COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHEME

AND

SYLLABUS

B.TECH CIVIL ENGINEERING(P.T)

(2017 Scheme)

SCHEME - B.TECH (P.T)

SEMESTER I

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
AS17P-1101	Linear Algebra and calculus	3	0	3	40	60	100
GE17P-1102	Computer Programming	3	0	3	40	60	100
CE17P-1103	Strength of Materials	3	0	3	40	60	100
CE17P-1104	Concrete Technology	3	0	3	40	60	100
CE17P-1105	Fluid Mechanics –I	3	0	3	40	60	100
CE17P-11L1	Strength of Materials Lab	-	3	2	25	25	50
	TOTAL	**15**	**3**	**17**			

SEMESTER II

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
AS17P-1201	Complex Variables and Transform Techniques	3		3	40	60	100
CE17P-1202	Surveying						
CE17P-1203	Analysis of Determinate Structures	3		3	40	60	100
CE17P-1204	Engineering Geology and Seismology	3		3	40	60	100
CE17P-1205	Fluid Mechanics II	3		3	40	60	100

CE17P-12L1	Survey Practical	-	3	2	25	25	50
	TOTAL	**15**	**3**	**17**			

SEMESTERIII

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
AS17P-1301	Numerical and statistical Methods	3		3	40	60	100
HS17P-1302	Technical Communication and Professional Ethics	3		3	40	60	100
CE17P-1303	Analysis of Indeterminate Structures	3		3	40	60	100
CE17P-1304	Geotechnical Engineering –I	3		3	40	60	100
CE17P-1305	Transportation Engineering -I	3		3	40	60	100
CE17P-13L1	Transportation Engineering Lab	-	3	2	25	25	50
	TOTAL	**15**	**3**	**17**			

SEMESTER IV

Code No	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
CE17P-1401	Environmental Engineering -I	3		3	40	60	100
CE17P-1402	Design of Concrete Structures I	3		3	40	60	100
CE17P-1403	Matrix Methods of Structural Analysis	3		3	40	60	100
CE17P-1404	Geotechnical Engineering – II	3		3	40	60	100

CE17P-1405	Transportation Engineering-II	3		3	40	60	100
CE17P-14L1	Geotechnical engineering lab	-	3	2	25	25	50
	TOTAL	15	3	17			

SEMESTER V

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
CE17P-1501	Environmental Engineering - II	3		3	40	60	100
CE17P-1502	Design of Steel Structures	3		3	40	60	100
CE17P-1503	Quantity Surveying and Valuation	3		3	40	60	100
CE17P-1504	Water Resources and Irrigation Engineering	3		3	40	60	100
CE17P-1505	Elective –I	3		3	40	60	100
CE17P-15L1	Computer Applications in Civil Engineering – I		3	2	25	25	50
	TOTAL	**15**	**3**	**17**			

SEMESTER VI

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
CE17P-1601	Architecture andTown Planning	3		3	40	60	100
CE17P-1602	Design of Structures II	3		3	40	60	100
CE17P-1603	Construction Safety and Fire Engineering	3		3	40	60	100

CE17P-1604	Construction Management	3					
CE17P-1605	Elective –II	3		3	40	60	100
CE17P-16L1	Seminar and Project Preliminary	-	3	2	50		50
	TOTAL	**15**	**3**	**17**			

SEMESTER VII

Code No.	Subject	Hrs/week		C	Marks		Total
		L	T/D/P		CA	ESE	
CE17P-1701	Earthquake Engineering	3		3	40	60	100
CE17P-1702	Elective –III	3		3	40	60	100
CE17P-17L1	Computer Applications in Civil Engineering – II	-	3	2	50		50
CE17P-17L2	Project		9	7			
CE17P-17L3	Comprehensive Viva-Voce			2			
	TOTAL	**6**	**12**	**17**			

Elective	
Code	Name of Subject
E1	Finite Element Method
E2	Design of special Structures
E3	Retrofitting and rehabilitation of Structures
E4	Ground Improvement Techniques

E5	Pavement Analysis and Design
E6	Solid Waste Management
E7	Environmental Impact Assessment
E8	Remote Sensing and GIS
E9	Sustainable Construction Techniques
E10	Construction Engineering and Materials Management

AS17P-1101 LINEAR ALGEBRA &CALCULUS

(Common to all branches)

Course Objectives: To acquire fundamental knowledge of Calculus and apply in engineering disciplines.

Course Outcome:

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

1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Find area as double integrals and volume as triple integrals in engineering applications.
3. Solve ordinary and partial differential equations and apply them in engineering problems
4. Estimate the maxima and minima of multi variable functions.

Module I

Linear Algebra 1: Rank of a matrix, solution of linear system of equations-existence, uniqueness, general form-Eigen values and Eigen vectors- properties of Eigen values - Diagonalization of a matrix - Cayley Hamilton theorem (without proof) Verification-Finding inverse and power of a matrix using it-Quadratic form-orthogonal reduction of quadratic form to Canonical form.

Module II

Integral calculus:

Application of definite integrals: Area, Volume, Arc length, Surface area.

Multiple integral : Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals -Change of Variables in integrals.

Applications of multiple integrals. Plane Area, Surface area &Volumes of solids

Module III

Ordinary differential equations:

First order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.

Linear differential equations of higher orders with constant co-efficient-Methods of solution of these equations. Cauchy’s linear differential equations. Simultaneous linear differential equations- Simple applications of linear

differential equations in engineering problems –Electrical Circuits, Mechanical Systems.

Module IV

Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)- Simple applications.

Solution of first order equation-four standard types- Lagrange's equation— Linear homogeneous partial differential equation with constant coefficient.

References:

1. S.S.Sastry, Engineering Mathematics -Vol1, Prentice Hall India, 2009.
2. Erwin Kreyzig, Advanced Engineering Mathematics, 10th edition, Wiley, 2011.
3. T. Veerarajan, Engineering Mathematics, 3rd Edition, Tata McGraw Hill Publishers, 2011
4. B.S.Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2013.

Type of Questions for End Semester Exam.

Q 1.Ten short answer questions of 2 marks each with at least 2 questions from each of the four modules. (10x2 = 20 marks)

Q 2. to Q.5 : Two questions A & B of 10 marks from each module with option to answer either A or B.(4 x 10 = 40 marks)

GE17P 1102 COMPUTER PROGRAMMING

(Common to all branches)

Course Objectives

To learn the problem solving techniques by writing algorithms and to develop skills in programming using C language

Course Outcomes

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

1. Write algorithms for problems
2. Acquire knowledge of the syntax and semantics of C programming language
3. Code a given logic in C language
4. Use C language for solving problems

Module I

Basics of Computer and Information Technology:

Digital Computer System (CPU, Memory, I/O devices)- Working of a digital computer- Hardware and Software : Definition - Categories of Software, Application of Computers – Role of Information Technology – Internet Services

Problem Solving Methodology:

Problem statement, Analysis, Design a solution, Implement/Coding the solution, Test the solution, Design tools (Algorithm, Flow-chart, Pseudo-code)- Develop algorithms for simple problems.

Programming Languages:

Types and generation of programming languages- Compiler – Interpreter-Linker – Loader –Execution of Program

Module II

Basics of C:

Character set-Identifier- Keywords- Constants –Data Types- Variables and declaration –Operators and Expressions – Operator precedence and associativity – Expression Evaluation (Simple Examples) - Input and output functions – Simple computational problems involving the above constructs.

Control Statements:

Selection, Conditional operator, Iteration (for, while, do-while), Branching (switch, break, continue, goto), Nesting of control statements- Problems using control statements.

Module III

Arrays and Strings:

1D and 2D arrays –Searching (Linear and Binary) - Sorting (Bubble, Selection) – Matrix manipulation programs – Strings and basic operations on strings – Strings functions - Programs on string manipulation

Functions:

Definition – Calling – Declaration – Parameter Passing (by value and by reference) – Recursion – Library functions –Programs based on functions

User defined data types:

Structure – Union - Enumerated data type - Programs involving structure and union.

Module IV

Pointers:

Declaration, Initialization – Pointers and arrays – Pointers and structures – Pointers and functions – Command line arguments – Dynamic memory allocation – Operations on pointers – Programs involving the above concepts

Files:

File concept – File pointer – File handling operations (open, close, read, write etc) on sequential and random access files. Programs on file manipulations using fgetc(), fgets), fseek.

References:

1. PradipDey and Manas Ghosh, Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, 2013.
2. Smarajit Ghosh, All of C, PHI Learning Pvt. Ltd, 2009.
3. Byron Gottfried, Programming with C, 2nd edition, Tata McGraw-Hill, 2006.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson Education, 2001.
5. R.G. Dromey, How to solve it by Computer, Pearson Education, 2008.
6. SukhenduDey, Debobrata Dutta, Complete Knowledge in C, Narosa Publishing House, New Delhi, 2009.
7. Kanetkar Y, Let Us C, BPB Publications, 2007
8. Varghese Paul, Computer Fundamentals, Second Edition, Educational Publishers & Distributers, Ernakulam, 2007.
9. Jose Surendran, Introduction to Computer Programming in C, Pentagon Educational Services, Kollam, 2013.

