Environmental Engineering By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous | McGraw-Hill

l. Experiment List

Exp. No.	Name of the Experiment
1	Determine pH value of given sample of water.
2	Determine Young's Modulus of wire of Given Material.
3	Determine residual chlorine in a given sample of water.
4	Determine suspended, dissolved solids and total solids of given sample of water.
5	Determine the dissolved oxygen in a sample of water.
6	Undertake a field visit to water treatment plant and prepare a report.
7	Determine the optimum dose of coagulant in a given raw water sample by jar test.
8	Draw sketches of various valves used in water supply pipe line.
9	Draw a sketch of one pipe and two pipe system of plumbing .
10	Determine B.O.D. of given sample of sewage.
11	Determine pH value of given sample of sewage.

Exp. No.	Name of the Experiment
12	Determine suspended solids dissolved & total solids for sample of sewage.
13	Determine the dissolved oxygen in the given sample of sewage.
14	Determine C.O.D. of given sample of sewage.
15	Prepare a report of a field visit to sewage treatment plant .

Semester 5

a. **Course Name:** Estimating, Costing and Valuation
b. **Course Code:** 03605305
c. **Prerequisite:** Building Planning and Drawing and Construction Materials
d. **Rationale:** Construction industry projects are typically cost intensive. Specifications of the construction items greatly influence the project cost. Further, construction equipment hires charges wherever applicable and labour costs also play a significant role in cost estimation of construction projects. Hence, accurate calculation of quantities of works, proper framing of specifications becomes even more important. Likewise, resale of properties holds a significant market in Real estate industry. Real estate prices historically have always followed an upward trajectory. Predicting the market value of pre-existing property especially in a volatile market is very difficult. Knowledge of valuation and factors affecting valuation of property becomes handy in dealing in preexisting construction projects.
e. **Course Learning Objective:**

CLOBJ 1	Comprehend the principles of estimating and costing in civil engineering, including approval procedures and budget provision.
CLOBJ 2	Differentiate between types of estimates and understand their applications, including approximate estimates for various projects and detailed estimates for precise calculations.
CLOBJ 3	Recognize the roles and responsibilities of estimators and apply standard formats for measurement and abstraction.
CLOBJ 4	Apply methods of estimation such as service unit method and plinth area rate method, and conduct rate analysis considering factors like lead, lift, and overhead charges.
CLOBJ 5	Utilize valuation principles to assess civil engineering projects, understanding cost, price, value, and factors affecting valuation such as depreciation and obsolescence.

f. **Course Learning Outcomes:**

CLO 1	Select modes of measurements for different items of works.
CLO 2	Prepare approximate estimate of a civil engineering works.
CLO 3	Prepare detailed estimate of a civil engineering works.

CLO 4	Justify the rate for given items of work using rate analysis techniques.
CLO 5	Illustrate the factors affecting the value of property and rent fixation and Use relevant software for estimating the quantities and cost of items of works.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	2	0	5	20	20	30	60	20	150

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Fundamentals of Estimating and Costing Estimating and Costing –** Meaning, purpose, administrative approval, Technical Sanction and Budget provision. Types of estimates – Approximate and Detailed estimate Types and Uses of Estimates: Revised estimate, Supplementary estimate, Repair and maintenance estimate, renovation estimate. Roles and responsibility of Estimator. Checklist of items in load bearing and framed structure. Standard formats of Measurement sheet, Abstract sheet, Face sheet. Modes of measurement and desired accuracy in measurements for different items of work as per IS:1200. Rules for deduction in different category of work as per IS:1200. Description / specification of items of building work as per PWD /DSR	10%	6
2	**Approximate Estimates:** Approximate estimate- Definition, Purpose. Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical Bay method, Approximate quantity method (with simple numerical) Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects.	20%	8
3	**Detailed Estimate:** Detailed Estimate- Definition and Purpose, Data required for detailed estimate - Civil cost, GST, Contingencies, Supervision charges, Agency charges,	25%	10

	Procedure for preparation of detailed estimate- Taking out quantities and Abstracting. Methods of Detailed Estimate- Unit quantity method and total quantity method (with simple numerical) Long wall and short wall method, Centre line method Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc. Prime cost, Provisional sum, Provisional quantities, Bill of quantities, Spot items or Site items.		
4	**Estimate for Civil Engineering Works:** Earthwork - Quantities for roads, Embankment and canal by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method. Detailed estimate for septic tank, Community well. Use of computer /software's / programs for detailed estimate Preparation of Civil Engineering Works.	**25%**	**8**
5	**Rate Analysis Rate Analysis:** Definition, purpose and importance. Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit, Procedure for rate analysis. Task work- Definition, types. Task work of different skilled labour for different items. Categories of labor's, their daily wages, types and number of labors for different items of work. Transportation charges of materials - Lead and Lift, hire charges of machineries and equipment's Preparing rate analysis of different items of work pertaining to buildings and roads	**10**	**4**
6	**Valuation of Civil Engineering projects:** Cost, Price and Value, Types of property and Objects of valuation, Depreciation and Obsolescence– V Valuation of Civil ,Different forms of Value ,Valuation tables and Valuation methods for property and land, Types of rents and fixing standard rents Engineering projects	**10**	**6**

i. Text Book and Reference Book:

1. "Estimation and Costing' By B. N Dutta | UBS Publishers' Distributors Pvt. Ltd.
2. 2. Elements of Estimating & Costing By S.C.Rangwala | Charotar Publications
3. 3. A textbook of Estimating and Costing By G.S.Birdie

a. **Course Name:** Advance Construction Technology
b. **Course Code:** 03605307
c. **Prerequisite:** Construction Materials and Concrete Technology
d. **Rationale:** The course is designed to learn some advanced aspects of construction technology. Also the subject gives details about faster completion of project works using modern techniques, use of modern and waste materials, and through mechanized construction. This

course has been designed so that diploma engineers would be able to use advanced construction technology. In today's times the construction activities are undergoing lots of changes/developments due to internal and globalized market demands of quality and faster completion of project works using modern techniques, use of modern and waste materials, and through mechanized construction.

e. **Course Learning Objective:**

CLOBJ 1	Upon completion of the course, students will demonstrate the ability to effectively utilize appropriate materials in the advanced construction of structures, integrating theoretical knowledge with practical application to achieve desired outcomes.
CLOBJ 2	By the end of this course, students will be able to effectively select and apply appropriate methods of concreting and equipment based on the specific requirements and characteristics of various types of construction projects. They will develop the knowledge and skills necessary to analyze construction specifications, assess site conditions, and choose suitable concreting techniques and equipment to ensure the successful execution of concrete works in diverse construction settings. This includes understanding the principles of concrete placement, consolidation, and finishing, as well as the selection and operation of equipment such as concrete pumps, mixers, vibrators, and formwork systems.
CLOBJ 3	Upon completion of this course, students will be able to apply advanced construction methods tailored to specific site conditions, demonstrating proficiency in analyzing site characteristics and selecting appropriate construction techniques to optimize efficiency, safety, and sustainability.
CLOBJ 4	Select suitable hoisting and conveying equipment for a given situation. This objective encompasses the ability to analyze various scenarios and determine the appropriate hoisting and conveying equipment based on factors such as load requirements, site conditions, safety considerations, and operational efficiency. Students will develop the skills necessary to evaluate different types of equipment, understand their capabilities and limitations, and make informed decisions to ensure effective material handling in industrial and construction settings.
CLOBJ 5	Identify and evaluate advanced equipment necessary to effectively address specific site conditions, demonstrating comprehensive understanding of equipment selection criteria and their application in various contexts.

f.Course Learning Outcomes:

CLO 1	After Learning the Course the students shall be able to: Use relevant materials in advanced construction of structures.
CLO 2	Use relevant methods of concreting and equipment according to type of construction.
CLO 3	Apply advanced construction methods for given site conditions.
CLO 4	Select suitable hoisting and conveying equipment for a given situation.
CLO 5	Identify advanced equipment required for a particular site condition.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h.Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Advanced Construction Materials:** Fibres: Use and properties of steel, polypropylene, carbon and glass fibres Plastics: Use and properties of PVC, RPVC, HDPE, FRP, GRP. Miscellaneous Materials: Properties and uses of acoustics materials, wall claddings, plasterboards, micro-silica, waterproofing materials, adhesives.Use of waste products and industrial by products in bricks, blocks, concrete and mortar	10%	6
2	**Advanced Concreting Methods and Equipments:** Ready Mix Concrete: Necessity and use of ready mix concrete. Products and equipments forready mix concrete plant. Conveying of ready mix concrete, transit mixers. Vibrators for concrete consolidation: Internal, needle,surface, platform and form vibrators. Underwater Concreting: Procedure and equipments required for Tremie method, Dropbucket method. Properties, workability and water cement ratio of the concrete. Special concrete: procedure and uses of special concretes: Roller compacted concrete, Self-compacting concrete (SCC), Steel fibre reinforced concrete, Foam concrete, shotcreting.	20%	8
3	**Advanced Technology in Constructions:** Construction of bridges and flyovers: Equipments and machineries required for foundationand super structure. Construction of multistoried Building: Equipments and machinery required for constructionof multistoried building such as use of lifts, belt conveyers, pumping of concrete.Prefabricated construction: Methods of prefabrication, Plant fabrication and site fabrication,All prefabricated building elements such as wall panels, slab panels, beams, columns, door and window frames etc. Equipments and machineries used for placing and jointing	25%	10

	ofprefabricated elements.Strengthening of embankments by soil reinforcing techniques using geo-synthetics		
4	**Hoisting and Conveying Equipments:** Hoisting Equipments: Principles and working of Derrick-Pole, Gin Pole, Crane, Power driven scotch derrick crane, Hand operated crane, Locomotive crane, Tower crane, Lattice Girder, Winches, Elevators, ladders. Crawler cranes, Truck mounted cranes, Gantry cranes, Mastcranes. Conveying Equipments: Working of belt conveyers, types of belts and conveying mechanism.Capacity and use of dumpers, tractors and trucks.underpass	**20%**	**8**
5	**Miscellaneous Machineries and Equipments:** Excavation Equipment's: Use, working and output of following machinery – bull dozers, scrapers, graders, Clam Shell, trenching equipment, Tunnel boring machine, Wheel mounted belt loaders, power shovels, JCB, and drag lines.Compacting Equipments: Output of different types of rollers such as plain rollers, ship footedrollers, vibratory, pneumatic rollers rammers.Miscellaneous Equipments: Working and selection of equipments: Pile driving equipments,Pile hammers, Hot mix bitumen plant, bitumen paver, grouting equipment, guniting equipments,floor polishing and cutting machine selection of drilling pattern for blasting, Bentonite/mud slurry in drilling, Explosives for blasting, Dynamite, process of using explosives.	25%	10

a. Text Book and Reference Book:

1. 'Construction Technology'By Roy Chudley and Roger Greeno | Pearson

2. Construction Planning, Equipments and methods By R. L. Perurifoy

3. Building Construction By Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain | Laxmi Publicatons Delhi

4. Building Construction By S.C Rangwala | Charotar Publishing House

5. Construction Materials By D.N. Ghose | TATA Mc Graw Hill

a. Course Name: Advance Construction Technology Lab
b. Course Code: 03605308
c. Prerequisite: Construction Materials and Concrete Technology
d. Rationale: The course is designed to learn some advance aspects of construction technology. Also, the subject gives details about faster completion of project works using modern techniques, use of modern and waste materials, and through mechanized construction. This course has been designed so that diploma engineers would be able to used advanced construction technology. In today's times the construction activities are undergoing lots of changes/developments due to internal and globalised market demands of quality and faster completion of project works using modern techniques, use of modern and waste materials, and through mechanized construction

e. Course Learning Objective:

