EVALUATION SCHEME
&
SYLLABI

FOR

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING
(Effective from the Session 2019-2020)

Offered by

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology
Ghurdauri, Pauri Garhwal, U.K. 246194

EVALUATION SCHEME
B.TECH. (Civil Engineering)
I- Year (I-SEMESTER)
(Effective from session: 2019-2020)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TBS-111	Chemistry	3	1	0	40	40	80	120	200	4
2	TBS-112	Mathematics-I	3	1	0	40	40	80	120	200	4
3	TES-111	Programming for Problem Solving	3	1	0	40	40	80	120	200	4
4	TMC-111	Environmental Science	2	0	0	20	20	40	60	100	0
PRACTICALS											
5	PBS-111	Chemistry Lab	0	0	2	10	15	25	25	50	1
6	PES-111	Programming for Problem Solving	0	0	2	10	15	25	25	50	1
7	PES-112	Workshop/Manufacturing Practices	1	0	4	30	45	75	75	150	3
8	GPP-111	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**12**	**3**	**8**	**170**	**195**	**365**	**485**	**850**	**17**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
I- Year (II-SEMESTER)
(Effective from session: 2019-2020)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TBS-124	Physics	3	1	0	40	40	80	120	200	4
2	TBS-122	Mathematics-II	3	1	0	40	40	80	120	200	4
3	TES-123	Basic Electrical Engineering	3	1	0	40	40	80	120	200	4
4	TES-125	Engineering Mechanics	2	1	0	30	30	60	90	150	3
5	THS-121	English	2	0	2	30	30	60	90	150	3
PRACTICALS											
6	PBS-124	Physics Lab	0	0	2	10	15	25	25	50	1
7	PES-123	Basic Electrical Engineering Lab	0	0	2	10	15	25	25	50	1
8	PES-124	Engineering Graphics and Design	1	0	4	30	45	75	75	150	3
9	GPP-121	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**14**	**4**	**10**	**230**	**255**	**485**	**665**	**1150**	**23**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Second- Year (III-SEMESTER)
(Effective from session: 2020-2021)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-231	Basic Surveying	2	1	0	30	30	60	90	150	3
2	TCE-232	Building Materials	2	0	0	20	20	40	60	100	2
3	TCE-233	Fluid Mechanics	2	1	0	30	30	60	90	150	3
4	TCE-234	Solid Mechanics	2	1	0	30	30	60	90	150	3
5	THS-231	Effective Technical Communication	2	0	0	20	20	40	60	100	2
6	THS-232	Professional Practice, Law & Ethics	2	0	0	20	20	40	60	100	0
PRACTICALS											
7	PCE-231	Basic Surveying Lab	0	0	2	10	15	25	25	50	1
8	PCE-232	Building Materials Lab	0	0	2	10	15	25	25	50	1
9	PCE-233	Fluid Mechanics Lab	0	0	2	10	15	25	25	50	1
10	PCE-235	Industrial Interaction	0	0	2	0	50	50	0	50	1
11	GPP-231	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**12**	**3**	**8**	**160**	**225**	**385**	**465**	**850**	**17**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Second- Year (IV-SEMESTER)
(Effective from session: 2020-2021)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-241	Advanced Surveying	2	1	0	30	30	60	90	150	3
2	TCE-242	Concrete Technology	2	0	0	20	20	40	60	100	2
3	TCE-243	Hydraulic Engineering	2	1	0	30	30	60	90	150	3
4	TCE-244	Structure Analysis-I	2	1	0	30	30	60	90	150	3
5	TES-243	Energy Science and Engineering	2	0	0	20	20	40	60	100	2
6	TBS-241	Mathematics-III	2	1	0	30	30	60	90	150	3
PRACTICALS											
7	PCE-241	Advanced Surveying Lab	0	0	2	10	15	25	25	50	1
8	PCE-242	Concrete Technology Lab	0	0	2	10	15	25	25	50	1
9	PCE-243	Hydraulic Engineering lab	0	0	2	10	15	25	25	50	1
10	PCE-244	Structural Analysis Lab	0	0	2	10	15	25	25	50	1
11	GPP-241	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**12**	**4**	**8**	**200**	**220**	**420**	**580**	**1000**	**20**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Third- Year (V-SEMESTER)
(Effective from session: 2021-2022)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-351	Environmental Engineering-I	2	1	0	30	30	60	90	150	3
2	TCE-352	Geomatics Engineering	2	1	0	30	30	60	90	150	3
3	TCE-353	Hydrology	2	1	0	30	30	60	90	150	3
4	TCE-354	Soil Mechanics and Engineering Geology	2	1	0	30	30	60	90	150	3
5	TCE-355	Structure Analysis-II	2	1	0	30	30	60	90	150	3
6	TCE-356	Transportation Engineering	2	1	0	30	30	60	90	150	3
PRACTICALS											
7	PCE-351	Environmental Engineering Lab-I	0	0	2	10	15	25	25	50	1
8	PCE-354	Soil Mechanics and Engineering Geology Lab	0	0	2	10	15	25	25	50	1
9	PCE-356	Transportation Engineering Lab	0	0	2	10	15	25	25	50	1
10	PCE-357	Industrial Interaction	0	0	2	0	50	50	0	50	1
11	GPP-351	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**12**	**6**	**8**	**210**	**275**	**485**	**615**	**1100**	**22**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Third- Year (VI-SEMESTER)
(Effective from session: 2021-2022)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-361	Design of Concrete Structure-I	2	1	0	30	30	60	90	150	3
2	TCE-362	Engineering Economics, Estimation and Costing	2	1	0	30	30	60	90	150	3
3	TCE-363	Environmental Engineering-II	2	1	0	30	30	60	90	150	3
4	TCE-364	Foundation Engineering	2	1	0	30	30	60	90	150	3
5	TCE-365	Water Resource Engineering	2	1	0	30	30	60	90	150	3
6	TOE-XY	Open Elective I	2	0	0	20	20	40	60	100	2
PRACTICALS											
7	PCE-363	Environmental Engineering Lab-II	0	0	2	10	15	25	25	50	1
8	PCE-366	Implementation of Civil Engineering Software-I	0	0	2	10	15	25	25	50	1
9	PCE-367	Seminar	0	0	2	0	50	50	0	50	0
10	GPP-361	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**12**	**5**	**6**	**190**	**200**	**390**	**560**	**950**	**19**

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Fourth- Year (VII-SEMESTER)
(Effective from session: 2022-2023)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-471	Construction Engineering and Management	2	1	0	30	30	60	90	150	3
2	TCE-472	Design of Steel Structure	2	1	0	30	30	60	90	150	3
3	TCE-473	Railway and Airport Engineering	2	1	0	30	30	60	90	150	3
4	ECE-41X	Elective I	2	1	0	30	30	60	90	150	3
5	TOE-XY	Open Elective II	2	0	0	20	20	40	60	100	2
PRACTICALS											
6	PCE-474	Implementation of Civil Engineering Software-II	0	0	2	10	15	25	25	50	1
7	PCE-475	Industrial Interaction	0	0	2	0	50	50	0	50	1
8	PCE-476	Project – 1	0	0	8	0	100	100	100	200	4
9	GPP-471	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**10**	**4**	**12**	**150**	**305**	**455**	**545**	**1000**	**20**

Elective I

ECE-411	Air, Noise Pollution and Control
ECE-412	Building Information Modelling
ECE-413	Earthquake Resistant Design of Structure and Seismology
ECE-414	Ground Improvement Techniques
ECE-415	Optimization Methods
ECE-416	Traffic Engineering and Management

EVALUATION SCHEME
B.TECH. (Civil Engineering)
Fourth- Year (VIII-SEMESTER)
(Effective from session: 2022-2023)

S. No.	Course Code	SUBJECT	PERIODS			EVALUATION SCHEME					
						Sessional Exam			ESE	Subject Total	Credits
			L	T	P	CT	TA	Total			
THEORY											
1	TCE-481	Design of Concrete Structure-II	2	1	0	30	30	60	90	150	3
2	ECE-42X	Elective II	2	1	0	30	30	60	90	150	3
3	ECE-43X	Elective III	2	1	0	30	30	60	90	150	3
4	TOE-XY	Open Elective III	2	0	0	20	20	40	60	100	2
5	TOE-XY	Open Elective IV	2	0	0	20	20	40	60	100	2
PRACTICALS											
6	PCE-481	Structure Detailing Lab using CAD	0	0	2	10	15	25	25	50	1
7	PCE-482	Project – II	0	0	16	0	200	200	200	400	8
8	GPP-481	General Proficiency	0	0	0	0	50	50	0	50	0
SEMESTER TOTAL			**10**	**3**	**18**	**140**	**345**	**485**	**615**	**1100**	**22**

Elective II

ECE-421	Advanced Foundation Engineering
ECE-422	Advanced Remote Sensing Techniques and GIS
ECE-423	Bridge Engineering
ECE-424	Environmental Impact Assessment
ECE-425	Ground Water Engineering
ECE-426	Highway Construction and Management

Elective III

ECE-431	Eco-Hydro Climatology
ECE-432	Geoinformatics for Water Resources
ECE-433	Matrix Method for Structural Analysis
ECE-434	Pavement Material and Design
ECE-435	Solid and Hazardous Waste Management
ECE-436	Subsurface Investigations and Instrumentation

List of Open Electives

TOE-30	Air, Noise Pollution and Control
TOE-31	Basic of Geomatics Engineering
TOE-32	Construction Equipment and Automation
TOE-33	Construction Project Planning and Management
TOE-34	Disaster Preparedness and Planning
TOE-35	Environmental Impact Assessment
TOE-36	Hydropower Engineering
TOE-37	Infrastructure Planning and Management
TOE-38	Introduction to Civil Engineering
TOE-39	Machine Foundation

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
FIRST SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYLLABUS:

Unit 1: Introduction and Natural Resources; Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over exploitation of surface and ground water, floods, conflicts over water (international & inter-state). Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit 2: Ecosystems Concept of an ecosystem. Structure and function of ecosystem; Energy flow in an ecosystem: food chains; food webs and ecological succession, Case studies of the following ecosystems: Forest ecosystem**,** Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, systems, lakes, rivers, oceans, estuaries).

Unit 3: **Biodiversity and Conservation:** Levels of biological diversity : genetic species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value.

Unit 4: **Environmental Pollution, Policies & Practices:** Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution; Nuclear hazards and human health risks; Solid waste management : Control measures of urban and industrial waste.; Pollution case studies; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air(Prevention & Control of Pollution) Act; Water(Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD); Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

Unit 5: **Human Communities and the Environment:** Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management movements : Floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics : Role of Indian and other religions and cultures in

environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

TEXT/REFERENCE BOOKS:

- Environmental Studies by Anubha Kaushik & CP Kaushik, New age International Publisher.
- Environmental studies by Daniel. Wiley.
- Environmental studies by Erach Bharucha, University press.
- Ecology, Environmental Science and Conservation by JS Singh, SP Singh and SR Gupta. S. Chand Pubs Delhi.

COURSE OUTCOMES: After the end of the course, student

1. Will possess an understanding about the different resources and their distribution.
2. Will possess knowledge about ecosystem and its kind.
3. Will have exposure to the different human activities that are adversely affecting the biodiversity and environment.
4. Will be having clear understanding about pollution and the various measures that are set out to curb pollution.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
SECOND SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYLLABUS:

Unit 1: Fundamentals of Engineering Mechanics, System of Forces – Coplanar Collinear and Concurrent Forces, Resultant of Force Systems, Free body diagrams, Moment of Forces and its Application, Moment of Couples and Resultant of Force System.

Unit 2: Equilibrium of System of Forces on a Particle and on a rigid body, Types of friction, limiting friction, Laws of Friction, Angle of repose, Equilibrium of a body lying on a rough inclined plane, Analysis of ladder friction, analysis of wedge friction.

Unit 3: Centre of Gravity and its implications, Centroid of simple figures from first principle, centroid of composite sections, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections, Product of Inertia.

Unit 4: Type of beams and supports, determination of reactions for determinant beams under different type of loadings, Work, Virtual displacements, Virtual Work, Principle of virtual work for particle and ideal system of rigid bodies.

Unit 5: Simple Trusses, zero force members, the method of joints, the method of sections, bending moment (BM) and shear force (SF) diagrams for determinant beams under different type of loadings.

TEXT/REFERENCE BOOKS:

- Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
- F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
- R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
- Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
- Shanes and Rao (2006), Engineering Mechanics, Pearson Education
- Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education

COURSE OUTCOMES:

Upon successful completion of the course, student should be able to:

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures, Use the equilibrium equation and friction law
2. Draw Shear force and bending moment diagram of beam subjected to various loading and able to analyses

the trusses.

3. Determine the reactions for different determinate beams under different loading conditions
4. Determine centroid and moment of inertia for different shapes.
5. Understand the virtual work principles.

SYLLABUS:

Unit 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of line and dimensions, lettering, Conic sections; Scales – Plain, Diagonal and Vernier Scales;

Unit 2: Principles of Orthographic Projections, Projections of Points and lines; Projections of planes, Auxiliary Planes, Projections of Regular Solids i.e. Prism, Cylinder, Pyramid, Cone, Auxiliary Views.

Unit 3: Principles of Isometric projection, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Unit 4: Introduction of AutoCAD, Drawing Setting- Units, Limits; Basic drawing commands- Ortho, Line, Zoom, Polyline, Circle, Arc, Rectangle, Polygon, Ellipse, Osnap etc.; Editing Drawings- Select, Erase, Move, Copy, Break, Fillet, Trim, Extend, Rotate, Offset, Mirror, Stretch, Chamfer, Array; Intermediate Drawing Commands- Layers, Change, Fill, Hatch, Block, Insert, etc.;

Unit 5: Dimensioning- Associative, Base-line, Linear, Angular, Center Mark, Diameter, Leader, Radius; 3-Dimensioning Drafting- Iso commands, 3D Shapes, Draw cycloidal curves i.e. Cycloid, Epicycloid, and Hypocycloid

LIST OF PRACTICALS:

1. Lettering, Numbering and Dimensioning & line
2. Conic Section
3. Orthographic Projection
4. Section Views and Auxiliary Views
5. Isometric, Pictorial and Oblique Drawing
6. Development of Surfaces
7. Drawing setting and drawing commands
8. Editing commands
9. 3D drawings
10. Drawing cycloidal curves

TEXT/REFERENCE BOOKS:

- Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
- Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers (Corresponding set of) CAD Software Theory and User Manuals

COUSRE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Students understand basic knowledge of engineering graphics with using letter writing, different type of scales, lines and dimensions.
2. Student will be able to draw orthographic projections of points, lines, planes and solids.
3. Student will be able to understand principle of isometric projection and develop isometric views by different methods.
4. Students will become familiar with Auto CAD 2-D and 3-D drawings and learn various commands used in Auto CAD.
5. Students will be able to use appropriate computer technology and to work as a team.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
THIRD SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYLLABUS:

Unit 1: Importance of surveying to engineering projects, Fundamentals of surveying, basic principles. Scales and use of Vernier's, mistakes & errors, map sheet numbering, Plans and maps, coordinate and map projection, linear measurements, Ranging, error & corrections, Field Work.

Unit 2: Compass surveying, Angle measurement, types of bearing, magnetic declination, Local attraction, Dip, Types of compasses, theodolite - Basic definitions, fundamental lines, adjustments, method of repetition and reiteration, Errors in theodolite surveying, Spire test.

Unit 3: Traversing, methods. Angular measurements, balancing, bearing computations, adjustments of traverse, Gale's traverse table, Levelling – methods, level tube and its sensitivity, Dumpy level, tilting level and their adjustments, two peg test, booking of levels, effect of earth curvature and refraction, reciprocal levelling.

Unit 4: Tacheometry – methods, trigonometric levelling, Plane table surveys and mapping, adjustments, methods, two-point problem, three-point problem – Lehmann's rule, strength of fix, errors due to centring,

Unit 5: Contouring – characteristics, direct and indirect methods, interpolation, application, Computation of areas and volume, minor instruments – clinometer, sextant, pantograph, modern surveying instruments.

TEXT/REFERENCE BOOKS:

- Duggal S. K., "Surveying Vol 1" Tata McGraw Hill.
- Subramanian R., "Surveying and Levelling" Oxford Higher Education.
- Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill. 1998.
- Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House. 1995
- Chandra, A.M., "Surveying", New Age Publishers. 2002
- Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman. 2007

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Construct a map or plan of an area.
2. Determine relative positions and elevations of objects on the surface of the earth by taking linear and angular measurements in the horizontal and vertical plane.

3. Ability to apply knowledge of mathematics, and engineering to understand the measurement techniques and equipment used in land surveying.
4. Identify the error in surveying data and remove or reduce it.
5. Compute earth volume.

