Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Engineering

(Civil Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester - V

W.E.F. 2020 – 21

Syllabus Structure for Third Year Engineering (Semester – V) (Civil)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical/Oral		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
PCC CE301: Mechanics of Materials	D	3	-	-	3	40	60	-	-	100	3
PCC CE302: Hydraulic Engineering	D	3	-	-	3	40	60	-	-	100	3
PCC CE304: Geotechnical Engineering	D	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective Course – I	E	3	-	-	3	40	60	-	-	100	3
OEC Open Elective Course – I	F	3	-	-	3	40	60	-	-	100	3
PCC CE302: Hydraulic Engineering LAB	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE304: Geotechnical Engineering LAB	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE203: Disaster preparedness & Planning Management (LAB)	D	-	-	2	2	-	-	25	25 OR	50	1
Minor Project Stage I	G	-	-	6	6	-	-	50	-	50	3
MC III Constitution of India	-	-	-	-	-	-	-	-	-	-	0
		15	**0**	**12**	**27**	**200**	**300**	**125**	**75**	**700**	**21**

Professional Elective Course I	Open Elective Course I
Concrete Materials	**Air Pollution Control Technology**
Airport Planning and Design	**Geographical information system**
Repair & Rehabilitation of structures	**Project management techniques**

Syllabus Structure for Third Year Engineering (Semester – VI) (Civil)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical/Oral		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
PCC CE303 Structural Engineering	D	3	-	-	3	40	60	-	-	100	3
PCC CE306: Environmental Engineering	D	3	-	-	3	40	60	-	-	100	3
PCC CE307 Transportation Engineering	D	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective course II	E	3	-	-	3	40	60	-	-	100	3
OEC Open Elective Course II	F	3	-	-	3	40	60	-	-	100	3
PCC CE 303 Structural Engineering Lab	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE 306 Environmental Engineering Lab	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE 307 Transportation Engineering Lab	D	-	-	2	2	-	-	25	-	25	1
Minor Project	G	-	-	6	6	-	-	50	25 OR	75	3
Internship	H	-	-	-	-	-	-	-	-	-	-
		15		**12**	**27**				**75**	**700**	**21**

Professional Elective Course II	Open Elective Course II
Building construction practice	**Intelligent transportation system**
Railway Engineering	**Smart city planning**
Construction Equipments and Automation	**Numerical methods of analysis**

Mechanics of Materials					
COURSE OUTLINE					
Course Title:	***Mechanics of Materials***	**Short Title:**	***MoM***	**Course Code:**	

Course description:

Structural analysis is an important aspect of civil engineering. The determinate structures are covered by the previous courses. However this course covers the statically indeterminate structures. With emphasis on the analysis of statically indeterminate beams and rigid frames. Methods included are moment area method to calculate slope and deflection, and matrix analysis. The course also includes Influence Line Diagram and three hinged arches.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*04*

Prerequisite course(s):

Nil

Course objectives:

The objective of this course subject is to enable a student to analyze statically determinate and indeterminate structures such as beams and arches subjected to external loads. The student should get knowledge of different analytical tools for understanding the behaviour of statically determinate and indeterminate structures. The student should know computation of deflections, internal axial forces, shear forces, and bending moments in beams, frames and arches. The student should be able to deal with the methods necessary for analyzing various types of structures such as fixed beam, continuous beams and frames. Student should also know the fundamental concepts of flexibility and stiffness method of structural analysis, and influence line diagram including identification of positions of load for maximum shear force and bending

moments at specified sections

Course outcomes:

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

- To know basic concepts and principles for analysis of indeterminate structures and to understand the principles of strain energy and deflection of structures.
- To be able to analyse structures for moving loads; to be able to identify the most critical combination of load train.
- To be able to analyze fixed and continuous beams.
- To be able to analyze beams and frames using slope deflection method.
- To be able to analyze beams, sway and non – sway frames with stiffness and flexibility method.

COURSE CONTENT

Mechanics of Materials		**Semester:**	*V*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Strain Energy: Castigliano's first theorem and its application to find slope & deflection of simple beams and frames.

Deflection of trusses: deflection of statically determinate plain trusses by Castigliano’s theorem. Analysis of redundant trusses by Castigliano’s second theorem. Lack of fit and temperature changes in members, sinking of support.(degree of indeterminacy up to two only).

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Influence lines and moving loads: Basic concepts, influence line for reactions, B.M. & S.F. for simply supported, overhanging beams, Calculations for S.F. & B.M. in beam using influence

lines.

Moving Load: Introduction to moving loads, conditions for maximum B.M. and maximum S.F. at a section due to moving point loads, uniformly distributed load, longer or shorter than span and train of moving loads, Absolute maximum B.M. & S.F., Construction of Max. S. F. and B.M. diagram.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Fixed Beams: Concept, advantages and disadvantages, Nature of B.M. Diagrams, Fixed end moment due to various types of loads such as point, uniformly distributed, Uniformly varying, couples for beams, Effect of sinking of support, plotting of B.M. & S.F. diagrams.

Continuous Beams: Analysis of continuous beam by three moments (Clapyeron's theorem) up to three unknowns, Effect of sinking of supports, plotting of B.M. & S.F. diagrams.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Analysis of beams and frames (Sway and non – sway frames) using slope & deflection methods. Numerical problems on analysis of shape factor. Numerical problems on portal frame method and cantilever frame method.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Fundamental concept of flexibility method of analysis: formulation of flexibility method, Problem on continuous beams and frames (Sway and non – sway).

Fundamental concept of stiffness method of analysis: formulation of flexibility method, Problem on continuous beams and frames (Sway and non – sway).

Text Books:

1. Structural analysis Vol –I, II by S.S. Bhavikatti, Vikas Publishing House Pvt. Ltd.

2. Mechanics of structures Vol – II by S. B.Junnarkar and Dr. H.J. Shah, Charotar Publishing House.

Reference Books:

1. Analysis of structures (Volume - I & II) by V.N.Vazirani, M.M. Ratwani and Dr. S.K.Duggal,

Khanna Publications.

2. Theory of structures by S. Rammamrutham, Dhanpatrai Publishing Company.

3. Basic structural analysis by C.S.Reddy

4. Punmia B. C. – Theory of Structure, Laxmi Publication.

5. Pandit& Gupta -Structural Analysis,TataMcGrawHill,Pub. Co.Ltd ., New Delhi

6. Wang C.K.-Intermediate structural analysis, McGraw Hill, New York.

Hydraulic Engineering					
COURSE OUTLINE					
Course Title:	**Hydraulic Engineering**	**Short Title:**	**HDE**	**Course Code:**	

Course description:

The course is an advance course in fluid mechanics. It focuses on applications of fluid mechanics in civil engineering. The principal fluid used is water. The course includes boundary layer and fluid flow around submerged bodies, Analysis of turbulent flow in pipes and pipe flow systems, Analysis of open channel flows and Study of Hydraulic Turbines and centrifugal pump.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	3

Prerequisite course(s):

Nil

Course objectives:

To introduce the students to various advanced hydraulic engineering problems like open channel flows, laminar and turbulent flows, flow through pipes, losses etc. The student must have knowledge of hydraulic machines like pumps and turbines that are commonly used in civil engineering. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

Course outcomes:

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

- The student must have knowledge of laminar and turbulent flow analysis.
- The student must be able to analyze flow through pipes and design a pipe system.
- The student must be able to analyze and design channel flow system.

<table>
<tr><td colspan="5">COURSE CONTENT</td></tr>
<tr><td colspan="3"></td><td>Semester:</td><td>V</td></tr>
<tr><td colspan="3">Teaching Scheme:</td><td colspan="2">Examination scheme</td></tr>
<tr><td>Lectures:</td><td colspan="2">3 hours/week</td><td>End semester exam (ESE):</td><td>60 marks</td></tr>
<tr><td colspan="3" rowspan="2"></td><td>Duration of ESE:</td><td>03 hours</td></tr>
<tr><td>Internal Sessional Exams (ISE):</td><td>40 marks</td></tr>
<tr><td colspan="2">Unit–I:</td><td>No. of Lectures: 09 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Laminar Flow- Laminar flow through pipes – Hagen-Poiseuilli’s equation, Stoke’s law, Measurement of viscosity.
Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Turbulence phenomenon, scale and intensity Causes of turbulence Reynolds stresses, , Prandtl’s mixing length theory, universal velocity distribution equation(No derivation of velocity distribution equation), Darcy-Weisbach equation (no derivation)Hydrodynamically smooth and rough boundaries. Resistance to flow of fluid in smooth and rough pipes, Moody’s diagram.
Flow through Pipes: Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon.</td></tr>
<tr><td colspan="2">Unit–II:</td><td>No. of Lectures: 09 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Boundary Layer Analysis-Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, Local and average friction coefficients. Separation and Control.
Fluid flow around submerged bodies: Practical problems involving fluid flow around submerged objects, definitions and expressions of drag and lift, drag and lift coefficients, types of drag, drag on cylinder .Circulation, Magnus effect, lift on cylinder and airfoil, polar diagram.</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="2">Unit–III:</td><td>No. of Lectures: 08 Hours</td><td colspan="2">Marks: 12</td></tr>
<tr><td colspan="5">Introduction to Open Channel Flow- open channel flow, geometrical parameters of a channel,</td></tr>
</table>

classification of open channels, classification of open channel flow

Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n .*Most economical section of ch*annel for rectangular, triangular, circular and trapezoidal sections. Normal depth.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Non-Uniform Flow- Specific energy, Specific energy curve, critical flow,Specific force and Critical depth. Measurement of Discharge and Velocity – Venturi Flume,Measurement of Velocity- Current meter, Floats.

Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method.(No mathematical Treatment for methods of computation of water surface profile)

Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump, length and height of jump, Types, applications of hydraulic jump. Energy dissipation and other uses.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Hydraulic Turbines :Elements of hydro electric power plant, unit & specific quantities, Classification of hydraulic turbines, introduction to work done, head and efficiencies of turbines(mathematical treatment only for Pelton Wheel turbines)

Centrifugal Pumps: Classification of centrifugal pump, specific speed, priming, and introduction to work done by impeller, head and efficiencies, Characteristic curves of hydraulic turbines and centrifugal pumps.

Text Books:

A Textbook of Fluid Mechanics and hydraulic machines by Dr R. K. Bansal, Laxmi Publication

Fluid Mechanics and fluid power engineering by D S Kumar S K Kataria Publications.

Reference Books:

Fluid Mechanics – Dr. A. K. Jain, Khanna publisher, Delhi

Flow in open Channels –Dr. K. Subramanya, Tata Mcgraw-Hill education Pvt. Ltd., New Delhi

Hydraulic Machines- Dr. Jagdish Lal, Metropolitan Book Co. Pvt. Ltd., New Delhi

Hydraulic Machines- Dr. R. K. Rajput

GEOTECHNICAL ENGINEERING

COURSE OUTLINE

Course Title:	*GEOTECHNICAL ENGINEERING*	**Short Title:**	*GTE*	**Course Code:**	

Course description:

This course includes importance, applications and scope of soil mechanics and foundation engineering. It describes soil as a three phase system. It describes the basic engineering properties of soil and soil classification system. It describes the behavior of soil under various types of loadings and concept of bearing capacity. It also describes types of foundations including shallow as well as deep foundations and their design approaches.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	*12*	*36*	*3*

Prerequisite course(s):

Nil

Course objectives:

1. Know the basic principles of soil mechanics, soil properties, relationship between soil properties.
2. Understand the soil classification system
3. Investigate the soil in laboratories and field.
4. Estimate bearing capacity of soil.
5. Understand behavior of soil subjected to loads and water content.
6. Understand types of foundation and their performance.
7. To design the different types of foundations.

Course outcomes:

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

1. To introduce the students with subjects of soil mechanics, basic terms, properties and relationship between them and methods of soil investigations.
2. To appraise the student with soil classification systems.
3. To appraise students about soil compaction and consolidation of soils and mathematical treatment.
4. To introduce the students with effective stress and describe shear strength of soil, types of shear tests, principal stresses and relation between them.
5. To analyze and design different types of foundations

COURSE CONTENT

Name of the Subject: Geotechnical Engineering		**Semester:**	*V*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 08 Hours**	**Marks: 12**

Introduction–Types of soils, their formation, Scope of soil engineering, Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, etc, Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight-percent air voids, saturation- moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content, Specific gravity & Unit weight.

Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of Atterberg's limits.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Permeability of Soil - Darcy's law, Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping-out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil.

Effective Stress Principle - Introduction, nature of effective stress, effect of water table, effective stress in soils, quick sand condition.

Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density.

Consolidation of Soil - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Stresses in soils – Introduction, stresses due to point load, Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart.

Shear Strength - Mohr circle and its characteristics, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests,

Stability of Slopes - Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method.

Introduction to Earth Pressure: Introduction, Rankine's state of Plastic Equilibrium in soils, Active and Passive states due to wall movement, Earth Pressure at rest.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Soil Exploration- Introduction, methods of site exploration and soil investigation, advance soil exploration methods.

Foundation Engineering: Introduction, types of Foundations, Bearing Capacity of Foundations, definitions: Ultimate Bearing Capacity, Gross Bearing Capacity, Net and Safe Bearing Pressures,

Allowable Soil Pressure, Shallow Foundation- Introduction, types of Shallow foundation, types of Shear Failure, Load-Settlement Curve, Terzaghi's Bearing Capacity Analysis, Minimum depth of foundation, elastic settlement and analysis, Contact pressure, pressure bulb, Total and Differential Settlement.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Deep Foundation: Introduction, Pile Foundation-Introduction, necessity, Classification, Pile capacity analysis based on Static and Dynamic methods, Pile Load Test as per IS:2911 specifications, Negative Skin Friction, Pile Groups, Ultimate Load Capacity of Groups.

Piers and Cassions: Types of Piers, Methods of Installation, Cassions and Foundation Walls, Open, Box and Pneumatic Cassions, Sinking Method, Cassion Disease, Well Foundation, Sheet Piles and cofferdams

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy
2. Soil Mechanics And Foundation Engineering by P N Modi.
3. Dr. B.C.Punmia, Soil Mechanics and Foundation Engineering, Laxmi Publications,

Reference Books:

1. Gulhati and Datta , GeoTechnical Engineering, Tata McGraw Hill.
2. Dr. Alam Singh, Soil Engineering in Theory and Practice (Vol. -1), CBS Publication, Delhi.
3. Dr. Alam Singh, Modern Geotechnical Engineering & Foundation, CBS Publication, Delhi.
4. Ramamurthy T.N. and Sitharam T.G., GeoTechnical Engineering,
5. Venkatramaiah C., Geotechnical Engineering,
6. V. N. S. Murthy, Soil Mechanics and Foundation Engineering, Saitech Publications.
7. K. R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, New Delhi.
8. Taylor, D. W., Fundamentals of Soil Engineering, John Wiley & Sons

9. K. Terzaghi, Soil Mechanics in Engg. Pracice, John Wiley & Sons

10. Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

Kasmalkar B. J. "Geotechnical Engineering", Pune Vidyarthi Griha Prakashana, Sadashiv Peth Pune-30, Latest edition.

Professional Elective Course I (a)

Concrete Materials.

COURSE OUTLINE

Course Title:	***Concrete Materials***	**Short Title:**	**CM**	**Course Code:**	

Course description:

Engineering is an art of utilizing forces and materials for specific requirements. It requires selection of material for a particular task. Consequently it is necessary for an engineer to know the properties of material, particularly the construction material. This course suffices that aspect. It includes properties of various materials used in civil engineering construction like stones, gravel, sand, lime, cement, bricks, wood, paints varnishes, glass, metals and many such materials. The syllabus describes their basic civil engineering properties and their applications in civil engineering. The course also describes in detail about the concrete which is a derived material.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*12*	*36*	3

Prerequisite course(s):

Nil

Course objectives:

This course aims to appraise an student about various materials used in civil engineering

construction, their availability, their basic properties, methods of examinations as per prevailing standards, and their civil engineering applications. The student must be able to select appropriate material for his/her application. The student must be able to examine the material according to standards. The student must know the concreting process and should be able to design concrete mix also.

Course outcomes:

After completion of this course the student must be able to

1. Know the commonly used materials in civil engineering materials and their general engineering properties.
2. Examine a material as per relevant codes of practice.
3. Select a suitable material for a specific civil engineering task.
4. Design a concrete mix.
5. Know the advancements going on in material technology and concreting.

COURSE CONTENT

		Semester:	*V*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 08 Hours**	**Marks: 12**

Common materials used in construction industry. Stone as a parent material. Classification of stones. Testing of stones.

Cement: - history, Manufacture of cement, raw materials used in cement manufacturing, ingredients of cement, hydration process of cement, compounds in cement, Types of cement, properties and testing of cement, storage of cement.

Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**

Aggregates and testing of aggregates: sources, coarse and fine aggregates. Concept and

importance of shape, size, texture, strength and their influence on concrete properties. Concept and determination of bulk density, specific gravity, adsorption and moisture content, soundness, alkali aggregate reactions, thermal properties of aggregates, grading of aggregates, flakiness index, elongation index, clay and fine silt content, organic impurities, specific gravity, bulk density and voids, crushing value, impact value, abrasion value.

Recycled aggregates: their uses in concrete.

Water: role of water, water quality for concrete.

Admixtures in concrete: plasticizers and super plasticizers.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Fresh Concrete: Workability**,** factors affecting workability, determination of workability.

Retarders and accelerators in concrete.

Air entraining admixtures, effect on freezing and thawing, effect on workability, effect on strength. Effect on properties of hardened concrete.

Pozzolanic admixtures in concrete,

Segregation and bleeding, process of manufacturing of concrete, batching, mixing, transporting, use of pumps for transporting, placing of concrete, compaction of concrete, curing of concrete, finishing of concrete surfaces.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Strength of concrete: water cement ratio, gel/space ratio, maturity of concrete, relation between compressive and tensile strength, bond strength, high strength concrete, ultra high strength concrete, high performance concrete.

Elastic properties of aggregates, relation between elastic modulus of elasticity and strength, factors affecting modulus of elasticity, dynamic modulus of elasticity, poison's ration, creep: concept and measurement. Factors affecting creep. Shrinkage. Types, factors affecting shrinkage. Durability of concrete: definition, significance, Strength and durability relationship, impact of w/c ratio, permeability, cracks in concrete, factors responsible for cracks.

effect of temperature changes on concrete, effect of fire on concrete., sulfate attack on concrete, control of sulfur attack. Chloride attack and its control corrosion of concret, control measures.

Compression test on concrete.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Flexural strength of concrete**,** tensile strength of concrete, factors affecting strengths, non destructive testing of concrete. By common methods. concrete mix design: concept of mix design, terms and terminologies, introduction to American Concrete Institute Method of mix design, Indian Standard Recommended Method of concrete mix design in detail. special concretes: light weight concrete, Aerated concrete, No fines concrete, high density concrete, fiber reinforced concrete. cold weather concreting, hot weather concreting.		
Text Books:		
1. Concrete Technology by M.S.Shetty, S Chand Publication. 2. Concrete Technology by M. L. Gambhir, TMH Publication. 3. Concrete Technology by S. V. Deodhar, Central Techno Publication		
Reference Books:		
1. Properties of Concrete by A M Neville, Pearson Publications.		

Professional Elective Course I (b)					
Airport Planning And Design					
COURSE OUTLINE					
Course Title:	***Airport Planning And Design***	**Short Title:**	***APD***	**Course Code:**	
Course description:					
Air transportation is a rapidly growing field in developing countries like India. The role of civil engineer in air transportation is to provide infrastructural facilities for aircraft landing, takeoff, repair, maintenance and parking along with amenities for passengers and staff. This course aims to provide an introduction to design of airport planning such as surveys site selection, airport architecture. It deals with the design of runway, taxiway, terminal area, pavement design and drainage system.					

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):
Nil
Course objectives:

The student must know the importance and scope of air communication and must be able to provide basic infrastructural facilities needed for aircrafts for their operations. The student must know the concepts in Airport design and Planning with basic requirement for site selection, survey required also design of runway, pavement design and rainwater drainage system.

Course outcomes:

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

i. To know the role of an air port design and maintenance engineer.
ii. To know the civil engineering requirements of an airport.
iii. Select a site for airport.
iv. Design a runway, taxiway, hanger, apron, beacon and terminal building.
v. Design the various visual aids and learn the importance of air traffic control

COURSE CONTENT

Name of the Subject: Geotechnical Engineering		**Semester:**	**V**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 08 Hours**	**Marks: 12**

Introduction–

History of aviation, air transportation in India, IAAI,AAI, open sky policy, airport terminology, components parts of aero-plane, Aircraft characteristics, characteristics of the jet aircrafts, Relation between aircrafts & airports, importance of field length requirements, Effect of noise created by aircrafts, noise regulation by FAA, Classification of aerodromes, classification of airports.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Airport Surveys :objectives of surveys, types of surveys & drawings to be prepared, Airport

Planning : improvement of existing airport, Airport site selection, A/P size, obstructions, zoning laws, Regional planning A/P architecture, measures to control adverse impact, Importance of air traffic control, flight rules, Air traffic control network, air traffic control aids, Automation system in air traffic control aids, GPS air traffic control, free flight air traffic control.

Unit–III:	**No. of Lectures: 09 Hours**	**Marks: 12**

Runway Design: runway orientation, change in direction of runway, basic runway length, correction to basic runway length, Geometric design of runways, Balanced field concept, airport capacity, Runway pattern, comparison of runway patterns, **Taxiway Design**: layout of taxiways, geometric standards for taxiway, Exit taxiway, optimum location of exit taxiways, Design of exit taxiway, Loading and holding aprons.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Planning and Design Terminal Area: Terminal Building, Passenger flow, Parking of vehicles, Size of apron, Apron turntable, System of aircraft parking, Hangers, Protection from jet blast, Typical Airport Layout, Requirement of pilots for visual aids, Airport markings guidance to pilots during landing, Factor affecting airport lighting, elements of airport lighting, Beacon light, Runway threshold lighting, Apron hanger lighting.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Air Port Pavement Design : Types of pavements, design factors or requirements, Design of flexible , rigid pavements, LCN method of pavement design, Causes of failure of pavements, maintaintence & evaluation of air port pavement, Importance of airport grading, general requirement of grading, operation of grading, Aims of airport drainage, functions of airport drainage, special characteristics of air port drainage, Basic requirement of airport drainage system, surface drainage, ponding, subsurface drainage, types of pipes for drainage.

Text Books:

1. Airport Engineering, Ketki Dalal and S C Rangwala S K Chand Publisher.
2. Airport Engineering, S K Khanna, M G Arora, and S S Jain, TMH publications.

Reference Books:

1. Airport Engineering Planning and Design, S C Saxena CBS publication.
2. Planning and Design of Airports, William Sproule, Seth Young, Robert Horonjeff, Francis Mckelvey, TMH publications.

Professional Elective Course – I (c)

Repair and Rehabilitation of Structures

COURSE OUTLINE

Course title	**Repair and Rehabilitation of structure**	**Short Title**	**RRS**	**Course code**	

Course description

Civil engineering structures are designed to serve for long time. They are expensive. Hence a long service span is expected from them. However, they are degraded due to climatic effects, earth quakes and physical injuries caused manually and by accident. They need maintenance, timely repair and rehabilitation from time to time. This enhances their service life and functionality also. The present syllabus is aimed to enable a student to understand the importance and scope of Repairs and Rehabilitation of civil engineering structures, its scope and current day technology available to deal with the issue.

Lectures	**Hours/week**	**No. of weeks**	**Total Hours**	**Semester credits**

	3	14	42	3

Prerequisite courses

Nil

Course objectives

To learn various distress and damages to concrete and masonry structures

• To understand the importance of maintenance of structures

• To study the various types and properties of repair materials

• To assess the damage to structures using various tests

• To learn the importance and methods of substrate preparation

• To learn various repair techniques of damaged structures, corroded structures

Course outcomes:

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

• various distress and damages to concrete and masonry structures

• the importance of maintenance of structures, types and properties of repair materials etc

• assessing damage to structures and various repair technique.

COURSE OUTLINE

Repairs and Rehabilitation of Structures	**Semester:**	*VI*

Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures. Cracks in R.C. buildings Various cracks in R.C. buildings, causes and effects Maintenance importance of maintenance, routine and preventive maintenance. Damages to masonry structures Various damages to masonry structures and cause.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Repair materials Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials Special mortars and concretes Polymer Concrete and Mortar, Quick setting compounds Grouting materials Gas forming grouts, Salfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts. Bonding agents Latex emulsions, Epoxy bonding agents. Protective coatings Protective coatings for Concrete and Steel FRP sheets.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Damage diagnosis and assessment Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test, Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement Substrate preparation Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Crack repair Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing. Strengthening Strengthening, Beam shear strengthening, Flexural strengthening.