CLOBJ 1	Upon completion of the course, students will be proficient in utilizing pertinent materials for the advanced construction of structures, demonstrating a comprehensive understanding of their properties, applications, and integration techniques.
CLOBJ 2	Demonstrate proficiency in selecting and utilizing appropriate methods of concreting and equipment tailored to the specific requirements of diverse construction types, ensuring efficient and effective construction practices.
CLOBJ 3	Upon completion of the course, students will be able to: Apply advanced construction methods tailored to specific site conditions, integrating theoretical knowledge with practical application to optimize construction processes and outcomes.
CLOBJ 4	Upon completion of the course, students will be able to: Select suitable hoisting and conveying equipment for a given situation by: Analyzing the specific requirements and constraints of the situation, including load characteristics, environmental factors, and safety considerations. Evaluating the capabilities and limitations of different types of hoisting and conveying equipment available in the industry.
CLOBJ 5	By the end of this course, students will be able to identify and assess the advanced equipment necessary to effectively address specific site conditions encountered in various industries or projects

f. Course Learning Outcomes:

CLO 1	After Learning the Course the students shall be able to: Use relevant materials in advanced construction of structures.
CLO 2	Use relevant method of concreting and equipment according to type of construction.
CLO 3	Apply advanced construction methods for given site condition.
CLO 4	Select suitable hoisting and conveying equipment for a given situation.
CLO 5	Identify advanced equipment required for a particular site condition.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial	Lab Hrs/Week	Hrs/Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	

	Hrs/ Week									
-	-	2	-	1	-	-	30	-	20	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Text Book and Reference Book:

1. 'Construction Technology'By Roy Chudley and Roger Greeno | Pearson
2. Construction Planning, Equipments and methodsBy R. L. Perurifoy
3. B.C. PunmiaBy Building Construction | Laxmi Publications Limited
4. Building construction By S.C. Rangwala | Charotar Publishing House Pvt. Ltd. Anand
5. Construction Materials By D.N. Ghose | TATA Mc Graw Hill

i. Experiment List

Exp. No.	Name of the Experiment
1	Paste picture With Nomenclature and Short Details-Study and Information Based in Sketch book 1. Earthmoving machineries 2. Equipment for excavation 3. Handling equipment 4. Hoisting equipment 5. Conveying equipment
2	Plants And Equipment Used In Construction 1. Pumping equipment 2. Compacting equipment 3. Concrete vibrating equipment 4. Plants for Grouting, Guniting. 5. Drilling equipment 6. Concrete and mixing plant
3	Drilling and Blasting draw types drilling and blasting
4	Site Visit And Preparation Of Detailed Report Recording Main Operations (May Be With Photos) As Observed And Discusssed With Site Officers, Of At least One Visit
5	Prepare a site visit report regarding your visit in which construction work is going on with advanced equipment's stating list of equipment including its selection criteria and its advantages
6	PPT Presentation: Topic of Seminar shall be given to a group of students. The students are required to submit and present / defend the Seminar in presence of students and teachers and report including PowerPoint presentation to be attached with submission. Each individual student's contribution in Group work need to be made explicit
7	Case study Based on advanced construction technology curriculum, on any one related topic narrating the case with specific operations/

Exp. No.	Name of the Experiment

problems faced/resolved from nearby construction work area with short details

a. **Course Name:** Major Project - I
b. **Course Code:** 03605314
c. **Prerequisite:** Zeal to Learn the Subject
d. **Rationale:** One of the important criteria of "Project " is to develop the ability of "learning to Learn " on its own. This would go a long way helping the students in keeping pace with future changes in technology and in the acquisition of knowledge and skills as and when needed. The course of the "Project" is designed with an aim to all these requirements of the students. Which will include planning of the Programme, which must be completed within the time allocated. The Project should never have a single solution and process of arriving at a particular solution, the student must be required to make number of decisions after study information as he has gathered from experiments, surveys, analysis etc.
e. **Course Learning Objective:**

CLOBJ 1	Students will develop the ability to conduct practical experiments accurately, ensuring proper measurement techniques and adherence to experimental procedures.
CLOBJ 2	Students will learn to analyze experimental data and reduce it to the form of answers required, demonstrating proficiency in data interpretation and presentation.
CLOBJ 3	Students will gain an understanding of the information readers seek from experimental results, enabling them to communicate findings effectively and address potential questions or concerns.
CLOBJ 4	Students will develop skills in providing brief but clear answers to questions arising from experimental work, enhancing their ability to convey information effectively.
CLOBJ 5	Students will learn methods to validate their experimental findings and convince readers of their accuracy and reliability, fostering confidence in their results.

f. **Course Learning Outcomes:**

CLO 1	Know the questions to which he is finding answers through experimental work.
CLO 2	Perform the practical work with appropriate accuracy.
CLO 3	Reduce the experimental readings to the form of answers required.
CLO 4	Understand clearly what the reader will want to know.
CLO 5	Give brief but clear answers.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	T	CE	P	Theory	P	
3	-	0	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content
1	Introduction of the industry
2	Problem Identification and Definition, process modification; a Literature Survey and Prior Art Search
3	The description of the Industrial Process/ Product and problem analysis.
4	The Outline of the solution (with details including drawings, circuits , software, used for or developed for the solution etc. in detail)
5	Project Report

a. Course Name: Highway Engineering
b. Course Code: 03605331
c. Prerequisite: Transportation Engineering
d. Rationale: Road transport is one of the most common modes of transport. Population of the country is increasing day by day. The need for travel to various places at faster speed has also increased. In this scenario standards of highway engineering are continuously being improved. Highway engineers must know the future traffic flows, design of highway intersections/interchanges, geometric alignment and design, highway pavement design and materials, structural design of pavement thickness, and pavement maintenance etc. At diploma level, students are expected to study about these aspects of highway engineering because they are supposed to design and construct different types of roads in villages, towns and also roads connecting different villages and towns.

e. Course Learning Objective:

CLOBJ 1	Highlighting the significance of highway engineering.
CLOBJ 2	Explaining the geometrical considerations in road design and construction.
CLOBJ 3	Discussing traffic and its behavior.

CLOBJ 4	Conducting tests on materials utilized in highway construction.
CLOBJ 5	Describing essential elements and specifications of hill roads.

f. Course Learning Outcomes:

CLO 1	Students are capable of Explaining the importance of highway engineering.
CLO 2	Students are capable of Explaining the geometrical aspects with respect to design and construction of roads.
CLO 3	Students are capable of Explaining traffic and its characteristics and Demonstrate the basic Requirements of Curves.
CLO 4	Students are capable to Conduct various tests on the materials used in highway construction work and Explain various aspects related to the construction and maintenance of highways.
CLO 5	Explain essential features and requirements of hill roads and Explain ideal road alignment and Supervise construction of road pavements, drainage and material.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
					Internal Marks			External Marks		
Lecture Hrs/Week	Tutorial Hrs/ Week	Lab Hrs/Week	Hrs/ Week	Credit	T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Course Content:

Course Content **W - Weightage (%) , T - Teaching hours**

Sr.	Topics	W	T
1	**Introduction to Highway Engineering** Importance of roads in India & its' Road classifications in India (Nagpur plan & Third road development (Lucknow) Fixing location of Urban Requirements of an ideal road alignment & the factors affecting road Details of highway project report.	**10**	**6**
2	**Geometric Design of Highway.**	**20**	**8**

	terms used in Highway Camber – definition, purpose, types, IRC – recommendations. Kerbs, Road margin, road formation, right of way. Design speed IRC – Gradient - definition, types IRC – Sight distance - definition, types IRC - Curves - Necessity, types- Horizontal, vertical and transition curves, Widening of roads. Super elevation, definition, formula for calculating minimum and maximum Super elevation and method of providing super elevation Simple problems on geometric design of roads.		
3	**Construction of Road Pavements, Drainage and Materials** Types of road materials and their Tests -Soil, Aggregates, bitumen, cement concrete, test on soil sub grade- C B R test, Test on Aggregate- Los Angeles abrasion, Impact, & shape test, test on Bitumen- penetration, Ductility and Softening point test. Pavement – Types, Components and structure of Construction of bituminous road- Terms used –Bitumen, Emulsion, Cutback, Tar, grades of bitumen, prime coat, tack coat, seal coat, surface dressing construction, its Merits & demerits. Construction of cement concrete pavement, Construction joints, joints filler & Equipment's used in Highway Importance, necessity and methods of drainage. Surface drainage – side gutter, catch water drain, surface, Sub surface drainage –Longitudinal & cross drains	**20**	**6**
4	**Traffic Engineering** Traffic characteristics and traffic volume study. Passenger car unit and factors affecting it. Accident studies and its causes, collision diagram. Traffic control devices – road signs, marking, Signals, traffic island. Advantages & disadvantages of signals. Road intersections, Intersection at Grade, grade Separators.	**20**	**8**
5	**Hill Road** Hill roads, its' components, functions types of curves. Width of pavement formation, camber, sight distance, widening at curve. Drainage: Side drains; catch water drains, cross drains, retaining wall & breast wall. Construction procedure of hill roads. Causes of landslides & its classification. Prevention of landslides.	20	**8**
6	**Maintenance and Repair of Roads.** Flexible & Rigid pavement failures and their causes. Need for high way maintenance. Classification of maintenance. Special repair of flexible & Rigid pavements.	**10**	**6**

i. Text Book and Reference Book:

1. Highway Engineering By Khanna & Justo
2. Highway Engineering By Dr. L.R. Kadiyali | Khanna Publishers, New Delhi

a. Course Name: Precast and Prestressed Concrete

b. Course Code: 03605333

c. Prerequisite: Concrete Technology, Design of Structures, Theory of structures

d. Rationale: Building with Precast concrete components is as much old as constructing with concrete. Precast concrete construction however now has increased by leaps bounds and has taken industrialized form owing to development of heavy lifting equipment mechanized steel moulds, automated manufacturing systems. Precast concrete construction these days most sought after construction practice by developers as it facilitates construction, factory production presents excellent conditions for their use. However, construction techniques lack wider appreciation due to a lack of design instruction at the undergraduate level and limited exposure of engineers to design concepts and manufacturing erection stages. The inclusion of this subject aims to provide the engineers with an understanding & applications of Precast concrete construction.

e. Course Learning Objective:

CLOBJ 1	Select the most suitable precast concrete elements for construction projects based on structural, architectural, cost, and timeline considerations.
CLOBJ 2	Identify and utilize relevant components in prefabricated structures considering structural integrity, material properties, compatibility, and ease of assembly.
CLOBJ 3	Justify the application of prestressed elements in construction scenarios based on load-bearing capacity, durability, design flexibility, and cost-efficiency.
CLOBJ 4	Evaluate and select appropriate construction methods/systems based on project requirements, site conditions, resource availability, and safety considerations.
CLOBJ 5	Analyze structural requirements and calculate forces to propose cable profiles that optimize prestressed concrete members' performance, durability, and cost-effectiveness.

f. Course Learning Outcomes:

CLO 1	Select the relevant precast concrete element for a given type of construction.
CLO 2	Use relevant components for prefabricated structures.
CLO 3	Justify the relevance of prestressed elements in a given situation.
CLO 4	Select relevant methods/systems for given construction work.
CLO 5	Propose a suitable cable profile for the given prestressed concrete members.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial Hrs/ Week	Lab Hrs/Week	Hrs/Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.) **W** - Weightage (%) , **T** - Teaching hours

Course Content

Sr.	Topics	W	T
1	**Precast concrete Elements** Advantages and disadvantages of precast concrete members Non-structural Precast elements - Paver blocks, Fencing Poles, Transmission Poles, Manhole Covers, Hollow and Solid Blocks, kerb stones as per relevant BIS specifications Structural Precast elements – tunnel linings, Canal lining, Box culvert, bridge panels, foundation, sheet piles Testing of precast components as per BIS standards	20	8