SYLLABUS:

Unit 1: Building classification; Principal properties of Building Material; **Clay and Clay Products** - Brick, Manufacturing of Bricks, Classification of Bricks, Testing of Bricks, Defects of Bricks, Different form of Bricks, Clay Tiles, Fire Clay, Fire Clay Brick, Terracotta; **Stone** – Classification of rock, Quarrying, Seasoning, Dressing, Uses, Characteristic of good stone, Testing, Deterioration, Preservation, Selection Criteria, Common Building Stone, Artificial stone; **Aggregate** – Classification, Characteristic, Soundness, Alkali-Aggregate Reaction, Testing;

Unit 2: Cement- Introduction, Portland Cement, Chemical Composition of raw material, Bogue Compound, hydration of cement, Rate of hydration, testing of cement: Fineness, Normal Consistency, Setting Time, Soundness, Compressive Strength, Tensile Strength, Specific Gravity, Types of cement: Portland Pozzolana Cement, Ordinary Portland Cement, Storage; **Lime-** Introduction, Varieties of lime, Classification of lime, Slaking, Comparison between cement and lime; **Building Mortar**- Introduction, Classification, Characteristic of good mortar, Preparation of Different Mortar, Selection of Mortar; **Masonry-** Introduction, Classification, Importance of Brick Masonry, Different types of Brick Forms, Brick Positions and Brick Bonds, Different terms used in stone masonry, classification of stone masonry;

Unit 3: Timber- Introduction, Classification of Trees, Classification of Wood, Structure of Tree, Requirements of good Timber, Processing of Timber, Seasoning of Timber, Defects in Timber, Preservation of Timber; **Pozzolanas-** Introduction, Classification, Activity of Pozzolana, Fly Ash, Surkhi, Blast Furnace Slag, Silica Fume, Rice Husk Ash; **Glass-** Introduction, Chemical Components, Manufacturing Process, Annealing, Properties, Different types of glass and their application; **Tar, Bitumen and Asphalt-** Introduction, Different Forms;

Unit 4: Ferrous Metals- Iron, Pig Iron, Cast Iron, Wrought Iron, Steel, Stainless Steel, Rolled Steel Sections, Reinforcing Steel Bars; **Non-Ferrous Metals-** Aluminium, Copper, Zinc, Lead Tin, Lead; **Plastic-** Introduction, Composition, Classification based on: behaviour with respect to heating, structure and Physical & mechanical properties; **Paints-** Introduction, Constituents of Paint, Manufacturing of Paint, Water Based Paints: Distempers and Emulsion, Oil Based Paints, Cement Paints, Special Paints, Process of Painting, Characteristics of an Ideal Paint, Defects in Painting; **Wood Finishes-** Different Types, Process of varnishing, Characteristics of an Ideal Varnish; Wallpapers;

Unit 5: Construction Principle, Principles of Functional Planning of Building, Doors, Windows, Roofs, Lintel, Staircase, Damp Proofing, Anti Termite, Natural Ventilation, Plastering;

TEXT/REFERENCE BOOKS:

- Duggal, S.K. (2017), "*Building materials",* Routledge.
- Varghese, P.C. (2015), "*Building materials"*, PHI Learning Pvt. Ltd.
- Sushil Kumar "*Building Materials and construction*", Standard Publishers, 20th edition, reprint, 2015.
- Dr.B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, "*Building Construction*", Laxmi Publications (P) ltd., New Delhi.
- Rangawala S. C. "*Engineering Materials*", Charter Publishing House, Anand, India.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Identify building class as per NBC code.
2. Understand the concept of various methods of manufacture of bricks and their properties.
3. Identify rock using basic geological classification systems.
4. Predict the properties of building stones and its classifications.
5. Explain various types of cements and their applications in construction and various field and laboratory tests on cement.
6. Understand the application of lime as building material.
7. Prepare the different mortar for building construction.
8. Classify various types of masonry.
9. Explain the classification of various types of woods, the properties of timber and processing of timber.
10. Explain the various types of pozzolanic materials and their application.
11. Classify the various types of glass and explain their application.
12. Differentiate between Tar, Bitumen and Asphalt.
13. Differentiate the uses of Ferrous metals, Non-ferrous metals and plastic in construction.
14. Identify the use of different types of paints and wood finishes.
15. Explain Construction Principle and construction of Doors, Windows, Roofs, Lintel, Staircase.
16. Explain the process of Damp Proofing, Anti Termite, Natural Ventilation, Plastering.

SYLLABUS:

Unit 1: Fluid Statics: Definition of a fluid, Fluid as a continuum, Properties of fluids (mass density, specific weight, compressibility and vapour pressure), Pressure on a fluid element, Pascal's Law, Newton's law of viscosity, Surface Tension, Archimedes principle of buoyancy, Hydrostatic pressure and hydrostatic forces on submerged surfaces, Manometers, Stability of submerged bodies and metacentric height.

Unit 2: Fluid Kinematics: Lagrangian and Eulerian description of fluid flow visualization, Definitions of stream line, streak line and path line. Substantial derivative, Velocity field, local and convective acceleration, Angular velocity and angular acceleration, free and forced vortices, Velocity potential and stream function.

Unit 3: Fluid Dynamics: Different types of fluid flow (Steady and Unsteady, Rotational and Irrotational, Uniform and Non-uniform). System and control volume approaches, Reynold's Transport Theorem (RTT), Conservation of mass (continuity), Conservation of energy, Integration of Euler's Equation to Bernoulli's Equation. Conservation of momentum and development of Navier-Stokes Equation. Applications of conservation principles (mass, momentum and energy).

Unit 4: Dimensional Analysis and Flow through Pipes: Dimensional homogeneity, Buckingham's π method, Dimensionless numbers – Reynold's Number, Froude Number, Mach Number, Euler Number, Weber Number. Laminar Flow through pipes, Hagen-Poiseullie Equation, Flow measurement in pipes using venturimeter and orifice meter. Turbulent flow through pipes, friction factor, Moody's diagram, minor losses, pipe networks, Hardy-Cross method, water hammer and surge tanks. Reynold's Equation and Reynolds Stress tensor,

Unit 5: Boundary Layer Theory, Drag and Lift: Concept of Boundary Layer, Laminar and turbulent boundary layer, Boundary layer thickness- displacement, momentum and energy thickness, von Karman integral equation, Hydro-dynamically smooth and rough boundaries, separation of flow, Skin-friction and form drag, Drag on sphere, cylinder and flat plates, Von Karman vortex trail- eddy shedding, Coanda effect, Coriolis effect, Magnus effect, Generation of lift around a cylinder, Computation of lift force.

TEXT/REFERENCE BOOKS:

- Bansal, R.K., "A text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd. 2011
- Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House. 2011
- White, F.M., "Fluid Mechanics", Tata McGraw Hill Education Pvt. Ltd. 2013

- Fox and Mc Donald, “Introduction to Fluid Mechanics”, John Wiley and Sons Inc. 2009

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe the principles of the fluid statics such as Pascal’s Law, Newton’s Law of viscosity, surface tension, Archimedes Principle and Hydrostatic law and apply these principles in determining the forces on submerged surfaces and stability of floating bodies.
2. Understand the Lagrangian and Eulerian fluid flow visualizations of velocity fields, local and convective accelerations, angular velocity fields and vortex flows.
3. Derive the fundamental equations of continuity, Navier Stoke’s Equation and Bernouli’s Equation using the basic principles of conservation laws. Apply these equations to solve different problems of fluid flow.
4. Develop a small-scale physical prototype for a large-scale model. Determine the losses in a pipe network due to friction and bends. Analyse the effects of water hammer and provide remedial measures such as air relief valves and surge tanks.
5. Understand the concept of boundary layer and turbulence, Magnus, Coriolis and Coanda effects of fluid flow separation. Determine the drag and lift forces on bodies such as cylinders and other streamlined bodies.

SYLLABUS:

Unit 1: Simple Stresses and Strains- Concept of stress and strain, Types of stresses and strains, St. Venant's principle, Stress and strain diagram, Hooke's law, Properties of material, Strain Energy, Resilience, Working stress, Factor of safety, Bars of varying section, composite bars, Temperature stresses, Lateral strain, Poisson's ratio and volumetric strain, Elastic moduli and the relationship between them.

Unit 2: Compound Stresses and Strains- Plain stress, Transformation of plain stress, Angle of obliquity, Principal stresses and principal planes, Maximum shear stress and absolute maximum shear stress, Mohr circle of stress, Ellipse of stress, Plain strain, Transformation of plain strain, Principal strains and principal axis of strain, Strain rosette, Circle of strain and ellipse of strain. Theories of failure.

Unit 3: Bending moment and Shear Force Diagrams - Bending moment (BM) and shear force (SF) diagrams for determinant beams under different type of loadings.

Flexural Stresses-Theory of simple bending – Assumptions and Derivation of bending equation, Determination of bending stresses, Section modulus of different cross-sections, Beam of uniform strength, bending stresses of composite Section.

Unit 4: Shear Stresses Distribution- Derivation of shear formula, Shear stress distribution across various beam sections, Shear flow, Shear centre.

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts.

Unit 5: Thick and Thin shells - Derivation of formulae and calculations of hoop stress, longitudinal stress in a thin and thick shells subjected to internal pressures.

Columns- Introduction, Euler's theory, Rankine formula.

Slope and deflection- Relationship between moment, slope and deflection, Double integration method, Moment area method, Castigliano's Theorem.

TEXT/REFERENCE BOOKS:

- James, M. Gere Mechanics of Materials. 8th ed. (INDIAN). Cengage Learning Publishing, 2014
- Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
- Rajput, R. K. Strength of Materials (Mechanics of Solids). 6th ed. S. Chand Publishing, 2015

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components.
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures stresses by application of Mohr's circle of stress; apply various failure criteria for general stress states at points.
3. Draw shear force and bending moment diagram of beam subjected to various loading; analyze different beams under bending stresses.
4. Define shear stress distribution across various beam sections; Calculate the deflection at any point on a beam subjected to a combination of loads.
5. Solve torsion problems in bars and thin-walled members; Calculate the stresses in a cylinder and sphere subjected to internal pressures; determine the critical load for column supported by different end conditions.

SYLLABUS:

Unit 1: Introduction to Technical Communication- Basics, Importance, Objectives and Characteristics of Technical Communication. Process of Communication, Flow of Communication, Barriers to Communication, Non-verbal Communication, Grammar and Vocabulary Development

Unit 2: Active Listening, Effective Speaking, Conversations and Dialogues, Formal Presentations- Meaning and Art of Listening, Traits of a Good Listener, Basic Sounds of English, Word Stress, Sentence Stress, Intonation, Types of Conversation Telephonic Conversations and Etiquette, Outlining and Structuring Nuances of Delivery Controlling Nervousness and Stage Fright

Unit 3: Interviews and Group Discussions- Objectives of Interviews, Job Interviews, Résumé, Biodata, and Curriculum Vitae, Speaking in Group Discussion, Persuasive Strategies, Effective Intervention

Unit 4: Reading and Effective Writing (Technical Reports, Formal Letters, Memos, and Email)- Techniques for Good Comprehension, Importance and Objectives of Reports, Structure and writing of Reports, Business Letters, Cover Letters, Memo writing, Email writing etiquettes

Unit 5: Self Development and Assessment, Basic knowledge of MS Office- Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, taking notes; Complex problem solving; Creativity

Knowledge about various Menus, Writing, Editing and Organizing Texts using MS Word, Formulas and Data Processing using MS Excel, Designing of Presentation, Inserting animations in MS Power Point.

TEXT/REFERENCE BOOKS:

- David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004.
- Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003.
- Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
- Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
- Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004.
- Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand and plan for the improvement of Technical Communication

2. Improve Listening, Speaking and Professional communication
3. Properly conduct himself in Group Discussions and Interviews
4. Demonstrate Writing Skills in Business Reports and Letter
5. Demonstrate the basic skills of MS Word, MS Excel and MS PowerPoint
6. Do self-assessment and plan for self-development by practice

SYLLABUS:

Unit 1: Introduction to Business Ethics: Business Ethics: Meaning, Definition, Need and Objective of Ethics. Significance of Business Ethics. Ethical Dimensions. Factors Causing Unethical Behaviour.

Unit 2: Ethical Decision Making: Ethical Decision in Organization. Guidelines for Managers for Managers for Ethical Decision Making. Ethical Dilemmas in Organization. Salient Features of Ethical Dilemma. Ethical manager in modern day business.

Unit 3: Ethics in Functional Areas: Common Unethical Practices. Marketing Ethics-Important Issues. Ethical Products. Ethics in Pricing. Ethical Promotion. Ethics in Finance. Ethics in Human Resource Management. Ethics in Information Technology.

Unit 4: Development of Ethical Corporate Behaviour: Elements essential for Ethical Corporate Behaviour. Codes of Ethics. Organizational Ethics; Ethics Committee; Reward/Punishment System and Whistle Blowing. Ethical Issues: Gender Ethics, Sexual Harassment and Discrimination.

Indian Contract Act 1872: Definitions: Agreement, kinds of agreements, Contract-kinds of contracts: Valid, Void, Voidable, Contingent and Quasi Contract and E-contract, distinguish between Agreement and Contract.

Unit 5: Corporate Social Responsibility: Social Responsibilities: Meaning and Definition. Why Business should be Socially Responsible. Main Social Responsibilities of Business Organization. Corporate social Responsibility in India. Corporate Governance. How to Achieve Good Corporate governance in the Indian context.

Introduction to Intellectual Property Rights: Meaning, Relevance, Business Impact, Protection of Intellectual Property, Copyrights, Trademarks, Patents, Designs, Utility Modals, Trade Secrets and Geographical Indications. Bio-diversity and IPR.

TEXT/REFERENCE BOOKS:

- Mandal, S. K (2015) Business Ethics and Corporate Governance. McGraw Hill Education.
- Murthy, C S V (2016) Business Ethics-test and Cases. Himalayan Publishing House.
- Reddy, Nirmal & Rani (2016) Business Ethics and Corporate Governance. Himalayan Publishing House.
- Rao, A B (2009). Business Ethics and Professional Values. Excel Books.
- Ghosh, Bishwanath (2012). Corporate Governance: Principles, Policies and Practices. Pearson.
- Jain Arun K (2010). Corporate Governance: Strategy and Ethics. McGraw Hill Education.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Ability to understand the difference between ethical and unethical behaviour.
2. Ability to understand the concept of ethical decision.
3. Overview of various unethical practices in marketing.
4. Ability to understand the application of ethical behaviour in corporate world.
5. Ability to gather the knowledge regarding responsibility of corporate towards society.

LIST OF PRACTICALS:

1. Study of different types of topographical maps and to prepare conventional symbols chart.
2. To survey an open field by chain survey in order to calculate an area of the field
3. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
4. To find out reduced levels of given points using dumpy/Auto level.
5. To perform fly levelling with an Auto /tilting level.
6. To study parts of a vernier / Electronic theodolite and practice for taking angle measurements.
7. To measure vertical angle of given points by electronic theodolite.
8. To measure horizontal angle between two objects by repetition method with three repetitions.
9. To measure horizontal angle by method of reiteration
10. To determine the elevation of chimney top by trigonometrical levelling by taking observations in single vertical plane.
11. To study various parts and practice with Wild T-2 micro-optic theodolite and EDM (Distomat DI-1600).

TEXT/REFERENCE BOOKS:

- Duggal S. K., "Surveying Vol 1" Tata McGraw Hill.
- Subramanian R., "Surveying and Levelling" Oxford Higher Education.
- Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill. 1998
- Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House. 1995
- Chandra, A.M., "Surveying", New Age Publishers. 2002
- Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman. 2007

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential levelling and angular measurements.
2. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods.
3. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses.

4. Operate an automatic level to perform differential and profile levelling; properly record notes; mathematically reduce and check levelling measurements.
5. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station.
6. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion.

LIST OF PRACTICALS:

1. Dimension tolerances of brick
2. Water absorption of brick
3. Compressive strength of brick
4. Efflorescence of brick
5. Fineness of cement by sieving
6. Specific surface area of cement by Blaine's Apparatus
7. Specific Gravity of cement
8. Soundness test of cement by Le-Chatelier apparatus
9. Normal consistency of cement.
10. Initial & final setting time of cement
11. Compressive strength of cement
12. Tensile strength of hydraulic cement
13. Gradation and fineness modulus of coarse aggregate
14. Gradation and fineness modulus of fine aggregate (sand)
15. Silt content of sand
16. Bulking of sand
17. Tensile strength of steel

TEXT/REFERENCE BOOKS:

- Duggal, S. K. (2017). Building materials. New Age International Publication.
- Kukreja C.B. "Material Testing Laboratory Manual". Nem Chand Jain Publication.
- Indian Standards Codes for all tests, Bureau of Indian Standards.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. The theoretical concepts of properties of brick, cement, aggregate and steel will be better understandable by performing practical on these materials.
2. The students will be able to analyze experimental data using advanced tools.
3. Technical writing skills of students will be improved.
4. The students will be able to work as a team.

LIST OF PRACTICALS:

1. Differentiation of Laminar and Turbulent flows using Reynold's Apparatus.
2. Determination of coefficient of discharge and calibration of a venturimeter.
3. Determination of coefficient of discharge and calibration of an orifice meter.
4. Determination of coefficient of discharge and calibration of a mouth piece.
5. Determination of coefficient of discharge and calibration of an orifice.
6. Determination of friction factor of a flow through a pipe.
7. Determination of force on a flat plate by the impact of jet of water.
8. Determination of force on a curved plate by the impact of jet of water.
9. Determination of losses of energy in a pipeline through the bends.
10. Determination of drag on a cylinder in the wind tunnel experiment.

TEXT/REFERENCE BOOKS:

- Bansal, R.K., "A text book of Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd. 2011
- Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House. 2011

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Determine the flow behaviour of laminar, transition and turbulent flows.
2. Determine the coefficient of discharge and calibration of orifice, mouthpiece, venturi meter and orifice meter.
3. Determine the coefficients for major losses and minor losses in a pipeline.
4. Verify the force created due to impact of jet on a flat and curved plate.
5. Determine the drag on a cylinder due to flowing fluid.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
FOURTH SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYALLABUS:

Unit 1: Triangulation and Trilateration: Principle of Triangulation and Trilateration classification of Triangulation Systems, layouts of triangulation system, Station Marks, Towers and Signals, Criteria for selection of various triangulation components. Satellite station and its reduction to center, Angular Measurement, Base line measurement and its extension.

Unit-2: Adjustment Computations: Definition of true value, observed value. Laws related to errors, Most Probable Value, Weight of observations, Principle of Least Squares, Observations and correlative Normal Equations, Adjustment of triangulation figures.

Unit-3: Curves: Classification of curves, Elements of Simple Circular, Transition and Vertical curves, Theory and methods of setting out circular, transition and vertical curves.

Unit-4: Project Surveys: Engineering surveys, Reconnaissance, Route survey, Construction survey, Topographic surveys, City surveys, Underground surveys. Principles and practice of hydrographic surveys, Soundings, location, reduction and plotting of soundings.

Unit-5: Introduction to Photogrammetry and Field Astronomy: Photogrammetry- Introduction, Scale of photograph, Stereoscopic vision, Techniques of photo-interpretation. Introduction to Field Astronomy: Astronomical terms, co-ordinate systems.