Text Books:

1. Repair and protection of concrete structures by Noel P.Mailvaganam, CRC Press,1991.

2. Concrete repair and maintenance Illustrated by Peter.H.Emmons, Galgotia publications Pvt. Ltd., 2001.

3. “Earthquake resistant design of structures” by Pankaj agarwal, Manish shrikande, PHI,2006

Reference Books:

1. Failures and repair of concrete structures by S.Champion, John iley and Sons, 1961.

2. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.

3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.

4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House, 2010.

Open Elective Course I (a)

Air Pollution Control Technology

COURSE OUTLINE

Course Title:	**Air Pollution Control Technology**	**Short Title:**	**EE**	**Course Code:**	

Course description:

This course apprises a graduate student with the importance of air quality, sources of air pollution, basic causes of air pollution, energy – environment – economics relationship and impact of life style on environmental degradation. It describes the effects of air pollution of human beings, animals, plants and property. It also presents mathematical modeling of air pollution dispersion and its relation with climatic conditions. It aims to enable the engineer to design stack for air pollution control. It also aims to enable the engineer to conduct air pollution surveys and to design air pollution control devices.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3 hour /week	*14*	*42*	*3*

Prerequisite course(s):

-

Course objectives:

The basic objective of the course is to make aware a student about importance, scope and generation of air pollution, and meteorologically governed dispersion of air pollution. It is also to train the students for designing facilities for air pollution control, including equipments and estimation of height of stack. The course must enable student to provide air pollution control technology to the client depending upon their requirements.

Course outcomes:

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

1. Understand the air quality parameters of significance and importance of air quality and impact of pollution on human health, plant health and animal health.
2. Assess the sources and basic cause of air pollution.
3. To evaluate the dispersion of air pollution and impact of meteorological factors.
4. To design a stack.
5. To be able to design air pollution control devices.

COURSE CONTENT

Air Pollution Control Technology		**Semester:**	VI
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Definition of environment and pollution, sources of air pollution, elements of air pollution, effects of major air pollutants, summarized effects of air pollution on human being, animals, plants and property.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Meteorological parameters affecting dispersion of air pollution, Atmospheric stability conditions, thermal and subsidence inversions, maximum mixing depth, plume behaviors, Gaussian dispersion models- their limitations and use for estimation of air pollution dispersion for point source at GL, and point source at height, with and without reflection. Standard deviations to incorporate effect of meteorological conditions on air pollution dispersion, estimation of

maximum air pollution and its location, design of stack, estimation of plume rise.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Sampling of ambient air, exhaust air sampling, air pollution surveys, air pollution indices, visibility surveys, permissible limits of air pollution as a function of concentration and time of exposure, control of odor- introduction to common methods, introduction to control of CO, SO_x and NO_x, automobile air pollution- elements, why it is critical to be controlled,

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Nature's mechanism of cleaning of air pollution, air pollution control methods – change in raw material, change in design, change in process, alternative fuels, air pollution control by scrubbers- gravity settler, cyclone separator, fabric filter, wet scrubber, electro static precipitator- advantages and limitations of each scrubber, their applications, their design features.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Major air pollution episodes across the world, air pollution scenario in India, air pollution control act- salient features, global air pollution phenomena – global warming, climatic changes, global cooling, and acidic rains. Constitution of IPCC, its role, energy – environment and economics relationship, life style and environment. Major global initiatives to curb air pollution.

Text Books:

1. Air pollution by MN Rao and HVN Rao, TMH publications.

Reference Books:

Air Pollution: its origin and control, by Kenneth Wark and Cecil F Warner, Harper and Row Publishers, New York.

Open Elective Course I (b)					
Geographical Information System					
COURSE OUTLINE					
Course Title:	**Geographical Information System**	**Short Title:**	**GIS**	**Course Code:**	
Course description:					

This course offers an introduction to the concepts, principles, and theories behind Geographic Information Systems (GIS), with emphasis on the nature of geographic Information. This course is designed to enable student to evaluate, to apply and to analyze software's related to GIS .mainly to highlight the relevant basic knowledge of GIS modeling, spatial data analysis vector data and raster data processing. Students acquainted with related knowledge can be able to apply in design, and modeling. Apply knowledge of GIS to be a system of hardware, software, data, people, organizations, and institutional arrangements for collecting, storing, analyzing, and disseminating information about areas of the earth.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	42	*03*

Prerequisite course(s):

Nil

Course objectives:

- To know the different GIS software and their capabilities
- To study the various functions tools available and perform query operations in GIS
- To study the different analysis types in GIS
- To learn MCE, weight age and ranking capabilities of GIS
- To learn the Internet capabilities of Web GIS
- To study basic concept of GIS
- To study the data structure in GIS
- To study data conversion in GIS

Course outcomes:

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

- The gradate is expected to know the advanced techniques and methods that are required to conduct the GIS survey of vast areas
- A graduate is able to know different GIS software
- A graduate should develop skills to implement and practice the use of GIS software for areas of large areas.
- A graduate should obtain knowledge of spatial, vector data and raster data
- A Graduate is expected to express working principles used and methodology of the advanced GIS software

COURSE CONTENT

GIS		**Semester:**	**VI**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I: Introduction to GIS	**No. of Lectures: 09 Hours**	**Marks: 12**

Definition, concepts, Information System, components of GIS, History, elements of GIS, objectives of GIS, hardware and software requirements of GIS, Geospatial data architecture, Operations, Geographic co-ordinate system, Map Projections, Input data for GIS, display, types of output products, GIS categories, Level and scale of Measurement, importance of data quality.

Unit–II: Vector Data and Processing	**No. of Lectures: 09 Hours**	**Marks: 12**

GIS data types, data Representation, Data Sources, typical GIS data sets, Data Acquisition, vector data model, relationship between classes, data structure, data verification and editing spatial data models and errors- GIS databases, attributes data input and management.

Unit–III: Raster Data and Processing	**No. of Lectures: 08 Hours**	**Marks: 12**
Elements of data model, cell, value, data structure, cell by cell encoding, run length encoding, Quad tree, Header files, format, Types of raster data, data compression, Linking and integration of vector data.		
Unit–IV: Data Conversion and Editing	**No. of Lectures: 08 Hours**	**Marks: 12**
Data format conversion, Medium conversion, Spatial interpolation, measurement and analysis methods, Data accuracy and standards, Attribute data input and Management- Relational mode- Data manipulation- classification techniques, Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.		
Unit–V: Meta Data and GIS Modeling	**No. of Lectures: 08 Hours**	**Marks: 12**
Meta data- data standard - OGC - open source GIS - GIS modeling, basic elements, classification, model processing, integration, Binary models, Index model, Regression models, Linear Regression model, Logistic Regression model, Process model.		
Text Books:		
1.C P LO Albert K. W. Yeung, "Concept and Techniques of Geographic information System", Prentice Hall India 2.M Anji Reddy, "Textbook of Remote Sensing and Geographical Information systems", BS Publications, 3.Kang tsung Chang. "Introduction to Geographical Information System", Tata McGraw Hill, 7th edition, (2010)		
Reference Books:		

1. .Burrogh P.A., "Principles of Geograpical Information System for Land Resources Assessment", Oxford Publications.
2. A.M. Chandra and S.K. Ghosh. "Remote Sensing and Geographical Information System".
3. Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind ,"Geographic Information Systems and Science", Second Edition 2005, , John Wiley & Sons, New York.
4 Satheesh Gopi, R. Sathikumar, N. Madhu, "Advanced Surveying (Total Station, GIS and Remote Sensing)", First Edition 2007:

Open Elective Course I (c)					
PROJECT MANAGEMENT TECHNIQUES					
COURSE OUTLINE					
Course Title:	**Project Management Techniques**	**Short Title:**	**PMT**	**Course Code:**	
Course description:					

This course introduces the students about concepts in Project Management such as: Scope of Project Management civil Engineering society, Importance of Project Management for large scale works, Principles of Project Management and its techniques and Application of CPM and PERT techniques for project management with special applications to civil engineering.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	42	*03*

Prerequisite course(s):

Nil

Course objectives:

- To introduce the theory of Project Management in civil engineering works.
- Apply the project management techniques in various civil engineering fields.
- To appraise the concept of critical path methods and project evaluation and research techniques.
- To enable students to calculate scheduling of projects by CPM and PERT.

Course outcomes:

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

- A gradate is expected to know the advanced techniques and methods in project management that are required in civil engineering work.
- A graduate is able to schedule the time for project using the technique of project management.
- A graduate is expected to demonstrate and practice the basics of project management.
- A graduate should develop skills to implement and practice the use of project management techniques for civil engineering projects.
- The graduates are expected to plan the project by CPM and PERT.

COURSE CONTENT

PROJECT MANAGEMENT TECHNIQUES	**Semester:**	
Teaching Scheme:	**Examination scheme**	

Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 08 Hours**	**Marks: 12**

General Management: Comparison between traditional management and modern scientific management, Roles of Taylor, Fayol, Mayo and Megregor in management, Management functions, Management styles and Objectives of Management, Organizations, forms of organizations.

Tools and techniques of Project Management: Planning the Project, Work Breakdown Structures – Work Packages -Cost Accounts, Schedule Planning, Financial Planning, Introduction of Gantt chart and PERT (Performance Evaluation and Review Technique), Introduction of CPM (Critical Path Method) and Line of Balance.

Need of management industrial act.

Unit–II:	**No. of Lectures: 08 Hours**	**Marks: 12**

Excavating & Hauling Equipments:

a) Power shovels; size, basic parts, selection, factors affecting output.

b) Draglines: - types, size, basic parts.

c) Bulldozers-types, moving earth with bull dozers.

d) Clamshells – Clamshell buckets.

Advanced equipments: crushers, pile driving, compacting, hosting etc.

Unit–III: Gantt chart and CPM	**No. of Lectures: 08 Hours**	**Marks: 12**

a) Definition of Gantt chart, historical development and examples
b) Basics for using CPM and critical path schedule.
c) Crash duration and Float or Slack in Project Management.
d) Network diagram in CPM and Critical Path.
e) Determination of floats by CPM and comparison between CPM and PERT.
f) Advantages and disadvantages of CPM.

Unit–IV: Introduction of PERT	No. of Lectures: 08 Hours	Marks: 12

a) Overview of PERT, Events and activities, Four types of time required to accomplish an activity in PERT
b) Management tools for PERT and it's Examples.
c) Advantages and disadvantages of Gantt chart and PERT.

Unit–V: Cost Analysis	No. of Lectures: 08 Hours	Marks: 12

a) Cost analysis, cost curve, optimization & crashing of network for civil engineering project.
b) Updating of network, Job layout and Mass housing.
c) Value engineering and small scale industries.
d) Software use for project management.
e) Basic economic concepts, banking aspects.

Text Books:

1. Construction Project Management Planning, Scheduling and Controlling (Tata McGraw Hill, New Delhi)
2. Construction Management and Planning – *Sengupta and Guha* (Tata McGraw Hill publication)
3. Construction Management – *Roy, Pilcher*

Reference Books:

1. Construction Planning & management- P.S. Gahlot & B.M. Dhir (New Age international (p) Ltd.
2. Construction Management – *O'Brien.*
3. Project Management – *Ahuja H.N.* (John Wiely, New York.)

HYDRAULIC ENGINEERING LAB					
LAB COURSE OUTLINE					
Course Title:	**HYDRAULIC ENGINEERING LAB**	**Short Title:**	**HDE ENGG**	**Course Code:**	
Course description:					
This lab covers experiments related to measurement of drag and lift, flow properties in pipes and open channels and also characteristic of hydraulic turbines and centrifugal pump.					

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	02	*14*	28	1

End Semester Exam (ESE) Pattern:	***Oral (OR)***

Prerequisite course(s):

Nil

Course objectives:

In this laboratory students will be introduced to the application of viscous property of fluid to measure drag and lift. Also students are introduced to pipe and open channel flow and characteristics of hydraulic turbines and centrifugal pump.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

- Measure drag and lift forces on airfoil and explain their variation with angle of attack.
- Determine friction factor and hence to develop calibration equation for pipe.
- Explain uniform flow formulae, specific energy, specific force and hydraulic jump.
- Explain ventriflume and its calibration for discharge measurement in open channel.
- Measure discharge, head, input and output power for different hydraulic turbines and centrifugal pump.