2	**Prefabricated building** Precast Structural Building components such as slab panels, beams, columns, footings, walls, lintels and chajjas, staircase elements, Prefabricated building using precast load bearing and non load bearing wall panels, floor systems - Material characteristics, Plans & Standard specifications Modular co-ordination, modular grid, and finishes Prefab systems and structural schemes and their classification including design considerations Joints – requirements of structural joints and their design considerations Manufacturing, storage, curing, transportation and erection of above elements, equipment needed.	**25**	**10**
3	**Introduction to Prestressed Concrete** Principles of pre-stressed concrete and basic terminology. Applications, advantages and disadvantages of prestressed concrete Materials used and their properties, Necessity of high-grade materials Types of Pre-stressing steel -Wire, Cable, tendon, Merits-demerits and applications	**10**	**6**
4	**Methods and systems of prestressing** Methods of prestressing – Internal and External pre-stressing, Pre and Post tensioning-applications Systems for pre tensioning – process, applications, merits and demerits - Hoyer system Systems for post-tensioning - process, applications, merits and demerits - Freyssinet system, Magnel Blaton system, Gifford Udall system. Prestressing force in Cable, Loss of prestress during the tenioning process - loss due to friction, length effect, wobbling effect and curvature effect, (Simple Numerical problems to determine loss of pre-stress), Loss of pre-stress at the anchoring stage Loss of pre-stress occurring subsequently: losses due to shrinkage of concrete, creep of concrete, elastic shortening, and creep in steel, (Simple Numerical problems to determine loss of pre-stress). BIS recommendations for percentage loss in case of Pre and Post-tensioning.	**25**	**10**
5	**Analysis and design of Prestressed rectangular beam section** Basic assumptions in analysis of pre-stressed concrete beams. Cable Profile in simply supported rectangular beam section – concentric, eccentric straight and parabolic Effect of cable profile on maximum stresses at mid-span and support. Numerical problems on determining maximum stresses at mid spans with linear (concentric and eccentric) cable profiles only. Simple steps involved in the Design of simply supported rectangular beam section (No numerical problems)	**20**	**8**

h. Text Book and Reference Book:

Reference Books	
1.	**Design of Prestressed Concrete Structures,** By Krishnaraju | Tata Mc-Graw Hill
2.	**IS: 1343- Code of Practice for Prestressed Concrete**
3.	**Design of Prestressed Concrete Structures** By Lin. T.Y., Burns | John Wiley & Sons, 1982.
4.	**Prestressed Concrete,** By RajaGopalan N. | Narosa Publishing House, New Delhi,

a. Course Name: Rural Construction Technology
b. Course Code: 03605335
c. Prerequisite: Constriction Materials and Concrete Technology
d. Rationale: One of the primary functions of any Rural Engineer is not only to provide shelter to the inmates, but they should also facilitate them sufficient accommodations, physical comforts,

good appearance etc. Due to the economic crisis, this has necessitated to develop low cost safe houses in the rural area which should be fire and sound proof. An emphasis, in this direction has been created in the curriculum so that rural building construction work, performed by the technicians, can be completed systematically, safely and economically.

e. Course Learning Objective:

CLOBJ 1	Understand the principles of low-cost housing construction using locally available rural materials. Demonstrate the ability to identify and assess suitable materials for low-cost housing.
CLOBJ 2	Understand the procedures and requirements for accessing government funds and resources for construction projects.
CLOBJ 3	Develop proficiency in planning, designing, and supervising rural road construction projects in compliance with guidelines. Learn to assess watershed conditions, identify potential threats, and develop strategies for integrated watershed management in rural areas.
CLOBJ 4	Understand the different types of irrigation systems suitable for rural areas, considering factors such as water availability, soil type, and crop requirements.
CLOBJ 5	Recognize the importance of watershed management in rural development and sustainable resource utilization. Learn to assess watershed conditions, identify potential threats, and develop strategies for integrated watershed management in rural areas.

f. Course Learning Outcomes:

CLO 1	Plan low-cost housing using rural materials.
CLO 2	Make use of relevant government schemes for construction of roads and housing
CLO 3	Use guidelines for rural watery supply and sanitation.
CLO 4	Implement different pavements systems for rural areas.
CLO 5	Identify the need of watershed management in rural areas

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Rural Development and Planning:** Scope; development plans; various approaches to rural development planning. Significance of rural development. Rural Development Programe/Project	10%	6
2	**Rural Housing:** Low cost construction material for housing Composite material- ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rattrap bond for walls; Panels for roof, ferro-cement flooring/roofing units. Biomass - types of fuels such as firewood, agricultural residues, dung cakes. Renewable energy and integrated rural energy program - Objectives, Key elements, Implementation, Financial provisions, sources of renewable	30%	10
3	**Water Supply and Sanitation for Rural Areas:** Sources of water: BIS & WHO water standards. Quality, Storage and distribution for rural water supply works. • Hand pumps-types, installation, operation, and maintenance of hand pumps. Conservation of water - rainwater harvesting, drainage in rural areas. Construction of low-cost latrines: Two pit pour flush water seal, septic tank etc Low-cost community and individual Garbage disposal systems, Ferro-cement storage tanks.	20%	8
4	**Low-Cost Rural Roads:** Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases. Guidelines for Surfacing of Rural Road as per relevant IRC codes. Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.	20%	9
5	**Low Cost Irrigation:** Design consideration and construction of tube-well, drip & sprinkler irrigation systems. Watershed and catchment area development –problems and features of watershed management. Watershed management structures - K. T.	20%	9

	weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Bandhara system.		

i. Text Book and Reference Book:

1. "Rural development" By Satya Sundar | Himalaya Publishing.
2. "The Climatic Data Handbook" By Iswar Chand & P.K BhargavaCentral Building Research Institute (CBRI)
3. "Renewable Energy Sources" By Twidell J.W. and Weir. A | EFN Spon Ltd"Linear Systems and Signals" by B.P. Lathi.
4. "Dynamics of Rural Development", By Tripathi N S 2007 | Discovery Publication House, New Delhi

a. Course Name: Solid Waste Management

b. Course Code: 03605337

c. Prerequisite: Environmental Science and Public Health Engineering.

d. Rationale: Solid waste management is a pressing issue, and lack of know how in solid waste management is a great concern for all the Local Self Govt. units & community. Additionally, there is still little awareness on the importance of sound environmental management within the majority of the population. The course on Solid Waste Management gives the student an overview of municipal solid waste management including collection, transfer, transport, and disposal. Methods of processing, basic disposal facilities, disposal options, and the environmental issues of solid waste management will be covered in this course. In addition, this course provides the student with relevant information about municipal solid waste reduction and on hazardous waste management. This course is therefore an essential course for diploma programme in Environmental/Civil Engineering.

e. Course Learning Objective:

CLOBJ 1	Identify the various sources of solid waste, including residential, commercial, industrial, and institutional sources, and understand the composition and characteristics of different types of solid waste.
CLOBJ 2	Select appropriate methods for the collection and transportation of solid waste based on factors such as waste composition, quantity, location, and available resources, considering options such as curbside collection, transfer stations, and transportation modes (e.g., trucks, rail, or conveyor belts).
CLOBJ 3	Identifying appropriate feedstock materials, designing composting facilities, and implementing monitoring and management practices to ensure the efficient decomposition of organic waste into compost.
CLOBJ 4	Devise suitable disposal techniques for solid waste, considering factors such as waste composition, environmental impact, and regulatory requirements.
CLOBJ 5	This involves understanding regulatory requirements, implementing proper handling and storage practices, and coordinating with certified waste management facilities for treatment and disposal of bio-medical and e-waste streams.

f. Course Learning Outcomes:

CLO 1	Identify the sources of solid waste.
CLO 2	Select the relevant method of collection and transportation of solid waste.
CLO 3	Suggest an action plan for composting of solid waste
CLO 4	Devise suitable disposal technique for solid waste
CLO 5	Use the relevant method for disposal of Bio-medical and E-waste.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction:** Definition of solid waste, different solid waste – domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc. Sources of solid waste, Classification of solid waste – hazardous and non-hazardous waste. Physical and chemical characteristics of municipal solid waste.	20%	8
2	**Storage, Collection and Transportation of Municipal Solid Waste:** Collection, segregation, storage and transportation of solid waste. Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin.Transportation vehicles with their working capacity Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, location.Role of rag pickers and their utility for society.	20%	8
3	**Composting of Solid Waste:** Concept of composting of waste, Principles of composting process. Factors affecting the composting process. Methods of composting – Manual	10%	6

	Composting – Bangalore method, Indore Method, Mechanical Composting – Dano Process, Vermi composting.		
4	**Techniques for Disposal of Solid Waste:** Solid waste management techniques – solid waste management hierarchy, waste preventionand waste reduction techniques Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leach ate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste Incineration of waste: Introduction of incineration process, Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste – Definition, Methods	**30%**	**12**
5	**Biomedical and E-waste management:** Definition of Bio medical Waste. Sources and generation of Biomedical Waste and its classification Bio medical waste Management technologies. Definition, varieties and ill effects of E- waste, Recycling and disposal of E- waste.	**20%**	**8**

i. Text Book and Reference Book:

1. "Handbook of Solid Waste Management and Waste Minimization Technologies (Text Book)" by Nicholas P. Cheremisin off, Butterworth-Heinemann.

Semester 6

a. Course Name: Indian Constitution

b. Course Code: 03600351

c. Prerequisite: Zeal to learn Subject

d. Rationale: The course aims to give brief knowledge of Indian Constitution and administration of different bodies of India. To make governance better an engineer must conduce to E-governance through computers and knowledge of cyber laws. An engineer must know the limits of state action and regulations by acquainting himself with the laws that applied by the bureaucrats. Since an engineer works at different places and sights, he must have the basic knowledge of centre -state relations with reference to policy of financing the key projects. The knowledge of Constitution is necessary for him in order to ensure that the rules and regulations under which public and private sector works, do not violate the provisions of the Constitution. Knowledge of corporate culture is necessary for him. He must understand the compulsions of the public private partnership and philosophy of state ownership of key industries.

e. Course Learning Objective:

CLOBJ 1	Understand the historical context and significance of the Indian Constitution, including the Preamble and its interpretation.
CLOBJ 2	Comprehend the structure and roles of the Union Government, including the President, Prime Minister, and Parliament.
CLOBJ 3	Gain insight into the functions and powers of State Governments, including the roles of Governors, Chief Ministers, and State Legislatures.