TEXT/REFERENCE BOOKS:

- Arora, K.R., “Surveying”, Vol. II & III, Standard Book House, Delhi.
- Mc Cormac, Surveying, 5th Edition, Wiley India
- Agor, R., “Surveying”, Vol. II & III, Khanna Publications, Delhi.
- Duggal, S.K., “Surveying” Volume 2, TMH publications

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems.
2. Use modern instruments to obtain geo-spatial data and analyze the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments.
4. Design and implement the different types of curves for deviating type of alignments.

SYLLABUS:

Unit 1: Cement its property and types: - Manufacture of Portland Cement and its composition, Hydration of cement, physical and chemical properties, concept of strength development, Gel. Space Ratio, Powers Law, Gel structure, Testing of Cement for general physical and chemical properties as per BIS specifications, Different types of cement such as Slag Cement, Portland Pozzolana Cement and high Alumina cement, their characteristics, composition, use and properties.

Unit 2: Concrete Aggregates, its properties and testing of aggregate: - Aggregates, its source and classification of aggregate, Properties of aggregate, packing of aggregates and packing density of aggregates, testing of aggregates for its physical and mechanical properties.

Properties of Fresh concrete: - Properties of fresh concrete, Workability of concrete and factor affecting the workability and its measurement, Problem of segregation bleeding and laitance.

Unit 3: Properties of Hardened concrete: - Operations involved in concrete production, Chemical and mineral admixtures, Properties of hardened concrete and maturity concept of concrete, Strength and durability, Factors affecting strength and durability of concrete. Time dependent behavior of concrete -creep, shrinkage and fatigue, Mechanics of setting and hardening of concrete.

Unit 4: Concrete mix design: - Statistical Quality controls, Concrete Rheology, Concrete Mix Design: principle and Methods, Concrete mix design by IS 10262:2019, Illustrative examples of Concrete mix design following IS 10262:2019.

Unit 5: Introduction of special concrete: - Introduction of special concrete: Admixtures in concrete, Special concrete as lightweight concrete, High Density Concrete, Sulphur Impregnated concrete, Polymer concrete, Lime concrete constituents and uses, High strength concrete, Fibre Reinforced Concrete, High performance concrete, Ready mix concrete and mass concrete, Use of Fly Ash in concrete, Recycled aggregate concrete.

Material testing and Instrument: - Material testing and instrumentation, Conventional vs. Non-Destructive Testing, Methods and principles of NDT.

TEXT/REFERENCE BOOKS:

- Shetty, M.S. "Concrete Technology Theory & Practice", Published by S.CHAND & Company, Ram Nagar, New Delh (2005).
- Gambhir, M.L. (2013). "Concrete technology: Theory and Practice". Tata McGraw-Hill Education.
- Neville, A.M. "Fundamentals of Concrete Technology" Latest Edition, Pearson Publication

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Identify the properties and functional role of ingredients of concrete and apply this knowledge to mix design philosophy.
2. Understand the properties of fresh and hardened concrete and identifying the factors which influence these properties and its impact on mix design of concrete.
3. Understand the impact and importance of waste material like fly ash, silica-fume, ground granulated blast furnace slag, rice husk ash as a supplementary cementitious material in concrete making and develop an awareness to utilize the waste materials as novel innovative materials for concrete production.
4. Evaluate the effect of the environment on service life performance of concrete, properties and failure modes of structural concrete and demonstrate techniques of Non-Destructive Testing of concrete structure.
5. Do concrete mix design as per IS 10262:2009 which fulfills the required properties for fresh and hardened concrete with emphasis on its strength and durability in given environmental condition and also discuss other prevalent methods of concrete mix design.

SYLLABUS:

Unit 1: Turbines: General layout of a hydroelectric power plant, Efficiencies of a turbine, Classification of turbines, Impulse and Reaction turbines, Radial, axial and mixed flow turbines, Pelton turbine, Francis Turbine, Kaplan Turbine, Draft Tube, Unit Quantities of a turbine (Unit Speed, Unit Discharge and Unit Power), Specific speed of a turbine, Characteristic Curves of a turbine (Main Characteristics, Operating Characteristics and Iso-Efficiency Curves).

Unit 2: Pumps: Centrifugal Pumps, Work done by impeller, Efficiencies of centrifugal pump, multistage centrifugal pumps, Pumps in Series and parallel, Specific speed of centrifugal pump, Main, Operating and Constant efficiency characteristic curves, Priming of centrifugal pump, Cavitation, Net Positive Suction Head (NPSH), Reciprocating pumps and work done, Comparison between centrifugal and reciprocating pumps.

Unit 3: Open Channel Hydraulics (Uniform Flow): Introduction, Velocity and pressure distributions in open channels, Froude number, Specific energy and critical depth, Alternate depths, Hydraulic radius and Hydraulic mean depth, Chezy's Equation, Darcy-Weisbach friction factor, Manning's formula, bed shear stress, Hydraulically efficient channel sections.

Unit 4: Open Channel Hydraulics (Gradually Varied Flow): Introduction to gradually varied flow, differential equation of GVF, Classification of flow profiles, Features of all the flow profiles, Direct integration of GVF differential equation, Bresse's Solution, Simple numerical solutions of GVF equation, Direct step method.

Unit 5: Open Channel Hydraulics (Rapidly Varied Flow): Introduction to Rapidly varied flow, Momentum equation formulation, Definition of Specific force, Hydraulic jump in a horizontal rectangular and non-rectangular channel, Use of jump as an energy dissipater, Types of Hydraulic Jump, Subcritical and Supercritical flow transitions, Rapidly varied Unsteady flows (Positive and Negative Surges).

TEXT/REFERENCE BOOKS:

- Subramanya, K. "Flow in Open Channels", Tata McGraw-Hill, 1982.
- Bansal, R.K. "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 1983.
- Modi, P.N., and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, 1973.

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the behaviour of different types of turbines and suggest an appropriate turbine that is efficient for the given conditions at a construction site of a hydroelectric power plant.
2. Develop an understanding of working of centrifugal and reciprocating pumps and suggest a pump based on the requirements of head and discharge that are needed to be generated by the pumps.
3. Design a channel that is most efficient in conductance of water and is most economical in construction. Differentiate between subcritical and supercritical flows, uniform and non- uniform flows in open channels.
4. Determine the gradually varied flow profiles that can occur at the back of a dam or at the fall from a spillway or when the slope is horizontal or adverse or when the flow transitions from a slope type to a different slope type. Approximately determine the inundation of a reservoir with the flow profiles.
5. Understand the behaviour of a hydraulic jump and use the jump as an energy dissipater for flow transitions from supercritical to subcritical. Calculate the impact of positive and negative surges of flash floods in an open channel.

SYLLABUS:

Unit 1: Static and kinematics indeterminacy, stability of structure, Conjugate Beam Method, deflection of beams and frames by Strain Energy Method, Castigliano's Theorems, Maxwell's Reciprocal Theorem.

Unit 2: Deflection of beams and frames by Unit load method, deflection due to lack of fit and temperature changes.

Unit 3: Moving loads and influence lines for determinate beams, influence lines for bridge trusses, maximum shear force and bending moment values due to moving loads.

Unit 4: Analysis of two and three hinged arches, influence lines and rolling loads, maximum bending moment diagram, effect of temperature on two and three hinged arches.

Unit 5: Analysis of cables, forces on anchor cables and towers, effect of temperature on cable, suspension bridge with two and three hinged stiffening girders, maximum shear force and bending moment diagram, influence lines and rolling loads.

TEXT/REFERENCE BOOKS:

- Bhavikatti S.S., Structural Analysis, Volume 1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi-4.
- Pandit G.S. and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd. 2006.
- Norris, C.H. et.al, "Elementary Structural Analysis", Tata McGraw Hill. 2003
- Hibbeler, R.C., "Structural Analysis", Pearson Press. 2007
- Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill. 2000

COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Enable the students to understand various methods to find slope and deflection of determinate beam.
2. Bring the knowledge of unit load method for beams and frames.
3. Understand influence lines and its applications.
4. Bring the understanding of different types of arches.
5. Analyze cables and suspension bridges.

SYLLABUS:

UNIT 1: Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment

UNIT 2: Energy Sources: Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries).

UNIT 3: Energy & Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy

UNIT 4: Civil Engineering Projects connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems

UNIT 5: Engineering for Energy conservation: Concept of Green Building and Green Architecture, Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption

TEXT/REFERENCE BOOKS:

- Boyle, Godfrey (2004), Renewable Energy (2nd edition). Oxford University Press
- Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press

- Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam
- Jean-Philippe; Zaccour, Georges (Eds.), (2005), Energy and Environment Set: Mathematics of Decision Making, Loulou, Richard; Waaub, XVIII,
- Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
- UNDP (2000), Energy and the Challenge of Sustainability, World Energy assessment
- E H Thorndike (1976), Energy & Environment: A Primer for Scientists and Engineers, Addison-Wesley Publishing Company
- Related papers published in international journals

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

1. List and generally explain the main sources of energy and their primary applications nationally and internationally.
2. Have basic understanding of the energy sources and scientific concepts/principles behind them
3. Understand effect of using these sources on the environment and climate.
4. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
5. List and describe the primary renewable energy resources and technologies.
6. To quantify energy demands and make comparisons among energy uses, resources, and technologies.
7. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
8. Understand the Engineering involved in projects utilising these sources.

SYLLABUS:

Unit 1: Transform Calculus-1: Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, evaluation of an integral using Laplace transform. Finding inverse Laplace transform by different methods, convolution theorem, application to solve ordinary differential equations and simultaneous linear differential equation.

Unit 2: Transform Calculus-2: Fourier transforms, Fourier sine transform, Fourier cosine transform, Z transform, Properties of Z transform, inverse Z transform, Properties of inverse Z transform and its application to solve deference equations.

Unit 3: Sets, Relations and Functions: Basic operations on sets, Cartesian products, disjoint and power sets, countable and uncountable set, complement of a set, Cardinal number, algebra of cardinal number. Different types of relations, different types of functions.

Unit 4: Introduction to Counting: Basic counting techniques – inclusion and exclusion, pigeon-hole principle permutation, combination, Derangements. Introduction to recurrence relation and generating functions.

Unit 5: Lattice Theory and Algebraic Structures: Partially ordered set, supremum and infimum, lattice, complete, distributive, modular and complemented lattices. Algebraic structures, binary operation, semigroup, monoid, group, order of a group, cyclic group. Boolean algebra (definition and simple example only)

TEXT/REFERENCE BOOKS:

- Erwin Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley & Sons, 2006.
- N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010
- C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill 2000.
- R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
- K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw_Hill, 2007.
- M. K. Gupta, Discrete Mathematics, Krishna Publication, Meerut.

COURSE OUTCOMES: The students will learn:

1. To understand the concept of Laplace transform that is used in various techniques dealing engineering problems.

2. To understand the concept of Fourier transforms, Z- transform and their application to solve difference equations.
3. To understand the concept of sets, relations & functions.
4. The tool of Basic counting techniques for learning advanced engineering problems.
5. The essential tool of Lattice theory and algebraic structures in a comprehensive manner.

LIST OF PRACTICALS:

1. Perform triangulation in the field with the help of theodolite and tape.
2. Perform trilateration in the field with the help of tacheometry method.
3. Set out a simple circular curve using method of offsets from long chord.
4. Set out a simple circular curve using method of offsets from tangents.
5. Set out a simple circular curve using method of offsets from chord produced.
6. Set out a simple circular curve using Rankine's method.
7. Set out a simple circular curve using Two-theodolite method.
8. Study and use of electronic theodolite and total station.
9. Demonstration of GPS & GIS.
10. Demonstration of visual interpretation of satellite imagery.

TEXT/REFERENCE BOOKS:

- Arora, K.R., "Surveying", Vol. II & III, Standard Book House, Delhi.
- Mc Cormac, Surveying, 5th Edition, Wiley India
- Agor, R., "Surveying", Vol. II & III, Khanna Publications, Delhi.
- Duggal, S.K., "Surveying" Volume 2, TMH publications

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Apply the knowledge of geometric principles to arrive at surveying problems.
2. Use modern instruments to obtain geo-spatial data and analyze the same to appropriate engineering problems.
3. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments.
4. Design and implement the different types of curves for deviating type of alignments.

LIST OF PRACTICALS:

1. Soundness test of cement by Le-Chatelier apparatus
2. Fineness of cement by sieving
3. Specific surface area of cement by Blain's Apparatus
4. Tensile strength of hydraulic cement
5. Tensile strength of steel
6. Workability of concrete by slump test
7. Workability of concrete by compaction factor
8. Concrete mixed design as per Indian Standard recommendation guidelines
9. Compressive strength of plain cement concrete
10. Modulus of elasticity of plain cement concrete
11. Effect of water cement ratio on the compressive strength of concrete
12. Split tensile strength of plain cement concrete
13. Flexural strength of plain cement concrete

TEXT/REFERENCE BOOKS:

- Shetty, M.S. "Concrete Technology Theory & Practice", Published by S. CHAND & Company, Ram Nagar, New Delh (2005).
- Gambhir, M.L. (2013). "Concrete technology: Theory and Practice". Tata McGraw-Hill Education.
- Gambhir, M.L. "Concrete Manual". Dhanpat Rai Publication.
- Indian Standards Codes for all tests, Bureau of Indian Standards.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. The theoretical concepts of properties of cement, steel and concrete will be better understandable by performing practical on these materials.
2. The students will be able to analyze experimental data using advanced tools.
3. Technical writing skills of students will be improved.
4. The students will be able to work as a team.

LIST OF PRACTICALS:

1. Determination of Characteristic curves in a Pelton wheel turbine.
2. Determination of Characteristic curves in a Francis turbine.
3. Determination of Characteristic curves in a Kaplan turbine.
4. Determination of Characteristic curves in a Centrifugal pump.
5. Series and Parallel connections in a multistage centrifugal pump.
6. Determination of shape of a specific energy curve using subcritical and supercritical depths in an open channel.
7. Determination of Discharge in an open channel using Alternate depths.
8. Determination of Discharge in an open channel using Sequent depths of hydraulic jump.
9. Determination of Gradually Varied Flow (GVF) profile in an open channel in subcritical conditions.
10. Determination of Coefficient of discharge of Rectangular, Triangular and Trapezoidal notches.

TEXT /REFERENCES BOOKS:

- Subramanya, K. "Flow in Open Channels", Tata McGraw-Hill, 1982.
- Modi, P.N., and Seth S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, 1973.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Determine the characteristic curves of turbines (both impulse and reaction turbines).
2. Determine the characteristic curves of centrifugal pumps.
3. Determine the arrangement of multistage centrifugal pumps in series and parallel.
4. Develop a specific energy graph for a given discharge in an open channel.
5. Determine the discharge of a channel using alternate depths and sequent depths.
6. Determine the GVF flow profiles for backwaters and coefficient of discharges for different notches.

LIST OF PRACTICALS:

1. To verify clerk Maxwell's reciprocal theorem.
2. To find the value of flexural rigidity (EI) for a given beam and compare it with theoretical value.
3. To determine the elastic displacement of the curved members experimentally and verification of the same by analytical methods.
4. To determine the horizontal thrust in a three hinged arch for a given system of loads experimentally and verify the same with calculated values.
5. To study experimentally a two-hinged arch for the horizontal displacement of the roller end for a given system of loading and to compare the same with those obtained analytically.
6. To study behaviour of different types of columns and find Euler's buckling load for each case.
7. To determine the deflection of a pin connected truss analytically & graphically and verify the same experimentally.
8. To analyse a redundant system of a coplanar forces with the help of a three-bar suspension system and compare theoretical and experimental values.

TEXT/REFERENCE BOOKS:

- Bhavikatti S.S., Structural Analysis, Volume 1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi-4.
- Pandit G.S. and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd. 2006.
- Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill. 2000

COURSE OUTCOMES:

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

1. Apply the concept of slope and deflection to solve the beam.
2. Relate the behaviour of column in different end conditions & solve for critical load.
3. Apply concept of horizontal thrust in maintaining parabola of two hinged parabolic arch for external loading & analyze the horizontal thrust.
4. Compare the experimental and theoretical results.
5. Work as a team.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
FIFTH SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYLLABUS:

Unit 1: Water: -Sources of water supply and quality issues, water quality requirement for different beneficial uses, Water quality standards, Water Supply systems, Need for planned water supply schemes, types of water demand and population forecasts.

Unit 2: Water Treatment: Aeration, sedimentation, coagulation, flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes.

Unit 3: Components of water supply system, Transmission of water, distribution system, water pipes, water supply system in building, plumbing and various valves used in W/S systems, service reservoirs and design.

Unit 4: Water pollution, cause and ill effects, Noise- Basic concept, measurement, specification and various control methods, effects of noise on health.

Unit 5: Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution. Air quality standards, Control measures for Air pollution.

TEXT/REFERENCE BOOKS:

- Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
- Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
- Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.
- MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
- Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

COURSE OUTCOMES:

After successfully studying this course, students will:

1. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
2. Be able to plan strategies to control, reduce and monitor air and water pollution.
3. Be able to select the most appropriate technique for the treatment of water.
4. Be able to design various treatment units for water treatment.
5. Apply sampling techniques for water, air and noise.

SYLLABUS:

Unit 1: Introduction, history of geomatics engineering, Fundamentals of remote sensing, EMR, Platforms and sensors, visual image interpretation, Types of remote sensing and their applications, resolutions in remote sensing.

Unit 2: Introduction to digital image processing, data formats, image pre-processing- radiometric & geometric, remote sensing image distortion and rectification, georeferencing, image enhancement, transformation, classification, classification algorithms, accuracy assessment, image fusion and change detection.

Unit 3: Photogrammetry – advantages and disadvantages, types of photographs, and geometry of aerial photograph, scale of tilted photograph. relief displacement, flight planning. Stereoscopy, introduction, types of stereoscopes, base lining, parallax and its use for elevation determination, Introduction to LiDAR, UAV photogrammetry.