Type of Questions for End Semester Exam.

Q 1.Ten short answer questions of 2 marks each with at least 2 questions from each of the four modules. (10x2 = 20 marks)

Q 2. to Q.5 : Two questions A & B of 10 marks from each module with option to answer either A or B.(4 x 10 = 40 marks)

CE17P 1103 STRENGTH OF MATERIALS

Course Objectives: To smoothly drive the student's imagination and thought process from the realm of rigid body (Newtonian) mechanics into the wonderful world of elementary deformable body solid mechanics through the introduction of internal effects of forces on linearly elastic, homogeneous and isotropic materials, motivated by the application of the principles developed (in this course) in structural design.

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

1. Assimilate the fundamentals of stress and strain and their relationship, basic elastic and inelastic properties of materials and elastic response of bodies to axial force.
2. Thoroughly understand the importance of principal stresses and strains, physical measurement of strains and internal actions like shear force and bending moment due to transverse external forces.

3. Deep root ideas regarding the theory of simple bending, shear stresses due to shear force and simplified theory of torsion of bars with circular cross-sections (importance of geometry in torsion).
4. Conceive the concept of strain energy and its applications, elementary analysis of stability of slender columns and principal stresses and strains in thin pressure vessels distinguishing the role of "thickness" in structural action.

MODULE I

Material properties and Basic assumptions in strength of materials – elasticity, plasticity, ductility, brittleness, malleability, isotropy / anisotropy, linear / non-linear elasticity, Stress-strain curve of a mild steel bar in a tension test.

The concept of Stress and Strain: Definition of stress and strain, average stress and strain, stress and strain at a point, normal stress and shear stress, Complementary shear stress, shear strain, Hooke's law and Poisson' s ratio, Constitutive equations, Elastic moduli, Relationship between elastic moduli of an isotropic material, Factor of safety, Allowable stress.

Axially loaded Members: Changes in lengths of axially loaded members, Changes in lengths of non-uniform bars, Statically indeterminate problems, Thermal effects, misfits and pre strains.

MODULE II

Principal stresses and strains - Stress on inclined planes for axial and biaxial stress fields associated with shear stress, principal stresses, Mohr's circle of stress, principal strains, strain rosette.

Shear force and bending moment: Types of beams (determinate and indeterminate), loads and reactions in determinate beams, shear force and bending moment, relationships between intensity of loading, shear forces and bending moment, Shear force and bending moment diagrams of statically determinate beams.

MODULE III

Stresses in beams : Pure bending and non uniform bending, Assumptions, Curvature of a beam, Longitudinal strains in a beam, Normal stresses in beams (linearly elastic and isotropic materials) due to bending, Design of beams for bending stresses, Non-prismatic beams, **Shear stresses** in beams of rectangular, circular, I and T cross sections.

Torsion: Circular bars of linearly elastic and isotropic materials, uniform torsion, assumptions, angle of twist, transmission of power by circular shafts, statically indeterminate problems, non-uniform torsion, Close and open coiled helical springs.

MODULE IV

Strain Energy: Definition of strain energy and complementary energy, strain energy due to axial load, bending moment, shear force and twisting moment, Introduction to applications of strain energy in solid mechanics.

Columns : Structural behavior of short and slender (long) columns, Buckling and stability, Euler's formula, Columns with pinned ends, and other support conditions, Slenderness ratio, Limitations of Euler's formula, Columns with eccentric axial loads, The secant formula for columns.

Thin Cylinders: Stresses and strains in thin cylinders and spherical shells.

References:

1. Gere, J. M. *Mechanics of Materials*. Brooks/Cole Thomson Learning.
2. Popov, E. P.*Engineering Mechanics of Solids*. Prentice-Hall of India Limited, New Delhi, India.
3. Timoshenko, S. P. and Young, D. H.*Elements of strength of materials*. East-West Press Private Limited, New Delhi, India.
4. Case, J.,Chilver, L. and Ross, C. T. F.*Strength of Materials and Structures.* Elsevier, New Delhi.
5. Nash.*Strength of Materials*.Shaum's outline series, McGraw Hill publishers.
6. Subramanian, R.*Strength of Materials*. Oxford University Press.
7. Vazirani, V. N. and Ratwani, N. M.*Strength of Materials*. Vol I. Khanna Publishers.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1104 CONCRETE TECHNOLOGY

Course Objectives: To introduce the most versatile civil engineering construction material, concrete, its ingredients, properties, manufacture, tests and uses.

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

1. Understand the constituent materials of concrete, their properties and functions in concrete.
2. Design concrete mixes of specified grades via IS and ACI methods and generate an awareness regarding manufacturing process of concrete.
3. Clearly understand properties of concrete in its fresh and hardened state and tests for determination of them.

4. Generate awareness regarding special forms of concrete and some non-destructive testing methods of concrete.

MODULE I

Materials: Cement – Ingredients, Chemical composition, basic properties of cement compounds, Hydration of cement- heat of hydration, physical properties of Portland cements, Indian standard tests and specification, various types and grades of cement, storage of cement

Aggregates:- Classification of aggregates. Characteristics of aggregates – Strength of aggregate, particle shape and texture, specific gravity, bulk density, porosity, water absorption and moisture content of aggregate, bulking of fine aggregate, deleterious substance in aggregate, soundness of aggregate , alkali-aggregate reaction , sieve analysis:- grading curves, fineness modulus, grading requirements, grading of fine and coarse aggregates, zoning, IS tests and specification for aggregates for concrete.

Water: - Quality of mixing water, effect of impurities in water on properties of concrete. permissible impurities as per I.S

Admixtures:- Functions and classification of admixtures, factors influencing the dosage of different admixtures- IS specification for admixtures for concrete. accelerators - retarders - plastizers - water reducing agents - use of silica fumes.

MODULE II

Mix Design:Quality Control - Factors causing variations in the quality of concrete - mix design - nominal mixes - design mixes - factors influencing mix design - A.C.I method - I.S method - design for high strength mixes.

Process of manufacture of Concrete:- Mix proportion and grade of concrete - Various types of batching, mixing, transporting, placing, compacting, curing and finishing of concrete (in detail). Joints in concreting – construction and expansion.

MODULE III

Properties of fresh concrete:Water/ Cement ratio and its significance in fresh concrete- workability- different methods for assessing workability according to IS Specification, factors affecting workability, requirements of workability for various work, segregation, bleeding, setting, hardening, strength development.

Properties of Hardened concrete: Strength of concrete- strength of concrete in compression, tension and flexure - stress- strain characteristics and elastic properties - shrinkage and creep. durability of concrete - permeability - chemical attack - sulphate attack - resistance to abrasion and cavitaion - resistance to

freezing and thawing - resistance to fire - marine atmosphere - quality control - frequency of sampling - test specimens - statistical analysis of test results - standard deviation - acceptance criteria.

MODULE 1V

Special concrete:Lightweight concrete, High strength concrete, Polymer concrete, fiber reinforced concrete, Ferro-cement, Ready mixed concrete. vacuum concrete - shotcrete - steel fibre reinforced concrete- high performance concrete, reactive powder concrete, self-compacting concrete.

Non-destructive testing of concrete:Rebound hammer test, ultrasonic pulse velocity test, core cutter test.

References :

1. Neville, A. M.*Concrete Technology*. Pearson Education.
2. Neville, A. M. *Properties of Concrete* (4^{th} edition). Pearson Education.
3. Santhakumar, A. R. (2013).*Concrete Technology*. Oxford University Press, India.
4. Orchard, D. F.*Concrete Technology*. Vol. I & II
5. Raju, K. N. *Design of Concrete Mixes*. CBS publishers.
6. Bungey, J. H.*The Testing of Concrete in Structures*.Urrey University of Press Hall.
7. Shetty, M. S.*Concrete Technology*. S I Chand & Company.
8. Gambhin, M.L. *Concrete Technology*. Tata McGraw Hill.
9. Thomas, J. (2015).*Concrete Technology*.Cengage Learning (India), 475p.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1105 FLUID MECHANICS – I

Course Objectives:To introduce the students to the mechanics of fluids through a thorough discussion of the properties of the fluids, behavior of fluids under static conditions and to expose to the applications of the conservation laws to flow measurements and flowthrough pipes (both laminar and turbulent).

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

1. Appreciate the purpose of learning fluid mechanics, properties of fluids and pressure measurement devices.
2. Understand thoroughly how to compute hydrostatic forces and transport of mass, momentum and energy through introduction of the dynamics of fluids through the control volume approach.
3. Apply principles of dimensional analysis to design experiments.
4. Analyze and design simple pipe systems.

MODULEI

Introduction: Fundamental difference between a solid and a fluid, constituent relationships for solids and fluids, conservation principles applied in fluid mechanics.

Properties of fluids, concept of continuum, viscosity, compressibility, ideal and real fluids, surface tension, capillarity.

Stress at a point, pressure, Pascal's law, Variation of pressure with elevation in compressible and incompressible fluids, hydrostatic law, Pressure measurement, piezometers and manometers.