LAB COURSE CONTENT

Hydraulic Engineering		**Semester:**	*V*
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***

At least seven out of 11 experiments should be performed.

1. Study of boundary layer on flat plate.

2.Measurement of drag and lift on airfoil

3.Determination and analysis of pressure distribution over circular cylinder

4.Dtermination of friction factor and calibration equation for given pipe 5.Study of uniform flow formulae in open channel 6.Study of specific energy and specific force in open channel flow 7.Calibration of venturiflume 8.Measurement of different parameters of hydraulic jump in laboratory 9.Study of operating characteristic of Pelton Wheel Turbine 10.Study of operating characteristic of Francis Turbine 11. Study of performance of centrifugal pump **At least one site visit to hydro power plant is compulsory.**
Text Books:
A Textbook of Fluid Mechanics & Hydraulic Machines- Dr. R. K. Bansal, Laxmi Publications Limited.
Reference Books:
Fluid Mechanics – Dr. A. K. Jain, Khanna publisher,Delhi Flow in open Channels –Dr. K. Subramanya,Tata Mcgraw-Hill education Pvt. Ltd., New Delhi Hydraulic Machines- Dr.Jagdish Lal, Metropolitan Book Co. Pvt. Ltd., New Delhi Hydraulic Machines- Dr. R. K. Rajput
Guide lines for ICA:
ICA shall be based on continuous evaluation of students performance throughout the semester and practical assignments submitted by the students in the form of journal.
Guidelines for ESE:
ESE shall be based on laboratory journal submitted by the student. In ESE the student may be asked to answer questions based on experiments/assignments. Evaluation will be based on performance in oral examination.

Geotechnical Engineering Lab					
LAB COURSE OUTLINE					
Course Title:	*Geotechnical Engineering Lab*	**Short Title:**	*GTEL*	**Course Code:**	
Course description:					

This laboratory course covers experiments related to properties of soils and their measurement. It deals with learning of the practical applications through assignment work such as field investigations, bearing capacity of shallow foundations, pile foundations, etc. They are required to determine the relevant parameters necessary for applications such as prediction of bearing capacity, foundation design, design of pile foundations etc.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	*14*	*28*	*1*

End Semester Exam (ESE) Pattern:	***Practical (PR) / Oral (OR)***

Prerequisite course(s):

Nil

Course objectives:

To enable the students:

1. To measure the various properties of soils in laboratory.
2. To carryout field soil investigations.
3. To estimate bearing capacity of shallow foundations by various theories.
4. To study design of different types of foundations.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Determine properties of soils.
2. Carryout soil investigation and prepare report.
3. Design foundations for different conditions of bearing capacity and other design parameters.

LAB COURSE CONTENT

Name of the Subject: GTE		**Semester:**	*V*
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***

A) Any **eight** experiments out of following set-

1. Field density by core cutter method, sand replacement method.
2. Sieve analysis and particle size determination or hydrometer analysis.
3. Specific gravity determination by voluminometer/ pycnometer method.
4. Determination of liquid limit and plastic limit
5. Determination of shrinkage limit
6. Determination of co-efficient of permeability by constant head and falling head method.
7. Direct shear test.
8. Unconfined compression test
9. Vane shear test.
10. Proctor's test (MDD / OMC)
11. Tri- axial shear test
12. C.B.R. test or Consolidation test
13. Differential free swell test or swelling test.
14. Assignments on the following topics (any eight)
    a) Rebhann's and Cullman's graphical method for determination of earth pressure.
    b) Solution of problems on shear strength parameters using graph.
    c) Design on flexible pavement and rigid pavement.
    d) Determination of BC by Terzaghi's Method.
    e) Study of Plate Load Test/SPT Test.
    f) Preparation of Soil investigation report based on given data.
    g) Problems on Settlement analysis.
    h) Problems on Design of pile foundations.
    i) Design considerations of caissons and well foundation.
    j) Design of under reamed pile.

C) Demonstration of any **one** of following tests;

1. Plate load test.

2. Standard penetration test.

Text Books/ Reference Books:

1. Dr. B.C.Punmia, Soil Mechanics and Foundation Engineering, Laxmi Publications,
2. Gulhati and Datta , GeoTechnical Engineering, Tata McGraw Hill.
3. Dr. Alam Singh, Soil Engineering in Theory and Practice (Vol. -1), CBS Publication, Delhi.
4. Dr. Alam Singh, Modern Geotechnical Engineering & Foundation, CBS Publication, Delhi.

Guide lines for ICA:

ICA shall be based on continuous evaluation of students' performance throughout the semester and practical assignments submitted and term work prepared by the students in the form of Journal.

Guidelines for ESE:

ESE will be based on laboratory journal submitted and term work prepared by the student. In ESE the student may be asked to answer questions based on experiments/assignments. Evaluation will be based on performance in oral examination.

Disaster Preparedness & Planning Management Lab

LAB COURSE OUTLINE

Course Title:	Disaster Preparedness & Planning Management	**Short Title:**	***DPPM***	**Course Code:**	

Course description:

Disasters may be manmade or natural like earth quake, volcanoes, floods tsumani etc. Manmade disasters pertaining to civil engineering include construction site accidents like collapse of under construction structure or old structure, landslides, explosions etc. Modern technology enables mankind to prevent or overcome the damage caused by them. However technology alone is not adequate. Proper planning and management of resources is required to prevent and overcome the damages of such disasters. The present course describes the importance, scope and technical approaches for disaster preparedness and planning management.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	*14*	*28*	*1*

End Semester Exam (ESE) Pattern:25	***Oral (OR):25***

Prerequisite course(s):

Nil

Course objectives:

The present course aims to enable students to understand basic concepts in disaster management, definitions & terminology used in disaster management, types & categories of disaster, the challenge posed by disaster, and impa*cts* of disaster. It trains a student in key skills required for disaster preparedness and planning management.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

- Identify various types of disasters
- Learn the disaster management techniques & its analysis
- Implement safety management & public awareness regarding disaster management.

LAB COURSE CONTENT

Disaster Preparedness & Planning Management Lab	**Semester:**	*V*

Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***

	Internal Continuous Assessment (ICA):	***25 marks***

LIST OF PRACTICAL

1) **To identify various types of disasters**

a. **Natural Disasters**: Study of Earthquake, Floods, Coast Hazard, landslides etc.

b. List out & collect information data for above natural disaster happened in last ten years.

c. **Manmade Disaster**: Chemical and industrial hazard, nuclear hazard etc.

d. List out & collect information data for above manmade disaster happened in last ten years.

2) **To learn the disaster management techniques and its analysis**

a. Rescue operation & casualty management

b. Risk management & emergency management

c. Administrative set up & organization

3) **To implement public awareness regarding disaster management**

a. The study Disaster Management acts

b. To study emergency support function (EPF) and nodal/support agencies.

- **Lab course content : two assignment on each of above content**

Text Books:

1. *Pradeep Sahni, Disaster Risk Reduction in south Asia,*
2. *Ghosh G. K. 2006, Disaster Mangement, APH Publishing corporation*
3. *Rajdeep Dasgupta, Disaster Mangement, Mittal Publication*
4. *Dr.Kadambaui Sharma, Disaster Mangement in India, Jnanda Prakashan, New Delhi*

Reference Books:

1. *Davies V S Thomsan K- Thomsan Construction safety, Telford London*
2. *Disaster Medical Systems Gudelins, Emergency Medical Services Authoroty, State of Californa. EMSAn214 June 2003*

Guide lines for ICA:
❖ ICA shall be based on continuous evaluation of student's performance throughout the semester & term work prepared by student in the form of journal.
Guidelines for ESE:
❖ The student may be asked to answer questions based on ICA. Evaluation will be based on performance in oral examination.

Minor Project (Stage – I)					
LAB COURSE OUTLINE					
Course	**Minor Project (Stage – I)**	**Short**	**MPROJ-**	**Course**	

Title:		**Title:**	**SI**	**Code:**	

Course description:

Laboratory work or experimentation is a line of distinction between science and other subjects. A project is an integration of experimental work performed to achieve an specific task. Projects not only teach experimentation, they teach resource planning and management, time and manpower management and ability work in team also. It also aims to enable to apply the theoretical concepts to solve problems with multidisciplinary approach. Ultimately it enables to demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Hence projects are given due space in the curriculum right from third year level.

The Minor project stage I is the first link in the series. The objective of this project is primarily to formulate or identify a 'problem' that can be solved in the specified time and resources available and to actually solve it. The word problem is used in broad sense referring to any activity like analyzing, designing, fabricating, developing, surveying, etc.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	6	**14**	**84**	**3**

End Semester Exam (ESE) Pattern:	**----**

Prerequisite course(s):

Nil

Course objectives:

1. To understand the meaning, objectives and purpose of projects.
2. To understand the value of achieving perfection in project implementation & completion.
3. To apply the theoretical concepts to solve problems with teamwork and multidisciplinary approach.
4. To demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Undertake problem identification, formulation and solution

2. Demonstrate a sound technical knowledge of their selected project topic.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Demonstrate the knowledge, skills and attitudes of a professional engineer for problem solving.
5. Demonstrate ability to work in team

LAB COURSE CONTENT

Minor Project (Stage – I)		**Semester:**	**V**
Teaching Scheme:		**Examination scheme:**	
Practical:	**6 hours/week**	**Internal Continuous Assessment (ICA):**	**50 marks**

At third year the students shall carry out a minor project in a group of maximum five students. The project work spans both the semesters. By the end of Semester – V the students shall complete the partial work, and by the end of Semester – VI the students shall complete remaining part of the project. Assessment for the project shall also include presentation by the students. Each teacher can guide maximum 04groups of minor projects.

The project may be either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department. The work may also be Study/Survey/Design.

Minor Project (Stage – I) Report will include literature survey, problem identification, work methodology, preparing material specification and material procurement, collection of data etc. Approximately 60% work should be completed by the end of Semester – V. Each student group should submit partial project report in the form of thermal bound at the end of Semester –V.

Guide lines for ICA:

The Internal Continuous Assessment (ICA) for project shall be based on continuous evaluation of students' performance, active participation, knowledge / skill acquired throughout semester and presentation by the students. The final assessment shall be done jointly by the guide and departmental committee. A three-member departmental committee including guide, appointed by

Head of the department, shall be constituted for the assessment. The assessment for Minor Project (stage – I) in Semester – V shall be as per the guidelines given in Table – A.

Table – A

		Assessment by Guide					Assessment by Departmental Committee		
Sr. No.	Name of the Student	Attendance / Participation	Problem Identification / Project Objectives	Literature Survey	Methodology / Design/work done	Report writing	Depth of Understanding	Presentation	Total
	Marks	5	5	5	15	5	10	5	50

Constitution of India

Basic features and fundamental principles

The Constitution of any country is the documentation of supreme rules and regulations used to govern the nations. It decides the powers of various components of the government and mode of their exercise. India is the world's largest country having world's largest written constitution. The constitution has been proven to be robust enough in the voyage of democratic functioning of 70 years of this nation. In fact it proven to be the world's strongest constitution to tackle all critical socio-political conditions. The Constitution of India demonstrates the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America. At the same time the constitution of India is based upon the ancient vedic ideology of consensus and unity amongst diversity. It defines 'right is might' not might is right.

The Constitution of India is not only a legal document but it also demonstrates social, political and economic perspectives of the Indian Society. It represents India's legacy of "diversity".