Unit 4: GIS- Introduction, Data Sources, Data Models and Data Structures, Algorithms, DBMS, Creation of Databases (spatial and non-spatial), Spatial analysis - Interpolation, Buffer, Overlay, Terrain Modelling and Network analysis.

Unit 5: GNSS- Principle used, Components of GNSS, Data collection methods, DGPS, Errors in observations and corrections.

TEXT/REFERENCE BOOKS:

- Duggal S. K., "Surveying Vol 1 & 2" Tata McGraw Hill.
- Subramanian R., "Surveying and Levelling" Oxford Higher Education.
- Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill. 1998
- Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House. 1995
- Chandra, A.M., "Surveying", New Age Publishers. 2002
- Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman. 2007

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. To enable the students to understand and apply the basic concepts of geospatial analysis.
2. To augment imagination of students so that they can visualize 3D models before the construction of civil work.
3. To enhance the capabilities of student in analysis of survey data which is very important for designing a civil engineering work.

4. To increase knowledge of modern techniques in surveying like remote sensing, GPS, GIS for industry readiness.
5. To broaden the scope of surveying keeping in mind environmental impacts of civil engineering projects.

SYLLABUS:

Unit 1: Water as a resource and residence times, Hydrologic cycle, Hydrologic Planning, Precipitation and its types, Measurement of rainfall, Average depth of rainfall over an area by different methods, Mean annual rainfall, Analysis of Rainfall Data, Consistency of rainfall record, Methods to find the missing data of rainfall, Double mass curve, Depth Intensity and Frequency (IDF) curves, Depth area duration (DAD) curves.

Unit 2: Infiltration, Factors affecting infiltration and its determination, Infiltrometers, Evaporation and Evapo-Transpiration, Pan Evaporation, Consumptive use, determination of evapotranspiration by different methods, interception and depression storage, rain water harvesting and its procedure.

Unit 3: Runoff measurement, w-index and ϕ-index from hyetograph, Streamflow measurement in a watershed, factors effecting runoff and streamflow, Flood hydrograph, Base flow separation, Direct runoff hydrograph (DRH) and Unit hydrograph (UH), SCS Curve number method, Calculation of DRH for different durations from UH, Direct method of proportioning, S-Curve method, Synthetic Unit Hydrograph.

Unit 4: Frequency Analysis, Return period, random variables, flood-frequency distributions, binomial, Gumbell and poisons distributions, simple regression and correlation analysis, Governing equations of Flood Routing, Reservoir routing, Hydrologic Routing by Modified Pul's Method, and by Muskingam Method.

Unit 5: Groundwater and other forms of subsurface water, Aquifer properties, Porosity and Compressibility of aquifers, Equation of motion (Darcy Law), Hydraulic Conductivity and Transmissivity of an aquifer, Wells, Steady flow into an unconfined and a confined aquifer in radial coordinates, Dupuit's assumptions and equation of motion in an unconfined aquifer, Unsteady flow into a confined aquifer, Specific capacity of a well.

TEXT/REFERENCE BOOKS:

- Chow, V.T., Maidment, D.R. and Mays, W.L., "Applied Hydrology", McGraw Hill. 1988.
- Subramanya, K., "Engineering Hydrology", Tata McGraw Hill, 1994.
- Singh, V.P., "Elementary Hydrology", Prentice Hall. 1992.

COURSE OUTCOMES:

On the successful completion of the course the student will be able to:

1. Determine the importance of hydrological cycle on the environment and analyze the rainfall and other hydrological data.
2. Distinguish the different sources of storage in hydrological cycle along with their residence times.
3. Estimate the amount of conversion of rainfall to runoff through unit hydrographs.

4. Develop a frequency analysis and compare the results with different distribution systems.
5. Determine the role of subsurface water resource and manage the resources of groundwater to use for human activities.

SYLLABUS:

Unit 1: Engineering Geology: Geological processes, rock forming minerals, rock types and their engineering properties. Structural geology: Dip, strike, faults, folds, joints, their formation and importance in respect of civil engineering structures, rock mass movements, causes of landslides.

Unit 2: Elementary properties: Soil types, composition, three phase relations, Physical properties: Specific gravity, water content, in-situ density, consistency of soils, grain size distribution curves, relative density, IS soil classification system, field identification tests, soil structure and clay mineralogy.

Unit 3: Capillarity, Permeability: Darcy's law, determination of coefficient of permeability, factors affecting permeability, equivalent permeability of stratified soils, in-situ permeability test, effective stress, seepage analysis, 1-D flow, Laplace's equation, flow nets, uplift pressure, confined and unconfined flows, piping failure, filter criteria.

Unit 4: Compressibility: Compaction: General principles, Proctor tests, factors affecting compaction, field compaction, compaction techniques.

Consolidation: Fundamentals, 1-D consolidation, normally and over-consolidated soil, void ratio – pressure relationships, compressibility characteristics, time rate of consolidation, coefficient of consolidation, curve fitting techniques, settlement analysis, secondary consolidation, vertical sand drains.

Unit 5: Shear strength of Soil: Principle of effective stress, Mohr-Coulomb failure criterion, direct shear test, unconfined compression test, triaxial shear test: unconsolidated undrained, consolidated undrained, consolidated drained, vane shear test, shear strength of clays and sands, critical void ratio, stress path, pore-pressure coefficient.

TEXT/REFERENCE BOOKS:

- Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2007
- Punmia, B. C., "Soil Mechanics and Foundations", Laxmi Publications (P) LTD. 2017
- Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers. 2007
- Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, new Delhi. 2002
- Das, B.M., "Principles of Geotechnical Engineering", Thomson Asia. 2002
- Holtz, R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall. 1981
- Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman. 2007

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. Student will able to identify the main and most common igneous, sedimentary and metamorphic rocks.
2. Solve three phase system problems, Carry out soil classification.
3. Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
4. Solve practical problems related to consolidation settlement and time rate of settlement.

SYLLABUS:

Unit 1: Analysis of Pin-connected indeterminate frames, indeterminate beams and rigid frames by Method of Consistent Deformation, stresses due to error in length of member, temperature stresses.

Influence Lines for Indeterminate Beams- Muller Breslau's principle, influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one) and fixed beams.

Unit 2: Moment Distribution Method- Stiffness and carry over factors, distribution and carryover of moments, analysis of continuous beams, plane rigid frames with and without sway, support settlement, symmetric frames with symmetric and skew-symmetric loadings.

Unit 3: Slope Deflection Method- Slope deflection equations, equilibrium conditions, analysis of continuous beams and rigid frames, rigid frames with inclined members, support settlements, symmetric frames with symmetric and skew-symmetric loadings.

Unit 4: Matrix Method- Primary structures, compatibility conditions, formation flexibility matrices, analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility method, restrained structure, formation of stiffness matrices, analysis of continuous beams, pin-jointed plane frames and rigid frames by direct stiffness method.

Unit 5: Plastic Analysis- Plastic theory, statically indeterminate structures, plastic moment of resistance, plastic modulus, shape factor, load factor, plastic hinge and mechanism, collapse load, static and kinematic methods, upper and lower bound theorems, plastic analysis of indeterminate beams and frames.

TEXT/REFERENCE BOOKS:

- Bhavikatti S.S., Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt. Ltd., NewDelhi-4.
- Pandit G.S. and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd. 2006.
- Norris, C.H. et.al, "Elementary Structural Analysis", Tata McGraw Hill. 2003.
- Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill. 2000.
- Gambhir M.L., Fundamentals of Structural Mechanics and Analysis, PHIL earning Pvt. Ltd., 2011.
- Prakash Rao D.S., Structural Analysis, Universities Press, 1996.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. To bring the understanding of Method of consistent deformation and influence line.
2. To understand Moment distribution method.
3. To analyze Slope deflection method.
4. To understand Matrix method.
5. To enable the students to understand Plastic Analysis of structure.

SYLLABUS:

Unit 1: Highway development and planning- Classification of roads, road development in India, Current Road projects in India; highway alignment and project preparation, road development plans, engineering surveys.

Unit 2: Geometric design of highways- Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.

Unit 3: Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems, intelligent transport systems.

Unit 4: Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements.

Unit 5: Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC.

TEXT/REFERENCE BOOKS:

- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
- Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.
- Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
- Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley

COURSE OUTCOMES:

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

1. Carry out surveys involved in planning and highway alignment.
2. Design the geometric elements of highways and expressways.
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design.
4. Characterize pavement materials.
5. Design flexible and rigid pavements as per IRC.

LIST OF PRACTICALS:

1. Measurement of pH of water samples.
2. Determination of Turbidity of water samples.
3. Determination of Electrical conductivity water samples.
4. Determination of Total Dissolved Solids in water samples.
5. Determination of Chlorides in water.
6. Determination of Iron in water samples.
7. Determination of Fluoride in water samples.
8. Determination of Alkalinity and acidity in water samples.
9. Determination of hardness of water samples.
10. Ambient Air quality monitoring (RSPM)
11. Ambient noise measurement.
12. Determination of optimum coagulant dosage.

TEXT/REFERENCE BOOKS:

- APHA, "Standard Methods for the Examination of Water and Wastewater", 21st Ed. Washington, 2005.
- "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist, H. – Second Edition, VCH, Germany, 1992.
- "Methods of air sampling & analysis", James P.Lodge Jr(Editor) 3rd Edition, Lewis publishers,Inc,USA,1989.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. The students at the end of the experimental exercise would be able to perform field-oriented testing of water, Air and Noise waste for microbial contamination.
2. The students would be knowledgeable to perform toxicity test.
3. The students would be able to observe and identify the Bacteriological quality of water.

LIST OF PRACTICALS:

1. Megascopic study: Igneous, Sedimentary, Metamorphic of Rocks.
2. Megascopic study of minerals.
3. Field Density using Core Cutter method.
4. Field Density using Sand replacement method.
5. Natural moisture content using Oven Drying method.
6. Field identification of Fine-Grained soils.
7. Specific gravity of Soils.
8. Grain size distribution by Sieve Analysis.
9. Grain size distribution by Hydrometer Analysis.
10. Consistency limits by Liquid limit.
11. Consistency limits by Plastic limit.
12. Consistency limits by Shrinkage limit.
13. Permeability test using Constant-head test method.
14. Permeability test using Falling-head method.
15. Compaction test: Standard Proctor test.
16. Compaction test: Modified Proctor test.
17. Relative density.
18. Consolidation Test.
19. Triaxial Test (UU).
20. Vane shear test.
21. Direct Shear Test.
22. Unconfined Compression Strength Test.

TEXT/REFERENCE BOOKS:

- Das, B. M. (2021). Soil mechanics laboratory manual.
- Kalinski, M. E. (2011). Soil mechanics: lab manual (No. Ed. 2). John Wiley & Sons.
- Ventura Tejeda, F. R. (2020). Soil Mechanics Laboratory Manual.
- Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2007.
- Punmia, B. C., "Soil Mechanics and Foundations", Laxmi Publications (P) LTD. 2017.

COURSE OUTCOMES:

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

1. Determine index properties of soils.
2. Classify soils.
3. Determine engineering properties of soils.

LIST OF PRACTICALS:

1. Shape test (flakiness and elongation) of aggregate
2. Impact value test of aggregate
3. Crushing strength test of aggregate
4. Abrasion test of aggregate
5. Specific gravity test of bitumen
6. Ductility test of bitumen
7. Flush point and fire point test of bitumen
8. Float test of bitumen
9. Penetration test of bitumen
10. Softening test of bitumen
11. Viscosity test of bitumen
12. Water content test of bitumen
13. Marshal test for stability and flow value

TEXT/REFERENCE BOOKS:

- Khanna, S. K., & Justo, C. E. G. (1971). *Highway Material Testing: Laboratory Manual*. Nem Chand.
- Khanna, S. K., & Justo, C. E. G. (1991). *Highway engineering*. Nem Chand & Bros.
- Kadiyali, L. R. (2017). *Highway Engineering*. KHANNA PUBLISHING HOUSE.

COURSE OUTCOMES:

After a successful completion of the course, the students will be able to

1. Understand the importance of these highway materials in construction of road.
2. Identify engineering properties of aggregate.
3. Identify the grade & properties of bitumen.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
SIXTH SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYALLABUS:

Unit 1: Introduction, Materials for Reinforced Concrete and IS Code requirements, Sampling and strength of designed concrete mix, **Design Philosophies** - Working stress and limit state design methods, Characteristic and design loads, Characteristic and design strength, Design stress-strain curve of concrete and steel.

Unit-2: Limit State Design of R.C. Beams in Flexure: Singly and doubly reinforced rectangular, flanged Beam, Design for shear.

Unit-3: Bond and Anchorages of bars, check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, **General aspects of serviceability**-serviceability limits in IS: 456-2000, Calculation of deflections and crack width as per IS code, Design of RC beams subjected to torsion,

Unit-4: Design of Slabs: General consideration of design of slabs, Design of one-way and two-way slabs, design of staircases.

Unit-5: Design of Columns: General aspects, effective length of column, loads on columns, slenderness ratio for columns, minimum eccentricity, design of short axially loaded columns, design of column subject to combined axial load and uniaxial moment and biaxial moment using SP – 16 charts.

TEXT/REFERENCE BOOKS:

- Shah, V.L. et al., "Limit State Theory and Design of Reinforced Concrete: Structures Publications 2007.
- Pillai, S.U. and Menon, D., "Reinforced Concrete Design", Tata McGraw Hill 2003.
- Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice-Hall 2002.
- Park, R. and Pauley, T., "Reinforced Concrete Structures", John Wiley 1976.
- Gambhir, M.L., "Fundamentals of Reinforced Concrete Design", Prentice-Hall of India 2006.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand basic properties of materials used in RCC, and variation in strength based on various parameters and difference between limit state and working stress method.
2. Design of beams for flexure and shear stresses.
3. Understand the concept of development length and general aspects of serviceability criteria.
4. Design of one way and two-way slabs.
5. Design of columns under axial and biaxial loadings.

SYALLABUS:

Unit 1: Basic Principles and Methodology of Economics. Demand/Supply – elasticity. Basic Macro- economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes. Public Sector Economics, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

Unit 2: Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

Unit 3: Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works, adding equipment costs; labor costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

Unit 4: Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labor, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management. Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Unit 5: Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

TEXT/REFERENCE BOOKS:

- Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
- M Chakravarty, Estimating, Costing Specifications & Valuation
- Joy P K, Handbook of Construction Management, Macmillan
- Relevant Indian Standard Specifications.
- B.S. Patil, Building & Engineering Contracts
- Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016
- Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand the basic macro and microeconomic parameters and fiscal tools that govern the economy as a whole.
2. Understand the different parameters involved in the business strategy of different organizations.
3. Understand various measurements involved and different methods of making estimates.
4. Understand different types of tenders, their applications in different types of projects and various legal terminology involved.
5. Understand the general specification of different types of structures and the logic behind them.

SYLLABUS:

Unit 1: Wastewater Collection: Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; fixtures and fittings used. Sewer appurtenances, self-cleaning velocity, hydraulic of sewers, design of sewer, laying of sewers, sewerage systems.

Unit 2: Wastewater characterization, wastewater treatment on sites, pre-and primary treatment system: screen, grit removal, oil and grease removal.

Unit 3: Secondary Treatment: activated sludge process, conventional and extended aeration, waste oxidation ponds, trickling filter, rotating biological contractor, UASB process, advance wastewater treatment.

Unit 4: Wastewater and sludge disposal: Reuse system, wastewater disposal on land and water bodies and disposal of sludge, septic tank.

Unit 5: Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: solid waste from construction activities, Disposal of solid waste-segregation, reduction at source, recovery, recycle and disposal methods. Hazardous waste: Types and nature of hazardous waste, as per the HW Schedules of regulating authorities.

TEXT/REFERENCE BOOKS:

- Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
- Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M.Morgan, Thompson /Brooks/Cole; Second Edition 2008.
- Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, McGraw - Hill International Editions, New York 1985.
- MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.

COURSE OUTCOMES:

After successfully studying this course, students will be able to:

1. Understand the characteristic of wastewater, and able to treat for different uses.
2. Identify the effect of the pollutants on the quality of water and soil.
3. Plan strategies to control, reduce and monitor water pollution.

4. Select the most appropriate technique for the treatment of wastewater.
5. Design various treatment units for wastewater management.

SYALLABUS:

Unit 1: Introduction: Role of civil engineer in the selection, design and construction of foundation of civil engineering structures, brief review of soil mechanics principles used in foundation engineering.

Unit-2: Soil Exploration: Methods of soil exploration; boring, sampling, penetration tests, correlations between penetration resistance and soil design parameters.

Earth Pressure and Retaining Walls: Earth pressure at rest, active and passive earth pressure, Rankine and Coulomb's earth pressure theories, earth pressure due to surcharge, retaining walls, stability analysis of retaining walls, proportioning and design of retaining walls.

Unit-3: Foundations: Types of foundations, mechanism of load transfers in shallow and deep foundations, shallow foundations, Terzaghi's bearing capacity theory, computation of bearing capacity, effect of various factors, use of field test data in design of shallow foundations, stresses below the foundations, settlement of footings and rafts, proportioning of footings and rafts, sheeting and bracing of foundation excavation.

Unit-4: Pile Foundation: Types and methods of construction, estimation of pile capacity, capacity and settlement of group of piles, proportioning of piles.

Well foundations: Methods of construction, tilt and shift, remedial measures, bearing capacity, settlement and lateral stability of well foundation.

Unit-5: Stability of Slopes: Modes of failure-mechanism, stability analysis of infinite slopes, methods of slices, Bishop's simplified method.

Machine Foundations: Types of machine foundations, mathematical models, response of foundation - soil system to machine excitation, cyclic plate load test, block resonance test, criteria for design.