CLOBJ 4	Familiarize with the structure and functions of local administration, including District Administration, Municipal Corporations, and Zila Panchayats.
CLOBJ 5	Understand the role and functioning of the Election Commission, including the Chief Election Commissioner and State Election Commissions, in conducting free and fair elections in India.

f. Course Learning Outcomes:

CLO 1	Understanding the Constitution.
CLO 2	Ability to understand, Union Government State Government , Local Administration and Election Commission.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	-	-	-	20	20	-	-	-	40

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**THE CONSTITUTION -INTRODUCTION:** The History of the Making of the Indian Constitution Preamble and the Basic Structure, and its interpretation Fundamental Rights and Duties and their interpretation, State Policy Principles.	25%	7
2	**UNION GOVERNMENT:** Structure of the Indian Union, President -Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha	20%	5
3	**STATE GOVERNMENT:** Governor -——————————————Role and Power, Chief Minister and Council of Ministers, State Secretariat.	20%	4
4	**LOCAL ADMINISTRATION:** District Administration, Municipal Corporation, Zila Panchayat	15%	4
5	**ELECTION COMMISSION:** Role and Functioning, Chief Election Commissioner, State Election Commission	20%	4

j. Text Book and Reference Book:

1. An Introduction to the Constitution of India D.D. Basu; Prentice Hall, New Delhi

2. An Introduction to the Constitution of India M. V. Pylee; Vikas New D

a. **Course Name:** Design of Steel Structure
b. **Course Code:** 03605351
c. **Prerequisite:** Engineering Mechanics, Mechanics of Materials, Theory of Structure, and Geotechnical Engineering.
d. **Rationale:** Civil Engineering structures are normally made up of either Steel Sections or of Reinforced Cement Concrete. Normally, industrial structures are constructed using steel sections. In industry, to cover wider area without any obstruction at floor level due to columns etc., normally steel roof truss is provided and hence Load calculation using IS 875 is required for such trusses. Using our previous semester study of Structural Analysis and design provisions as per IS-800-2007, in this subject, students will analyze and design different components of steel structure. In Steel Structure, Rolled Steel Sections are used and its connections at different stages on site is highly important for the safety of Structure and hence, study of Connection through Welding or Bolting is important. This course is therefore an important course for civil engineering students.
e. **Course Learning Objective:**

CLOBJ 1	Design bolted connections and welded connections of angle sections to gusset plates, ensuring structural integrity and load-bearing capacity. Implement lacing systems (single or double) & batten systems for built-up columns to enhance structural stability.
CLOBJ 2	Apply appropriate load combinations and factors to accurately assess the structural loads on roof trusses, ensuring compliance with safety standards and design requirements.
CLOBJ 3	Design tension members, considering factors such as material properties, load conditions, and safety requirements to ensure structural stability and integrity.
CLOBJ 4	Design compression members, ensuring they can adequately support loads and withstand compressive forces while meeting safety standards and design criteria.
CLOBJ 5	Applying engineering principles and standards to create effective designs that meet load requirements and withstand applied forces and ensuring the structural integrity and stability of the foundation system, including assessing bearing capacity, settlement, and potential failure modes.

f. **Course Learning Outcomes:**

CLO 1	Design Bolt Connection and Welded Connection of Angle Section to Gusset Plate & Welded Connection of Angle Section to Gusset Plate. Lacing System (Single or Double) for Built up Column & Batten System for Built up Column.

CLO 2	Calculate Dead Load, Live Load and Wind Load on panel points of a Roof Truss as per IS-875-1984 / IS-875-2015.
CLO 3	Analyze and Design Tension Member.
CLO 4	Analyze and Design Compression Member (Strut & Column).
CLO 5	Design Laterally Restrained Simply Supported beam, Purlin made up Angle Section and Slab Base Foundation under Axially Loaded Column made up of Single H Section.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

- **L-** Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Bolted and Welded Connections:** Introduction Structural Steel, Advantages and Disadvantages of Structural Steel, Structural Steel Products, Physical & Mechanical properties of structural steel, Design Philosophies, Bolted Connections: Rigid Connection, Pinned Connection, Semi Rigid Connection, Black Bolts, Turned Bolts, HSFG Bolts, Grade of Bolts. Lap and Butt Joint, Minimum and Maximum Pitch, Tack Bolting, Edge Distance, Gauge Distance, Bolt Hole. Shear Capacity of Bolt – Vdsb, Bearing Capacity of Bolt – Vdpb as per IS-800-2007, Bolt Value, Efficiency of Joint. Numerical on Bolted Connection of Angle Section to Gusset Plate and for Efficiency of Joint having Chain Bolting. Welded Connections: Types of Weld, Fillet Weld, and Numerical on welded connection. Objective of Lacing, Single Lacing ,Double Lacing, Objective of Batten.	**30%**	**10**
2	**Calculation of Load on Roof Truss:** Rolled Steel Section – ISA, I & H Section, Channel Section and its application in Steel Structure. Types of Trusses, Pitch of Truss, Rise, Spacing of	**15%**	**8**

	Truss, Purlin, Principal Rafter, Main Tie, Sag. Tie, Members of Truss, Roofing material- GI and AC Sheets. Dead Load of Truss per panel point- Self Weight, Weight of Purlin, Wind Bracing, Weight of Roofing Material. Live Load per panel point in Truss as per IS – 875 – Part II -1984 when access is not provided. Wind Load per panel point in Truss using IS – 875 – Part III - 1984		
3	**Tension Member:** Examples of Tension Members in Civil Engineering Structures. Design Strength of Tension Member, Design Strength due to Yielding of Gross Section, Design Strength due to Rupture of Critical Section for Angle Section, Design Strength due to Block Shear in Angle Section as per IS – 800-2007. Slenderness ratio of Tension Member as per IS – 800-2007. Numerical for Analysis & Design type based on 1.2 for Single and Double Angle Sections on same side and either side of Gusset Plate.	**15%**	**6**
4	**Compression Member Strut & Column:** Strut, Maximum Slenderness Ratio, Classification of Cross – Sections and Buckling Class as per IS-800-2007. Angle Strut as per Cl. 7.5, IS-800-2007. Design Compressive Stress – fcd according to Tables of IS-800-2007. Numerical on Strut made up of Single Angle, Double Angle same and either side of G.P as per 1.2 & 1.3 Built up Column, Effective Length of Column as per Table 11, IS-800-2007. Design Compressive Stress – fcd according to Tables of IS-800-2007. Numerical on Column made up of ISHB, ISHB with Flange Plate, Double Channels Back to Back and Toe to Toe.	**15%**	**6**
5	**Lateral Restrained Beam & Purlin:** Shear buckling, Shear Strength and Bending Strength of Section as per Cl. 8.4.1 and Cl. 8.2.1.2 of IS-800-2007, Deflection as per Table-6 of IS-800-2007, Shear Leg Effect, Web Crippling	**10%**	**4**
6	**Slab Base Foundation:** Slab Base, Gusseted Base , Base plate and its Thickness as per IS-800-2007 , Concrete Block , SBC of Soil , Anchor Bolt , Cleat and Dummy Angle. Numerical on Slab Base Foundation under Column made up of Single H Section.	**15%**	**8**

Text Book and Reference Book:

1. "IS-800 – 2007" by Bureau of Indian Standard.
2. "Handbook on Steel – SP-6" by Bureau of Indian Standard.
3. "IS – 875 – 1984, Part - III" by Bureau of Indian Standard
4. "Design of Steel Structures (By Limit State Method As Per Is: 800—2007)" by S S Bhavikatti.

5. "Design of Steel Structures" by N. Subramanian.
6. "Limit State Design of Steel Structures" by S. K Duggal

a. Course Name: Design of Steel Structure Lab

b. Course Code: 03605352

c. Prerequisite: Engineering Mechanics, Mechanics of Materials, Theory of Structure, and Geotechnical Engineering.

d. Rationale: Civil Engineering structures are normally made up of either Steel Sections or of Reinforced Cement Concrete. Normally, industrial structures are constructed using steel sections. In industry, to cover wider area without any obstruction at floor level due to columns etc., normally steel roof truss is provided and hence Load calculation using IS 875 is required for such trusses. Using our previous semester study of Structural Analysis and design provisions as per IS-800-2007, in this subject, students will analyze and design different components of steel structure. In Steel Structure, Rolled Steel Sections are used and its connections at different stages on site is highly important for the safety of Structure and hence, study of Connection through Welding or Bolting is important. This course is therefore an important course for civil engineering students.

e. Course Learning Objective:

CLOBJ 1	Design bolted connections and welded connections of angle sections to gusset plates, ensuring structural integrity and load-bearing capacity. Implement lacing systems (single or double) & batten systems for built-up columns to enhance structural stability.
CLOBJ 2	Apply appropriate load combinations and factors to accurately assess the structural loads on roof trusses, ensuring compliance with safety standards and design requirements.
CLOBJ 3	Design tension members, considering factors such as material properties, load conditions, and safety requirements to ensure structural stability and integrity.
CLOBJ 4	Design compression members, ensuring they can adequately support loads and withstand compressive forces while meeting safety standards and design criteria.
CLOBJ 5	Applying engineering principles and standards to create effective designs that meet load requirements and withstand applied forces and Ensuring the structural integrity and stability of the foundation system, including assessing bearing capacity, settlement, and potential failure modes.

f. Course Learning Outcomes:

CLO 1	Design Bolt Connection and Welded Connection of Angle Section to Gusset Plate & Welded Connection of Angle Section to Gusset Plate. Lacing System (Single or Double) for Built up Column & Batten System for Built up Column.

CLO 2	Calculate Dead Load, Live Load and Wind Load on panel points of a Roof Truss as per IS-875-1984 / IS-875-2015.
CLO 3	Analyze and Design Tension Member.
CLO 4	Analyze and Design Compression Member (Strut & Column).
CLO 5	Design Laterally Restrained Simply Supported beam, Purlin made up Angle Section and Slab Base Foundation under Axially Loaded Column made up of Single H Section.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**4**	**2**	**-**	**-**	**60**	**-**	**40**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Experiment List

Exp. No.	**Name of the Experiment**
1	Find Forces in given Truss Members using Graphical Method due to D.L, L.L and W.L and Design Forces in the Members – Drawing Sheet – No: 01, A1 Size
2	Draw Plan & c/s Elevation of Eaves Level Joint, Ridge Joint and Two Other Joints of a Truss Selected in Sheet No:01 with all design details like Size of Angle Section, G.P , Connection Details , Purlin , Roofing Material – Drawing Sheet – No: 02 A1 Size
3	Draw Plan and c/s Elevation of Built-up column made up of Double Channel provided back to back with Single or Double Lacing Draw Plan and c/s Elevation of Slab Base Foundation under column made up of H section Sheet No:03 – A1 Size

Exp. No.	Name of the Experiment
4	Prepare following Neat sketches in Sketch Book Different Types of Truss Truss Details – Spacing of Truss, Principal Rafter, Main Tie, Members, Ridge, span, Roof Covering, Purlin etc… Eaves Level Joint of Truss, Ridge Level Joint of Truss, Beam to Beam Connection at Same Level Beam to Beam, Connection at Different Level, Column to Beam Seated Connection (Weld & Bolt Connection), Column to Beam framed Connection (Weld & Bolt Connection), Gusseted Slab Base Foundation
5	Prepare a Report File related to Calculation work of Drawing Sheet No: 1, 2 & 3
6	Site Visit of Industry Truss, Steel Structure Railway Platform – Report, Photographs

a. Text Book and Reference Book:

1. "IS-800 – 2007" by Bureau of Indian Standard.
2. "Handbook on Steel – SP-6" by Bureau of Indian Standard.
3. "IS – 875 – 1984, Part - III" by Bureau of Indian Standard
4. "Design of Steel Structures (By Limit State Method As Per Is: 800—2007)" by S S Bhavikatti.
5. "Design of Steel Structures" by N. Subramanian.
6. "Limit State Design of Steel Structures" by S. K Duggal

a. Course Name: Construction management
b. Course Code: 03605353
c. Prerequisite: Estimating, Costing and Valuation
d. Rationale: Project management skills are important for overall planning, coordination, and control of a project from commencement to accomplishment of the project efficiently and effectively. The awareness of various project management techniques is very essential to ensure that construction projects are completed within time and budget which is a biggest challenge. Thus students would be able to complete the project in time & budget and as per desired quality. This course is therefore very important course for diploma holders in civil engineering since they have to manage construction projects on their own.

e. Course Learning Objective:

CLOBJ 1	Understand the organizational structure and objectives of construction companies, including principles of organization, types of organizations (government/public vs. private), and the roles of various personnel involved in construction projects, such as owners, promoters, builders, designers, architects,

	and consultants.
CLOBJ 2	Apply principles governing site layout and factors affecting it, including land acquisition procedures, compensation, and the preparation of site layouts, ensuring efficient utilization of resources and adherence to regulatory requirements.
CLOBJ 3	Develop skills in planning and scheduling construction projects, including identifying activities, methods of scheduling, developing bar charts, understanding network elements, critical path analysis, float management, crashing techniques for time and cost optimization, and material management techniques such as Economic Order Quantity and inventory control.
CLOBJ 4	Analyze different types of construction contracts, contract documents, specifications, and general/special conditions, and gain an understanding of contract management procedures, arbitration, and settlement processes.
CLOBJ 5	Recognize the importance of safety management in the construction industry, identify common causes of accidents, and implement preventive measures. Gain knowledge of safety precautions for various construction activities such as excavation, demolition, erection, scaffolding, ladder, piling, and bituminous works. Additionally, understand relevant labor laws and acts pertaining to civil construction activities.