MODULEII

Hydrostatic forces exerted on submerged surfaces.

Description of fluid flow: with reference to translation, rotation and deformation, concept of continuum, control mass and control volume approach, Reynolds transport theorem. Steady flow and uniform flow.

Velocity field, one and two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flownet.

MODULEIII

Forces exerted in a fluid flow, derivation of Continuity equation and Euler's equation. Bernoulli's equation and its applications. Momentum equation and its applications.

Dimensional Analysis as a tool in design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods.

Measurement of flow in pipes and open channels.

MODULEIV

Head loss in flow through pipes, Darcy Weisbach equation, major and minor losses. Flow through pipes and pipe networks, equivalent pipe.

Laminar flow and its characteristics, Reynolds experiment. Laminar flow between parallel plates.

Laminar flow through pipes, Hagen-Poiseuille equation.

Turbulence, Reynolds turbulent stresses, Prandtl's mixing length theory.

Velocity distribution in turbulent flow.

References:

1. White, F. M. (2011).*Fluid Mechanics*. Tata McGraw Hill Publication.
2. Fox, R. W., Pritchard, P. J. and McDonald, A. T. (2011).*Introduction to Fluid Mechanics*(7th Student edition). Wiley India Edition.
3. Shames (1988).*Mechanics of Fluids*.McGraw Hill Book Co., New Delhi.
4. Streeter, V. L. and Wylie, B. (1999).*Fluid Mechanics*. McGraw Hill Book Co., New Delhi.
5. Modi, P. N. and Seth, S. M. *Hydraulics and Fluid Mechanics (including hydraulic machines)*. Standard Book House, Delhi, India.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-11L1 STRENGTH OF MATERIALS LAB

Course Objectives: To reinforce the concepts learned in strength of materials and to familiarize testing methods for the determination of certain material properties.

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

1. Conceive and reinforce the ideas of axial tension, compression, bending, torsion (circular bar), thoroughly through the respective experiments.
2. Understand the determination of certain material properties, like, hardness, toughness, Young's modulus, Rigidity modulus, ductility, flexural strength, etc.
3. Familiarize with testing equipment and machine in the laboratory.

LIST OF EXPERIMENTS

1. Tension test on mild steel bar.
2. Double shear test on mild steel bar
3. Torsion test on mild steel bar
4. Izode Impact test.

5. Charpy Impact test.
6. Rockwell Hardness test.
7. BrinellHardness test.
8. Determination of modulus of rigidity of springs– close coiled and open coiled.
9. Fatigue strength test
10. Bending test of wooden / steel beam – determination of flexural strength and modulus of elasticity.
11. Compression test on wood and brick.
12. Verification of Clark-Maxwell's theorem.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 45 %minimum in the end semester examination for a pass.

SEMESTER-II

AS17P-1201 COMPLEX VARIABLES AND TRANSFORM TECHNIQUES

(Common for all branches)

Course Objectives: To acquire fundamental knowledge of linear algebra and transformation techniques and throw light on their application in engineering disciplines.

Course Outcomes: On completion of this course,a student will be able to

1. Solve linear system of equations and to determine Eigen values and vectors of a matrix.
2. Understand basic principles of vector space and its properties including linear transformation and their applications.
3. Determine Fourier series and transform.
4. Solve linear differential equation and integral equation using Laplace transform.

Module 1

Analytic function- Cauchy-Riemann equation (Cartesian and polar)-Harmonic function- construction of analytic function given real or imaginary parts- Conformal mapping of standard elementary function and bilinear transformation.

Module 2

Cauchy's integral theorem, Cauchy's integral formula and for derivatives-Taylor's and Laurent's expansion (without proof)-Singularities-Residues-Cauchy's Residues theorem- Contour integration involving unit circle.

Module III

Fourier Analysis: Periodic function, Fourier series, Functions of arbitrary period, Even and odd functions, Half Range Expansion, Harmonic analysis, Complex Fourier Series, Fourier Integrals, Fourier Cosine and Sine Transform, Fourier Transform.

Module IV

Laplace Transforms: Gamma functions and Beta function-Definition and properties, Laplace transforms. Inverse Laplace Transform, Shifting theorem, Transform of Derivative and Integrals, Solution of differential equation and integral equation using Laplace transform, Convolution, Unit step function, Second Shifting theorem, Laplace transform of periodic function.

References:

References:

1. Kreyzig, E. (2011). *Advanced Engineering Mathematics* (10^{th}edition).John Wiley & Sons, Hoboken, N.J.
2. Grewal, B.S.(2013).*Higher Engineering Mathematics*(43^{rd} edition). Khanna Publishers, New Delhi.
3. Hsiung,C. Y. and Mao, G. Y.*Linear Algebra*. World Scientific, New Jersey.
4. Hoffman, K.andKunze, R.(1971).*Linear Algebra*. Prentice Hall of India, New Delhi.
5. Venkataraman, M. K.*Linear Algebra*. (1999).The National Publishing Company, Chennai.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1202 SURVEYING

Course Objectives: To understand advanced concepts of surveying by using basic instruments to study modern trends in surveying.

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

1. Set out horizontal curves.
2. Carry out a geodetic survey, taking accurate measurements using instruments and apply mathematical adjustment of errors involved in surveying measurements.
3. Plan a survey for applications such as road alignment and height of the building.
4. Invoke advanced surveying techniques over conventional methods in the field of civil engineering.

Module-I

Levelling and contouring: Description of a point (position) on the earth's surface, instruments for leveling, principle and classification of leveling, bench marks, leveling staff, readings and booking of levels, field work in leveling, longitudinal section and cross section, plotting the profile, height (level) computations, contours, characteristics of contours, contours of natural features, methods of contouring, interpolation, contour gradient, contour maps.

Module-II

Areas and volumes: Computation of areas from plans, calculation of areas of a closed traverse, instruments for map areas computation, measurements from cross section, calculation of volumes from spot levels, earth work calculations, practical problems.

Theodolite survey and traversing: Theodolite component parts, classification, theodolite observations, principle of theodolite survey and traversing, field work, traverse computations, practical problems.

Module-III

Tacheometric surveying: Instruments, principle of tacheometry, methods of tacheometry, tacheometric tables, reduction diagram, tacheometry as applied to subtense measurement, field work for tacheometric surveying, errors.

Trigonometrical surveying: Base of the object accessible, base of an inclined object accessible, reduced level of the elevated points with inaccessible bases, instrument axes at different levels.

Module-IV

Curve settting:Types of curves, elements of a curve, setting out a simple curve, setting out a compound curve, checks on field work, reverse curve, transition

curves, super elevation, deflection angles, transition curves, characteristics of transition curves, method of setting out a compound curve, types of vertical curves, setting out vertical curves, sight distance.

Triangulation: Principle of triangulation, purpose and classification of triangulation surveys, layout of triangulation, field work, triangulation stations, triangulation computations, EDM instruments, Total Station, Global Positioning System.

REFERENCE

1. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain., Surveying I & II, Laxmi Publications, 2005.

2. Chandra A. M., Higher Surveying, New Age International Publishers, 2007.

3. Chandra A. M., Plane Surveying, New Age International Publ., 2007.

4. Charles D Ghilani, Paul R Wolf., Elementary Surveying, Prentice

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1203 ANALYSIS OF DETERMINATE STRUCTURES

Course Objectives: To motivate the students to enter the endless world of structures and their analysis as a smooth transition from the strength of materials, initiated through statically determinate structures and the concept of moving loads and influence lines.

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

1. Appreciate the effects of sudden loading and stress concentration on determinate structures and behavior of beams to asymmetric loading and geometry and initial curvature.
2. Cleary identify elastic deflection and slope in determinate structures motivated by the importance of serviceability part of analysis and design.

3. Develop basic concepts of built-up and composite beams, governing equations of two-dimensional linear elasticity and employing principal stresses in design through theories of failure in an elementary level through the introduction of plastic analysis.
4. Thoroughly assimilate the powerful concepts of moving loads and influence lines and their applications in determinate structural analysis.

MODULE I

Behavior of Structures to Impact and Stress concentration: Impact loading, Fatigue (progressive fracture), Stress concentration in axial loading, bending and torsion (elementary treatment only).

Asymmetry in Bending: Asymmetry in loading and geometry, Stresses in doubly symmetric beams with inclined loads, bending of determinate beams with initial curvature subjected to symmetrical loading.

Shear centre: The concept of shear centre introduced through singly symmetric and asymmetric cross-sections of beams.

MODULE II

Elastic Deflection of Determinate Beams: Basic concept of slope and deflection, Differential equation of elastic line of a beam, Relation between intensity of loading, shear force, bending moment, slope and deflection, Macaulay's method, Moment-area method, Strain energy method – Castigliano's theorems, Unit load method.

Deflection of Determinate Trusses: Deflection of joints of trusses through Castigliano's theorems, Unit load method, temperature effects.

MODULE III

Built-up and Composite Beams: Analysis of built-up and composite beams, shear flow, Combined stresses in Beams subjected to axial load, bending and torsion.