TEXT/REFERENCE BOOKS:

- Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2007
- Das, B.M., "Principles of Foundation Engineering", PWS. 2004
- Peck, R.B., Hanson, W.E. and Thornburn, T.H., "Foundation Engineering", John Wiley. 1974
- Punmia, B. C., "Soil Mechanics and Foundations", Laxmi Publications (P) LTD. 2017
- Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers. 2007
- Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, new Delhi. 2002

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Determine the earth pressures on foundations and retaining structures.
2. Analyze shallow and deep foundations.
3. Calculate the bearing capacity of soils and foundation settlements.
4. Understand soil exploration methods.

SYALLABUS:

Unit 1: Water resources in India, need for irrigation in India, Definition of irrigation, Types of irrigation systems – Direct and Indirect, Lift and Inundation irrigation Systems, Methods of irrigation – Surface and Sprinkler methods, Trickle or Drip Irrigation, Soil moisture Constants, Depth of water held by soil in different zones, Water extraction - Quality of irrigation water.

Unit 2: Water requirements of crops, Duty, Delta and Base period - Their relationship, Crops – Seasons, Factors affecting duty and methods of improving duty, consumptive use of water – Determination of canal capacities for cropping patterns, Size of reservoir, Types of reservoir, Zones of storage in a reservoir, Purpose of reservoir, Reservoir yield, Mass curve and Demand curve, Determination of reservoir capacity, yield from a reservoir of given capacity.

Unit 3: Classification of irrigation canals – Canal alignment, Design of unlined canals, Regime theories – Kennedy's and Lacey's theories, Critical Tractive force method, Design problems – Balancing depth – L.S. of a channel. Schedule of area statistics, Cross section of an irrigation channel, -Maintenance of irrigation channel, Regulation of channel system – Canal outlets, Requirements of a good outlet – Types of outlets, Water logging-Causes and control – land drainage.

Unit 4: Storage works: Classification of dams, factors governing selection of types of dam, selection of site, preliminary investigation, Gravity Dams: Forces acting on a gravity dam, stability criteria, modes of failure, elementary and practical profiles, stability analysis, principal and shear stress. Earth Dams: Types, foundation for earth dams, design of earth dams, causes for failure of earth dams, criteria for safe design, phreatic line, seepage analysis – seepage control through body and foundation.

Unit 5: Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater, stilling basins – USBR and IS standard basins. Types, location and components of diversion head works, effects of construction of weirs on permeable foundation, Bligh's, Lanes and Khosla's theories.

TEXT/REFERENCE BOOKS:

- Punmia, B.C., "Water Resources Engineering", Laxmi Publications.
- Asawa, G.L., "Irrigation and water Resources engineering", New Age International, 2005.
- K. Linsley, Water Resources Engineering, McGraw Hill, 1995.
- S. K. Garg, Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 1992.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Differentiate the types of irrigation systems and their suitability for practice.
2. Estimate the water requirement of crops and determine the size and capacity of reservoirs to meet the requirement.
3. Design the conveyance of estimated water through lined and unlined canals.
4. Analyze the forces on a gravity dam or an earth dam to carry out the requirement of storage in reservoirs.
5. Determine the different types of spillways and evaluate the suitability of an appropriate spillway for a designed hydraulic structure.

LIST OF PRACTICALS:

1. Measurement of pH of the given sample.
2. Determination of total solids from the given sample.
3. Determination of Total dissolved solids from the given sample.
4. Determination of Total suspended solids from the given sample.
5. Determination of Dissolved Oxygen (D.O).
6. Determination of Biochemical Oxygen Demand (BOD).
7. Determination of Chemical Oxygen Demand (COD).
8. Determination of Heavy metals.
9. Determination of O&G (oil and grease)
10. Determine of Ammonia Nitrogen in the given sample.

TEXT/REFERENCE BOOKS:

- APHA, "Standard Methods for the Examination of Water and Wastewater", 21st Ed. Washington, 2005.
- "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist, H. – Second Edition, VCH, Germany, 1992.
- "Methods of air sampling & analysis", James P.Lodge Jr(Editor) 3rd Edition, Lewis publishers,Inc,USA,1989.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. The candidate at the end of the experimental exercise would be able to perform field-oriented testing of wastewater for microbial and heavy metals contamination.
2. The candidate would be knowledgeable to perform toxicity test.
3. The candidate would be able to observe and identify the Bacteriological quality of waste water.

LIST OF PRACTICALS:

1. Introduction to Civil 3D interface (Application menu, Ribbon, Quick Access Toolbar, the tool space, drawing area, Command Area, Status bar) and Creating Object Styles and Labels Description Keys, an easy way to process survey data.
2. Creating points from a Surface, from segment: divide object by Intervals: measure object and creating points on an alignment, elevation from the surface finally exporting point.
3. Creating and defining surfaces by point groups, from break lines, surface Boundary, surface by Edits, and surface from Contours.
4. Surface Properties, Analysis by Water Drop Path, Analysis by Quick Profiles, Volume Surfaces (Cut and Fill), Surface Styles and Labels, Surface Labels and Tables
5. Introduction to Parcel, Sites, Parcel from Objects, Parcel Creation Tools, Free Form Create, Parcel Adjustment, Parcel Cul-de-Sac Area, Parcel renumbering, Parcel Styles, Parcel Label Style.
6. Introduction to alignment, Alignment from objects, Alignment by Layout, Alignments Labels
7. Introduction to Profile, Profile from Surface, Profile by Layout, Profile Styles and Labels
8. Introduction to Corridor, Cross-section or Assembly, Corridor Creation,
9. Modifying a Corridor: Baselines, Corridor Frequencies, Corridor targets, splitting a corridor, Creating a corridor Surface
10. Laying out a Storm Sewer network, Pipe Rules, Pipe Parts List, creating a Network by objects, Creating a Network by Creation Tools, Projecting Pipes in Profiles

TEXT/REFERENCE BOOKS:

- Eric Chappell, 2016, AutoCAD Civil 3D 2016 Essentials, Autodesk Official Press, Sybex
- Davenport Cyndy, Voiculescu Ishka, Mastering AutoCAD Civil 3D 2016: Autodesk Official Press.

COURSE OUTCOMES:

At the end of the course, students will achieve following outcomes:

1. To creating object styles and labels description keys in AutoCAD Civil 3D.
2. To perform analysis by water, drop path, quick profiles and volume surfaces (cut and fill) AutoCAD Civil 3D.
3. To perform alignment from objects, alignment by layout, alignments labels in AutoCAD Civil 3D.
4. To do laying out a storm sewer network creating a network by objects, by creation tools in AutoCAD Civil 3D.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
SEVENTH SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYALLABUS:

Unit 1: Construction project planning: Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution; Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning role of client and contractor, level of detail. Process of development of plans and schedules, work breakdown structure.

Unit-2: Techniques of planning: Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion.

Unit-3: Construction Equipment basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Unit-4: Project Monitoring &Control: Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Unit-5: Contracts Management basics: Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

TEXT/REFERENCE BOOKS:

- Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
- Chudley, R., Construction Technology, ELBS Publishers, 2007.
- Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
- Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
- Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
- Punmia, B.C, Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Apply knowledge and skills of modern construction practices and techniques.
2. Plan, control and monitor construction projects with respect to time and cost.
3. Optimize construction projects based on costs.
4. Have an idea how construction projects are administered with respect to contract structures and issues.
5. Put forward ideas and understandings to others with effective communication processes.

SYALLABUS:

Unit 1: Design of Connections Common steel structure, advantages and disadvantages of steel structures, type of steel, rolled steel sections, special considerations in steel design, design philosophy, limit state design, design strength, deflection and serviceability limits, stability checks; Riveted, bolted and welded connections.

Unit 2: Design of Tension Members: Design strength of tension member due to yielding of gross section, rupture strength of critical section and block shear, tension splices and lug angles; design of bolted and welded connections for ties subjected to both bending and axial tension.

Unit 3: Design of Compression Members: Shape of compression members, buckling class of cross–section, slenderness ratio, design compressive stresses and strengths, use of IS800-2007 tables for design stresses, design of compression members.

Unit 4: Design of Beams: Behaviour of beam in flexure, section classification, plastic moment carrying capacity of a section, bending and shear strengths of laterally supported beams, design of laterally supported beams, deflection limits, web buckling and web crippling.

Unit 5: Plate-girders including stiffeners, splices and curtailment of flange plates.

TEXT/REFERENCE BOOKS:

- Limit State Design of Steel Structures, S.K. Duggal, Tata Mcgrawhill Publication-2010.
- Limit State Design of Steel Structures by N. Subramanium, Oxford University Press-2009
- IS 456-2000, Code of practice for Plain and R. C., Bureau of Indian Standards, New Delhi.
- I.S.800-2007, Code for general construction in steel structures, Bureau of Indian Standards, New Delhi.
- I.S. 875 (Part I to Part V), Code of Practice for Design Loads, Bureau of Indian Standards, New Delhi.
- I.S.808-1989, Code for Classification of Hot Rolled Steel, Bureau of Indian Standards, New Delhi.
- I.S.816-1969, Code of practice for use of metal arc welding for general construction in mild steel, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES:

On successful completion of the course student should be able to:

1. Learn the concept of analysis and design of steel structures.
2. Analyze and design of bolted and welded connections.
3. Analyze and design of tension members with different failure criteria.
4. Analyze and design of columns/built up columns with various configurations and end conditions.
5. Analyze and design of plate girder.

SYALLABUS:

Unit 1: Introduction, Permanent Way and Components: History and administrative setup of Indian Railways; rail gauges, permanent way – functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, components – rails, sleepers, ballast and formation. Resistances and Stresses in Tracks, Hauling Capacity: Types of resistances to traction, stresses in different components of track, hauling capacity of a locomotive, tractive effort.

Unit 2: Joints and Fastenings: Types of joints: short welded rails, long welded rails and continuous welded rails, rail to rail and rail to sleeper fastenings, elastic fastenings. Track Geometrics, Turnouts and Crossings: Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings.

Unit 3: Track Safety, High speed tracks, Urban railways: Signals classification and their functions, train operation control systems – absolute, automatic block systems, centralized train control system, ATS, interlocking of tracks – principle of interlocking, types of interlocking, high speed tracks – track requirements, speed limitations, high speed technologies, and urban railway - railway systems in urban areas**.**

Unit 4: Introduction, Aircraft Characteristics and Airport selection: Air transport development in India, national and international organizations in air transport, aircraft characteristics and their impact on planning of an airport, selection of site for an airport, airport obstruction, imaginary surfaces, runway orientation clam period and wind coverage.

Unit 5: Geometric Designs: Runway and taxiway geometric designs, exit taxiway, its design and fillet curves, runway configuration, separation clearance, design of apron and their layouts. **Airport Traffic control Aids:** Visual aids, marking and lighting of runway and apron area, wind and landing direction indicator.

TEXT/REFERENCE BOOKS:

- Chandra, S. and Agarwal, M. M., "Railway Engineering", Oxford.
- Arora, S. P. and Saxena, S. C., "A Text Book of Railway Engineering", Dhanpat Rai Publications.
- Mundrey, J. S., "Railway Track Engineering", Tata Mcgraw Hill.
- Khanna, S. K., Arora, M. G. and Jain, S. S., "Airport Planning & Design", Nem Chand and Bros.
- Horonjeff, Robert and McKelvey, Francis X., "Planning & Design of airports', 4th Ed., McGraw Hill.
- Saxena, S.C., "Airport Engineering – Planning and Design", CBS Publishers.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand the basics of railway engineering, its history and components.
2. Get insight into practical design of laying down railway tracks by understanding the numeric behind it.
3. Understand the safety aspects in railways and high-speed rails including signal systems.
4. Comprehend the need, design and planning of Airports.
5. Learn the design of components of Airports like runway, taxiways, aprons etc. according to their specific purposes.

SYALLABUS:

Unit 1: Air pollutants, Sources, classification, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect.

Unit 2: Air sampling and pollution measurement methods, principles and instruments, Indoor and ambient air quality and emission standards, Air pollution indices.

Unit 3: Air Act, legislation and regulations, control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation.

Unit 4: Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation, and biological air pollution control technologies.

Unit 5: Noise- Basic concept, noise monitoring procedure, specification and various control methods, effects of noise on health.

TEXT/REFERENCE BOOKS:

- Kenneth, W., Warner, F.C. And Davis Wayne, T., "Air Pollution, Its Origin and Control", 3rd Ed., Prentice Hall.
- Mishra, P.C., "Fundamentals of Air and Water pollution", South Asia Books.
- Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill.
- S.P Singal Noise Pollution and Control Technology, Narosa Pub House; 1 edition (March 1, 2000).

COURSE OUTCOMES:

On completion of the course, the student will:

1. Be able to understand the impact of air and noise on human's health and environment.
2. Be able to identify the success of air and noise pollution.
3. Be able to plan strategies to control, reduce and monitor air and noise pollution.
4. Be able to select the most appropriate technique for mitigation of air and noise pollution.
5. Be conversant with basic environmental legislation comprehend the need, design and planning of Airports.

SYALLABUS:

Unit 1: BIM & Construction industry: Introduction to BIM, physical and functional characteristics of a building, Definition of BIM, History of BIM, Importance of BIM in construction industry.

Unit 2: BIM and Infrastructure: Components of BIM, Advantages of BIM over traditional design-build process, Use of BIM, Benefits of BIM for a construction project.

Unit 3: BIM and Modern tools: Introduction to modern tools like big data, IOT, Machine learning and Artificial Intelligence, Laser scanning. Introduction to various types of sensors and ICT. Role of above modern tools in the BIM process, scan to BIM.

Unit 4: BIM, GIS & Smart Cities: Concept and definition of GIS, Smart Cities. Linking information exchange between GIS and BIM (citygml). Understanding Smart cities and BIM. Future of BIM and its role in creating Smart Cities.

Unit 5: BIM related case studies: Application of above tools and techniques by reading related research papers.

TEXT/REFERENCE BOOKS:

- Crotty, R: The impact of Building Information Modelling: transforming construction. London and New York: Spon Press, 2012
- Garber, R: BIM design: realising the creative potential of building information modelling. E-Book. Chichester: John Wiley & Sons, 2014
- Hardin, B: BIM and construction management: proven tools, methods, and workflows. Indianapolis: John Wiley & Sons, 2015
- Kensek, K: Building Information Modeling: BIM in current and future practice. E-Book. Hoboken, NJ: John Wiley & Sons, 2014

COURSE OUTCOMES:

On completion of the course, the student will be able:

1. To realize the importance of BIM in construction industry by knowing its history.
2. To understand the role of BIM as an effective project management tool in Infrastructure engineering.
3. To introduce the students to the basics of futuristic tools like AI, IOT, laser scanner etc. which will change how the construction industry works in the future.
4. To realize the interface of BIM, GIS i.e., scaling of single component to multi-component leading to conception of smart cities.

SYALLABUS:

Unit 1: Introduction to Earthquake Parameters: Earthquake occurrences –Global Seismic Belts. Indian Seismic Zoning map, their engineering implications: Damage survey, seismic intensity, isoseismal maps, more commonly used earthquake parameters like epicenter, epicentral distance, origin time, focus, magnitude, frequency. Elementary information on seismic wave propagation. Demonstration of seismographs to explain earthquake recording.

Unit 2: Single Degree of Vibration Freedom System: Introduction to vibration problems, Undamped and Damped free vibration with viscous damping, Forced vibrations, Steady state, Vibration Isolation.

Unit 3: Single Degree of Vibration Freedom System: Vibration Measuring Instruments, (Demonstration for determination of damping, frequency etc.), Response of undamped systems to time dependent force functions (Pulse/impulses), Duhamel's Integral, Response to ground motion, Response spectra.

Unit 4: Two Degree of Freedom System: Determination of natural frequency and mode shapes, Steady state forced vibrations, Undamped vibration absorbers.

Multi Degree of Freedom System: Rayleight's Method - Determination of fundamental frequency of simple systems, free vibrations of undamped systems – Determination of frequency and mode shapes by Holzer method, Stodola Method, Evaluation of earthquake forces in multi-storeyed buildings using response spectra.

Unit 5: Earthquake Effects: Ground failures, Local site effects, Effects on ground and structure.

Introduction to IS Code: IS-1893, Codal Provisions for evaluation of earthquake forces on buildings.

TEXT/REFERENCE BOOKS:

- Krishna, J., Chandrasekaran, A. R., & Chandra, B. (1994). Elements of earthquake engineering. South Asian Publishers.
- Chopra, A. K. (2007). Dynamics of structures. Pearson Education India.
- Damodarasamy, S. R. (2009). Basics of structural dynamics and aseismic design. PHI Learning Pvt. Ltd.
- Shrikhande, M., & Agarwal, P. (2006). Earthquake Resistance Design Of Structure. First Revised Edition, PHI Learning Private Limited, New Dehli.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Summaries engineering seismology and discuss the causes and effects of earthquakes.
2. Characterize different types of vibration for single degree freedom system.

3. Understand principle of vibration measuring instrument.
4. Analyze pulse or impulse loading using Duhamel's Integral.
5. Draw the response spectra for different ground condition and understand their application.
6. Explain the concept of isolators.
7. Draw the node shape for multi degree freedom system using different methods.
8. Understand the effects of earthquake.
9. Determine the earthquake forces on multi stories structure using IS:1893.

SYLLABUS:

Unit 1: Introduction- Problematic Geomaterials and Conditions, Ground Improvement Methods and Classification, Selection of Ground Improvement Method.

Unit 2: Mechanical modification- Dynamic compaction, Impact loading, Compaction by blasting, Vibro-compaction; Pre-compression, Stone columns; Hydraulic modification: Dewatering systems, Preloading and vertical drains, Electro-kinetic dewatering.

Unit 3: **Chemical modification and Thermal modification-** Modification by admixtures, Stabilization using industrial wastes, Grouting, Ground freezing and thawing.

Unit 4: Soil reinforcement- Reinforced earth, Basic mechanism, Type of reinforcements, Selection of stabilization/Improvement of ground using Geotextiles, Geogrid, Geomembranes, Geocells, Geonets and Soil nails.