Course content

1. Meaning of the constitution, constitutionalism and law.
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation

7. Federal structure and distribution of legislative and financial powers between the Union and the States

8. Parliamentary Form of Government in India – The constitution powers and status of the President of India

9. Amendment of the Constitutional Powers and Procedure

10. The historical perspectives of the constitutional amendments in India

11. Emergency Provisions: National Emergency, President Rule, Financial Emergency

12. Local Self Government – Constitutional Scheme in India

13. Scheme of the Fundamental Right to Equality

14. Scheme of the Fundamental Right to certain Freedom under Article 19

15. Scope of the Right to Life and Personal Liberty under Article 21

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Third Year Engineering

(Civil Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester - VI

W.E.F. 2020 – 21

Syllabus Structure for Third Year Engineering (Semester – VI) (Civil)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical/Oral		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
PCC CE303 Structural Engineering	D	3	-	-	3	40	60	-	-	100	3
PCC CE306: Environmental Engineering	D	3	-	-	3	40	60	-	-	100	3
PCC CE307 Transportation Engineering	D	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective course II	E	3	-	-	3	40	60	-	-	100	3
OEC Open Elective Course II	F	3	-	-	3	40	60	-	-	100	3
PCC CE 303 Structural Engineering Lab	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE 306 Environmental Engineering Lab	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE 307 Transportation Engineering Lab	D	-	-	2	2	-	-	25	-	25	1
PROJ Minor Project Stage II	G	-	-	6	6	-	-	50	25 OR	75	3
Internship*	H	-	-	-	-	-	-	-	-	-	-
		15		**12**	**27**				**75**	**700**	**21**

Professional Elective Course II	Open Elective Course II
Building construction practice	**Intelligent transportation system**
Railway Engineering	**Smart city planning**
Construction Equipments and Automation	**Numerical methods of analysis**

*It is a mandatory non-credit course. It will be during Summer Vacations after Semester VI. The satisfactory completion report of internship should be submitted to the University at the end of the semester VIII

Structural Engineering					
COURSE OUTLINE					
Course Title:	**Structural Engineering**	**Short Title:**	***SE***	**Course Code:**	

Course description:

The primary aim of this course is to provide an introduction to the analysis and design of reinforced concrete structures, by limit state method conforming to IS 456:2000 and design of steel structures through the use of the Indian Standard (IS 800:2007) design code. The course covers design of various elements viz. beams, slabs, columns, and footing in RCC. It also deals with the design of steel members and connections, such as, the design of riveted/bolted and welded connections, design of tension members, compression members, beams, and beam columns;. It equips the students with the tools necessary for designing steel structures and to familiarize them with the relevant national design code.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*43*	*03*

Prerequisite course(s):

Nil

Course objectives:

The primary course objective is to equip the students with the tools necessary for designing Concrete structures and to familiarize them with the relevant national design codes such as IS 456:2000. Also this course is to serve as an introduction to the concepts in structural steel design through the use of the Indian Standard IS 800:2007 design code. It deals with the concepts of various limit states such as limit state of collapse, serviceability and durability etc. It covers design of various components of structure. It also deals with analysis and design of individual members and connections such as the design of tension members, compression members, beams, and beam columns; and bolted and welded connections, etc. The primary course objective is to equip the students with the tools necessary for designing steel structures and to familiarize them with the relevant national design codes.

Course outcomes:

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

- Understand various design philosophies for reinforced concrete structures including limits states of collapse, serviceability, durability, characteristics strength, characteristics load, partial safety factors for material and loads. Concept of singly and doubly reinforced beams and flange sections.
- To be able to design one way and two way slabs and beams.
- To be able to design various components of structures such as columns, footings Staircase
- .To know about bolted and welded connections. Analysis and design of tension members.
- To be able to analyze concept and design of compression members, column bases and built up columns.

COURSE CONTENT

Structural Designing		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction to various design philosophies of R.C structures, working stress method, ultimate load method, limit state method , limit state of collapse, limit state of serviceability, limit state of durability, characteristic strength, characteristic load, partial safety factors for material strengths and loads, structural properties of concrete.

Limit state method for flexure, Assumptions, stress &strain diagram, Balanced, under reinforced & over reinforced RC sections, analysis and design of rectangular section, analysis and design of doubly reinforced sections, analysis and design of flanged sections.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Design of beams for flexure, shear and bond: Simply supported, cantilever beams & continuous beams using IS code coefficient method.

Design of slabs: One way simply supported, cantilever slab & continuous slab, two way simply supported & continuous slabs.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Design of Columns and Footing: Introduction, strain and stress variation diagrams, axially loaded short column with minimum eccentricity requirements, Design of short column for axial load.

Design of isolated pad footing for axial load & uniaxial bending. Design of RCC dog legged staircase.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Introduction to Steel Structures: Types of steel structures, grades of structural steel, various rolled steel sections, Limit state method of design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, Strength of bolted & welded Connections, Design of connections subjected to Axial Forces & Moments.

Tension members: Behaviour, Modes of failure– Yielding of cross-section, Net section Rupture, block shear. Design of single and double angle sections with gusset plate with bolted and welded end connections.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Behaviour of Compression member– effective length, and slenderness ratio, Modes of failure-failure with full strength, local buckling, and torsion buckling. Classification of cross sections, Buckling curves. Design of compression members with bolted and welded connection using single and double angle sections.

Built up Column and Column Bases: Design of lacing. Introduction to battened column, design of connections, Column bases under axial load: design of slab base, gusseted base.

Text Books:

1) Pillai Menon ,Reinforced Concrete Design, Tata Mc Graw Hill, New Delhi., 3rd edition 2013

2) Duggal S. K.,Limit State Design of Steel Structures, Tata Mc Graw Hill publishing company Ltd., New Delhi, 3rd Edition, 2009

Reference Books:

1) B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Limit State Design of Reinforced Concrete, Laxmi Publication, 1st edition 2007

2) P. C. Varghese ,Limit State Design of Reinforced Concrete, PHI, 2nd Edition2006

3) S. Ramamrutham, R. Narayan, Design of Reinforced Concrete Structures (conforming to IS 456), Dhanpat Rai Publication, 7th Edition 2013

4) Dr. V. L. Shah and Dr. S. R, Limit State Theory and Design. Karve, Pune Vidharthi Gruh Publication, Pune, 6th Edition

5) P. Dayaratnram, Limit State Analysis and Design, Wheeler Publishing company, Delhi.,12th edition 2009

6) Subramanian N.,Design of Steel Structures., Oxford University Press, New Delhi, 2008

7) Shah V. L. &Gore, Limit state design of Steel Structure, Structures Publication, Pune, 5th Edition.

8) Bhavikatti S. S ,Design of Steel Structure by Limit State Method as per IS: 800-2007., I K International Publishing House, New Delhi, 3rd Edition

9) Ram Chandra, Design of Steel Structures Vol.I& Vol.II, Standard Book House, New Delhi, 10th Edition, 2011

Environmental Engineering					
COURSE OUTLINE					
Course Title:	**Environmental Engineering**	**Short Title:**	**EE**	**Course Code:**	

Course description:

This course apprises a graduate student with the importance of water supply and wastewater engineering. The syllabus includes population forecast, assessment of design periods of water treatment and wastewater treatment facilities, their design, commissioning, operation, maintenance, trouble shooting and augmentation, water supply and wastewater carriage network design, importance and scope of sanitation.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3 hour /week	*12*	*36*	*3*

Prerequisite course(s):

-

Course objectives:

The basic objective of the course is to make aware a student about importance, scope and methods of water treatment process and sewage treatment process. The student must know the sources of water contamination and mechanism of nature's self cleaning. It is also aimed to technically train a student to be able to provide sanitation to localities and to provide a safe and health ambience to the residents.

Course outcomes:

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

1. Understand the importance of water quality, sanitation and health.
2. To know the water quality parameters of significance and parameters of water pollution assessment
3. To know the methods of water treatment process, their design, operation and

maintenance.

4. To know the wastewater sources, mechanism of water pollution. and self purification capacity of environment.
5. To be able to design the wastewater treatment facilities and to do their operation and maintenance.

COURSE CONTENT

Environmental engineering		**Semester:**	VI
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Importance of water quality and its relation with public health, sources of water contamination, objectives of water treatment.

Factors affecting water demand, population forecast by arithmetic, geometric and incremental methods, fire water assessment.

Physical chemical and biological parameters in water and their examination.

Sources of water and their water quality.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Conventional water treatment schemes for river, lake, open well and tube well water. Theory of plain sedimentation, design of rectangular plain sedimentation tanks.

Theory of chemical coagulation, jar test for optimum coagulant dose, quality criteria of a good coagulant, features of static and mechanical flocculator, concept of SOR and weir loading, features and design of clariflocculator, theory of filtration, types of filters, design of rapid sand filters, back washing process, common disinfectants and selection of best option, chemistry of chlorine in water, break point chlorination, residual chlorine, types of chlorination, bleaching powder chemistry.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Hardness in water, effects, Softening of water by lime soda process: chemistry, recarbonization, demineralization, necessity of aeration of water, theory of aeration, methods of aeration. Use of

copper sulfate in water treatment, introduction to de-fluoridation and color removal.

sources of water pollution, important microorganisms, role of microorganisms in recycling of organic waste, concept self purification of water bodies, parameters of wastewater pollution, determination of DO in water, BOD and COD measurement, concept of MLSS and F/m

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Theory of conventional treatment of wastewater, Introduction to preliminary treatment and primary treatment unit, their functions and features.

Theory of biological treatment of wastewater, aerobic and anaerobic treatment, Activated sludge process- theory, design by APHA method, MLSSS and F/m ratio method, design of SST, trickling filter- theory, design of high rate TF, concept of extended aeration.

Theory and design of oxidation pond. Sludge generation, handling and introduction to disposal methods.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Water intake structures. Valves in water supply networks, pipes materials.

Materials used for sewer construction, types of sewers, estimation of domestic sewage, concept of coefficient of runoff, common values of coefficients of runoff, estimation of storm sewage by rational formula, self cleaning velocity, design of sewer using Manning's formula for slope estimation.

Design of septic tanks. Low cost toilets. Anaerobic digestion-theory, working of digester, design parameters.

Text Books:

2. Water Supply and Sanitary Engineering, by G. S. Birdie, J. S. Birdie, Dhanpatrai and sons publication.
3. Waste Water Engineering by Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Firewall Media publication
4. Water Supply Engineering by Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Firewall Media publication.
5. Water Supply and Sewerage by E. W. Steel and Terence J. McGhee, International Student Edition, McGraw Hill Publications.

Reference Books:

1. Wastewater Treatment and Disposal: Engineering and Ecology in Pollution Control by S J Arceivala, Marcel Dekker Inc Publications.

Transportation Engineering

COURSE OUTLINE

Course Title:	**Transportation Engineering**	**Short Title:**	**TRE**	**Course Code:**	

Course description:

Transportation facilities ensure the prosperity, security and integrity of a nation. The present course describes the importance of transportation network, their types, and role of civil engineer in their development. The syllabus is principally focused on highways. The other types of transportation modes are just introduced as they are included in the elective courses. This course enables a student to plan design and execute a roadway project. It introduces complete geometric design and structural design of road pavements using relevant IS codes. It also introduces a student with and traffic engineering so that a student can design a traffic control system for smooth flow of vehicles. The modern trends in roadway engineering are also introduced.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	3

Prerequisite course(s):

Nil

Course objectives:

The basic objective of this course is enable a student to plan, design and execute a highway project. The student must be able to carryout required topographic surveys, anticipatory traffic survey, geometric design of the highway, structural design of the pavement using available material and execution of the project. The student must also be able to design traffic signaling network using

most advanced technology.

Course outcomes:

After completion of this course an student is expected to be:

1. Understand the importance of transportation system in the development of a country, classification of roads and highway planning in India.
2. Demonstrate ability to carryout topographic survey required for the road laying.
3. Demonstrate ability to decide a road geometry depending upon the anticipatory traffic and Structural design of pavement using IS codes.
4. Execution of a highway project.
5. Installation, commissioning and maintenance of a advanced signalling system and maintenance of road.

COURSE CONTENT

		Semester:	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Highway development and planning-Classification of roads, rural and urban roads, road, road authorities i.e. IRC, CRRI, NHAI etc., road development in India, Current road projects in India; highway alignment and project preparation Financing of road projects, road safety audit Reconnaissance, aerial surveys, location surveys, location of bridges.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Geometric design of highways-: Introduction; highway cross section elements; carriageway width, formation width, right of way, etc friction, camber, design speed, super-elevation, transition curve ,gradients .sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems Basic requirements of an ideal alignment and factors controlling it, special

requirements for hill roads .		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of parking facilities; highway lighting; problems traffic flow characteristics, speed, traffic volume studies, parking studies - definition, purpose, types, survey methods. Accident studies - purpose, types,causes, collision diagram, condition diagram, preventive measures pavement marking, signs, signals, Traffic management, various types of intersection and their design criteria, Traffic Simulation & it's advantages, Arboriculture, street lighting. Classification, mass and rapid transit system, introduction to intelligent transportation System (ITS), electronic toll Collection.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, characteristics, emulsions and cutbacks, basic tests on all materials, soil investigation, test on soil; CBR, plate load test. bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Stabilized earth, gravel roads, W.B.M. roads, high cost Roads: bituminous roads, cement concrete roads. Surface and sub-surface drainage arrangements, Numerical Treatment.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
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, Maintenance & Strengthening of pavements; Numerical treatment.		
Text/Reference Books:		
1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th		

Edition, Nem Chand & Bros, 2017

2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

3 . Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,

4 . L. R. Kadiyali, N B. Lal, Principles & practice of Highway Engineering, Khanna Publication, 2005.