f. Course Learning Outcomes:

CLO 1	Understand the principles and practices of contract management in construction projects, as well as the relevant labor laws governing civil construction activities.
CLO 2	Apply their understanding of principles governing site layout and factors affecting it to effectively execute site layouts while considering land acquisition procedures, compensation, and regulatory requirements.
CLO 3	Apply knowledge of planning and scheduling techniques to prepare networks and bar charts for construction projects, demonstrating proficiency in organizing project activities and timelines.
CLO 4	Understand the complexities of disputes that may arise in construction projects, as well as the arbitration and settlement laws involved, to effectively manage and resolve disputes in accordance with legal frameworks.
CLO 5	Apply safety management principles and regulations to implement appropriate safety measures at construction sites, ensuring the prevention of accidents and adherence to safety protocols for various construction activities.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
Lecture Hrs/ Week	**Tutorial Hrs/ Week Lab Hrs/ Week**	**Tutorial Hrs/ Week Lab Hrs/ Week**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	

3	**1**	**0**	**4**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Construction Industry and Management** Organization-objectives, principles of organization, types of organization: government/public and private construction industry, Role of various personnel in construction organization, Agencies associated with construction work- owner, promoter, builder, designer, architects, Role of consultant for various activities: Preparation of Detailed Project Report (DPR), monitoring of progress and quality, settlement of disputes.	**20%**	**8**
2	**Site Layout** Principles governing site layout, Factors affecting site layout, Preparation of site layout, Land acquisition procedures and providing compensation.	**15%**	**7**
3	**Planning and Scheduling** Identifying broad activities in construction work & allotting time to it, Methods of Scheduling, Development of bar charts, Merits & limitations of bar chart. Elements of Network: Event, activity, dummy activities, Precautions in drawing Network, Numbering the events. CPM networks, activity time estimate, Event Times by forward & backward pass calculation, start and finish time of activity, project duration. Floats: Types of Floats-Free, independent and total floats, critical activities and critical path. Purpose of crashing a network, Normal Time and Cost, Crash Time and Cost, Cost slope, Optimization of cost and duration. Material ManagementOrdering cost, inventory-carrying cost, Economic Order Quantity. Store management, various records related to store management, inventory control by ABC technique, Introduction to material procurement through portals.	**30%**	**12**
4	**Construction Contracts and Specifications**	**20%**	**8**

	Types of Construction contracts. Contract documents, specifications, general special conditions. Contract Management, procedures involved in arbitration and settlement (Introduction only)		
5	**Safety in Construction** Safety management-requirement, importance. Safety in Construction Industry—Causes of accidents and its type, Remedial and Preventive Measures. Safety precaution-Excavation work, Demolition, Erection. Safety measures-Scaffolding, Ladder, Piling, Bituminous works. Labour Laws and Acts pertaining to Civil construction activities (Introduction only).	**15%**	**7**

i. **Text Book and Reference Book:**
   1. Construction Engineering & Management,By Seetharaman, S | Umesh Publications
   2. Industrial Engineering and Management Dr. B.Kumar, Khanna Publishers
   3. Fundamnetals of Construction Planning and Management By Sharma, M.R, | S.K. Kataria & Son

a. **Course Name:** Repair and Maintenance of Structures
b. **Course Code:** 03605355
c. **Prerequisite:** Construction Materials, Concrete Technology, and Advanced Concrete Technology
d. **Rationale:** Maintenance of a building is the work done for keeping an existing building in a condition where it can continue to perform its intended functions. Proper maintenance not only improves functional and aesthetic value but also extends the life of building/structure and ensures safety of the users. Normally constructed building remains in a good shape for only for 40 to 50 years and starts deteriorating if not maintained properly. Inadequate maintenance and lack of repair works may lead to limited life span of buildings. However, with regular inspection and maintenance that enable timely identification of deteriorated elements and appropriate remedial measures, the life of normally constructed buildings/structures may be extended up to 100 years.
e. **Course Learning Objective:**

CLOBJ 1	Students will be able to recognize various types of maintenance, including repair, retrofitting, re-strengthening, rehabilitation, and restoration, and understand their significance in preserving the integrity and functionality of structures.

CLOBJ 2	Students will analyze the objectives of maintenance, including preserving structural integrity, minimizing deterioration, extending service life, enhancing usability, and optimizing operational efficiency, to appreciate the holistic approach required for effective maintenance management.
CLOBJ 3	Students will develop skills in effective maintenance management by learning strategies such as regular inspections, proactive issue identification, prioritization of tasks, implementation of preventive measures, and documentation of maintenance activities.
CLOBJ 4	Students will learn to implement periodical maintenance procedures, including creating checklists covering structural, mechanical, electrical, and aesthetic elements, developing maintenance manuals containing detailed instructions and guidelines, and executing pre- and post-monsoon maintenance tasks to ensure building durability and safety.
CLOBJ 5	Students will acquire practical knowledge of maintenance and repair methods for both masonry and RCC (Reinforced Cement Concrete) constructions, including identifying causes of damages, conducting visual observations, performing load tests and non-destructive tests, selecting appropriate repair materials, and applying remedial measures to address cracks, dampness, efflorescence, and other structural issues.

f. Course Learning Outcomes:

CLO 1	Explain maintenance and types of maintenance and assess the health condition of structures.
CLO 2	Identify and define all the terms and concepts associated with deterioration of concrete structures..
CLO 3	Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration
CLO 4	Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
CLO 5	Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**		
L	**T**	**P**	**C**	**Internal Evaluation**	**ESE**	**Total**

				T	CE	P	Theory	P	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basics of maintenance Types of Maintenances - repair, retrofitting, re-strengthening, rehabilitation and restoration. Necessity, objectives and importance of maintenance. Approach of effective management for maintenance. Periodical maintenance: check list, maintenance manual containing building plan, reinforcement details, material sources, maintenance frequency, corrective maintenance procedures and sources. Pre- and post- monsoon maintenance.	10	8
2	Causes and Detection of Damages Causes of damages due to distress, earthquake, wind, flood, dampness, corrosion, fire, deterioration, termites, pollution and foundation settlement. Various aspects of visual observations for detection of damages. Load test and non-destructive tests (brief description). NDT tests on damaged structure such as rebound hammer, ultrasonic pulse velocity, rebar locator, crack detection microscope, digital crack measuring gauge. Chemical test - Chloride test, sulphate attack, carbonation test, pH measurement, resistivity method, Half-cell potential meter (Introduction and demonstration only).	**20**	**8**
3	Materials for Maintenance and Repairs Types of repair material, material selection. Essential parameters for maintenance and repair materials such - bond with substrate, durability. Waterproofing materials based on polymer modified cement slurry, UV resistant acrylic polymer, ferro-cement. Repairing materials for masonry: plastic/aluminum nipples, non-shrink cement, polyester putty or 1:3 cement sand mortar, galvanized steel wire fabrics and clamping rods, wire nails, ferro-cement plates. Repairing materials for RCC: epoxy resins, epoxy mortar, cement mortar impregnated with polypropylene, silicon, polymer	**25**	**10**

	concrete composites, sealants, fiber reinforcement concrete, emulsions and paints.		
4	Maintenance and Repair Methods for Masonry Construction Causes of cracks in walls - bulging of wall, shrinkage, bonding, shear, tensile, vegetation. Probable crack location: junction of main and cross wall, junction of slab and wall, cracks in masonry joints. Repair methods based on crack type - For minor & medium cracks (width 0.5 mm to 5mm): grouting and for major cracks (width more than 5mm): fixing mesh across cracks, RCC band, installing ferrocement plates at corners, dowel bars, propping of load bearing. Remedial measures for dampness & efflorescence in wall.	**20**	**8**
5	Maintenance and Repair Methods for R.C.C. Construction Repair stages such as concrete removal and surface preparation, fixing suitable formwork, bonding/passive coat and repair application, various methods of surface preparation. Repair options such as grouting, patch repairs, carbonated concrete, cleaning the corroded steel, concrete overlays, latex concrete, epoxy bonded mortar and concrete, polymer concrete, corrosion protection such as jacketing. Building cracks and its prevention, common methods for dormant crack repairs such as Epoxy injection, grooving and sealing, stitching, grouting and guniting/ shotcreting. Strengthening methods for live cracks such as addition of reinforcements, Jacketing, brackets, collars, supplementary members i.e. shoring, underpinning and propping of framed structure.	**25**	**10**

i. Text Book and Reference Book:

1. Handbook on Repairs and Rehabilitation of RCC buildings CPWD, Government of India.
2. 11. Repairs and rehabilitation of concrete structures By P. I. Modi & C. N. Patel | PHI Publication
3. Learning from failures By R.N. Raikar | Structural Designers and Consultants, New Delhi
4. Concrete Technology By M.S. Shetty | S.Chand& co.Ltd
5. B.C. Punmia By Building Construction | Laxmi Publications Limited

a. Course Name: Repair and Maintenance of Structures Lab

b. Course Code: 03605356

c. **Prerequisite:** Construction Materials, Concrete Technology, and Advanced Concrete Technology
d. **Rationale:** Maintenance of a building is the work done for keeping an existing building in a condition where it can continue to perform its intended functions. Proper maintenance not only improves functional and aesthetic value but also extends the life of building/structure and ensures safety of the users. Normally constructed building remains in a good shape for only for 40 to 50 years and starts deteriorating if not maintained properly. Inadequate maintenance and lack of repair works may lead to limited life span of buildings. However, with regular inspection and maintenance that enable timely identification of deteriorated elements and appropriate remedial measures, the life of normally constructed buildings/structures may be extended up to 100 years.
e. **Course Learning Objective:**

CLOBJ 1	Students will comprehend the concept of maintenance, its various types, and their applications in preserving structural integrity. They will be able to assess the health condition of structures and determine appropriate maintenance strategies.
CLOBJ 2	Students will identify and define terms and concepts related to the deterioration of concrete structures, enabling them to recognize signs of degradation and understand underlying mechanisms.
CLOBJ 3	Students will develop skills to conduct damage assessment and rapid visual inspection of buildings exhibiting signs of deterioration. They will be capable of identifying potential causes/sources of deterioration based on observed conditions.
CLOBJ 4	Students will gain insight into the concrete repair industry, including various repair materials and techniques. They will develop a comprehensive understanding of different repair methods and their applications in restoring structural integrity.
CLOBJ 5	Students will describe the importance of quality control in concrete construction and the significance of protecting and maintaining structures. They will recognize the role of quality assurance measures in ensuring long-term durability and performance of concrete structures.

f. **Course Learning Outcomes:**

CLO 1	Explain maintenance and types of maintenance and assess the health condition of structures.
CLO 2	Identify and define all the terms and concepts associated with deterioration of concrete structures.

CLO 3	Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration
CLO 4	Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
CLO 5	Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
0	**-**	**2**	**1**	**0**	**0**	**30**	**0**	**20**	**50**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-

Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**
1	Prepare a report on (based on internet search) a. Importance of Maintenance. b. Various routine maintenance works in building
2	Prepare a report on (based on internet search) A .Causes of distress in structures b. Points to be taken care of during inspection and evaluation of damaged structure
3	Prepare a report on structural Audit of residential building.
4	Study the maintenance of a nearby building/civil structure being carried out (or carried out recently) and prepare a case study on it including financial aspects. (this may includes study of maintenance of cracks)
5	Study the Demolition/dismantling work of a nearby building/civil structure being carried out (or carried out recently) and prepare a case study on it (including financial aspects and resale value of materials obtained in dismantling).
6	Study the guide lines of the Municipal Corporation or R& B department, BIS standards etc.. regarding declaring buildings/structures unsafe for living/use and based on this identify buildings/structures if any in your locality and prepare a case study on it. OR Study the preservation work of a historical building being carried out by Archaeological department in nearby location and prepare a report on it.