Unit 5: Application of soil reinforcement- Shallow foundations on reinforced earth, Design of reinforced earth retaining walls, Reinforced earth embankments structures, Wall with reinforced backfill, Analysis and design of shallow foundations on reinforced earth, road designs with geosynthetics.

TEXT/REFERENCE BOOKS:

- Patra, N. R. (2014). Ground improvement techniques. Vikas Publishing House.
- Hausmann, M.R., Engineering Principles of Ground Modification, McGraw-Hill International Editions, 1990.
- Yonekura, R., Terashi, M. and Shibazaki, M. (Eds.), Grouting and Deep Mixing, A.A. Balkema, 1966.
- Moseley, M.P., Ground Improvement, Blackie Academic & Professional, 1993.
- Xanthakos, P.P., Abramson, L.W. and Bruce, D.A., Ground Control and Improvement, John Wiley & Sons, 1994.
- Koerner, R. M., Designing with Geosynthetics, Prentice Hall Inc. 1998.

COURSE OUTCOMES:

At the completion of the course the students will be able to:

1. Identify difficult ground conditions in engineering practice.
2. Identify different ground improvement techniques and select site specific method of improvement and its design.
3. Promote wider use of techno – economical construction techniques such as Stone columns, Reinforced soil structures, Soil Nails etc.

SYALLABUS:

Unit 1: Introduction to Optimization: Basics of engineering analysis and design, need for optimal design, Difficulties associated with optimization problems, Problems of global and local optima, Single and multivariable problems, Necessary and sufficient condition for optimality.

Unit 2: Classical Optimization 1: Basics of constrained and unconstrained problems, Stationary points, points of maxima, points of minima and inflection points, Exhaustive search method, Bounding phase method, Region elimination method, Interval halving method, Golden section search method, Newton-Raphson Method and Bisection method.

Unit 3: Classical Optimization 2: Definition of descent direction, Steepest descent direction method, Newton method, Quadratic approximation of a function, convex and concave functions, convex optimization problem, Kuhn-Tucker conditions, Linear Programming, Simplex method and Dynamic programming, Graph theory.

Unit 4: Non-Classical and Metaheuristic Optimization Algorithms: Evolutionary algorithms, Introduction to Genetic Algorithm (GA), Differential Evolution (DE), Particle Swarm Optimization (PSO), Shuffled Frog Leaping Algorithm (SFLA), Simulated Annealing (SA), Invasive Weed Growth Optimization (IWO) and other metaheuristic principles of biomimicry.

Unit 5: Geo-statistics: Review of fundamentals of probability and statistics, Concepts of conditional probability, Random variables and their transformations, commonly used probability distribution functions, Principles of hypotheses testing; Principles of Monte Carlo simulation and Least squares minimization, Random fields and stochastic-dynamic systems. Spatial interpolation methods: Inverse Distance Weight method, Spline interpolation for surfaces, kriging. Applications of Geo-statistics in civil engineering.

TEXT/REFERENCE BOOKS:

- Deb. K., Optimization for engineering design: Algorithms and examples, PHI Pvt Ltd., 1998.
- Arora., J.S., Introduction to optimum design, McGraw Hill International edition, 1989.
- Hafta, R.T. and Gurdal. Z., Elements of structural optimization, Kluwer academic publishers, Third revised and expanded edition, 1996.
- Hayter, A.J., Probability and statistics, Duxbury, 2002

COURSE OUTCOMES:

On completion of the course, the student will be able:

1. Determine the need for optimal design in engineering, necessary and sufficient conditions of optimality.

2. Determine the optimality of constrained and unconstrained problems using classical search techniques.
3. Determine the optimality of non-linear problems and linear problems using classical optimization methods
4. Apply evolutionary algorithms for basic problems as wells as advanced engineering design problems.
5. Apply the concepts of Geo-statistics for the engineering problems and interpolation of datasets using different techniques.

SYALLABUS:

Unit 1: Scope of Traffic Engineering & Study of its elements: Introduction, Objectives and Scope of Traffic Engineering; Components of Road Traffic – Vehicle, Driver and Road; Road User and Vehicle Characteristics and their effect on Road Traffic; Traffic Maneuvers. Traffic Stream Characteristics Relationship between Speed, Flow and Density.

Unit 2: Traffic Engineering Studies and Analysis: Sampling in Traffic Studies, Adequacy of Sample Size; Objectives, Methods of Study, Equipment, Data Collection, Analysis and Interpretation (including Case Studies) of (a) Speed (b) Speed and Delay (c) Volume (d) Origin and Destination (e) Parking (f) Accident & other Studies.

Unit 3: Design of Traffic Engineering Facilities: Control of Traffic Movements through Time Sharing and Space Sharing Concepts; Design of Channelizing Islands, T, Y, Skewed, Staggered, Roundabout, Mini-roundabout and other forms of AT-Grade Crossings including provision for safe crossing of Pedestrians and Cyclists; Grade Separated Intersections, their Warrants and Design Features; Bus Stop Location and Bus Bay Design, Design of Road Lighting.

Unit 4: Traffic Regulation and Management: Traffic Signs, Markings and Signals; Principles of Signal Design, Webster's method of Signal Design, Redesign of Existing Signals including Case Studies; Signal System and Coordination. Traffic Management measures: Speed, vehicle, parking, enforcement regulations, mixed traffic regulation, various management techniques.

Unit 5: Traffic Management system for Safety: Road safety Audits and Tools for Safety Management System, Road safety Audit Process, Approach to safety, Road safety improvement strategies, ITS and safety Causes of road accidents, collection of accident data- influence of road, the vehicle, the driver, the weather and other factors on road accident.

TEXT/REFERENCE BOOKS:

- Kadiyali L.R. Traffic Engineering and Transport planning, Khanna Tech Publishers, 2011
- Khanna O.P and Justo C.G; Highway Engineering, Nem Chand Publishers.
- The Institute of Transportation Engineers, Traffic Engineering Handbook, 7th edn, 2016.
- Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD), 2009.

COURSE OUTCOMES:

On completion of the course, the student will be able:

1. Identify the influence of traffic stream components on traffic flow.

2. Establish the relationships between traffic stream parameters.
3. Conduct traffic engineering studies, analyse the data and present the results.
4. Design traffic and road facilities, and intersection control measures for smooth traffic movement.
5. Identify appropriate traffic control and management measures.

LIST OF PRACTICALS:

1. Introduction to Staad Pro, Setting up Configuration, Starting a new project, menu bar, tool bar and main windows, page setup and control and mode of operation.
2. Introduction to analysis of RRC beam, Defining the Nodes, Understanding the Views in STAAD Pro, Drawing the Beam, Defining the Beam Section, Assigning the Beam Section, Assigning the Beam Supports, Defining the Loads Part, Assigning the Loads, Analyzing the Beam, Error Log.
3. Post Processing Mode Introduction, Getting the Support Reactions, Displaying the Moment Diagram, Displaying the Shear Force Diagram, Displaying the Deflection of a Beam, Animation and Report Generation, Test 1: Practice the given continuous beam.
4. Setting up the 2D Model, Defining the Nodes, Drawing the Beams and Columns, Defining Beam and Column Sections, Assigning Beam and Column Sections, Assigning the Supports, Defining the Loads, Assigning the Loads, Analyzing the Structure and Post Processing Mode, Check Reactions, BMD, SFD and Deflections, Practice the given Frame.
5. Starting the 3D Model, Getting to Know the Structure, Modelling the Structure, Defining and Assigning the Frame Properties, Assigning the Supports, Defining the Beam Loads, Defining the Floor Loads, Assigning the Beam Loads, Defining the Load Combination, Defining the Design Parameters and Commands, Assigning the Design Parameters and Commands, Redesigning the Sections, Viewing the Results of Design, Displaying Reactions, Deflection, SFD and BMD, Test Analyse and Design the given Frame.
6. Starting the Structural Wizard Model, Understanding the Concept of Bays, Modelling Frame Using Wizard, Modelling Truss using Wizard
7. Starting a New Moment Release and Offset Model, Concept of Moment Release, Full Moment Release, Partial Moment Release, Introduction to Member Offset, Offsetting the Beam Members, Miscellaneous Specification Options, Read Architectural Drawing, Flow Map of a Project, Reading the elevations, Reading the Floor Plans, Understanding the Grid Lines, Reading the Sections.
8. Modelling the Building, Defining the Base Nodes, Adding Beams at the Base, Modelling of the Building Floors, Concept of Modelling the Balcony, Modelling of the First Floor Balcony, Modeling of the Second Floor Balcony, Correcting the Third Floor Plan
9. Preliminary Design of Beam Slab and Column; Defining The Beam and Column Sections, Concept of the Cracked Sections, Assigning Cracked Section Properties, Concept of Slab Rigidity, Assigning the Master Slave Node, Introduction to The Floor Diaphragm and Select Series-6, Assigning the Floor Diaphragm

10. Introduction to IS 1893/2002/2016: Introduction to Base Shear, Introduction to Seismic Code, Introduction to Seismic Weight of the Building, Horizontal Acceleration Coefficient, Zone Factor (Z), Design Acceleration Coefficient (Sa/g), Response Reduction Factor (R), Importance Factor (I), Live Load Reduction, Introduction to Dynamic Analysis, Storey Shear
11. Calculation of Staircase Load, Application of Wall Load, Application of Floor Load, Application of Wind Load, Application of Staircase Load, Application of Seismic Weight, Error Correction in STAAD Pro.
12. Making Load Combination, Designing the Structural Member, Studying the Design Results, Creating and Assigning the Beam and Column Groups, Beam Design Results, Column Design Results
13. Detailing of Column Longitudinal Bars, Detailing of Column Ties, Detailing of Beam Longitudinal Bars, Detailing of Beam Stirrups, Defining the Response Spectrum Load Cases, Application of the Response Spectrum Loads.
14. Extracting Data from Staad-Pro, Design of Footing, Design of Slab, Detailing of slab, Design checks to be performed.

TEXT/REFERENCE BOOKS:

- Sham Ticko, 2015, Learning Bentley Staad.Pro V8I for Structural Analysis, Dreamtech Press.

COURSE OUTCOMES:

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

1. Analyze and design beams, columns, walls and resisting frames in international design standards
2. Apply loads and load combinations during design process.
3. Prepare the structural design documentation (detailing beam, column slab)
4. Extracting Data from Staad-Pro and share structural model.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
EIGHT SEMESTER

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYLLABUS:

Unit 1: L.S. Design of Foundation: Foundation types, types of footings, general design considerations and code requirements, design of isolated footings. **L.S. Design of earth retaining structures:** Types of retaining walls, earth pressures and stability requirements, design of gravity, proportioning and design of cantilever retaining walls.

Unit 2: Design of continuous R.C. beams, moment redistribution, and design loads on buildings, wind and earthquake loads as per IS 875.

Unit 3: Framing systems, member proportioning, Analysis of RC framed buildings, Analysis of lateral load on frame, detailing of beam-column joint.

Unit 4: Design of Water Retaining structure: General design criteria as per IS 3370, material specifications, joint consideration, design of circular tank.

Unit 5: Pre-stressed concrete: Advantages, materials, prestressing systems, stress analysis & losses of prestress, cable profile, L.S. design of simple prestressed rectangular sections.

TEXT/REFERENCE BOOKS:

- Shah, V.L. et al., "Limit State Theory and Design of Reinforced Concrete: Structures Publications 2007.
- Pillai, S.U. and Menon, D., "Reinforced Concrete Design", Tata McGraw Hill 2003.
- Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice-Hall 2002.
- Park, R. and Pauley, T., "Reinforced Concrete Structures", John Wiley 1976.
- Gambhir, M. L. (2008). Design of reinforced concrete structures. PHI Learning Pvt. Ltd.
- Punmia, B. C., Jain, A. K., Jain, A. K., Jain, A. K., & Jain, A. K. (2007). Limit state design of reinforced concrete. Firewall Media.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand the concept of designing isolated footing and retaining walls.
2. Analyze continuous beam using moment redistribution principle.
3. Determine different types of forces on building frame as per IS 875.
4. Analyze the building frame using different methods.
5. Design the water retaining structure.
6. Explain the basic concept of prestress concrete.

SYLLABUS:

Unit 1: Planning of soil exploration for different projects, methods of subsurface exploration, methods of borings along with various penetration tests

Unit 2: Shallow foundations, requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footings and rafts, proportioning of foundations using field test data, IS codes.

Unit 3: Pile foundations, methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, analytical estimation of load- settlement behaviour of piles, proportioning of pile foundations, lateral and uplift capacity of piles.

Unit 4: Well foundation, IS and IRC Codal provisions, elastic theory and ultimate resistance methods

Unit 5: Foundations on problematic soils: Foundations for collapsible and expansive soil.

TEXT/REFERENCE BOOKS:

- Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers. 2007
- Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, new Delhi. 2002
- Peck, R.B., Hanson, W.E. and Thornburn, T.H., "Foundation Engineering", John Wiley. 1974
- Punmia, B. C., "Soil Mechanics and Foundations", Laxmi Publications (P) LTD. **2017**
- Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers. 2007

COURSE OUTCOMES:

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

1. Determine the earth pressures on foundations and retaining structures.
2. Analyze shallow and deep foundations.
3. Calculate the bearing capacity of soils and foundation settlements.

SYLLABUS:

Unit 1: Concept of Remote Sensing, types of remote sensing and sensor characteristics. History of remote sensing and Indian space program. Photographic Imaging.

Unit 2: Digital Imaging, framing and scanning systems, spectrometer, spectroradiometer, Thermal remote sensing, Lidar, Microwave remote sensing.

Unit 3: Visual image interpretation, Digital image processing, high and low pass filters, convolution matrices, Data integration, analysis and Presentation.

Unit 4: Applications of remote sensing, Geological, geomorphological and urban, Concept of Geographic information systems, Functions and advantages of GIS, Special data models.

Unit 5: Attribute data management and metadata concept. Process of GIS, Geospatial analysis, Planning, implementation and management of GIS, Modern trends of GIS.

TEXT/REFERENCE BOOKS:

- Remote Sensing and GIS 3rd Edition, Dr. Basudeb Bhatta.
- Fundamentals of Remote Sensing by George Joseph and C Jeganathan.
- Concepts and Techniques of Geographic Information Systems by Chor Pang Lo & Albert K.W. Yeung.

COURSE OUTCOMES:

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

1. Understand the basic concept of remote sensing and the factors affecting them.
2. Know about the different remote sensing systems and the relative advantages and disadvantages.
3. Understand the different spectral reflectance curves and benefit of using different band combinations to extract the information of interest.
4. Understand various key parameters that aid visual interpretation.
5. Understand different methods of digital image processing to extract useful information.
6. Know the Basics of GIS and its application areas, different geospatial models.
7. Assign and analyse different attribute data to GIS models for specific applications.

SYLLABUS:

Unit 1: Introduction, components of bridges, classification of bridges, related structures, classical examples of various types of bridges, Selection of site and initial decision process, survey and alignment, geotechnical investigations, collection of bridge design data, hydrological calculations, waterway calculations, scour, depth of foundation, freeboard considerations, vertical clearance

Unit 2: Standard loadings for bridge design as per different codes of practice, IRC, BS and AASHTO codes, various types of loads considered for design of bridges, impact factor, centrifugal force, wind and seismic considerations, width and roadway considerations, influence lines, load combinations, limit and working stress design considerations, pre-design considerations, roadway vs. railway bridges.

Unit 3: Superstructure of bridge: selection of main bridge parameters, design methodologies, choice of superstructure type, load distribution in various types of superstructures, RCC and PSC superstructures, longitudinal analysis of bridges, transverse analysis of bridge, temperature analysis, effect of differential movements of supports, reinforced earth structures, box girder bridges

Unit 4: **Substructure of bridge:** pier, abutment, wing walls, importance of substructure soil interaction, open foundation, pile foundation, well foundation, simply supported and continuous bridges.

Unit 5: **Bearings and deck joints:** types of bearings, expansion joints, design of bearings and joints, parapets and railings for highway bridges, definitions, classifications of bridge parapets, related details.

TEXT/REFERENCE BOOKS:

- M.J. Ryall, Parke G.A.R and Harding J.E., "The manual of bridge engineering", Thomas Telford Publishers ASIN 8000Q91ZDY 1997.
- Raina V.K., "Concrete bridge practice – analysis, design and economics", Tata McGraw-Hill Publishing Company Ltd. (ISBN 8184043783) 2002.
- Ponnuswamy S., "Bridge engineering", Tata McGraw-Hill Publishing Company Ltd. ISBN: 9780070656956200.

COURSE OUTCOMES:

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

1. To understand the essentials of bridge engineering.
2. To understand the various types of bridge loadings.
3. To understand the RCC girder bridges.
4. To understand the substructure of RCC girder bridges.
5. To design bearings.

SYLLABUS:

Unit 1: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle, Concepts of EIA methodologies, Rapid and Comprehensive EIA, Types and limitations of EIA – EIA process- screening – scoping - setting – analysis – mitigation.

Unit 2: Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis.

Unit 3: Social impact assessment - Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts, measures of effectiveness of pollution control activities.

Unit 4: Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Legislation, Policy and guidelines for planning and monitoring programmes – Post project audits.

Unit 5: Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance & Management Review; Operational Control; Case Studies on EIA.

TEXT/REFERENCE BOOKS:

- Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996.
- Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Inter science, New Jersey. 2003.
- World Bank –Source book on EIA.
- Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York, 1996.
- K. V. Raghavan and A., A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
- Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

COURSE OUTCOMES:

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

1. Demonstrate the understanding of concept of Sustainable Development and justify the methods of achieving SD.
2. Appreciate the importance of EIA as an integral part of planning process.
3. Apply the different methodologies to predict and assess the impacts of project on various aspects of

environment.

4. Enumerate the role of public participation in environmental decision-making process.
5. Characterize the environmental attributes.

SYLLABUS:

Unit 1: Groundwater occurrence and its role in hydrologic cycle, Moisture distribution in a vertical profile, Classification of aquifers, Continuum approach to flow through porous media, Darcy's law, Hydraulic Conductivity, Eigen values of the hydraulic conductivity tensor, Flow in anisotropic aquifers, Dupuit assumptions for a phreatic aquifer.