5 . Rangwala, Highway Engineering, Charotar.

Professional Elective Course II (a)

Building Construction Practices

COURSE OUTLINE

Course Title:	**Building Construction Practice**	**Short Title:**	**BCP**	**Course Code:**	

Course description:

This is a basic course which makes a student familiar with the detailed features of various building components and appraises about construction practices. The course includes description of Types of building structures & various parts of building, Different types of masonry, scaffolding, shoring, under pinning and strutting, Description of building finishes and types, Concrete and R.C.C. construction, Types of foundations, Study of building materials such as stone, bricks & timber, Aluminium, glass, heat insulating and sound absorbent materials.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	3

Prerequisite course(s):

Nil

Course objectives:

The student must become aware of common building components and their detailed constructional features. The students should know about the types of buildings according to their material and load distribution system. Student should also know about the construction practices like form work making, shoring, under pinning and shuttering etc. Execution of various types of

finishing works should also be known.

Course outcomes:

After successful completion of this course a student must be able to:

1. Know about types of building structures.
2. Various materials used in building construction.
3. Constructional features of various components of buildings.
4. Finishing and decoration aspects of buildings.
5. Execution of a construction work at site.

COURSE CONTENT

		Semester:	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Types of building, load bearing, framed structure, steel structure, timber structure, composite structure. Various parts of building, sub structure and super structure. Plinth, sill, floor, and roof level, plinth height, plinth protection, cornice, coping and their function.

Foundation: Purpose and classification, advantages and disadvantages of each and circumstances under which each is used. Factor considered for selection of foundation.

Specifications, details and sequence of activities and construction co-ordination – Site learance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Masonry: Principle of masonry construction, types of masonry, types of wall (load bearing, partition, timber partition, glass partition etc.).

Brick and brick masonry: Various types of bond in brick masonry, reinforced brick masonry, precautions to be taken in masonry construction, composite masonry, solid and hollow blocks used for masonry, cavity wall, etc.

Formwork: Function of form work, form erection, oiling and stripping of form, requirements of form and form work, material used for form work.

Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Types of lintel, detailing of R.C.C. lintel, precast lintel and stone lintel.

Doors and windows: Type of each and circumference under which each is used, minimum area of window opening for different climatic conditions, various material used for doors and window, fixtures and fastening used. I.S. notations for doors and windows.

Circulation: Horizontal and vertical, stair and staircase planning and design, types of staircase as per shape and material used, type of circulation.

Floor and roof: Ground floor, upper floor, mezzanine floor, design and constructional requirements, various types of floor finishes used, advantage and disadvantages, special flooring.

Sub Structure Construction- Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Steel trusses: Types, Methods of connections, connecting materials. Scaffolding, shoring, under pinning and strutting, their types, purposes and precautions.

R.C.C. framed structure, column, beam, footing, slab and their connections, general requirements and details.

Plant equipment for underground open excavation; Super Structure Construction- Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks

– in-situ pre-stressing in high rise structures.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks;

Stone: Natural bed of stone, stone quarrying, uses of stones and qualities of good building stone, test's on stone.

Bricks: Composition of good brick earth, classification of burnt brick, manufacturing of bricks, qualities of good bricks, test on bricks.

Timber: Properties and uses, testing, conservation and sawing, defects in timbers, artificial timber, veneers, plywood and block board.

Other miscellaneous materials: Aluminum, glass, heat insulating materials, sound absorbent materials.

Text/Reference Books:

1. Building Construction by Rangwala- Published by Charotar Publishing House ISBN-13 9789380358482, ISBN-10 9380358482.

2. Building Construction by Sushil Kumar- Published by Standard Publishers Distributors, Publication Year2010, ISBN-13 9788180141683, ISBN-10 8180141683, Edition 19.

3. Building Construction by S.P. Bindra, S.P. Arora, Published by Dhanpat Rai Publications, Publication Year 2010, ISBN-13 9788189928803, ISBN-10 8189928805.

4. Building Construction by Ashok Kr. Jain, B. C. Punmia, Arun Kr. Jain, Published by Laxmi Publications, Publication Year 2009, ISBN-13 9788131804285, ISBN-10 8131804283, Edition 10thEdition.

5. Engineering Materials by Rangwala, Publisher Charotar Publishing House, Publication Year 2011, ISBN-13 9789380358260, ISBN-10 9380358261

6. Civil Engineering Material by Dr. S.V. Deodhar.

Professional Elective Course II (b)					
Railway Engineering					
COURSE OUTLINE					
Course Title:	**Railway Engineering**	**Short Title:**	*RE*	**Course Code:**	

Course description:

Railways are a very important mode of conventional transportation system. They play very important role in the country's economy. Particularly in countries like India, railways are the most preferred transportation system having huge potential to expand in the times to come. The present syllabus describes scope and importance of railway engineering, planning and designing of railway engineering and execution of railway projects.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	3

Prerequisite course(s):

Nil

Course objectives:

The course aim to train a civil engineer in the fundamentals of railway engineering, an role of

civil engineer in a railway project the course aims to train a student for planning designing and executing a railway project. The student must also get an exposure towards the new technology getting emerged in the field of railway transport network.

Course outcomes:

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

1. Understand Role of civil engineers in railway engineering projects.
2. To know alignment of track, geometric design of track, creep measurement, construction and maintenance of track.
3. To know the point and crossing, signaling systems, welding of rails its suitability.
4. Do design & construction of station and yards, safety of running trains.
5. Know about construction requirement of High Speed Rail.

COURSE CONTENT

Name of the Subject **Railway Engineering**		**Semester:**	**V**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Role of Civil Engineers in infrastructure developments, Railway Track Gauge : different gauges on Indian railways, problems caused by change of gauge, Track & Track stresses : Requirements, forces acting on tracks, coning of wheels, tilting of rails, Sleeper : function, requirements types of sleepers, concrete sleepers,prestressed sleeper, sleeper density, manufacturing and spacing of sleepers, Ballast : Function, specifications of track ballast, Track fitting and Fastening , subgrade and formation.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Alignment of railway line: Importance, basic requirements of an ideal alignment, selection of a good alignment, geometric design of track, necessity for geometric design, gradients, grade

compensation on curves, super elevation, equilibrium cant, cant deficiency, maximum permissible speed, negative super elevation, engineering survey and construction of new lines

Resistance to traction, resistance to friction, wave action, causes of creeps, effects of creep, measure to reduce creep, Construction and track maintenance plate laying method, operation involved tools and common items of track maintenance, Modern method of track maintenance.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Points and Crossing : Necessity, important terms, types of track layout, sketches of turnout, diamond crossing, triangle, double junction, scissors cross over, Single slip, double slip, gathering line, Classification of signal, CTC and ATC system, interlocking and its principles Welding of rails, advantages of welding of rails, methods of welding.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Railway stations and yards : classification of railway stations, purpose of railway station, selection of site for railway station, facilities required at railway station, types of station platforms : types and its detailing, Yards: types ,important points to be considered in the design of marshalling yards, essential requirement of locomotive yards, Signaling : objective, types, classification, Interlocking definition, principal of interlocking, method of interlocking, Safety of the running trains with respect to signaling and interlocking.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

High Speed Rail Engineering (HSR), types of railways, high speed improvements in track structure, Key elements of HSR system, Introduction to sky-bus, monorail and metro rails, Construction of HSR stations.

Text Books:

1. Rail Engineering : by Satish Chandra, M Agarwal, *OXFORD University Press*
2. Rail Track Engineering ; J. S. Mundrey, *Mc Graw Hill Publications*
3. Rail Engineering : by Saxena and Arora , *Dhanpat Rai Publication*
4. Railway Engineering : by Rangwala , *CHAROTAR Publishing House Pvt. Ltd.*

Reference Books:

1. Modern Railway Engineering Consultation: Methods And Practices by Zhu Ying and Chen Lie, World Scientific Publishing Company.
2. High Speed Railway Track Dynamics: Models, Algorithms and Applications by Lei, Xiaoyan, Springer Publications.

Professional Elective Course II (c)

Construction Equipment & Automation

COURSE OUTLINE

Course Title:	***Construction Equipment & Automation***	**Short Title:**	*CEA*	**Course Code:**	

Course description:

Civil engineering projects have two distinct aspects: design and execution. The design is an office job. It can be done on paper or using a computer. However execution is a field job. It requires management and administration of resources and use of labor. Earlier most of the jobs were done manually. Now human beings are being replaced by machine due to their higher capacity, higher efficiency, higher speed and even low cost. In fact most of the modern meg size projects cannot be done without aid of machines. Hence a civil engineer must have knowledge of machines used for mega construction project. He/she must have skill to utilize them skillfully and achieve economy thereby. The present course is designed to meet this requirement. Further,

present era is an era of automation. The machines are working with digital interface. The automation has entered into each and every aspect of construction. This course describes the importance and scope of automation to students.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

The student must know the various advanced construction equipments being used in the various construction activities. The student must know to use them efficiently and optimally. s/he must know the significance, definition, scope, history and objectives of automation at construction sites. s/he msu be aware of various software pertaining to construction automation and their applications. s/he must know about use of robotic technology in construction and repair/maintenance activity. Students must also know the various types of robots commonly being deployed for construction activities.

Course outcomes:

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

1. Demonstrate awareness about importance, scope and application of various construction machines.
2. Demonstrate importance of construction automation.
3. Student must be able to apply a correct machine for a specific construction task and get optimal output of the same.
4. Student must know about importance of construction automation and software pertaining to it. S/he must be able to use them.
5. Student must know about the robots being used for critical construction tasks and must be able to deploy them as per need.

COURSE CONTENT

Construction Equipment & Automation		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Conventional construction methods: Introduction, Conventional construction methods Vs Mechanized methods, advantages of mechanized methods, Equipment for Earthmoving- types of earthmoving equipment, excavators (draglines, dredging, front shovel), loaders(skip loaders and wheel loaders), construction tractors (scraper, material handler), etc.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Dewatering Equipments: Introduction, Factors Affecting Choice of Equipments, Type of Dewatering Equipments, Concrete Mixing: Method of Concrete Mix, Equipment For Concrete Mixing, Type Of Concrete Mixer.

Transporting and Placing : methods of transportation- Chutes, Barrows (wheel barrows and power barrows), Dumpers, Monorail system, Elevating Towers and hoists, Belt Conveyors, Trimie,etc.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Plastering Machines: Introduction, need of plastering, working of plastering machines.

Prestressing Jacks and Grouting: Description of Prestressing and Grouting, Prestressing Jack mechanism, Process of Grouting, Grouting equipments.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Cranes, Hoists and other equipment for lifting: mobile crane, types of mobile Cranes, Hoists Crane, Lifting Accessories, Lifting equipment, working of lifting Equipment.

Equipment for transportation of materials: Material Handling Equipment, Type of Material Handling Equipments, safety precautions while handling equipments.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12
Equipment Productivities: definition of productivity, role of productivity concept in Construction, Ways to increase productivity in construction field. Use of Drones for spread out sites; Use of robots for repetitive activities.		
Text Books:		
1. Construction Planning, Equipment and Methods By R L PEURIFOY, C J Schexnayder and A V Shapira, Mc Graw Hill publication. 2. Construction Equipment and Its Management by S C Sharma, Khanna Publications.		
Reference Books		
1. Modern Construction Equipment and Methods by Frank Harris, Longman Publications. **2.** Materials Handling By David E. Mulchay, McGraw Hills Publications		

Open Elective Course II (a)					
Intelligent Transportation System					
COURSE OUTLINE					
Course Title:	**Intelligent Transportation System**	**Short Title:**	**ITS**	**Course Code:**	
Course description:					
Transportation sector has got radically revolutionized in past two decades. New modes of transportation facilities have emerged up. At the same time the conventional transportation facilities have also got techno-savvy. Safety, comfort and speed as well as economy are ensured by the intelligent transport system. An intelligent transport system is achieved by the aid of modern technology like GPS, GIS, and internet and automation facilities. The present course describes the importance scope and applications of intelligent transport system. It trains a student					

in planning and designing an intelligent transport system to meet today's requirement.