7 Seminar (Present case studies and reports prepared in above practical in seminar type situation)

i. Text Book and Reference Book:

1. Handbook on Repairs and Rehabilitation of RCC buildings, CPWD, Government of India.
2. 11. Repairs and rehabilitation of concrete structures, By P. I. Modi & C. N. Patel | PHI Publication
3. Learning from failures, By R.N. Raikar | Structural Designers and Consultants, New Delhi
4. Concrete Technology, By M.S. Shetty | S.Chand& co.Ltd
5. B.C. Punmia,By Building Construction | Laxmi Publications Limited

b. Course Name: Major Project - II

c. Course Code: 03605360

d. Prerequisite: Zeal to learn the subject

e. Rationale: One of the important criteria of "Project" is to develop the ability of "learning to Learn " on its own. This would go a long way helping the students in keeping pace with future changes in technology and in the acquisition of knowledge and skills as and when needed. The course of the "Project" is designed with an aim to all these requirements of the students. Which will include planning of the Programme, which must be completed within the time allocated. The Project should never have a single solution and process of arriving at a particular solution, the student must be required to make number of decisions after study information as he has gathered from experiments, surveys, analysis etc.

f. Course Learning Objective:

CLOBJ 1	Students will develop the ability to identify and select a topic relevant to the civil engineering field, considering current trends, challenges, and emerging technologies, to demonstrate an understanding of the diverse areas within civil engineering practice.
CLOBJ 2	Students will learn to recognize and report on modern advancements, innovations, and breakthroughs in civil engineering, including new materials, construction techniques, sustainable practices, and infrastructure projects, fostering an awareness of contemporary industry developments.
CLOBJ 3	Students will become familiar with various ethical, legal, environmental, and societal issues relevant to professional engineering practice, including codes of conduct, sustainability considerations, regulatory requirements, and social responsibilities, to prepare for ethical decision-making in their careers.
CLOBJ 4	Students will acquire proficiency in communicating and presenting technical information using modern presentation tools and techniques, such as

	multimedia presentations, graphical representations, and digital platforms, to effectively convey ideas, analyses, and findings to diverse audiences in the civil engineering community.
CLOBJ 5	Students will learn methods to validate their experimental findings and convince readers of their accuracy and reliability, fostering confidence in their results.

g. Course Learning Outcomes:

CLO 1	Identify and select any topic of interest to civil engineering community.
CLO 2	Identify and report modern developments in civil engineering.
CLO 3	Recognize various issues related to professional engineering practice.
CLO 4	Effectively present acquired information using a variety of modern presentation tools.
CLO 5	Give brief but clear answers.

h. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	**-**	**12**	**6**	**-**	**-**	**60**	**-**	**40**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

i. Experiment List

Exp. No.	**Name of the Experiment**
1	Identification of problem and Framing of Problem Statement.
2	Problem Analysis
3	Feasibility of proposed solution
4	Adherence to Action plan
5	Content appropriateness
6	Technical knowledge and awareness related to the project
7	Project Report and Presentation

a. **Course Name:** Railway, Harbour and Tunnel Engineering
b. **Course Code:** 3605381
c. **Prerequisite:** Basic Transportation Engineering
d. **Rationale:** The development of railways and harbours is paramount for prosperity of our country. Developmental works in railway and harbours are taking place at a rapid pace due to increase in volume of material being transported within country as well as internationally. Metro construction projects are being initiated in many cities of our country where large part of the metro would be underground beneath the city; this requires construction of long deep tunnels. Subways, which are being constructed under busy squares of the cities to help pedestrians cross the roads also requires tunnels. New materials, concepts of design and construction practices are being employed internationally for these civil structures. Diploma civil engineers working in
transportation sector should therefore be aware of these materials, concepts and practices so that they can provide effective.supervision during construction and maintenance of these structures. The role of technicians in creation and management of such

e. **Course Learning Objective:**

CLOBJ 1	Understand the significance of railway and harbor development in fostering national prosperity, recognizing their pivotal role in facilitating domestic and international transportation of goods and passengers..
CLOBJ 2	Familiarize with the rapid advancements in construction technologies, materials, and design concepts, particularly in the context of railway infrastructure, harbors, metro systems, and subways.
CLOBJ 3	Acquire knowledge of the construction and maintenance practices specific to long, deep tunnels required for metro systems and subways, including excavation techniques, structural integrity considerations, and safety protocols.
CLOBJ 4	Develop proficiency in the supervision of construction projects related to transportation infrastructure, including the ability to evaluate the suitability of materials, adherence to design specifications, and compliance with safety standards.
CLOBJ 5	Gain insight into the role of civil engineering technicians in the creation and management of transportation structures, emphasizing their responsibilities in ensuring efficient construction processes, quality control, and effective maintenance procedures.

a. Course Learning Outcomes:

CLO 1	Students will able to analysis various aspects related to construction and maintenance of Railway Track.
CLO 2	Student will able to create various track geometry and can prepare SOP for maintenance of railway track.
CLO 3	Able to differentiate between the use of various Station, Yards, Points & Crossing, Signaling and Interlocking
CLO 4	Able to Supervise Harbor construction activity.
CLO 5	Able to Supervise Tunnel construction activity.

b. Mapping of Course Learning Outcomes and Bloom's Taxonomy:

c. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

d. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Introduction to Railway and Permanent Way**Roll of rail transportation and its limitation, merits and demerits. Railway track, concept of gauge, Advantages of uniform gauge and loading gauge. Components of permanent way and its ideal requirement. Rail, various type of rail cross section, length of rail, defects in rail and remedies to reduce the defects. Measure to reduce the wear of rails Characteristics of an ideal rail joints. Rail fastening and fixtures. Purpose of welding of rail joints. Type, function and requirement of an ideal sleeper. Merits and demerits of various sleepers. Coning of wheels and its purposes. Various type of Ballast materials its function. Cross section of ballast and Quantity	**10**	**4**

2	**Track Geometrics and Maintenance**Gradient and classification. Grade compensation on curves. Relation between radius and Versine of a curve. Function of Super elevation or cant, Maximum super elevation, safe speed on Curve, Cant deficiency, examples, negative super elevation and Widening of gauge on curve. Maintenance of surface levels of track, Alignment, Drainage, track materials	**10**	**4**
3	**Station, Yards, Points & Crossing, Signaling and Interlocking** Types of station, site selection and requirements for a railway station and yards. Type of yards, Marshalling yards & its types and platform Function and necessity if Points and Crossing. Types of Point or Switches. Types of crossing, Merits & demerits, crossing clearance, special fitting with turn outs and combination of points and crossing, Differentiate between Left and Right hand Turn Out . Classification of Signals in details, layout of Signals and control of train movements. Principle and Methods of Interlocking and Devices used for interlocking. Introduction of high speed train.	**20**	**8**
4	**Introduction to Harbors**Growth of ports in India, Requirements of good harbour, Element of harbour and their function. Classification and types of Harbours based on their utility and location Wind characteristics, Wind rose, Tide, Tide forces and theories, types of currents. Hydro graphic and Topographic Survey , Site selection for Harbou. Importance of Navigation Aids, Type of Navigation, Requirements of Signals, Light house, Beacons, Beacon light, Floating Navigation aids, Range light and Radar Reflectors . Wear house, Cold storage. Coastal zone and Beach profile, Causes of beach erosion, coastal protection work (Sea wall, Bulk head, Groynes, Off shore break water, Revetments)	**20**	**10**
5	**Introduction to Tunnel, Its Surveying and Construction**Necessity, classification, advantages and disadvantages of Tunnel. Shape and size of Tunnel .Surveying work operation for tunnel. Types of Explosive, Quantity of Explosive, and Precaution in handling and transporting, Type of Detonators, Method of blasting Classification, Location, size, Shape, and construction of Shaft. Method of Tunneling in Soft soil , in Rock and contraction Equipment	**20**	**8**
6	**Tunnel Lining, Ventilation and Drainage System**Objective of lining and Types of lining .Advantages of concrete lining. Materials for lining .Method of tunnel Ventilation. Source of water, water handling, dewatering and permanent drainage. Advanced case study in tunnel construction	**20**	**8**

e. Text Book and Reference Book:

1. **Text Book of Railway Engineering**
   By B.L. Gupta
2. **Transportation Engineering Vol I**
   By V.H. Vazirani & S.P. Chandola,
3. **Dock and Harbour Engineering**
   By S. Seetharaman | Umesh Publications
4. **A Course in Docks and Harbour Engineering**
   By S. P. Bindra | Dhanpat Rai & Sons

a. Course Name: Tendering Accounts
b. Course Code: 03605383
c. Prerequisite: Estimating, Costing and Valuation
d. Rationale: The course is designed to give the detailed understanding of terminologies in contract and tender document and their significance, to know different types of contracts and their uses, to learn preparation of typical Tender documents for civil engineering work, to get acquainted with rent fixation and valuation of civil structures.
e. Course Learning Objective:

CLOBJ 1	Upon completion of the course, students will demonstrate the ability to comprehend various types of contracts and discern their appropriate application in relevant contexts.
CLOBJ 2	Upon completion of this course, students will be able to: Analyze various civil engineering projects and accurately identify the appropriate type of contract based on project specifications, requirements, and constraints.
CLOBJ 3	Upon completion of this course, students will be able to: Prepare comprehensive tender documents tailored to the requirements of civil engineering projects, demonstrating proficiency in: Identifying and understanding the specific requirements of the civil engineering work.Structuring tender documents effectively to communicate project scope, specifications, and contractual terms clearly to potential bidders.Applying relevant industry standards, regulations, and best practices in drafting tender documents.

CLOBJ 4	Analyze various factors influencing the decision-making process in selecting appropriate payment methods for executed work, considering factors such as financial feasibility, contractual obligations, and industry standards.
CLOBJ 5	Prepare comprehensive and professionally structured tender documents tailored specifically for civil engineering projects, demonstrating proficiency in understanding the intricacies of tendering processes, including legal, technical, and administrative requirements.

f. Course Learning Outcomes:

CLO 1	After Learning the Course the students shall be able to: Understand the procedure to execute any civil engineering works.
CLO 2	Suggest the relevant type of contract for the given civil engineering work.
CLO 3	Got familiar with specifications for various civil engineering works
CLO 4	Prepare the typical Tender document for the given civil engineering work.
CLO 5	Justify the various forms of accounts and their use.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	**Content**	**Weightage**	**Teaching Hours**
1	**Procedure to Execute the Work** :Administrative approval, technical sanction, budget provision, expenditure sanction,	**5%**	**4**