Plane stress and Plane strain problems: Introduction to plane stress and plane strain problems, equations of equilibrium, compatibility and constitutive equations in two-dimensions, examples of plane stress and plane strain problems.

Theories of failure: Maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, maximum distortion energy theory, applications of each theory.

MODULE IV

Moving Loads and Influence Lines: Moving loads in structures introduced through examples of bridge girders, Definition and purpose (in analysis) of influence line, influence lines for reaction, shear force and bending moment at a given cross-section in statically determinate beams, criteria for maximum reaction, shear and bending moment at a section and absolute maximum of the same in determinate beams, Muller-Breslau influence theorem for statically determinate beams, influence lines for statically determinate trusses, criteria for maximum bending moment at a panel point on the loaded chord, and unloaded chord of a truss, Muller Breslau influence theorem for statically determinate trusses.

References:

1. Timoshenko, S. P. and Young D.H.*Elements of strength of materials*. East-West Press Private Limited New Delhi, India.
2. Gere, J. M. *Mechanics of Materials*. Brooks/Cole Thomson Learning.
3. Wang, C. K. *Intermediate Structural Analysis*. McGraw Hill International Edition.

4. Popov, E. P.*Engineering Mechanics of Solids*. Prentice-Hall of India Limited, New Delhi, India.
5. Srinath, L. S. *Advanced Mechanics of Solids*. Tata McGraw Hill Education Pvt Ltd, New Delhi.
6. Punmia B. C., Jain A. K. and Jain A. K. *Strength of Materials and Theory of Structures*: Vol. II., Laxmi Publications (P) Ltd, New Delhi.
7. Menon, D.*Structural Analysis*.Narosa publishers.
8. Pytel, A. and Kiusalaas, J. *Mechanics of Materials*. Brooks/Cole Thomson Learning.
9. Reddy, C. S. *Basic Structural Analysis*. Tata McGraw Hill.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1204 ENGINEERING GEOLOGY AND SEISMOLOGY

Course Objectives: To make the students familiar with physical and structural geology as well as the basics ofmineralogy and petrology which help them to plan accordingly for the construction of Civilengineering structures.

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

1. Understand weathering process and mass movement.
2. Distinguish geological formations.
3. Identify subsurface information and groundwater potential sites through geophysical investigations.
4. Apply geological principles for mitigation of natural hazards.

MODULE I

Introduction: Definition - branches of geology -scope of geology – geology in civil engineering-Geological time scale.

Physical Geology: Rock weathering and soils - physical weathering - chemical weathering - climate and soil formation - classification of soil - soil erosion and its control. *Wind* - Wind erosion - Wind transportation - Wind deposition

Rivers - erosion - transportation - deposition - river meandering - types of rivers - drainage patterns.-*Oceans* – sea erosion - transportation - deposition – coastal protection.

MODULE II

Mineralogy: Definition of minerals - physical properties – Study of physical properties of the following minerals - quartz, Telspar, Muscovite, Biotite, Kyanite, Serpentine.

Petrology : Classification, texture and structures of Igneous , Sedimentary and Metamorphic rocks- factors & kinds of metamorphism – Engineering properties of rocks- Description, engineering properties and uses of the following rocks – Granite , Gabbro, Basalt, Limestone, Shale, Laterite, Quartzite, Marble.

Structural Geology: Attitude of beds, study of structures –folds, faults, fractures and joints – classification, recognition in the field, relevance to civil engineering.

MODULE III

Geological Investigation : Objectives – Methods of investigation – Surface investigation – Sub - surface explorations –Geophysical Methods

Engineering Geology : Geological conditions necessary for design and construction of dam & reservoirs, tunnels, buildings & road cuttings – Landslides –definition, classification, causes and their corrections.

MODULE IV

Seismology : Internal structures of the earth – M-discontinuity – sources of seismic activity - Continental Draift - Plate tectonics –fault movement – Reservoir associated earthquakes – Elastic Rebound Theory - seismic waves – Terminology – Intensity and Magnitude of Earthquake – Energy Released during on earthquake – Locating Epicentre and Focus – Recording of an earthquake – Seismograph – working Principle and Sensitivity of a Seismographs – classification of earth quakes - based on depth of focus , magnitude, cause of origin –effects of earthquakes – Primary effects – Secondary effects - Distribution of earth quakes –Seismic History of India Seismic Zones of India – Tsunami – Introduction – Tsunami velocity – Velocity in deep ocean –Velocity in shallow

water – wavelength of tsunami wave – Drawdown and Run up of a tsunami – inundates of Tsunami waves.

References:

1. Singh, P.*A text book of Engineering and General Geology*.Katson Publishers, Ludhiana.
2. Waltham,.T.*Foundations of Engineering Geology*.Spon Press, London.
3. Blyth, F. G. H.and de Frieitis, M. H. *Geology for Engineering*
4. Judo, W. R. *Principles of Engineering Geology and Geotechnics*.McGraw Hill.
5. Mukerjee, P. K.*A text book of geology*.World Press Ltd., Calcutta.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1205 FLUID MECHANICS – II

Course Objectives: To introduce the students to various hydraulic engineering problems like open channel flowsand hydraulic machines.

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

1. Compute drag and lift coefficients and design channels.
2. Compute flow profiles in channel transitions and analyze hydraulic transients.
3. Design the working proportions of hydraulic machines.
4. Analyze compressible flows of liquids and gases.

MODULEI

Boundary Layer Theory: Concepts of boundary layer flows, Laminar and turbulent boundary layers, Integral momentum equation for boundary layer flows, Boundary layer separation and control, Drag and lift.
Uniform Flow in Open Channels: Specific energy, Critical flow, Channel transitions, Uniform flow formulae, best hydraulic sections.

MODULEII
Steady Gradually Varied Flow: Non uniform flow in open channels, gradually varied flow equation, Type of GVF profiles, Computation of GVF profiles.
Steady Rapidly Varied Flow: Hydraulic jump in a horizontal rectangular channel, Specific force, Computation of energy loss.

MODULEIII
Unsteady Flow: Celerity of a gravity wave, Monoclonal rising wave, Positive and negative surges, St. Venant's equations, Method of characteristics, Hydraulic routing.
Hydraulic Similitude: Similarity laws, and Model studies.
Compressible Flows: Celerity of an elasticity wave, Area velocity relationships, Flow through nozzles, Constant area flow, Normal shocks, Water Hammer.

MODULEIV
Hydraulic Machinery: Impact of jets, Classification of hydraulic machines, one dimensional flow analysis and velocity triangles, Design of Pelton turbine, Design of Francis turbine, Design of a Kaplan turbine Design of centrifugal pump, Design of axial flow pump, Selection of hydraulic machines.

References:

1. Chow, V.T. (2009).*Open Channel Hydraulics*. Blackburn Press.
2. White, F. M. (2011). *Fluid Mechanics*. Tata McGraw Hill Publications.
3. Fox, R. W., Orutcgardm, O. H. and McDonald, A. T. (2011). *Introduction to Fluid Mechanics* (7^{th} student edition). Wiley India.
4. Subramnaya, K. (2008).*Flow In Open Channel*. Tata McGraw Hill Publications, New Delhi.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-12L1 SURVEY PRACTICALS

Course Objectives: To train the students to acquire skills in making precisemeasurements and obtaining accurate result.

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

1. Conduct survey and field data, prepare field notes from survey data, interpret survey data and compute areas and volumes.

Plane Table survey:

1. Method of Radiation.
2. Method of Intersection.
3. Solving three point problem - Bessel's method.
4. Solving three point problem - trial and error method & tracing paper method.
5. Solving two point problem.

Leveling:

6. Study of leveling instruments.
7. Fly leveling.
8. Longitudinal sectioning.
9. Cross sectioning.
10. Contour surveying.
11. Permanent adjustments.

Theodolite

12. Study of Theodolite.
13. Permanent adjustments of Theodolite.
14. Determination of Tacheometric Constants.
15. Heights and distances by stadia tacheometry.
16. Heights and distances by tangential tacheometry.
17. Heights and distances by solution of triangles.
18. Setting out simple curve-angular methods.
19. Demonstration of Total Station.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the

aggregate and* 45 %*minimum in the end semester examination for a pass.

SEMESTER-III

AS17P -1301 NUMERICAL AND STATISTICAL METHODS

(Common to all branches)

Course Objectives:

To understand the concept of probability, statistics and numerical methods which arise in engineering application.

Course Outcomes:

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

1. Solve algebraic and transcendental equations by numerical methods

2. Perform numerical differentiation and integration

3. Find the mean and variance of a probability distribution including the binomial distribution.

4. Use statistical tests in testing hypotheses on data

Module1

Numerical solution of algebraic and transcendental equation by - Regula-Falsi method, Newton Raphson's method. Gauss Seidal iteration method to solve a system of equations and convergence (without proof) Newton's forward and backward interpolation formula. Lagrange interpolation, Newton's divided difference and central differences.

Module II

Numerical differentiation at the tabulated points with forward, backward and central diffrences. Numerical integration with trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Taylor series method. Euler method, Modified Euler method, Runge–Kutta method of second and fourth order for solving 1st order ordinary differential equation.