Lecture	Hours/week	No. of weeks	Total hours	Semester credits
	03	14	42	03

Prerequisite course(s):

Nil

Course objectives:

1. To learn about Intelligent Transportation system
2. To study the concepts of GIS (Geographical Information System)
3. To illustrate Advanced Rural Transportation Systems (ARTS) with its need.

Course outcomes:

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

1. Understand the revolutionary changes going on in the transportation system.
2. Demonstrate ability to plan an intelligent transportation system
3. Demonstrate ability to design an intelligent transportation system
4. Apply knowledge to maintain an existing intelligent transportation system.
5. Apply knowledge to upgrade an existing intelligent transportation system.

COURSE CONTENT

Name of the Subject: INTELLIGENT TRANSPORTATION SYSTEM		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	No. of Lectures: 09 Hours	Marks: 12

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI).

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Geographic Information Systems (GIS)-Introduction to GIS Systems ,Need of GIS System,Application of GIS System, video data collection. Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC),National traffic control centre (NTCC) Vehicle – Road side communication – Vehicle Positioning System.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS)		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Advanced Rural Transportation Systems (ARTS); ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.		
Text Books / Reference Books:		
1. Intelligent Transport Systems: Technologies and Applications by Ignacio Julio García Zuazola, Enrique Onieva, Unai Hernandez-Jayo, Asier Perallos, Wiley Publications. 2. Geographical Information Systems Simplified: GIS by, Gofamodimo Mashame, available on Amazon. 3. Transportation Engineering and Planning by C. S. Papacostas and P. O. Prevedouros, Pearson Publications.		

Open Elective Course II (b)					
Numerical Methods in Civil Engineering					
COURSE OUTLINE					
Course Title:	***Numerical Methods in Civil Engineering***	**Short Title:**	*NMCE*	**Course Code:**	
Course description:					
The numerical methods course involves solving engineering problems from all fieldsof engineering. Course will cover the fundamental topics in numerical methods such as numerical integration, differentiation and numerical linear algebra, solution of nonlinear algebraic systems and solution of ordinary and partial differential equations, curve fitting, interpolation. The student will be familiar in using numerical tools to solve problems in their own field of interest.					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	03	14	42	3	
Prerequisite course(s):					

Nil

Course objectives:

To introduce students to the mostly used numerical methods in different engineering fields. The aim is to study and apply various numerical methods such as Gaussian Elimination Method, Gauss Jordon Method, Method of Bisection, Method of false position, Newton Raphson Method, Method of Simple Iteration, Method of Least Square, Newton Interpolation, Lagrange Interpolation, Euler's Method, Modified Euler's Method, Runge Kutta Method and develop program for the same.

Course outcomes:

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

- Solve an algebraic or transcendental equation using an appropriate numerical method
- Solve a differential equation using an appropriate numerical method and evaluate a derivative at a value using an appropriate numerical method
- Solve a linear system of equations using an appropriate numerical method
- Perform an error analysis for a given numerical method
- Code a numerical method in a modern computer language.

COURSE CONTENT

Numerical Methods in Civil Engineering		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

a)Introduction: Mathematical Modelling and Engineering Problem Solving, AlgorithmDesign, Flowchart, Errors in Numerical Computation.

b)Solution of Linear algebraic Equation: Gauss Elimination method, Gauss Seidel method,Gauss Jordan method, Partial Pivoting method and its conditions for convergence.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
a)Solution of Non Linear Algebraic and Transcendental Equations: Bisection, Falseposition, Newton Raphson Method, Generalized Newton Raphson Method. **b)Linear Programming Problem**: Introduction, Requirements, Assumptions, Applications, Limitations, General Mathematical Model, Formulations, Introduction to Artificial Variables, Simplex Algorithm for Maximization & Minimization Cases.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
a)Curve Fittings: Linear Regression, Polynomial Regression, Multiple Linear Regression,General Linear Least Squares, and Engineering Applications of Curve fitting. **b)Interpolation:** Newton's divided difference interpolating polynomials, Non-linear regression, Lagrange Interpolating polynomials, Coefficient of interpolating polynomials.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
a)Numerical Differentiation: High accuracy differentiation formula, First order differentiationEquations, Second order differentiation Equations, Derivatives of Equally Spaced Data. **b)Numerical Integration:** Trapezoidal rule, Simpson's one third and 3/8th rule, Gaussian Quadrature 2 point Formula.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
a)Numerical methods for Solution of ordinary differential equation: Taylor's seriesmethod, Euler's method, Modified Euler's method, Runge Kutta method, Predictor Corrector Method. **b)Numerical methods for Solution of Partial Differential Equation:** Introduction to initial value and boundary value problem, Finite difference methods for the solution of one dimensional wave equation two dimensional (parabolic and elliptic) and higher order PDE.		
Text Books/Reference books		
1. S. Rajasekaran, "Numerical Methods in Science & Engineering", A.H.Wheeler &Company		

Private Limited, 2000

2. Sharma J.K., "Operation Research", MACMILLAN India Limited, 2003

3. Jain, Iyenger & Jain, "Numerical Methods", New Age Publishing Company, New Delhi, 2004

4. Sastry S.S., "Introductory Methods of Numerical Analysis", Prentice Hall (India) Limited, New Delhi, 2000.

Reference Books:

1. Steven C Chapra & Raymond P. Canale, "Numerical Methods for Engineers", Tata Mc-Graw Hill Company Limited, New Delhi, 2002

2. Schilling & Harries, "Applied Numerical Methods for Engineers", THOMSON, Brooks/Cole, New York, 2000.

Open Elective Course II (c)

SMART CITY PLANING

COURSE OUTLINE

Course Title:	**SMART CITY PLANNING**	**Short Title:**	**SCP**	**Course Code:**	

Course description:

This course introduces the students about concepts such as:

- Scope of Smart city planning in civil Engineering society.
- Importance of smart city planning for large scale work.
- Principles of smart city and its techniques.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	42	*03*

Prerequisite course(s):

-

Course objectives:

- To introduce the theory of smart city planning in civil engineering works.
- Apply the Smart city planning techniques in fields.

Course outcomes:

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

- Know the importance and scope of smart city planning.
- Know the principles of smart city planning.
- Know the Apply his/her knowledge for planning and designing a smart city.
- Demonstrate ability transform a given city into smart city.
- Assess the parameters of a smart city.

COURSE CONTENT

SMART CITY PLANNING		**Semester:**	**VI**
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I: Smart city:	**No. of Lectures: 09 Hours**	**Marks: 12**

a) What is smart city? Future of smart city
b) Objectives, principles, stages in to smart city planning.
c) Growth of city and theories of developments (ribbon, sector zone, concentric, multiple zone etc)
d) Planning and role in urban development, Smart city planning schemes.

Unit–II: Concept of master plan :	**No. of Lectures: 09 Hours**	**Marks: 12**

a) Structure plan, detailed smart city planning scheme and action plan.
b) Estimating future needs, planning standards for different land use allocation for commerce, industries, public amenities, open areas etc.

c) Planning standards for density distributions, density zones.

d) Planning standards for traffic network ,standard of roads , Plan implementation.

Unit–III: Smart City planning legislations and municipal acts	**No. of Lectures: 08 Hours**	**Marks: 12**

a) Planning of control development schemes and urban financing.

b) land acquisition ,slum clearance schemes ,pollution control aspects.

c) Study of Smart cities. (infrastructure, disaster management, etc.)

Unit–IV: City development plan	**No. of Lectures: 08 Hours**	**Marks: 12**

g) City development plans Scope & purpose, Surveys- demographic, housing, land use, ws & sanitation, etc.

h) Traffic: transport- urban road objectives, classification, traffic management.

i) Legislative mechanism: planning agencies for various levels of planning. Their organization and purpose.

Unit–V: Environmental Studies in Building Science	**No. of Lectures: 08 Hours**	**Marks: 12**

f) Components of Ecosystem: ecological principles concerning environment, climate.

g) Responsive design: Energy efficient building design; thermal comfort; solar architecture.

h) Acoustics: Concepts of Acoustic, noise pollution & its control.

Text Books:

1. UDPFI guidelines, ministry of urban affairs and employment, Govt. & India.

2. Koenigsbeger, “Manual of tropical housing and building”, Universities Press (India)

3. Sustainable Building - Design Manual: Sustainable Building Design Practices, 2009 by TERI

Reference Books:

1. G.K .Hiraskar , “Town planning”,Dhanpatrai Publication 2002

2. S. Rangwala, “Town planning”, Charotar Publishing House Pvt. Ltd.,2009

3. G Muthu,Shobha,Mohan, “Principles of Architecture “2006

4. MRTP act 1966
5. Shah, Kale, Patki, "Building Drawing", Tata McGraw-Hill Education, 5th edition
6. Gevorkian, "Green Buildings", Mc Graw hill.
7. Haselbach, "The engineering guide to LEED", new construction-sustainable construction for engineers,the McGraw-Hill, 2008.
8. Satish Chandra Agarwala , "Architecture & Town Planning", Dhanpat Rai & Co (P) Ltd.
9. Prakash Apte, "The building of Gandhinagar", Power publishers.
10. Annapurna Shaw, "The making of new Mumbai", Orient Blackswan, 2004

Structural Engineering Lab

LAB COURSE OUTLINE

Course Title:	***Structural Engineering Lab***	**Short Title:**	*SEL*	**Course Code:**	

Course description:

In this Laboratory course emphasis is given on analysis & design of different RCC structural members such as beam, slab, column, footing etc. using Indian Standard (IS 456:2000) design code and to prepare detailed drawings of the same. Also emphasis is given on analysis & design of different structural members such as roof truss, welded plate girder, etc. using Indian Standard (IS 800:2007) design code and to prepare detailed drawings of the same.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	*14*	*28*	*1*

End Semester Exam (ESE) Pattern:	***Oral (OR)***

Prerequisite course(s):			
Nil			
Course objectives:			
The primary lab course objective is to analyze and design a building with all the details and relevant drawings for various components of the structure. Also the course objective is to analyze and design Roof Truss and Welded Plate Girder and prepare relevant drawings and details for these structures.			
Course outcomes:			
Upon successful completion of lab Course, student will be able to: o Analyze various types of load acting on the building structure and internal forces developed thereof. o Design components of the RCC and Steel structures. o Demonstrate use of IS 456. o Demonstrate use of IS 800. o Demonstrate the details and drawings of the structure.			
LAB COURSE CONTENT			
Structural Engineering Lab		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***
1) Structural Layout. a) To prepare a simple line plan G+2 building (Residential). b) To draw structural plan indicating slabs, beams, columns, column footings. **2) Analysis and design of various beams and slabs.** a) To calculate loads and internal forces on beams and slabs. b) To decide the sections and calculate steel reinforcement.			

c) To Prepare Detailing & drawing of beams, slab.

3) Analysis and design of column and column footing.

a) To calculate loads and internal forces on columns and footings.

b) To decide the sections and calculate steel reinforcement.

c) To Prepare Detailing & drawing of column, footings.

4) Design of Steel members

a) Design of Tension and Compression member

b) Design of connection as per IS 800 -2007.

5) Analysis and Design of beams and built up columns

a) Designing and detailing of members for one/two storied buildings. drawing

6) A report on one site visit.

a) A report on at least one site visit shall be submitted in ICA.

b) Drawing shall be on half imperial sheets. At least one sheet of above designs shall be in A3/A4 size sheets using drafting software.