	Methods for carrying out works- contract method, departmental method -rate list method, piece work method, day's work method, employing labors on daily wages basis.		
2	**Contracts** :Definition of contract, objects of contract, requirements of contract, overview of Indian Con- tract Act. Types of engineering contract with advantages, disadvantages and their suitability - Lump sum contract, item rate contract, percentage rate contract, cost plus percentage, cost plus fixed fee, cost plus variable percentage and cost plus variable fee contract, labour contract, demolition contract, target contract, negotiated contract, Engineering Procurement Construction Contract (EPC), Annuity Contract, Introduction of FIDIC Conditions of contract. Classification of contractor on basis of financial limits, Requirement of documents for registration of contractor, Build Operate Transfer (BOT) Project, BOT Toll contract, BOT (Annuity) contract, Design, Build, Finance, Operate and Transfer (DBFOT) contract, Hybrid Annuity contract, Operate Maintain and Transfer (OMT) contract, Operation & Maintenance contract (Introduction only).	**25%**	**10**
3	**Specifications**: Necessity and importance of specifications of an items, points to be observed in framing specifications of an item, Types of specification – Brief and Detailed, Standard and Manufacturers Specification. Preparing Detailed Specifications of items in civil engineering works from each of following- Building construction, Irrigation Engineering transportation Engineering , Public health Engineering.	**20%**	**8**
4	**Tender and Tender Documents** :Definition of tender, necessity of tender, types of tender- Local, Global, Limited. E - Tendering System – Online procedure of submission and opening of bids (Technical and Financial). Notice to invite tender (NIT)- Points to be included while drafting tender notice, Drafting of tender notice. Procedure of submitting filled tender Documents (Two envelope system), procedure of opening tender, comparative statement, scrutiny of tenders, award of contract, letter of award. Meaning of terms - Earnest Money Deposit (EMD), Performance Security Deposit, Validity period, corrigendum to tender notice and its necessity, Unbalanced bid. Tender documents – Index, tender notice,	**25%**	**10**

	general instructions, special instructions, Schedule A, Schedule B, Schedule C etc. Terms related to tender documents – contract conditions- time limit, time extension, penalty, defective material and workmanship, termination of contract, suspension of work, subletting of contract, extra items, price variation clause(escalation), defect liability Period, liquidated Damages. Arbitration- Meaning, Qualification of an arbitrator, Appointment, Dispute and Settlement of disputes, Arbitration and Conciliation Act, Arbitration award.		
5	**Accounts:** Various account forms and their uses – Measurement Books, E- Measurement book (E-MB), Nominal Muster Roll(NMR), Imprest Cash, Indent, Invoice, Bill, Vouchers, Hand receipt Cash Book, Temporary Advance. Heads of Accounts. Mode of Payment to the contractor and its necessity -Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E - payment.	25%	10

i. Text Book and Reference Book:

1. Estimating and Costing in Civil Engg.By B.N.Dutta | Ubspd, New Delhi

2. Estimating and Costing in Civil Engg. By S.C.Rangwala | Charotar Publication, Anand,Gujarat

3. A textbook of Estimating and Costing (TextBook)By G.S.Birdie

4. 'Estimation and Costing'By M. Chakraborti | M. Chakraborti

a. Course Name: Construction Quality Control & Monitoring
b. Course Code: 03605385
c. Prerequisite: Construction Materials, and Concrete Technology
d. Rationale: : In rapidly developing countries like India, where infrastructure projects are booming, ensuring quality control and monitoring in construction is crucial for achieving durable and sustainable structures within planned timeframes. For any civil engineering project, regular day-to-day inspections and monitoring play a vital role in maximizing lifespan and minimizing environmental impact. Implementing robust quality control measures can extend the life of civil structures by its design life without significant cost increases. This becomes especially vital considering the depletion of construction resources and the growing emphasis on sustainability. Therefore, for diploma students aspiring to a career in civil engineering, understanding green building concepts and thorough quality control practices is indispensable. Their future roles will likely involve supervisory positions, making them directly responsible for upholding construction quality. Thus, mastering these skills equips them to perform their duties efficiently, effectively, and with environmental responsibility in mind.

e. Course Learning Objective:

CLOBJ 1	Understand the principles and philosophies of Total Quality Management (TQM) within the context of construction projects, including its historical evolution, key concepts, and relevance in contemporary construction practices.
CLOBJ 2	Demonstrate proficiency in establishing and implementing Construction Quality Control Inspection Programs, including defining duties and responsibilities of staff, creating comprehensive checklists, and conducting quality inspections across various construction activities and materials, ensuring compliance with standards and specifications.
CLOBJ 3	Analyze and apply Statistical Quality Control (SQC) methods and techniques for monitoring and improving construction quality, including the use of control charts for attributes and variables, acceptance sampling, and quality measurement methodologies, to effectively manage and control construction processes and outcomes.
CLOBJ 4	Evaluate the significance of quality standards and certifications in the construction industry, including Indian Standard Code, National Building Code, and International Organization for Standardization (ISO) standards, and comprehend their application in ensuring compliance, quality references, and certification procedures to promote sustainable built environments and green building practices.
CLOBJ 5	Understand the principles, goals, advantages, and disadvantages of green building, including strategies for sustainable construction, certification processes by agencies such as GRIHA and LEED, life cycle assessment (LCA), efficiency in siting, structure design, energy, water, and materials usage, enhancement of indoor environmental quality, and optimization of operations and maintenance, with a focus on waste reduction.

f. Course Learning Outcomes:

CLO 1	Apply total quality management in civil construction.
CLO 2	Check the quality in civil construction works.
CLO 3	Identify the variations in quality of civil works.
CLO 4	Use various standard codes in civil construction works.
CLO 5	Design energy efficient buildings.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
Lecture Hrs/ Week	**Tutorial Hrs/ Week Lab**	**Tutorial Hrs/ Week Lab**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	

	Hrs/ Week	Hrs/ Week							
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**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, calibration, testing, measurements, recording of data and information etc. Accuracy in calculation, finding area, volume, etc.	**15%**	**7**
2	**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.	**25%**	**10**
3	**Statistical Quality Control& Monitoring** Statistical Quality Control. Quality Measurement: Attributes and Variables. Statistical Process Control (SPC) Methods. Control Charts for Attributes: p-Charts - Proportion Defective c-Charts - Number of Defects Per Unit. Control Charts for Variables. Other Types of Attribute-Sampling Plans. Acceptance Sampling.	**25%**	**10**
4	**Quality Standards** Quality standards in construction related to Building materials and other inputs for construction processes.	**15%**	**7**

	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.		
5	**Sustainable Built Environment Green Building** 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 .	**15%**	**7**

i. Text Book and Reference Book:

1. Total Quality Management – Dr. S. Kumar, Laxmi Publication Pvt. Ltd
2. Quality Assurance and Total Quality Management (ISO 9000, QS 9000 ISO 14000) by K C Jain and A K Chitale, Khanna Publishers
3. Fundamentals of Quality Control and Improvement By Amitava Mitra | 3rd Edition, Prentice Hall
4. National Building Code of India' Government of India

a. Course Name: Green Building and Energy Conservation
b. Course Code: 03605387
c. Prerequisite: Environmental Science and Public Health Engineering.
d. Rationale: The course is designed to know various aspects of green buildings, to use different steps involved in measuring environmental impact assessment to relate the construction of green building with prevailing energy conservation policy and regulations, to know and identify different green building construction materials, to learn different rating systems and their criteria.

e. Course Learning Objective:

CLOBJ 1	Identify various requirements for green building, including principles of sustainability, energy efficiency, water conservation, material selection, and indoor environmental quality.

CLOBJ 2	Demonstrate proficiency in using different steps in environmental impact assessment, including identification of potential environmental impacts, assessment methodologies, and mitigation strategies.
CLOBJ 3	Relate the construction of green buildings with prevailing energy conservation policies and regulations, ensuring compliance with local, national, and international standards aimed at promoting sustainable construction practices.
CLOBJ 4	Skills necessary to supervise the construction of green buildings using green materials, including overseeing material selection, construction processes, and quality control measures to ensure adherence to sustainability goals.
CLOBJ 5	Particular rating systems for the assessment of green buildings, understanding the requirements and metrics used in certification programs such as LEED, BREEAM, or Green Star, and applying them to evaluate the sustainability performance of specific building projects.

f. Course Learning Outcomes:

CLO 1	Identify various requirements for green building
CLO 2	Use different steps in environmental impact assessment.
CLO 3	Relate the construction of green building with prevailing energy conservation policy and regulations.
CLO 4	Supervise the construction of green building construction using green materials.
CLO 5	Focus on criteria related to particular rating system for assessment of particular green building.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Green Building and Design Features:** Definition of Green Building, Benefits of Green building, Components/features of Green Building, Site selection, Energy Efficiency, Water efficiency, Material Efficiency, Indoor Air Quality. Site selection strategies, Landscaping, building form, orientation, building envelope and fenestration, material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, waste reduction during construction.	**10%**	**6**
2	**Energy Audit and Environmental Impact Assessment (EIA):** Energy Audit: Meaning, Necessity, Procedures, Types, Energy Management Programs. Environmental Impact Assessment (EIA): Introduction, EIA regulations, Steps in environmental impact assessment process, Benefits of EIA, Limitations of EIA, Environmental clearance for the civil engineering projects.	**25%**	**10**
3	**Energy and Energy conservation:** Renewable Energy Resources: Solar Energy, Wind Energy, Ocean Energy, Hydro Energy, Bio- mass Energy. Non-renewable Energy Resources: Coal, Petroleum, Natural Gas, Nuclear Energy, Chemical Sources of Energy, Fuel Cells, Hydrogen, Bio-fuels. Energy conservation: Introduction, Specific objectives, present scenario, Need of energy conservation, LEED India Rating System and Energy Efficiency.	**20%**	**8**
4	**Green Building:** Introduction: Definition of Green building, Benefits of Green building, Principles: Principles and planning of Green building Features: Salient features of Green Building, Environmental design (ED) strategies for building construction. Process: Improvement in environmental quality in civil structure Materials: Green building materials and products- Bamboo, Rice husk ash concrete, plastic bricks, Bagasse particle board, Insulated concrete forms. reuse of waste material-Plastic, rubber, Newspaper wood, Nontoxic paint, Green roofing.	**25%**	**10**
5	**Rating System:** Introduction to (LEED) criteria, Indian Green Building council (IGBC) Green rating, Green Rating for Integrated Habitat Assessment. (GRIHA) criteria, Heating Ventilation Air Conditioning (HVAC) unit in green Building, Functions of Government organization working for Energy conservation and Audit(ECA), National Productivity	**20%**	**8**

	council(NPC), Ministry of New and Renewable Energy (MNRE), Bureau of Energy efficiency (BEE)		

i. Text Book and Reference Book:

1. "Sustainable Construction: Green Building Design and Delivery" by Kibert, C.
2. "Energy Technology" by O.P. Gupta.
3. "Non-Conventional Energy Resources" by B. H. Khan.

a. Course Name: Pavement Design and Maintenance

b. Course Code: 03605389

c. Prerequisite: Basic Transportation Engineering

d. Rationale: Maintenance of a building is the work done for keeping an existing building in a condition where it can continue to perform its intended functions. Proper maintenance not only improves functional and aesthetic value but also extends the life of building/structure and ensures safety of the users. Normally constructed building remains in a good shape for only for 40 to 50 years and starts deteriorating if not maintained properly. Inadequate maintenance and lack of repair works may lead to limited life span of buildings. However, with regular inspection and maintenance that enable timely identification of deteriorated elements and appropriate remedial measures, the life of normally constructed buildings/structures may be extended up to 100 years. Roads are the dominant mode of transportation in India today. They carry almost 90 percent of the country's passenger traffic and 65 percent of its freight. However, most highways in India are narrow and congested with poor surface quality, and 40 percent of India's villages do not have access to all weather roads. Development of roads infrastructure required sound knowledge and competency of various road design aspects so that required type of pavements/road can be design. At diploma level, students are expected to study about different aspects of pavement so as to develop their understanding in order to apply their knowledge in construction industry. There are many job opportunities in this sector in both Government Departments such as PWD (Road and Buildings), Municipal Corporations, National Highway Authority etc. in private sectors such as Contractors working in this area, housing societies etc. This course attempts to provide knowledge and skills for working in this area and hence the course is prerequisite for understanding principles of machine design at various levels.

e. Course Learning Objective:

CLOBJ 1	Identify and classify different types of pavements, including flexible, rigid, and semi-rigid, and understand their distinct characteristics, construction methods, and performance attributes.
CLOBJ 2	Evaluate and compare rigid and flexible pavement systems based on factors such as design precision, life maintenance, initial cost, stages of construction, material availability, surface characteristics, water penetration, utility location, and night visibility, enabling informed decision-making in pavement selection.