Module III

Random variable (discrete and continuous) Expectation-mean and variance of probability distribution. Binomial, Poisson and Normal distribution and Fitting of this Distribution to the given data. Curve fitting-fitting of straight line, parabola, exponential.

Module IV

Population and Sample-Sampling Distribution (of mean and variance) Testing of Hypothesis-level of significance, Z-test statistic, Chi square test for variance, for goodness of fit and F-test.

References:

1. Erwin Kreyzig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, (2010).
2. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, (2013).
3. Kandaswamy, P., Thilagavathy, K., & Gunavathy, K., Numerical methods, S. Chand & Co., (2007).
4. Richard A. Johnson, Irwin Miller & Freund, J. E., Probabilty and statistics for Engineers, 8th Edition, Pearson, (2010).

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

HS17P-1302 TECHNICAL COMMUNICATION & PROFESSIONAL ETHICS

Course Objectives

The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for their professional needs. It is also intended to

develop awareness about the role of ethics in the practice of engineering profession.

Course Outcomes:

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

1. Understand basic grammar principles and comprehend English speech sound system, stress and intonation
2. Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.
3. Read, comprehend and answer questions based on literary, scientific and technological texts
4. Write instructions, recommendations, check lists, CV, process description, letters and reports.
5. Recognise the importance of ethical principles in engineering profession and understand the responsibilities and rights of engineers.

Module I

Remedial Grammar :Errors of Accidence and syntax with reference to Parts of Speech; Agreement of Subject and Verb; Tense and Concord; Conditional Clauses; Use of connectives in Complex and Compound sentences; Question tags and short responses. Word Formations (by adding suffixes and prefixes); Technical Word Formation; Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words; Phrasal Verb Idioms.

Elementary Phonetics (Speech Mechanism, The Description of Speech Sounds, The Phoneme, the syllable; Prosodic Features, Word Accent, Features of Connected Speech); Paralanguage and Body language; and Classroom Presentations, Hearing and Listening; Essentials of Good Listening: Achieving ability to comprehend material delivered at relatively fast speed.

Module II

Oral Communication: Starting and ending a conversation; telling and asking people to do things; expressing opinions and ideas, decisions and intentions, offers and invitations, feelings, right and wrong, numbers and money.

Purpose and audience; dealing with customers and clients; face-to-face discussions; meetings and attending meetings; checking understanding; raising questions; giving and receiving feedback; using body language; leading and directing discussions; concluding discussions; using graphics in oral presentations

Group Discussion: Use of persuasive strategies including some rhetorical devices for emphasizing (for instance; being polite and firm; handling questions and

taking in criticism of self; turn-taking strategies and effective intervention; use of body language).

Reading Comprehension and reference skills: Skimming and scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; comprehending graphics in technical writing.

Reading strategies; reading speed; reading between the lines for hidden meaning; interpreting graphics; using a dictionary; using an index; using a contents list to find information; choosing the right reference source.

Module III

Written Communication: note making and note taking; summarising; notes and memos; developing notes into text; organisation of ideas: cohesion and coherence; paragraph writing: ordering information in space and time; short essays: description and argument; comparison and contrast; illustration; using graphics in writing: tables and charts; diagrams and flow-charts; maps, plans and graphs.

Spelling rules and tips; writing a rough draft; editing and proof reading; writing the final draft; styling text; filling in complex forms; standard letters; CV; writing a report; writing leaflets and brochures; writing references; essay writing:expository writing; description of processes and products; classification; the instructional process; arguments and presentation of arguments; narrating events chronologically.

(Emphasis should be given to the practice sessions for developing the oral and written communication skills of students.)

Module IV

Engineering ethics: Senses of Engineering Ethics - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral autonomy. Kohlberg's theory - Gilligan's theory - Consensus and Controversy - Professional ideals and virtues - Attributes of an ethical personality - Theories about right action - Self interest.

Responsibilities and Rights of engineers - Collegiality and Loyalty - Respect for authority - Collective bargaining. Confidentiality - Conflicts of interest - Professional rights.

REFERENCES

1.JohnSeely, Oxford Guide to Writing and Speaking, Oxford University Press.
2.C. Muralikrishna and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011.
3.Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2004.
4. Krishna Mohan and Meenakshi Raman, Effective English Communication,Tata Mc-GraHill,2000.
5. William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication – A Practical Approach, Pearson, 2007.
6. R.C. Bhatia, Business Communication, 2nd Edition, Ane Books Pvt. Ltd., 2008.
7. Krishna Mohan and MeeraBanerji, Developing Communication Skills, Mac Millan India Ltd, 2000.
8. Jayashree Suresh and B.S. Raghavan, Professional Ethics, S. Chand & Company Ltd,

2005

9. Edmund D. Seebaur& Robert L. Barry, Fundamentals of Ethics for Scientists and

Engineers, Oxford University Press, 2001

Type of Questions for End Semester Exam.

Q 1.Ten short answer questions of 2 marks each with at least 2 questions from each of the four modules. (10x2 = 20 marks)

Q 2. to Q.5 : Two questions A & B of 10 marks from each module with option to answer either A or B.(4 x 10 = 40 marks)

The questions shall be framed in such a way that they test the grammatical and communication skills of the student.

CE17P-1303 ANALYSIS OF INDETERMINATE STRUCTURES

Course Objectives: To sail through to indeterminate structures smoothly from determinate ones motivating the students via the advantages possessed by the former and to introduce the conventional methods of their elastic analysis.

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

1. Distinguish clearly static and kinematic indeterminacy of structures and force and displacement methods of analysis of indeterminate structures and master a few force methods of analysis of pin-jointed and rigid-jointed structures.

2. Analyze rigid-jointed structures by the well known displacement based method, the slope-deflection technique motivated by matrix formulation of equilibrium equations of the method and its computer implementation.
3. Familiarize the iterative procedure of analysis of rigid-jointed structures illustrated via the moment distribution method.
4. Identify the advantage of certain geometrical features in structures and supports through the analysis of arches and cable stayed suspension bridges.

MODULE I

Indeterminacy of structures: Degree of static and kinematic indeterminacy of pin-jointed and rigid-jointed structures (sufficient examples should be included to reinforce the concept), redundant and degree of freedom, brief introduction to force and displacement methods based on the degree of static and kinematic indeterminacy.

Force method of Analysis of indeterminate trusses: Force method in which reactions as redundant, axial forces in members as redundant, both reactions and axial forces in members as redundant, induced reactions due to yielding of support, pre-strains.

Force method of Analysis of indeterminate beams and frames: Method of consistent deformation, strain energy method (Castigliano's theorems), unit load method, induced reactions due to yielding of supports, Three moment equation method – application of three moment equation to continuous beams, analysis of continuous beams subjected to uneven support settlement.

MODULE II

Displacement Method of Analysis – The Slope Deflection method: Derivation of the slope-deflection equation for a one-span beam, analysis of continuous beams, beams subjected to uneven support settlement, analysis of rigid jointed frames with and without unknown joint translation, rigid frames subjected to support settlement, analysis of gable frames.

MODULE III

Displacement Method of Analysis – The Moment Distribution method: Stiffness and carry over factors, distribution factors, analysis of continuous beams, check on moment distribution, modified stiffness factors at the near end when far end is hinged, beams subjected to uneven support settlement, analysis of rigid jointed frames with and without joint translation, rigid frames subjected to support settlement.

MODULE IV

Arches and frames: Theory of arches, Eddy's theorem, Three hinged arches, two hinged arches, fixed arches, Influence lines for bending moment, shear force and axial thrust.

Cable Suspension bridges: Equilibrium of un-stiffened cable, tension in the cable, length of the cable, anchor cable, roller support, saddle support, effect on cable length due to change in temperature.

References:

1. Wang, C.K. *Intermediate Structural Analysis*. McGraw Hill International Edition.
2. Menon, D. *Structural Analysis*.Narosa publishers.
3. Pandit, G. S. and Gupta, S. P. *Theory of structures*, Tata McGraw Hill.
4. Roy and Chakrabarty.*Fundamentals of Structural Analysis*. S Chand.

5. Norris, C. H. and Wilbur J. B.*Elementary Structural Analysis*. McGraw Hill, New York.
6. Punmia, B.C. and Jain, A. K. *Theory of Structures*, Laxmi Publications (P) Ltd.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1304 GEOTECHNICAL ENGINEERING –I

Course Objectives: To equip the student to understand the properties and behavior of soil for the design of foundations, earth and earth retaining structures.

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

1. Understand the properties of soils and to classify them through laboratory investigation.
2. Compute the effect of water and stress due to external load.
3. Understand the principles of compaction and its control.
4. Understand the volume change behavior under static loading; compute consolidation settlement in soft soil and time rate of settlement.
5. Gain knowledge of shear strength parameters, itsdetermination and its applications in slopes.

MODULE I

Nature of soil and functional relationships: Soil types – residual soil and transported soil. Three phase system – void ratio –specific gravity-– porosity-

water content-dry,saturated and submerged unit weight-– degree of saturation – relative density -Relationship between Basic Soil properties.