Unit 2: Aquifer storativity, Dupuit-Forchimer Equation, Basic equation of continuity in Cartesian coordinates, initial and boundary conditions, Simplified case of the continuity equation wit isotropic hydraulic conductivity and steady state, Laplace equation.

Unit 3: Differential equations governing ground water flow in polar coordinates, well hydraulics, analytical solutions for confined, leaky confined and unconfined aquifers, image well theory, time-variant pumping rates, well interference, Analysis of pumping test data.

Unit 4: Concept of interfacial tension, principles of flow in the unsaturated zone, Capillary pressure and retention curves, soil water characteristic curves (SWCC), Continuity equation in unsaturated zone, One dimensional Richard's equation.

Unit 5: Reasons for the depletion of groundwater, Artificial recharge, Contamination of Groundwater, different sources of contamination, solution procedure of the source identification problem, management of the aquifer using aquifer remediation techniques. Groundwater Modelling Systems (GMS): A software to model flow and transport in groundwater.

TEXT/REFERENCE BOOKS:

- Todd, D.K., "Groundwater Hydrology", Wiley.
- Bear J., "Hydraulics of Groundwater", McGraw-Hill.
- Bouwer, H., "Groundwater Hydrology", McGraw-Hill.
- Kruseman, G.P. and Ridder, N.A., "Analysis and Evaluation of Pumping Test Data", IILRI.

COURSE OUTCOMES:

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

1. Understand the importance of Groundwater for the domestic as well as industrial purposes.
2. Classify different kinds of aquifers and identify the aquifer parameters such as permeability and storativity by interpreting the experimental datasets.
3. Determine the role of unsaturated water with soil water characteristics for the root development of plants.

4. Modelling the fate and transport of contaminants in groundwater using Groundwater Modelling Systems (GMS) software.

SYLLABUS:

Unit 1: Pavement Materials and Design Considerations: Road Materials, Alternate forms of aggregates, theory and specifications of fillers, additives, emulsions, cutbacks and modified binder, Mix designs-Marshall, Hubbard Field and Hveem Method, requirement of a mix. Design factors, empirical, semi-empirical and analytical design methods of flexible pavement design. Design of flexible pavement using IRC 37: 2012.

Unit 2: Flexible Pavement Construction: Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub- base, base, binder and surface course layers and their choice.

Unit 3: Cement Concrete Pavement Construction: Design of Rigid Pavements, Design factors, load and temperature stresses, load transfer devices, design of Dowel and Tie bars, joint requirement and working, Specifications and method of cement concrete pavement construction; Construction of interlocking block pavements, Quality control tests; Construction of various types of joints.

Unit 4: Soil Stabilized Pavement: Principles of gradation/proportioning of soil- aggregate mixes and compaction; Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods. Use of additives, Numerical problems on mix design and applications.

Unit 5: Pavement Evaluation and Management: Pavement Distress - Functional and structural condition of pavements, Pavement distresses, Functional condition evaluation of pavements. Structural evaluation of pavements - nondestructive testing, Benkelman beam and Falling Weight Deflectometer, Pavement strengthening based on deflection as per IRC, Maintenance and rehabilitation techniques; Pavement Management Systems - Components, structure, data requirements.

TEXT/REFERENCE BOOKS:

- L R kadiyali and N B Lal, principles and practices of highway engineering.
- S K Khanna and Justo, highway engineering.
- Yoder and Witczak, ‘Principles of Pavement Design’, John Wiley,1975
- Huang Yang H., Pavement Analysis and Design, Pearson Education India, 2008
- Nai C. Yang, ‘Design of Functional Pavements’, McGraw Hill ,1972
- IRC: 37 -2001, ‘Guidelines for the Design of Flexible Pavements’
- IRC: 58 -2002, ‘Guidelines for the Design of Rigid Pavements’

- Hass and Hudson, ‘Pavement Management System’, McGraw Hill Book Co. ,1978
- Mix Design Methods for Asphalt Concrete and other Hot mix types MS 2, Sixth Edition, The Asphalt Institute, 1997
- IRC 81-1981, ‘Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques’

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Understand the purpose and characteristics of different materials used in highway design and factors affecting them.
2. Understand the process of flexible pavement construction and filed checks while laying different layers.
3. Understand the process of rigid pavement and effect of various factors that governs the structural characteristics.
4. Understand the need and process of soil stabilization, different factors in design and effect of different additives.
5. Understand the different techniques that are used to check the quality of pavement post construction and maintenance techniques.

SYLLABUS:

Unit 1: Introduction: Climate system; climate, weather and climate change; overview of earth's atmosphere; vertical structure of atmosphere; radiation and temperature; laws of radiation; head-balance of earth atmosphere system; Random temperature variation; modelling vertical variation in air temperature; temporal variation of air temperature; temperature change in soil; thermal time and temperature extremes

Unit 2: Hydrologic Cycle: Introduction; Global water balance; cycling of water on land, a simple water balance model; climate variables affecting precipitation, precipitation and weather, humidity, vapor pressure, forms of precipitation, types of precipitation; cloud; atmospheric stability; monsoon; wind pattern

Unit 3: Climate Change: Introduction; causes of climate change; modelling of climate change, global climate models, general circulation models, downscaling; IPCC scenarios.

Unit 4: Statistical Methods in Hydro-Climatology: Trend analysis; Empirical orthogonal functions, principal component analysis; canonical correlation; statistical downscaling with regression.

Unit 5: Ecological Climatology: Leaf energy fluxes and leaf photosynthesis; plant canopies, ecosystem and vegetation dynamics; coupled climate vegetation dynamics, carbon cycle climate feedbacks, introduction to precipitation recycling.

TEXT/REFERENCE BOOKS:

- Bonan G. B., Ecological climatology, Cambridge university press, 2002.
- Campbell, G. G. and Norman J. M., An introduction to environmental biophysics, Springer, 1998.
- IPCC Assessment report 4.
- Recent articles in journal, specifically water resources research, journal of geophysical research, journal of climate, climatic change, nature geoscience, nature climate change etc.

COURSE OUTCOMES:

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

1. Distinguish the weather and climate along with laws governing the earth climate system.
2. Determine the importance of hydrological cycle and its patterns in climate change of earth.
3. Evaluate the models of climate change like general circulation models and downscaling scenarios.
4. Estimate the impact of vegetation and plant canopies in the ecological climatic scenario.

SYLLABUS:

Unit 1: A Brief History of GIS and Its Use in Water Resources Engineering: What is geocomputation, Geocomputation and water resources science and engineering, GIS-enabled geocomputation in water resources science and engineering, why should water resources engineers and scientists study GIS, A Brief History of GIS and Its Use in Water Resources Engineering, History of GIS in water resources applications, Recent trends in GIS, Benefits of using GIS in water resources engineering and science Challenges and limitations of GIS-based approach to water resources.

Unit 2: Hydrologic Systems and Spatial Datasets: Hydrological processes in a watershed, Fundamental spatial datasets for water resources planning: management and modelling studies, Sources of data for developing digital elevation models, Sensitivity of hydrologic models to DEM resolution, Accuracy issues surrounding land use land cover maps, Sensitivity of hydrologic models to LULC resolution, Sources of data for developing soil maps, Accuracy issues surrounding soil mapping Sensitivity of hydrologic models to soils resolution.

Unit 3: **Water-Related Geospatial Datasets**: River basin, watershed, and sub-watershed delineations, Streamflow and river stage data, Groundwater level data, Climate datasets, Vegetation indices, Soil moisture mapping, Water quality datasets, Monitoring strategies and needs, Sampling techniques and recent advancements in sensing technologies, Data Sources and Models, Digital data warehouses and repositories, Software for GIS and geocomputations, Software and data models for water resources applications.

Unit 4: **Lake Volume Monitoring from Space**: Satellite Altimetry, Past, Present, and Future Satellite Altimetry, Combination of Multi-Satellite Data, Accuracy of Satellite Altimetry Over Lakes, Storage Change Calculation, Case Study.

Unit 5: **Assessing Global Water Storage Variability from GRACE**: Trends, Seasonal Cycle, Sub-seasonal Anomalies and Extremes, Signal Decomposition, Monthly Averaging of the Daily Decomposed Forcing Time Series, Significance Testing and Correlation Analysis, Identifying Droughts in the GRACE Record. Global Hydrological Variability in the GRACE Data, Groundwater Depletion in North West India, Major Challenges in Monitoring Groundwater Change Using GRACE.

TEXT/REFERENCE BOOKS:

- Barnali Dixon, Venkatesh Uddameri, 2016, GIS and Geocomputation for Water Resource Science and Engineering, John Wiley & Sons, Ltd, ISBN 978-1-118-35414-8.
- A. Cazenave • N. Champollion J. Benveniste J. Chen, 2016, Remote Sensing and Water Resources, Surveys in Geophysics, Volume 37, Issue 2, Springer, DOI 10.1007/978-3-319-32449-4.

COURSE OUTCOMES:

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

1. Prepare the necessary data input for hydrological modelling such as watershed, drainage network etc. with the help of DEM.
2. Analyze and process LULC data, various indices, climate data set, soil maps etc. required in hydrological modelling.
3. Monitoring and estimating water reservoir using satellite altimeter data.
4. Monitoring and estimating ground water using GRACE satellite data.

SYLLABUS:

Unit 1: Types of skeletal structures, conditions of equilibrium, static and kinematic indeterminacy, conditions when law of superposition is valid, stiffness and flexibility.

Unit 2: Various matrices and matrix operations, methods for solution of equations, stiffness and flexibility methods of analysis, inclined supports, use of symmetry and anti-symmetry.

Unit 3: Basic steps of stiffness method, stiffness matrix in local axis system of beam and plane frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.

Unit 4: Stiffness matrix in local axis system of grid and plane truss members, transformation of the stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions.

Unit 5: Stiffness matrix in local axis system of space truss and space frame members, transformation of stiffness matrix from local axis system to global axis system, equivalent load vectors, assembling of load and stiffness matrices of various members, solution of equations, determination of support reactions and member end actions. Appropriate experiments would be taken up.

TEXT/REFERENCE BOOKS:

- Matrix Methods of Structural Analysis, P.N. Godbole, R.S. Sonparote and S.U. Dhote, PHI Learning Pvt. Ltd., Delhi (ISBN-978-81-203-4984-1) 2014.
- Matrix Analysis of Framed Structures, William Weaver Jr. and James M. Gere, CBS Publishers and Distributors, New Delhi (ISBN: 81-239-1151-3) 2004.
- Elementary Structural Analysis, Charles Head Norris, John Benson Wilbur and Senol Utku,Tata McGraw-Hill Publishing Company Limited, New Delhi (ISBN:0-07-058116-9) 2004.

COURSE OUTCOMES:

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

1. To understand the essentials of Structures.
2. To understand the various types of matrix operations.
3. To understand the Stiffness matrix.
4. To apply the matrix method in frame and truss analysis.

SYLLABUS:

Unit 1: Introduction to highway pavements, Types and component parts of pavements, Factors affecting design and performance of pavements, Functions and significance of sub grade properties, Various methods of assessment of sub grade soil strength for pavement design, Mix design procedures in mechanical stabilization of soils.

Unit 2: Introduction to analysis and design of flexible pavements, Stresses and deflections in homogeneous masses, Burmister's 2 layer and 3-layer theories, Wheel load stresses, ESWL of multiple wheels, Repeated loads and EWL factors. Empirical, semi - empirical and theoretical approaches for flexible pavement design, Group index, CBR, Triaxial, Mcleod and Burmister layered system methods. design of flexible pavements as per IRC.

Unit 3: Introduction to analysis and design of rigid pavements, Types of stresses and causes, Factors influencing stresses, General conditions in rigid pavement analysis, Warping stresses, Frictional stresses, Combined stresses, Joints in cement concrete pavements, Joint spacings, Design of slab thickness, Design and detailing of longitudinal, contraction and expansion joints, IRC methods of Design.

Unit 4: Introduction to pavement evaluation, Structural and functional requirements of flexible and rigid pavements, Quality control tests for highway pavements.

Unit 5: Evaluation of pavement structural condition by Benkelman beam, rebound deflection and plate load tests, Introduction to design of pavement overlays and the use of geosynthetics.

TEXT/REFERENCE BOOKS:

- Matrix Methods of Structural Analysis, P.N. Godbole, R.S. Sonparote and S.U. Dhote, PHI Learning Pvt. Ltd., Delhi (ISBN-978-81-203-4984-1) 2014.
- Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros.
- Yang, Design of functional pavements, McGraw- Hill,1972.
- Khanna S. K. & Justo C. E. G., Highway Engineering, Nemchand & Bros, 9e.

COURSE OUTCOMES:

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

1. To understand the criteria that govern the selection of different types of pavements
2. To have an understanding of different methods of designing flexible pavements and the criteria's governing the design
3. To have an understanding of different methods of designing rigid pavements and the criteria's governing the design.

4. To understand the different checks that are done to assess the quality of pavement both prior and after construction.

SYLLABUS:

Unit 1: Types and Sources of solid and hazardous wastes, Origin, Analysis, composition and Characteristics.

Unit 2: Integrated Solid Waste Management System: Collection, Storage, and Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal.

Unit 3: Management of Municipal, Biomedical, Nuclear, Electronic and Industrial solid wastes and the rules and regulations.

Unit 4: Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Salient features of Indian legislations on management and handling of Hazardous wastes, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment, Ground water contamination.

Unit 5: Solid waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills, leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation.

TEXT/REFERENCE BOOKS:

- George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.
- Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York, 2001.
- CPHEEO, “Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

COURSE OUTCOMES:

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

1. Understand the characteristics of different types of solid and hazardous wastes and the factors affecting variation.
2. Define and explain important concepts in the field of solid waste management and suggest suitable technical solutions for treatment of municipal and industrial waste.
3. Understand the role legislation and policy drivers play in stakeholders' response to the waste and apply the basic scientific principles for solving practical waste management challenges.

SYLLABUS:

Unit 1: Introduction to Soil Exploration

Objectives of Site Investigation, Phases of investigation, Classification, Planning for Subsurface Exploration, Fact finding and Geological survey, Reconnaissance, Preliminary Exploration, Detailed Exploration, Codal Provisions.

Unit 2: Methods of investigations and Sampling

Trial pits/Trenches, Borings/drilling, Auger boring, Wash boring, Percussion drilling, Rotary drilling, Sample Disturbance, Disturbed Sample, Undisturbed Samples, Sampling by standard split spoon, Sampling by thin-wall tube, Sampling by Piston sampler.

Unit 3: **Geotechnical investigation (Semi-direct methods)**

Vane Shear test, Standard Penetration Test, Pressuremeter Test, Cone Penetration Test, Dilatometer test, Rock core drilling, Sampling of rock, Core stacking, Rock Quality Designation (RQD), Total Core Recovery (TCR).

Unit 4: **Geophysical Tests (Indirect methods)**

Seismic reflection survey, Seismic refraction survey, Electrical resistivity Survey, Applications, Advantages, Disadvantages and Limitations.

Unit 5: Soil Exploration Report and Field Instrumentation

Components of Soil Exploration Report, Drafting of Reports, Graphic Presentations of Bore Log, Study of Sample Reports, Field Instrumentation: Pressure meters, Piezometer, Pressure cells, Sensors, Inclinometers, Strain gauges etc.

TEXT/REFERENCE BOOKS:

- Principles of Geotechnical Engineering, Braja M. Das, Cengage
- Basic and applied Soil Mechanics, Rajan & Rao, New Age International Publishers
- Soil Properties and their correlations, Micheal Carter and Stephen P. Bentley, Wiley Publications

COURSE OUTCOMES:

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

1. Describe the phases of soil investigation in depth and identify the plan for soil investigation.
2. Identify various methods of soil investigation and soil sampling.
3. Illustrate various field test of soils and rocks.
4. Examine components of soil exploration report and estimate properties using correlations.
5. Work with relevant instrumentation required for characterizing the soil.

LIST OF PRACTICALS:

1. Design detailing of reinforced beam.
2. Design detailing of circular column.
3. Design detailing of slab.
4. Design detailing of footing.
5. Design detailing of retaining wall.
6. Rolled section and connections.
7. Gusset bases detailing.
8. Design detailing of roof truss.
9. Grillage footing.

TEXT/REFERENCE BOOKS:

- Sham Ticko, 2015, Learning Bentley Staad.Pro V8I for Structural Analysis, Dreamtech Press.
- Handbook on Concrete Reinforcement and Detaling SP 34 (1987), Bureau of Indian Standards.
- Manual for Detaling of steel Structure by S. Kanthimathinathan.
- Structural Design and Drawing renforced concrete and Steel by N Krishna Raju, University Press.
- Practical Design of Reinforced Concrete Structures by Karuna Moy Ghosh, PHI publications.
- Handbook on Concrete Reinforcement and Detaling SP 34 (1987), Bureau of Indian Standards.

COURSE OUTCOMES:

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

1. Understand various reinforcement and their locations in Beam Design.
2. Understand various reinforcement and their locations in Column Design.
3. Differentiate between main and distribution reinforcement in slab design.
4. Understand various reinforcement and their locations in footing and retaining wall.
5. Acquire knowledge about various rolled section and different connections.
6. Explain about Gusset base design and details.
7. Identify various roof components and their position.
8. Learn Grillage foundation detailing.

BACHELOR OF TECHNOLOGY
in
CIVIL ENGINEERING

SYLLABI
of
OPEN ELECTIVE

Department of Civil Engineering
G. B. Pant Institute of Engineering and Technology, Pauri Garhwal, U.K.

SYALLABUS:

Unit 1: Air pollutants, Sources, classification, Effects on Health, vegetation, materials and atmosphere, Reactions of pollutants in the atmosphere and their effects, Smoke, smog and ozone layer disturbance, Greenhouse effect.