CLOBJ 3	Analyze the fundamental factors affecting pavement design, including design wheel load, traffic factors, environmental conditions, road geometry, material characteristics, soil properties, and drainage situations, to develop appropriate pavement designs tailored to specific project requirements.
CLOBJ 4	Apply various pavement design methods, including theoretical and empirical approaches for flexible pavements, and consider factors influencing concrete pavement design, such as joint requirements and spacing, as per relevant guidelines
CLOBJ 5	Utilize methods such as visual rating, pavement serviceability index, roughness measurements, and Benkelman Beam deflection to assess pavement condition and performance, incorporating the latest highway code standards to ensure compliance with construction regulations.

f. Course Learning Outcomes:

CLO 1	Students will distinguish between flexible, rigid, and semi-rigid pavements, understanding their characteristics and construction methods.
CLO 2	Students will compare rigid and flexible pavements, analyzing factors like design precision, maintenance needs, cost, and construction stages.
CLO 3	Students will apply pavement design principles, considering factors such as traffic, environment, materials, and drainage to develop effective designs.
CLO 4	Students will master pavement design methods for both flexible and rigid pavements, adhering to industry standards and guidelines.
CLO 5	Students will gain practical skills in assessing pavement condition, using methods like visual rating and deflection testing to inform maintenance decisions for infrastructure longevity and safety.

g. Teaching & Examination Scheme:

Teaching Scheme				**Evaluation Scheme**					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				T	**CE**	**P**	**Theory**	**P**	
3	**-**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	Basics of Pavement Design Types of pavements - Flexible, Rigid and Semi Rigid. Comparison of Rigid and flexible pavement according to Design precision, life maintenance, initial cost, stages of construction, availability of materials, surface characteristic, penetration of water in the pavement, utility location, glare and night visibility. Functions and characteristics of pavement. Factors affecting selection of type of pavement.	10	8
2	Fundamentals of Pavement Design Factors affecting pavement design-design wheel load ,Traffic factors, Environmental factors, Road geometry and material, Characteristics of soil and Drainage situation.	**20**	**8**
3	Design Overview of Flexible and Concrete Pavement Methods of flexible pavement design-Theoretical method, Empirical method with and without soil strength test.IRC37 guidelines for design of flexible pavement (overview only) Factors affecting design of concrete pavement.IRC58 guidelines for design of concrete pavement (overview only) Joints-Need, Types, requirements, spacing of joints.	**25**	**10**
4	Pavement Evaluation Definition and purpose of pavement evaluation. Methods of Pavement evaluation – Visual rating, Pavement serviceability index, Roughness measurements, Benkelman Beam deflection method Latest Highway code used in construction.	**20**	**8**
5	Pavement Maintenance Types of pavement maintenance - routine, periodic, and special. Need for inspection and maintenance schedule. Causes of pavement failure and remedial measures. Typical flexible and rigid pavement failures Types and causes of damages in flexible pavement, surface defects, cracks. Deformations- Rutting, fatigue, settlement and upheaval. Disintegration- loss of aggregate, stripping, pothole. Remedial measures - slurry seal, liquid seal, fog seal, and patching, ready mix patch. Types of damages to rigid pavement - cracking, spelling, slab rocking, settlement, joint sealant failure. Methods of repair - repair of spelled joints, full depth reconstruction, replacement of dowel bars.	**25**	**10**

i. Text Book and Reference Book:

1. Handbook on Repairs and Rehabilitation of RCC buildings CPWD, Government of India.
2. 11. Repairs and rehabilitation of concrete structures By P. I. Modi & C. N. Patel | PHI Publication
3. Learning from failures By R.N. Raikar | Structural Designers and Consultants, New Delhi
4. Concrete Technology By M.S. Shetty | S.Chand& co.Ltd
5. B.C. Punmia By Building Construction | Laxmi Publications Limite

a. **Course Name:** Building Services and Maintenance
b. **Course Code:** 03605391
c. **Prerequisite:** Public Health Engineering and Maintenance Repair and Rehabilitation of Structures
d. **Rationale:** This course focuses on students' acquisition of knowledge, skills & practices of essential building services for proper functioning & utility of building as a 'whole' unit/entity. Knowledge about domestic water supply & sanitation systems (external & internal) and house drainage& disposal facilities, ventilation and air conditioning, acoustics and creation of movement provisions is imparted. The knowledge and application of such aspects of the building are essential in developing a good architectural assistant who can be useful in creating good functional buildings with the right kind of building services requiring the least and easiest maintenance.

e. **Course Learning Objective:**

CLOBJ 1	Categorize building services based on their functional necessities for efficient operation and maintenance.
CLOBJ 2	To develop a comprehensive plan ensuring fire safety measures explicitly tailored for multistorey buildings, mitigate potential risks, and ensure occupant safety.
CLOBJ 3	To design water supply and sanitation systems customized to meet the specific needs and requirements of a particular type of building, ensuring efficient usage and waste management.
CLOBJ 4	To assess the viability and effectiveness of rainwater harvesting and solar water heater systems in meeting the water demands and promoting sustainability for a specific type of building.
CLOBJ 5	To justify the importance and benefits of designing a tailored lighting, ventilation, and acoustics system to enhance occupant comfort, well-being, and overall functionality of a particular type of building.

f. Course Learning Outcomes:

CLO 1	Classify various types of building services as per functional requirements.
CLO 2	Propose the fire safety requirements for multistorey buildings.
CLO 3	Devise suitable water supply and sanitation systems for a given type of building.
CLO 4	Evaluate the potential of rainwater harvesting and solar water heater systems for the given type of building.
CLO 5	Justify the necessity of designing the lighting, ventilation, and acoustics system for the given type of building.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
					Internal Marks			External Marks		
Lecture Hrs/Week	Tutorial Hrs/Week	Lab Hrs/Week	Hrs/Week	Credit	T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

W - Weightage (%) , **T** - Teaching hours

Sr.	Topics	W	T
1	**Overview of Building Services** Introduction to building services, Classification of buildings as per National Building code, Necessity of building services, Functional requirements of building, Different types of building services i.e. HVAC (Heat, Ventilation and Air Conditioning), Escalators and lifts, fire safety, protection and control, plumbing services, rain water harvesting, solar water heating system, lighting, acoustics, sound insulation and electric installation etc. Role and responsibility of Building Service Engineer, Introduction BMS (Building Management Services), Role of BMS, concept of smart building.	15	7
2	**Modes of Vertical Communication** Lifts: Different types of lifts and its uses, Component parts of Lift- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push etc., Design provisions for basic size calculation of space enclosure to accommodate lift services, Safety measures. • Escalators: Different Types of Escalators and its Uses, Components of escalators, Design provisions for basic size calculation of space enclosure to accommodate escalator services, Safety measures. Ramp: Necessity, design consideration, gradient calculation, layout and Special features required for physically handicapped and elderly.	20	8
3	**Fire Safety** Fire protection requirements for multistoried building, causes of fire in building, Fire detecting and various extinguishing systems, Working principles of various fire protection systems. Safety against fire in residential and public buildings (multistoried building),	15	7

	National Building Code provision for fire safety, Fire resisting materials and their properties, Fire resistant construction, procedures for carrying out fire safety inspections of existing buildings, Provisions for evacuation.		
4	**Plumbing Services** Importance of plumbing, AHJ (Authority Having Jurisdiction) approval, Plumbing Terminology andfixtures: Terms used in plumbing, Different types of plumbing fixtures, shapes/ sizes, capacities, situation and usage,Traps, Interceptors. System of plumbing for building water supply: storage of water, hot and cold-water supply system. System of plumbing for building drainage: Types of drainage system such as two pipe system, one pipe system, types of Vents and purpose of venting, Concept of grey water and reclaimed water. Different pipe materials, and jointing methods, fittings, hanger, supports and valves used in plumbing and their suitability.	**25**	**10**
5	**Lighting, Ventilation and Acoustics** Concept of SWH (Solar water heating), component parts of SWH, various systemof SWH (heat transfer, propulsion, passive direct system, active direct system, Do-it-yourself), installation and maintenance. Concept of lighting, types of lighting (natural and artificial), factors influencing the brightness of room, factors affecting selection of artificial lighting, installation of light (direct, half-direct, indirect, half-indirect and direct-indirect), types of light control (manual switch, remote switch, timer switch and photo-electric cell switch), types of lamps (incandescent, tungsten halogen and electric discharge), Lamp selection as per room sizes. Concept of ventilation, necessity and Types of ventilation. Bull; Building Acoustic, Objectives, acoustic Control in a building, acoustic material (porous absorber and cavity resonator).	**25**	**10**

h. Text Book and Reference Book:

Reference Books	
1.	**'Building Services Handbook'** By Roger Greeno and Fred Hall | Routledge
2.	**'Building Services, Technology and Design'** By Roger Greeno | Longman

a. Course Name: Disaster Management
b. Course Code: 03605393
c. Prerequisite: Environment Science and Public Health Engineering.
d. Rationale: This subject is conceptual applications of principles of management to mitigate various disasters. The subject is intended to provide a general concept of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.
e. Course Learning Objective:

CLOBJ 1	Understand basic information about different types of disasters, including their causes, characteristics, and impacts.

CLOBJ 2	Demonstrate knowledge of precautions and awareness strategies relevant to various types of disasters, including preventive measures and risk reduction techniques.
CLOBJ 3	Develop the ability to decide on the appropriate first actions to be taken when facing different types of disasters, considering safety protocols and emergency response procedures.
CLOBJ 4	Gain familiarity with organizations in India that specialize in disaster management, including government agencies, non-governmental organizations (NGOs), and other relevant institutions.
CLOBJ 5	Evaluate and select appropriate IT tools and technologies to assist in disaster management activities, including communication systems, data analysis software, and decision support systems.

f. Course Learning Outcomes:

CLO 1	Acquainted with basic information on various types of disasters.
CLO 2	Knowing the precautions and awareness regarding various disasters.
CLO 3	Decide first action to be taken under various disasters.
CLO 4	Familiarized with organization in India which are dealing with disasters.
CLO 5	Able to select IT tools to help in disaster management.

g. Teaching & Examination Scheme:

Teaching and Examination Scheme

Teaching Scheme					Examination Scheme					Total
Lecture Hrs/Week	Tutorial Hrs/ Week	Lab Hrs/Week	Hrs/ Week	Credit	Internal Marks			External Marks		
					T	CE	P	T	P	
3	-	-	-	3	20	20	-	60	-	100

SEE - Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

h. Course Content:

Course Content

W - Weightage (%) , T - Teaching hours

Sr.	Topics	W	T

1	**Understanding Disaster** Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity. Disaster and Development, and disaster management.	**10**	**4**
2	**Types, Trends, Causes, Consequences and Control of Disasters** Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.	**20**	**10**
3	**Disaster Management Cycle and Framework** Disaster Management Cycle – Paradigm Shift in Disaster Management. Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness. During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency. Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early. Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Stretegy, Hyogo Framework of Action.	**30**	**10**
4	**Disaster Management in India** Disaster Profile of India – Mega Disasters of India and Lessons Learnt. Disaster Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies.	**20**	**8**
5	**Applications of Science and Technology for Disaster Management** Geo-informatics in Disaster Management (RS, GIS, GPS and RS). Disaster Communication System (Early Warning and Its Dissemination). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non-Structural Mitigation of Disasters. S&T Institutions for Disaster Management in India.	**20**	**10**

i. Text Book and Reference Book:

1. Disaster Management By Ghosh G.K.
2. Handbook of Disaster Management: Techniques & Guidelines By Singh B.K
3. Environment Engineering and Disaster Management By Sharma, Sanjay K. | Luxmi Publications, New Delhi
4. Disaster Management Guidelines By GOI-UNDP Disaster Risk Reduction Programme (2009-2012)