Concepts of single grained, honey combed and flocculent structure - Basic Structural units of clay minerals- common clay minerals.

Laboratory and field identification of soils: Determination of water content by oven drying – specific gravity using Pyenometer and specific gravity bottle – grain size analysis by sieve analysis, hydrometer analysis and pipette analysis – Atterberg limit and indices

field density by core cutter, sand replacement and wax coating methods. Classification of Soils: Necessity – Principles of classification – I.S. classification – plasticity chart.

MODULE II

Soil water: Classification- effective stress - total stress - pore pressure - pressure diagrams for different conditions.
Permeability: definition - Darcy's law - factors affecting permeability - laboratory determination – permeability of stratified soils.
Stress distribution: Boussinesque's and Westergaard's equations for vertical pressure due to point loads and uniformly distributed loads - assumptions and limitations - pressure bulb – Newmarks` charts and their use.

MODULE III

Compaction: definition and objectives of compaction - proctor test and modified proctor test - concept of OMC and maximum dry density - zero air voids line - factors influencing compaction - field compaction methods - Proctor needle for field control.
Consolidation: definition - concepts of coefficient of compressibility - coefficient of volume change and compression index - e-log p curves - pre-consolidation pressure - Terzaghi's theory of one dimensional consolidation - determination of coefficient of consolidation - difference between consolidation and compaction.

MODULE IV

Shear Strength: definition - Mohr's strength and stress circles - Mohr's envelope - Mohr-Coulomb strength theory - direct, triaxial and UCC tests - drainage conditions-UU, CU and CD tests - vane shear tests - total and effective stress - strength parameters – sensitivity andthixotropy.
Stability of slopes: Slope failure, base failure and toe failure - Swedish circle method - friction circle method - Taylor's stability number - stability charts.

References:

1. Ranjan, G.and Rao, A.S.R.*Basic and Applied Soil Mechanics*. Wiley Eastern Ltd.
2. Das, B.M.*Principles of Geotechnical Engineering*. Thomas Brooks Cole, Singapore.
3. Punmia, B.C. *Soil Mechanics and Foundations*.Laxmi Publications.
4. Terzaghi, K. and Peck, R.B. *Soil Mechanics in Engineering Practice*. John Wiley.
5. Venkataramaiah, C.*Geotechnical Engineering*. New Age International Publishers.
6. Arora, K.R. *Soil Mechanics and Foundation Engineering*. Standard Publishers and Distributors.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

. CE17P-1305 TRANSPORTATION ENGINEERING – I

Course Objectives: To build a strong, stable and deep concept on highway and air transportation and to equip the students to plan, and design various structures and traffic control devices coming under these two modes of transportation.

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

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Carry out the surveys, perform geometric design for airports.

MODULE I

Classification, Alignment and surveys: Classification of highways – typical cross sectionof roads in embankment and in cutting, definition of various cross sectional elements – requirements and factors controlling alignment of roads, Engineering surveys.
Geometrical Design of Highways: Camber – sight distances – Stopping, passing and overtaking Sight distances, Overtaking zone requirements, worked out problems – design of horizontal alignments, design speed – horizontal curves – Super elevation – Super elevation design – radius of horizontal Curve – extra widening of pavement – transition curves and methods of provision of super elevation and design of horizontal alignment – design of vertical alignment – gradient and grade Compensation Vertical curves – summit curves – length of summit curve - valley curves – length of valley curve.

MODULE II
Traffic Engineering: Introduction - road user, vehicle and traffic characteristics - traffic engineering studies – speed – speed and delay - volume - origin and destination - parking and accident studies.

Road intersections- principles of design of at grade intersection - simple layouts.

Traffic operation-Traffic control devices- classifications and uses of traffic signs and markings – traffic signals.

MODULE III
Highway Materials, Testing and Design:Road aggregates – Desirable props & tests – Bituminous materials – Types of bituminous materials used in highway construction – requirements – desirable properties and tests.
Highway construction and Maintenance: Construction ofbituminous concrete and cement concrete pavements . Joints in Concrete pavements – types and causes of failures in flexible and rigid pavements, Pavement Design –Basic difference between flexible and rigid pavements – factors to be considered in Design of pavements.

MODULE IV
Airport planning and design

Introduction - aircraft characteristics and their influence on planning of airports – classification of airports- airport obstructions and zoning - component parts of airports and site selection – runway design - orientation - basic runway length - corrections to basic runway length - worked out problems- geometric design of runways; design of taxiways and aprons – Controlling of air traffic-Operation of instrument landing system-terminal area planning concepts and its facilities - aircraft parking configurations.

References:

1. Khanna, S.K., Justo and Veeraraghavan.*Highway Engineering*.NemChand and Bros, Roorkee, India.
2. Khadiyali, L.R.*TrafficEngineering and Transport Planning*. Khanna Publishers.

3. Ministry of Road Transport and Highways Specifications for Road and Bridge Works. Fourth Edition. Indian Roads Congress, New Delhi, India.
4. Khanna, S. K., Arora, M. G., and Jain, S. S. *Airport planning and Design*, Sixth Edition.Nem Chand and Bros, Roorkee, India.
5. Rangwala, S.C.*Airport Engineering*.Charoter Publishing House.
6. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B. *Planning and Design of Airports*. Fifth Edition. McGraw-Hill, New York.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-13L1 TRANSPORTATION ENGINEERING LABORATORY

Course Objectives: To learn the characteristics, properties and testing procedures of aggregate, bitumen and bituminous mixtures.

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

1. Characterize the aggregates and bitumen used for road construction.
2. Design a bituminous mixture.

1. **Tests on Aggregates**

Crushing Value
Los-Angeles Abrasion Value
Impact Value
Specific Gravity
Water Absorption
Shape Test – Flakiness Index, Elongation Index & Angularity Number

2. **Tests on Bitumen**

Viscosity Test
Ductility Test
Softening Point Test
Specific Gravity

Penetration Test
Flash Point Test

3. **Tests on Soil**

CBR Test

4. **Test on Bituminous mixes**

Marshall Test

Note: 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks inthe aggregate and 45 %minimum in the end semester examination for a pass.

SEMESTER IV

CE17P-1401 ENVIRONMENTAL ENGINEERING –I

Course Objectives: To understand the basic principles and develop knowledge in unit operations, design and execution of water treatment system as well as the elements of environmental pollution.

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

1. Recognize the important professional and ethical responsibilities as an environmental engineer so as to estimate or analyze the quantity and quality of water required for a community water supply scheme.
2. Attain perfect knowledge on water supply sources, its collection, transport, transmission and maintenance.
3. Getting knowledge about sanitary plumbing systems, systems of sewerage and distribution systems in water supply engineering
4. Generate an ability to provide engineering solutions for the environmental problems related with air pollution, solid wastes disposal and noise pollution.

MODULE I

Scope of Environmental Engineering,Global environmental problems, Water supply Engineering: Rural and Urban water supply systems - Water demand – per-capita demand, factors affecting per capita demand, variations in the rate of consumption, fire demand, design period, forecasting population. Quality of water – impurities in water and their importance - water borne diseases - analysis of water - physical, chemical and bacteriological tests. WHO and Indianstandards for drinking water.

MODULEII

Sources of water: Surface water sources-groundwater sources.Collection of water: intakes - location, types, pipe materials- design of gravity and pumping main. Pumps: classification - selection of pumps - location of pumping stations. Distribution systems-different layout of pipe networks - appurtenances in the distribution system - meters, valves, fire hydrants etc. pipe laying, testing & disinfections of mains- detection and prevention of leaks in distribution system-maintenance of distribution system. Storage of water - effect of storage on quality of water.

MODULE III

Sanitary plumbing: Sanitary fixtures-Systems of piping-House drainage-Connection of house drains and street sewers. Systems of sewerage-Quantity of storm sewage-Quantity of sanitary sewage-Sewers, types, materials, shape, construction, appurtenances, hydraulic design of sewers, sewage pumping, ejectors, sewer junctions-maintenance, inspection and ventilation of sewers.

MODULE IV

Natural methods of wastewater disposal: land disposal-Sewage farming-disposal by dilution-self-purification of streams-oxygen sag curve-dilution into sea, comparison of disposal methods. Air pollution: type of pollutants, sources, health effects, meteorological aspects, , monitoring and air pollution control. Solid waste management: type, sources, characteristics, collection, vehicles for transportation and processing – Disposal: composting, sanitary land fill, incineration. Noise pollution: Sources, effects, control, noise survey.

References:

1. Garg, S.K. (2001).*Environmental Engineering.*Vol I & II. Khanna publications, New Delhi**.**
2. Birdic, G.S. and Birdic, J.S.(1998). *Water supply and Sanitary Engineering*.DhanputRai& Sons, New Delhi.
3. Rowe, P. andTchobanoglous.*Environmental Engineering*. McGraw Hill International Editions.
4. Veslind and Morgan.*Introduction to Environmental Engineering*. Thomson Learning.
5. Rao, M.N. and Rao, H.V.N.*Air Pollution*. Tata McGraw Hill Pvt.Ltd, New Delhi.
6. Hammer, M. J. and Hammer, M. J.(Jr). (1998).*Water and Wastewater Technology*, Prentice Hall of India,Pvt Ltd, New Delhi.
7. CPHEEO, *Manual on Water Supply and Treatment*. Third edition. Ministry of Urban Development, Gov. of India.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1402 DESIGN OF CONCRETE STRUCTURES – I

Course Objectives: To introduce the structural design concepts to students through design philosophy, usage of the IS codes and structural detailing.