Unit 2: Air sampling and pollution measurement methods, principles and instruments, Indoor and ambient air quality and emission standards, Air pollution indices.

Unit 3: Air Act, legislation and regulations, control principles, Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation.

Unit 4: Wet collectors, fabric filters, electrostatic precipitators and other removal methods like absorption, adsorption, precipitation, and biological air pollution control technologies.

Unit 5: Noise- Basic concept, noise monitoring procedure, specification and various control methods, effects of noise on health.

TEXT/REFERENCE BOOKS:

- Kenneth, W., Warner, F.C. And Davis Wayne, T., "Air Pollution, Its Origin and Control", 3rd Ed., Prentice Hall.
- Mishra, P.C., "Fundamentals of Air and Water pollution", South Asia Books.
- Davis, M.L. and Cornwell, D.A., "Introduction to Environmental Engineering", McGraw Hill.
- S.P Singal Noise Pollution and Control Technology, Narosa Pub House; 1 edition (March 1, 2000).

COURSE OUTCOMES:

On completion of the course, the student will be:

1. Be able to understand the impact of air and noise on human's health and environment.
2. Be able to identify the success of air and noise pollution.
3. Be able to plan strategies to control, reduce and monitor air and noise pollution.
4. Be able to select the most appropriate technique for mitigation of air and noise pollution.
5. Be conversant with basic environmental legislation comprehend the need, design and planning of Airports.

SYLLABUS:

Unit 1: Introduction, history of geomatics engineering, Fundamentals of remote sensing, EMR, Platforms and sensors, visual image interpretation, Types of remote sensing and their applications, resolutions in remote sensing.

Unit 2: Introduction to digital image processing, data formats, image pre-processing- radiometric & geometric, remote sensing image distortion and rectification, georeferencing, image enhancement, transformation, classification, classification algorithms, accuracy assessment, image fusion and change detection.

Unit 3: Photogrammetry – advantages and disadvantages, types of photographs, and geometry of aerial photograph, scale of tilted photograph. relief displacement, flight planning. Stereoscopy, introduction, types of stereoscopes, base lining, parallax and its use for elevation determination, Introduction to LiDAR, UAV photogrammetry.

Unit 4: GIS- Introduction, Data Sources, Data Models and Data Structures, Algorithms, DBMS, Creation of Databases (spatial and non-spatial), Spatial analysis - Interpolation, Buffer, Overlay, Terrain Modelling and Network analysis.

Unit 5: GNSS- Principle used, Components of GNSS, Data collection methods, DGPS, Errors in observations and corrections.

TEXT/REFERENCE BOOKS:

- Duggal S. K., "Surveying Vol 1 & 2" Tata McGraw Hill.
- Subramanian R., "Surveying and Levelling" Oxford Higher Education.
- Anderson, J.M. and Mikhail, E.M., "Surveying: Theory and Practice", McGraw Hill. 1998.
- Arora, K.R., "Surveying", Vol. I, II and III, Standard Book House. 1995.
- Chandra, A.M., "Surveying", New Age Publishers. 2002.
- Schofield, W. and Breach M., "Engineering Surveying", 6th Ed., Butterworth-Heineman. 2007.

COURSE OUTCOMES:

The course aims to achieve the following objectives:

1. To enable the students to understand and apply the basic concepts of geospatial analysis.
2. To augment imagination of students so that they can visualize 3D models before the construction of civil work.
3. To enhance the capabilities of student in analysis of survey data which is very important for designing a civil engineering work.

4. To increase knowledge of modern techniques in surveying like remote sensing, GPS, GIS for industry readiness.
5. To broaden the scope of surveying keeping in mind environmental impacts of civil engineering projects.

SYLLABUS:

Unit 1: Sub Structure Construction and Equipment: Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques -Dewatering and stand by Plant equipment for underground open excavation. Excavating Equipment: Power shovels, Draglines, Hoes, Clam shells and trenching machines, Pile boring / driving equipment, Tunnel Boring machines

Unit 2: Super Structure construction and Equipment: Form work for R.C.C. Wall, slab, beam and column, centering for arches of large spans and dams, design features for temporary works, slip formwork, false work for Bridges, Construction of tall structures-Materials of tall structures. Structural system for tall structures. Methods of construction of tall structures. Fabrication and erection of steel trusses and frames. Demolition of Structure: Demolition, taking down, dismantling, methods, safety. Equipment's-Crushers – Feeders - Screening Equipment - Batching and Mixing Equipment - Pouring and Pumping Equipment – Ready mixed concrete carriers, Cranes,

Unit 3: Highway Construction Practice and Equipment: Embankment Construction - Ground improvement techniques, Retaining and Breast walls on hill road. Bituminous Constructions- Concrete road construction: Test - Construction equipment's - Method of construction of joints in concrete pavements - IRC specifications. Fundamentals of Earthwork Operations - Earth Moving Operations-Types of Earthwork Equipment - Tractors, Motor Graders, Scrapers, and Front-end Loaders, Earth Movers – capacity calculations.

Unit 4: Dams and Harbour Construction Practice: Construction Methods and Equipment for Dams, Harbours, River works and Pipelines.

Unit 5: Equipment Management: Factors affecting selection of equipment and methods –Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment – Depreciation Analysis, Methods of calculation of depreciation- Safety Management.

TEXT/REFERENCE BOOKS:

- Robert L. Peurifoy, Clifford J. Schexnayder, AviadShapira (2010), Construction Planning, Equipment and Methods, Indian Edition, Mc-Graw Hill-Education, New Delhi.
- Construction project management: Theory and Practices, 2nd edition, 2016, Kumar Niraj Jha, Pearson Education Publishers.
- Varghese P.C., (2012), Foundation Engineering, PHI Learning Private Limited, New Delhi.
- Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.

- Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. To derive feasibility of specific equipment in different project conditions.
2. To selection of automation techniques in construction industry of sub and super structure.
3. To perform the depreciation analysis for constructions equipment.
4. To manage the execution of construction of highways construction work.

SYLLABUS:

Unit 1: Introduction: A construction project, Phases of construction project, Importance of construction and construction industry, Stakeholders of construction Management, Construction company structure of construction organization, Organizing for construction project management, Management levels, Traits of project manager and coordinators. Ethical conduct for engineers, Factors for success of a construction organization.

Unit 2: Construction planning and scheduling: Types of project plans, Work breaks down structure, Planning techniques, Bar charts, CPM and PERT network analysis, Precedence network ladder network, Line of balance method. Project scheduling and Resource levelling, Resource allocation, Importance of project scheduling, deriving other schedules, Network crushing and cost time trade off.

Unit 3: Construction equipment and Account management: Construction equipment advanced concepts in economic analysis. Construction accounts management Principles of accounting, accounting process construction contract revenue recognition, Construction contract status report, Limitation of accounting, Balance sheet, Profit and loss account, Working capital, Ratio analysis, Fund flow statement.

Unit 4: Management material and cost: Material management functions, Inventory, Project cost management, Collection of cost related information, Cost codes, Cost statement, Value management in construction, Steps, Value engineering application in a typical case project, management, Job layout.

Unit 5: Construction quality and safety management: Construction quality, Inspection, Quality control and Quality assurance in projects, Total quality management, Quality gurus and their teaching cost of quality ISO standards, Principles of quality management systems, (CONQUAS) construction quality assessment system, Construction safety management, Evolution of safety, Accident causation theory, Unsafe conditions, Unsafe acts health and safety act and regulation cost of accidents, Role of safety personnel, Accident causes and principles of safety, Safety and health management system.

TEXT/REFERENCE BOOKS:

- Construction project management: Theory and Practices, 2nd edition, 2016, Kumar Niraj Jha, Pearson Education Publishers.
- Project management for engineering and Construction, By Garold D Oberlender, 2nd Edition, McGraw Hill Education (India), Pvt. Ltd.
- CPM and PERT: Punamia & Khandelwal.
- Construction planning and management, P S Gehlot and B M Dhir, Wiley Eastern Ltd.
- A management guide to PERT/ CPM by Weist and Levy, Prentice Hall.

- Construction management, P P Dharwadkar.
- Construction of Structures and Management of Works, S. C. Rangwala, Charotar Publications.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Execute all type of managerial tasks in construction projects.
2. To plan, schedule and control the construction of the project.
3. To use project planning tools.
4. To carry out cost analysis and project updating.
5. To study risk analysis and resource allocation at site.

SYLLABUS:

Unit 1: Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation).

Unit 2: Disasters - Disaster's classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit 3: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Unit 4: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

TEXT/REFERENCE BOOKS:

- Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
- Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
- Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

COURSE OUTCOMES:

The student will develop competencies in

1. the application of Disaster Concepts to Management.
2. Analyzing Relationship between Development and Disasters.
3. Ability to understand Categories of Disasters.

4. Realization of the responsibilities to society.

SYLLABUS:

Unit 1: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle, Concepts of EIA methodologies, Rapid and Comprehensive EIA, Types and limitations of EIA –.EIA process- screening – scoping - setting – analysis – mitigation.

Unit 2: Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis.

Unit 3: Social impact assessment - Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts, measures of effectiveness of pollution control activities.

Unit 4: Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Legislation, Policy and guidelines for planning and monitoring programmes – Post project audits.

Unit 5: Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance & Management Review; Operational Control; Case Studies on EIA.

TEXT/REFERENCE BOOKS:

- Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996.
- Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey. 2003.
- World Bank –Source book on EIA.
- Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York, 1996.
- K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
- Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

COURSE OUTCOMES:

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

1. Demonstrate the understanding of concept of Sustainable Development and justify the methods of achieving SD.
2. Appreciate the importance of EIA as an integral part of planning process.
3. Apply the different methodologies to predict and assess the impacts of project on various aspects of

environment.

4. Enumerate the role of public participation in environmental decision-making process.
5. Characterize the environmental attributes.

SYLLABUS:

Unit 1: Introduction: Prospects of hydropower, sources of energy, hydropower potential, distribution and development, basin-wise development of hydropower, constraints in hydro power development.

Unit 2: Stream Flow Data and Hydropower Potential: Flow and load duration curves, estimation of flow duration curve at ungauged site, primary and secondary power, storage and pondage, load factor, capacity factor, utilization factor, diversity factor.

Unit 3: Types of Hydro Power Plants: Base and peak load Hydro-power plants, run-ofriver plants, valley dam plants, diversion canal plants, high head diversion plants, pumped-storage power plants. Intake Structures: Functions of intake structures, its location types, trash rack dimensions, design, spacing of bars, methods of cleaning; design of transition.

Unit 4: Conveyance System: Power canal-location, site, surges in canals, pen stocks types, design and layout, economical diameter of penstock, hydraulic losses, branches, air vent, forebay. Hydraulic Turbines: Types of turbines, characteristics and efficiency of turbines, selection of turbines, selection of turbines, cavitation, casing, draft tubes, tail trace and their hydraulic design.

Unit 5: Hydraulic Transients: Basic equations of Unsteady flow through conduits, method of characteristics, boundary conditions, single-pipeline applications for various valve opening conditions, functions of surge tank and its location, types and design of surge tank, introduction to transient softwares like HAMMER and EPANET.

TEXT/REFERENCE BOOKS:

- Barrow, H.K., "Water Power Engineering", Tata McGraw-Hill, 1943.
- Choudhary, M.H., "Applied Hydraulic Transients, Van Nastrand Reinhold, 1987.
- Warnick, C.C., "Hydropower Engineering", Prentice-Hall, 1984.

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Determine the need, requirements and constraints of hydropower development.
2. Analyze the stream flow data to determine the hydropower potentiall.
3. Classify the different types of hydropower plants and the different parts of a typical hydroelectric power structure.
4. Determine the requirements of power generation as well as the water conveyance system.
5. Analyze the hydraulic transients and model the water hammer effects using HAMMER and EPANET software.

SYLLABUS:

Unit 1: Introduction to Infrastructure: Types of infrastructure, Role of infrastructure, Infrastructure crisis, Attributes of Infrastructure, Infrastructure and Economic Growth and poverty reduction. Indian scenario. Public Private Partnerships, Types of Private Public Partnerships (PPPs), Advantages and Disadvantages of PPP.

Unit 2: Infrastructural Sectors and their Status in India: Overview, Characteristics, Performance, Reforms and Policies, Targets, Subsidies and Privatization, Policy Initiatives, Reforms, National policies, Regulatory Authorities in Power Sector, Water sector, Transportation Infrastructure, Telecommunications Infrastructure in India

Unit 3: Urban and Rural Infrastructure in India: ***Urban Infrastructure:*** Scenario, Models of Urban Governance, Municipal Finances, Major municipal reforms, Framework for Urban Infrastructure Delivery, ***Rural Infrastructure*****:** The state of rural infrastructure in India, Infrastructure and rural growth, Rural Characteristics, Strategies to improve infrastructure in rural areas, Need for Reforms, Policy Incentives for attracting Private Investment, Regulatory Measures.

Unit 4: Infrastructure Economics and Finance: Infrastructure Economics, Developing Financial Models for Infrastructure, Project Finance, Net Present Value, Internal Rate of Return, Discounted Cash Flows, Perpetuities, Annuities Funding, Debt, Equity. Infrastructure Finance Models, Numerical Practice, Project Finance, Project Finance and Project Structuring, Objectives, Risk Allocation in Infrastructure Projects, Principles of Risk Allocation, Endogenous Risks and Exogenous risks, Mitigation, Tools, Risk Management Framework.

Unit-5: Phases of an Infrastructure Project and Miscellaneous Topics: Preliminary Feasibility, Detailed Studies and Project Structuring, Contracting and Procuring Services. Construction, Operation and Maintenance of Infrastructure Projects. ***Project Governance:*** Governability devices - relationship building, Internal Bonding Mechanisms, Coalitions and Flexibility, Models of Project Control- New Governance Model and Traditional Governance Model. ***Data – Base Management:*** Inventory data, Construction data, Performance data and Maintenance, Levels of Management, Life Cycle Management. ***Various Procurement Methods:*** Bidding Procedures: Competitive Bidding Direct Negotiations and Unsolicited Proposals, Design of Bidding Strategy, Bidding Process-Pre-qualification, Technical Proposals and Price Proposals, Critical aspects of each stage. Life-Cycle Cost Analysis (LCCA), Benefits and Limitations of LCCA, Benefit Cost Analysis (BCA), Applications and Challenges of BCA.

TEXT/REFERENCE BOOKS:

- Principles of Project Finance, E.R. Yescombe, Elsevier Publishing

- Infrastructure planning, Parkin and Sharma, Thomas Telford Publishing
- https://www.ibef.org, India Brand Equity Foundation

COURSE OUTCOMES:

On completion of the course, the student will be able to:

1. Summarize the concept of Infrastructure and their attributes
2. Interpret the data of various physical infrastructural sectors
3. Examine economical and financial aspects of infrastructural projects

SYLLABUS:

Unit 1: What is civil engineering, basics of civil engineering, importance of civil engineering, possible scopes for a career.

Unit 2: Basic knowledge of units and their conversion, surveying classification, ranging, compass surveying, bearings. Water supply system and waste water management.

Unit 3: Building materials: brick, stone, cement, concrete and steel. Building classification and components: beam, column, slab, roof and its types, foundation and its types, masonry, plastering.

Unit 4: Transportation: role and advantages, modes, classification of roads, highway cross-section, types of payments, highway materials, traffic, Basic of geotechnical engineering.

Unit 5: Fluid mechanics and basic hydraulic engineering, Construction methods of various types of structure, Construction Equipment, Basics of corrosion phenomena and other structural damages, repairs, carbon fiber and carbon composite use in repair.

TEXT/REFERENCE BOOKS:

- Satheesh Gopi basic civil engineering, dorling Kindersley pvt. Ltd. Pearson publication
- B.C. punmia Ashok k. jain, basic civil engineering, Laxmi publication ltd.
- N.N. Basak, Surveying and levelling, McGraw-hill publication.
- S.K. Khanna, C.E.G. Justo, Highway Engineering, McGraw-hill publication.

COURSE OUTCOMES:

1. Introduction to what constitutes Civil Engineering.
2. Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering.
3. Highlighting the depth of engagement possible within each of these areas.
4. Exploration of the various possibilities of a career in this field.
5. Understanding the vast interfaces this field has with the society at large.
6. Providing inspiration for doing creative and innovative work.
7. Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering.

SYLLABUS:

Unit 1: Introduction to vibration problems, Undamped and Damped free vibration with viscous damping, Forced vibrations.

Unit 2: Introduction: Various types of machine foundations; Permissible amplitudes of vibrations, factors affecting the resonant frequency and amplitudes of vibrations; Estimation of damping and plastic coefficients.

Unit 3: Foundations under Reciprocating Machine: Resonant frequency of the block foundations; Weightless spring and weighted spring method, Elastic half space method, miscellaneous methods; Behaviour and design of block foundations, permissible amplitudes.

Unit 4: Hammer Foundations: Hammer foundations, classification, natural frequencies and amplitudes of foundation vibrations; Design principles, permissible amplitudes.

Framed Foundations: Framed foundations, their advantage for high-speed machines; Permissible amplitudes, design principles.

Unit 5: Vibration Isolation and Screening: Methods of decreasing vibrations on existing foundations; Isolation of vibrations; Screening of vibrations.

IS Code of Practice: Critical review of IS code provisions for design of machine foundations.

Structural Design: General principles of design; Construction aspects; Case histories of failures of machine foundations.

TEXT/REFERENCE BOOKS:

- Handbook of Machine Foundations by P. Srinivasulu and G.V. Vaidyanathan, Tata McGraw Hill.
- Soil Dynamics by Shamsher Prakash.
- Dynamics of Bases and Foundations by Barken, McGraw Hill Publishing Co.,New York.
- Vibration of Soils and Foundations by Richart, Hall and Woods, Prentice Hall, eaglewood Cliffs, New Jersy, USA.

COURSE OUTCOMES:

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

1. Understand the dynamic behaviour of foundations.
2. Select foundation for dynamic loading.
3. Design machine foundations.
4. Identify vibration isolation techniques.