Note

a) A design report shall be prepared along with showing details on half imperial drawing sheets.

b) A few typical details of beam column etc. shall be shown on A4 / A3 size sheets using drafting software also.s

Text Books/Reference Books:

1) B. C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, Limit State Design of Reinforced Concrete, Laxmi Publication, 1st edition 2007

2) P. C. Varghese ,Limit State Design of Reinforced Concrete, PHI, 2nd Edition 2006

3) S. Ramamrutham, R. Narayan ,Design of Reinforced Concrete Structures (conforming to IS 456), Dhanpat Rai Publication, 7th Edition 2013

4) Dr. V. L. Shah and Dr. S. R, Limit State Theory and Design . Karve, Pune Vidharthi Gruh Publication, Pune, 6th Edition

5) P. Dayaratnram, Limit State Analysis and Design, Wheeler Publishing company, Delhi.,12th edition 2009

6) Pillai Menon ,Reinforced Concrete Design, Tata Mc Graw Hill, New Delhi., 3rd edition 2013

7) Subramanian N.,Design of Steel Structures., Oxford University Press, New Delhi, 2008

8)Shah V. L. & Gore ,Limit state design of Steel Structure, Structures Publication, Pune.

9) Duggal S. K.,Limit State Design of Steel Structures, Tata Mc Graw Hill publishing company Ltd., New Delhi, 3rd Edition, 2009

10) Bhavikatti S. S ,Design of Steel Structure by Limit State Method as per IS: 800- 2007., I K International Publishing House, New Delhi, 3rd Edition

Guide lines for ICA:

ICA shall be based on continuous evaluation of students performance throughout the semester and ICA drawing sheets submitted by the students.

Guidelines for ESE:

ESE will be based on drawing sheets submitted by the student. In ESE the student may be asked to answer questions based on ICA. Evaluation will be based on performance in **oral** examination.

Environmental Engineering Lab

LAB COURSE OUTLINE

Course Title:	Environmental Engineering Lab	**Short Title:**	*EE L*	**Course Code:**	

Course description:

This course trains a student in characterizing waters and wastewaters. The syllabus includes sample collection techniques, sample preservation techniques, physical, chemical and biological examination of water, data interpretation and applications.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	*14*	*28*	*1*

End Semester Exam (ESE) Pattern:	***Practical (PR) / Oral (OR)***

Prerequisite course(s):

-

Course objectives:

The basic objective of this course is to enable a student for examination of waters and wastewaters at laboratory level. The student must be able to collect samples, preserve and characterize as well as interpret. Thus the student must be able to audit a water treatment plant, wastewater treatment plant and industrial effluent treatment plant.

Course outcomes:

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

6. Collect water and wastewater samples.
7. Preserve water and wastewater samples.
8. Examine water and wastewater samples for physical, chemical and biological parameters.
9. Interpret the results.
10. Audit the treatment plants.

LAB COURSE CONTENT

Environmental Engineering Lab		**Semester: VI**	
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***

List of laboratory experiments to be performed:

1. To determination of pH and alkalinity of water sample.
2. To determination of turbidity of water and determine optimum coagulant dose using jar test apparatus.

3. To determine chlorine content of a given water sample by titration method.
4. To determine hardness of water.
5. To determine MPN of water sample.
6. To determine conductivity of water sample.
7. To determine DO content of water sample.
8. To determine BOD content of wastewater sample.
9. To determine COD content of wastewater sample.
10. To determine oil/grease content of the water sample.
11. To determine total solids, dissolved solids and suspended solids of the water sample.
12. To determine SVI of sludge.

Text Books:

Laboratory Manuals designed by teachers concerned.

Reference Books:

Standard Methods for examination of waters and wastewaters, APHA Publication.

Guide lines for ICA:

- The students must perform at least ten practical out of the prescribed list.
- Students should visit at least one water treatment plant and waste water treatment plant.

Guidelines for ESE:

The ESE must focus of the laboratory work performed by the students and site visit. However students are supposed to be examined for the theoretical aspect of the laboratory work also.

Transportation Engineering Lab					
LAB COURSE OUTLINE					
Course Title:	**Transportation Engineering Lab**	**Short Title:**	**TREL**	**Course Code:**	
Course description:					
The course in infrastructural engineering incorporates experimental methods, assignments and site visits. The experimental methods are as it is given by the Indian standard code for practice. It includes assignments based upon the data analysis and design, in order to fill the gap between theory and practice through real world exposure. It proposes a site visit to a major road project and also to a hot mix plant. Such site visits will enable the students with the real engineering constraints faced by a civil engineering at site.					

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	14	28	1

End Semester Exam (ESE) Pattern:	***Oral (OR)***

Prerequisite course(s):

Nil

Course objectives:

The basic objective of this syllabus is to appraise the students with experimental methods as applicable for various civil engineering materials used for road construction. It also includes the introduction to the IS practices applicable at every stage of the Lab work including sampling, testing in the laboratory and data interpretation. Over and above, the syllabus also aims to introduce the students with the real world situation through site visit. The experimental data can be used for design and this aspect is covered by assignments on certain topic of the syllabus.

Course outcomes:

1. Student will be aware of the IS codes prevailing in the testing of road construction materials
2. Apply knowledge to the testing of common road construction materials experimentally.
3. Apply knowledge to Student will be able to design flexible and rigid pavement.
4. Demonstrate ability handle site constraints.
5. Demonstrate ability to work in the working environment.

LAB COURSE CONTENT

Transportation Engineering Lab		**Semester:**	*VI*
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	
		Internal Continuous Assessment (ICA):	***25 marks***

Lab Course Content

1) Assignment on unit no 1

2) Assignment on unit no 2

3) Assignment on unit no 3

4) Assignment on unit no 4

5) Assignment on unit no 5

6)Numerical based on Flexible Pavement Design

7)Numerical based on Rigid Pavement Design

A report on at least one site visit.

Visit to construction site of major road projects, highways / expressways & preparation of report hot mix plant etc.

Text Books/Reference Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

3. Partha Chakraborty, ' Principles Of Transportation Engineering, PHI Learning,

4. L. R. Kadiyali, N B. Lal, Principles & practice of Highway Engineering, Khanna Publication, 2005.

5. Rangwala, Highway Engineering, Charotar

Guide lines for ICA:
ICA shall be based on continuous evaluation of students' performance throughout the semester and term work, sketches, visit report submitted by the students.
Guidelines for ESE:
-

Internship

Internship is a mandatory and non-credit course. It is mandatory for all admitted students to undergo Internship during the degree course. The course shall be of THREE weeks duration during summer vacation after Semester - VI. Following are the intended objectives of internship training:

- Will expose to the real world environment and creating professional competency in the students to make them fit for the industry.
- Provide opportunities to learn, understand and sharpen the technical and managerial skills required at the job.

- Exposure to the current technological developments relevant to the subject area of training.
- To bridge up the gap between theory and practice.

Students shall choose to undergo Training/Innovation/Entrepreneurship related activities for Internship. Students shall choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/Medium enterprises/academic institutions/research institutions. In case student want to pursue their family business and don't want to undergo internship, a declaration by a parent may be submitted to the Department Head.

The internship activities and list of sub-activities for Internship are as under.

- Innovation / Entrepreneurship:
    - Participation in innovation related Competitions for eg. Hackathons, Robocon, Baha, IIT TechFest, Chemcon, Dipex etc.
    - Development of new product/Business Plan/registration of start-up
    - Participation in Entrepreneurship Program of THREE weeks duration
    - Online certification courses by SWAYAM, NPTEL, QEEE etc.
    - Working for consultancy/ research project within the institutes
    - Training on Software (As per the need of respective branch);
    - Field Survey / Case Study
    - Work experience at family business
- Training based Internship:
    - Internship with Industry/Govt./NGO/PSU/Any Micro/ Small/Medium enterprise/academic institutions/research institutions
    - Online Internship
- Rural Internship
    - Any Long Term Goals may be carried out by students in teams:
        - Prepare and implement plan to create local job opportunities.
        - Prepare and implement plan to improve education quality in village.

- Prepare an actionable DPR for doubling the village Income.
- Developing Sustainable Water Management system.
- Prepare and Improve a plan to improve health parameters of villagers.
- Developing and implementing of Low Cost Sanitation facilities.
- Prepare and implement plan to promote Local Tourism through Innovative Approaches.
- Implement/Develop Technology solutions which will improve quality of life.
- Prepare and implement solution for energy conservation.
- Prepare and implement plan to Skill village youth and provide employment.
- Develop localized techniques for Reduction in construction Cost.
- Prepare and implement plan of sustainable growth of village.
- Setting of Information imparting club for women leading to contribution in social and economic issues.
- Developing and managing efficient garbage disposable system.
- Contribution to any national level initiative of Government of India. For eg. Digital India/ Skill India/ Swachh Bharat Internship etc.

Every Faculty Mentor/Supervisors have to play active roles during the internship. Maximum 20 students are to be supervised by each faculty mentor. Mentor shall be responsible for selection of Internship activities by the student under his/her supervision and shall avoid repetition of activities by the student. The college/Institute shall facilitate internship for the students.

Every student is required to prepare a file for Internship containing documentary proofs (daily training diary, comprehensive report and completion certificate) of the activities done by him/her. The students should record in the daily training diary the day to day account of the observations, impressions, informatid on gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily training diary should include Date, Time of Arrival, Time of Departure, Main points of the day.

The daily training diary should be signed by the supervisor/in charge of the section where the student has been working.

After completion of Internship, the student should prepare a comprehensive report to indicate what s/he has observed and learnt in the training period. The report should include Internship Objectives (in measurable terms), Internship Activities, and Internship Outcome.

The completion certificate should be signed by the supervisor/ in charge of the section where the student has been working with performance remark as Satisfactory / Good / Excellent.

The evaluation of Internship shall be in Semester – VII. The evaluation shall be done by expert committee constituted by the concerned department including Department Head/ TPO/ faculty mentor or guide. It should be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.
- Adequacy & quality of information recorded.
- Originality.
- Adequacy and purposeful write-up.
- Practical applications, relationships with basic theory and concepts taught in the course.
- Skill / knowledge acquired

Hence the satisfactory completion of Internship shall be submitted to the university at the end of Semester - VIII of FOUR year Bachelor of Engineering course. Only after successfully completion of Internship, Internship should be printed in the final year mark sheet as COMPLETED.

Minor Project					
LAB COURSE OUTLINE					
Course Title:	**Minor Project**	**Short Title:**	**MPROJ**	**Course Code:**	
Course description:					
Minor project represent the culmination of study towards the Bachelor of Engineering degree.					

The minor project offers the opportunity to apply and extend material learned throughout the program. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	6	**14**	**84**	**3**

End Semester Exam (ESE) Pattern:	**Oral (OR)**

Prerequisite course(s):

Course objectives:

5. To understand the basic concepts & broad principles of projects.
6. To understand the value of achieving perfection in project implementation & completion.
7. To apply the theoretical concepts to solve problems with teamwork and multidisciplinary approach.
8. To demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

6. Demonstrate a sound technical knowledge of their selected project topic.
7. Undertake problem identification, formulation and solution.
8. Design engineering solutions to complex problems utilizing a systems approach.
9. Conduct an engineering project
10. Demonstrate the knowledge, skills and attitudes of a professional engineer.

LAB COURSE CONTENT

Minor Project		**Semester:**	**VI**
Teaching Scheme:		**Examination scheme:**	
Practical:	**6 hours/week**	**End semester exam (ESE): (OR)**	**25 marks**

	Internal Continuous Assessment (ICA):	**50 marks**

In continuation with Minor Project (Stage – I) at Semester – V, by the end of Semester – VI, the student should complete implementation of ideas as formulated in Minor Project (Stage – I). It may involve fabrication / coding, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. It may also include testing, results and report writing. Each student group should submit complete project report at the end of Semester-VI in the form of Hard bound.Assessment for the project shall also include presentation by the students.

Each student group is required to maintain separate log book for documenting various activities of the project.

Guide lines for ICA:

The Internal Continuous Assessment (ICA) for project shall be based on continuous evaluation of students' performance, active participation, knowledge / skill acquired throughout semester and presentation by the students. The assessment shall be done jointly by the guide and departmental committee. A three-member departmental committee including guide, appointed by Head of the department, shall be constituted for the assessment. The assessment for Minor Project in Semester – VI shall be as per the guidelines given in Table – B.

Table – B

		Assessment by Guide				Assessment by Departmental Committee			
Sr. No.	Name of the Stud	Attendance / Participation	Implementation	Results	Report	Depth of Understanding	Presentation	Demonstration	Total

	ent								
	Marks	5	5	5	5	10	10	10	50

Guidelines for ESE:

In End Semester Examination (ESE), the student may be asked for presentation / demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.