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

1. Identify and calculate different types of loads on structures.
2. Design Reinforced Concrete beams and slabs using limit state method.
3. Design structures for serviceability.
4. Design Reinforced Concrete Columns and staircase.

MODULE I

Introduction to different design philosophies, Principles of Working Stress and Limit State methods (Limit State method in detail), Analysis of singly and doubly reinforced beams of rectangular and flanged sections, Design for bending, compression, shear and torsion – Design of singly and doubly reinforced beams of rectangular and flanged sections.

MODULE II

Types of **slabs** – design of one-way slabs – temperature and shrinkage reinforcement – behavior of two way edge supported slab – analysis by coefficient method – Design of two way edge supported slab.

Analysis and design for torsion: Torsion in plain concrete members – torsion in reinforced concrete members – combined torsion and shear – Limit state design of beams – Code provision for torsion design.

MODULE III

Bond, anchorage and development length: Fundamentals of flexural bond – ultimate bond strength and development length – Code provisions for development of tension reinforcement – anchorage of tension bars by hooks – anchorage requirements for web reinforcement – development of bars in compression – bundled bars – bar cutoff and bend points in beams.

Serviceability: Cracking in flexural members – Code provisions for crack control – control of deflection – immediate deflection – deflection due to long term loads – Code provisions for control of deflection – deflection due to shrinkage and temperature changes.

MODULE IV

Staircases- types of staircase-design of straight flight stair cases.

Columns: Design of short columns – axial compression – lateral ties and spirals – compression plus bending in rectangular columns – strain compatibility analysis and interaction diagrams – balanced failure – distributed reinforcement – unsymmetrical reinforcement – circular columns – Code provisions for design of short columns – biaxial bending – Design of slender columns – concentrically loaded columns – compression plus bending – Code provisions for design of slender columns.

References:

1. Nilson, A.H. *Design of Concrete Structures*. McGraw Hill Companies Inc.
2. Pillai, S.U.andMenon, D.*Reinforced Concrete Design*. Tata McGraw Hill Publishing Company Limited, New Delhi, India.
3. Varghese, P.C. *Limit State Design of Reinforced Concrete*. Prentice Hall of India Pvt Ltd, New Delhi, India.
4. Syal and Goel.*Reinforced concrete structures*, S Chand.

Type of Questions for End Semester Examination.

Question nos. I and II [with sub sections (a), (b), ...] (15 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), ...] (15 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), ...] (15 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b), ...] (15 marks each with option to answer either VII or VIII) from Module IV.

Use of IS. Codes: 456-2000, 875-1987 and Interaction charts for column design are permitted in the Examination Hall.

CE 17P-1403 MATRIX METHODS OF STRUCTURAL ANALYSIS

Course Objectives: To motivate the students to computer implementation of structural analysis through the flexibility and stiffness matrix approaches evolved from the methods of consistent deformation and slope deflection, respectively and validation of computer outputs aided by approximate analysis.

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

1. Assimilate the concepts of element-based and structure-based flexibility matrix approaches to analyze rigid-jointed and pin-jointed structures initiated from the compatibility equations in the method of consistent deformation.
2. Formulate stiffness matrices of basic beam and truss elements and analyze rigid and pin-jointed structures (statically determinate and indeterminate) via element-based and structure-based stiffness methods, initiated from the equilibrium equations of the slope-deflection method.
3. Appreciate the direct stiffness method as a generalized approach which would in turn seed the concept of the finite element analysis of structures.
4. Quickly analyze multi-storied rigid-jointed frames by approximate methods so as to check the output given by any structural analysis software.

MODULE I

Introduction to the Flexibility and Stiffness Matrix Methods: Concept of flexibility and stiffness coefficients, Development of flexibility matrix, Concept of element approach, Development of equilibrium matrix, Element flexibility matrices for truss and beam elements, Development of structure flexibility matrix, Determination of displacements in statically determinate beams, rigid jointed and pin-jointed plane frames by flexibility matrix approach, Analysis of statically indeterminate beams and rigid jointed plane frames by flexibility method.

MODULE II

Analysis by Stiffness Matrix Method: Development of stiffness matrix, Element approach, Development of compatibility matrix, Element stiffness matrices for truss and beam elements, Equivalent joint loads, Development of structure stiffness matrix by element approach, Analysis of statically indeterminate beams, rigid jointed and pin-jointed plane frames by stiffness matrix approach, effect of fabrication errors or temperature changes, effect of support settlement.

MODULE III

Analysis by Direct stiffness Method: Local and global coordinate systems, Transformation of element stiffness matrices from local to global co-ordinates, Equivalent nodal forces and load vector, Global stiffness matrix, Application of direct stiffness method

to two span continuous beams, plane frames, Advantages of direct stiffness method, Concept of finite element method introduced through the procedure of the direct stiffness method, Comparison of flexibility matrix and stiffness matrix methods.

MODULE IV

Approximate methods of multi-storey frame analysis: Vertical and lateral load analysis of multi-storey frames, assumptions for vertical load analysis, The Substitute frame method, assumptions for lateral load analysis, Portal method, Cantilever method, Kani's method, comparison of the methods.

References:

1. Weaver, W. J. and Gere, J. M. *Matrix analysis of framed structures*, CBS Publishers, New Delhi.
2. Pandit, G. S. and Gupta, S. P. *Structural analysis – A Matrix Approach*. Tata McGraw Hill, New Delhi.
3. Krishnamoorthy, C. S. *Finite Element Analysis – Theory and Programming*. Tata McGraw Hill Publishing Company Limited, New Delhi, India.
4. Mukhopadhyay, M. and Sheik, A. H. *Matrix and Finite Element Analysis of Structures*,Ane Books Pvt. Ltd.
5. Wang, C. K.*Intermediate Structural Analysis*. McGraw Hill International Edition.
6. Punmia, B. C. and Jain, A. K.*Theory of Structures*.Laxmi Publications (P) ltd.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1404 GEOTECHNICAL ENGINEERING – II

Course Objectives:To impart knowledge on common methods on subsoil investigation and design of foundation.

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

1. Determine the earth pressure on retaining structures.
2. Gain knowledge on soil exploration methods.
3. Understand various foundations.
4. Assess the bearing capacity of soils and foundation settlements.

MODULE I

Earth Pressure-General and local states of plastic equilibrium – Rankines and coulomb's theories for active and passive conditions- influence of surcharge – Rebhann's and Culmann's graphical methods for active earth pressure

Sheet pile walls: Types and uses of sheet piles – Design of cantilever and anchored sheet pile walls(Free earth support only).

MODULE II

Site investigation and soil exploration: objectives - planning - reconnaissance - methods of subsurface exploration - test pits - Auger borings - rotary drilling - depth of boring - boring log - soil profile- location of water table - S.P.T, Cone Penetration Tests, Plate load test, field vane shear test - geophysical methods (in brief) - sampling - disturbed and undisturbed samples – soil investigation report.

MODULE III

Foundation -Functions of foundations - requisites of satisfactory foundations - definition of shallow and deep foundation - different types of foundations - selection of type of foundation.

Bearing capacity: ultimate bearing capacity and allowable soil pressure - Terzaghi's equation for bearing capacity for continuous , circular and square footings - bearing capacity factors and charts - Skempton's formulae - effect of water table on bearing capacity – IS recommendation.

Settlement analysis: distribution of contact pressure – estimation of immediate and consolidation settlement – effects, causes and remedial measures of total and differential settlement – permissible total and differential settlements as per IS recommendation -

Design considerations –Proportioning of shallow foundations.

Raft foundations: bearing capacity equations - design considerations - floating foundations.

MODULE IV

Pile foundations: uses of piles - classification of piles based on purpose and material –selection of type of piles - determination of capacity of axially loaded single vertical pile - (static and dynamic formulae) - determination of capacity by penetration tests and pile load tests (IS methods) - negative skin friction - group action and pile spacing – settlement analysis of pile groups.

Caissons and cofferdams: different types – different shapes of well foundations- component parts of well and forces- construction details and design considerations of well foundations - sinking of wells and remedial measures for tilts and shifts – types and uses of cofferdams.

References:

1. Arora, K.R. *Soil Mechanics and Foundation Engineering*. Standard Publishers, Distributors.
2. Ranjan, G.and Rao, A.S.R.*Basic and Applied Soil Mechanics*. Wiley Eastern Ltd.
3. Bowles, J. E.*Foundation Analysis and Design*. McGraw Hill.
4. Tomlinson.*Foundations Design and Construction*.
5. Teng, W. C.*Foundation Design*. Prentice Hall of India.
6. Kurian, N. P.*Design of foundation system*.Narosa Publication.
7. Das, B.M.*Principles of Foundation Engineering*. Thomson Learning.
8. Varghese, P. C.*Foundation Engineering*. Prentice Hall of India.

Note: *Structural designs of foundations are not contemplated in this course.*

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1405 TRANSPORTATION ENGINEERING –II

Course Objective: To provide a strong base in planning, designing, construction and maintenance of structures coming under railways, waterways and tunnelling.

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

1. Understand the basics and design of various components of railway track.
2. Study the railway operation control.
3. Learn the tunnel driving procedures, its lighting, ventilation and drainage.
4. Know the types of harbour and construction of break waters.
5. Acquire knowledge about the types of docks and dredgers.

MODULE I

Railway Engineering: Permanent way – main requirements – Component parts. Rails – functions of rails –requirements of a good rail, weight and length., defects in rails, rail joint and other fastenings, check and guard rails, coning of wheels, creep of rail. Sleeper- its functions and requirements, sleeper density, Ballast- functions and requirements, different types used.

Geometric Design: Design of horizontal curves-Super elevation, negative super elevation in branches, length of transition curves –grade compensation on curves, widening of gauge on curves.

MODULE II

Railway Operation control: Points and Crossings-Design features of a turn out-Types of railway track points –Details of station yards and Marshalling yards-Signaling and interlocking – Principles of track circuiting-Control of train movement by absolute block system-automatic block system-Centralized traffic control systems.

Tunnel Engineering: Tunnel sections-types size and shapes-tunnel surveying-Alignment, transferring center grade in to tunnel-tunnel driving procedure-tunneling through hard and soft soils(Only Full face Method and Compressed air method) –Tunnel lining ventilation lighting and drainage of tunnels.

MODULE III

Harbor Engineering: Classification of harbors Breakwaters-necessity and functions-different types-forces acting on breakwater-design principles-construction of breakwaters-general study of pier heads, quays, landing stages-wharves, jetties, transit sheds and warehouses-channel demarcation-signal characteristics Beacons,buoys,channel- lighting, light houses).

MODULE IV

Dock Engineering: Function and types of docks, dry docks, floating docks slipways, dock gates and caissons-s Dredging-Mechanical and hydraulic dredgers-general study of bucket ladder-Dredger, grab dredger and dipper dredgers.

References:

1. Chandra, S. and Agarwal, M.M.*Railway Engineering*. Oxford University Press, New Delhi, India.
2. Saxena, S.C, and Arora S. P.*Railway Engineering*.DhanpatRai and Sons, New Delhi, India.
3. Agarwal, M.M. *Indian Railway Track*.Prabha and Co., New Delhi, India.
4. Rangwala, S.C. *Principles of Railway Engineering*.Charotar Publishing House, Anand, India.
5. Bindra, S.P.*A Course in Docks and Harbour Engineering*.DhanpatRai and Sons, New Delhi, India.
6. Seetharaman, S. *Dock and Harbour Engineering*.Umesh Publications, New Delhi, India.
7. Srinivasan, R. *Harbour, Dock and Tunnel Engineering*.Charotar Publishing House, Anand, India.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-14L1 GEOTECHNICAL ENGINEERING LABORATORY

Course Objectives:To Attain Knowledge In Assessing Both Physical And Engineering Properties Of Soils Through Laboratory Testing Procedures.

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

1. Determine the index properties of soils.
2. Classify soils as per I.S.
3. Determine the engineering properties of soils.

LIST OF EXPERIMENTS

1. Determination of Specific gravity, water content and particle size distribution by hydrometer method.

2. Determination of field density by core cutter and sand replacement method.
3. Determination of Atterberg Limits.
4. Compaction tests – I.S. light and heavy compaction.
5. California Bearing Ratio Test
6. Permeability tests – constant head and variable head methods.
7. Consolidation test.
8. Shear strength tests – Direct shear, Triaxial, UCC & Vane Shear Test
9. Demonstration of field tests like Standard Penetration Test, Dynamic Cone Penetration Test, Static Cone Penetration Test, Electrical Resistivity method, Pressure meter test, Plate load test.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 45 %minimum in the end semester examination for a pass.

SEMESTER V

CE 17P-1501 ENVIRONMENTAL ENGINEERING – II

Course Objectives: To understand the basic principles and concepts of unit operations and processes involved in water and wastewater treatment thereby developing student's skill in the basic design of unit operations and processes with a sound knowledge in evaluating the performance of water and wastewater treatment plants.

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

1. Recognize the type of unit operations and processes involved in water treatment plants.
2. Design individual unit operation or process appropriate to the situation by applying physio- chemical engineering principles to treat the waste water.
3. Design individual unit process for biological waste water treatment.
4. Design anaerobic systems and appropriate methods for disposal and treatment of wastewater and sludge in a cost effective and sustainable way.

MODULE I

General layout of water treatment plant. Sedimentation – plain sedimentation, theory of sedimentation, continuous flow sedimentation tanks. Theory of coagulation and flocculation, design of flash mixers, clarifiers and clarifloculators. Filtration - Theory of filtration, Classification of filters, design, construction, control, operation and maintenance of these units. Disinfection, methods of disinfection, chlorination. Miscellaneous treatment methods: color, odour and

taste removal, iron and manganese removal, deflouridation, removal of hardness. Aeration, purpose of aeration.

MODULE II

Objectives of wastewater treatment - Effluent standards, KSPCB Standards, BIS Standards. Layout of conventional treatment plant - preliminary, primary, secondary and tertiary treatments in general. Preliminary process: screens - types of screens, design, disposal of screenings, grit chamber - function, design, construction and operation, disposal of grit , detritus tank, skimming tank - function, design and operation, disposal, Sedimentation: Design ,construction and operation, rectangular and circular tanks, disposal of sludge.

MODULE III

Biological process: principle and theory of biological treatment. Sewage filtration; Trickling filters - design, construction and operation. Activated sludge process: Design, construction and operation of conventional and extended aeration, aeration methods. Miscellaneous methods- Stabilization ponds, Oxidation ditch, Aerated lagoons, rotating biological contactors.

MODULE IV

Sludge treatment and disposal: quantity of sludge, characteristics of sludge, sludge thickening, digestion, conditioning and disposal, design of sludge digesters only. Septic Tanks: Design (as per Ministry of urban development) construction, disposal of effluents, cleaning of tanks, Imhoff tanks.

Sewage treatment by high rate anaerobic methods: Anaerobic digestion suspended growth, contact process, UASB, attached growth, filters, expanded bed- only basics.

References:

1. Garg, S. K. (1999).*Sewage Disposal and Air Pollution Engineering – Environmental Engineering*, Vol.II. Khanna Publishers, New Delhi.
2. Metcalf & Eddy, Inc. (2003), *Waste water Engineering Treatment and Reuse*. McGraw Hill International Editions, New Delhi.
3. Sawyer and mc Carthe, *Chemistry for Environmental Engineering*. McGraw Hill.
4. Fair, Geyer and Okun.*Water and Waste water Engineering*.
5. Hammer, M. J. *Water and waste water technology*. John Wiley and Sons,Inc.

6. Vesilind and Worrell, W. A.*Solid waste Engineering*. Thomson Learning.
7. Punmia, B. C. *Water supply Engineering*.Arihant Publications, Jodpur.
8. Peavy, H.S., Rowe, D.R. and Tchobanoglous, G. (1985).*Environmental Engineering*. McGraw Hill Inc., New York.
9. Modi, P.N. (2008).*Sewage treatment and Disposal and waste water Engineering – Environmental Engineering*. Vol.II. Standard Book House.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE17P-1502 DESIGN OF STEEL STRUCTURES

Course Objectives: To understand the concepts of steel design, know the analysis and design of plate girder and gantry girder and understand the concepts of plastic design.

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

1. Design bolt and weld connections.
2. Design tension and compression members.
3. Design beams and plate girders.
4. Design light gauge steel structures.

MODULE I

Materials and specifications: rolled steel sections- types of structural steels – specifications-Limit state and working stress design concepts, **Types of connections** – *Bolted joints*-Types of bolted joints-load transfer mechanism-failure of bolted joints-efficiency of the joint-*welded joints*- advantages and disadvantages of welded joints – types of welds and their symbols -Design of welded and bolted connections.

MODULE II

Tension member: Net sectional area – permissible stresses – design of axially loaded tension member. **Compression member**: strength of an axially loaded compression member – effective length – maximum slenderness ratio – compression member with two rolled sections back to back – design of compression members – lacing and battening for built-up compression member – column base – slab base – gussetted base.

MODULE III

Beams: design procedure for laterally supported and unsupported beams – built up beams

Plate girders- design of section, curtailment of flange plate, bearing and intermediate stiffeners, connections, flange and web splices, Gantry girders (only design concept).

MODULE IV

Light gauge steel structures – Types of sections, Flat width ratio, Buckling of thin elements, Effective design width, Form factor, Design of tension, compression members and beams.

Plastic design- basic assumptions - shape factor, load factor- Redistribution of moments - upper bound lower bound and uniqueness theorems- analysis of simple and continuous beams, two span continuous beams and simple frames by plastic theory - static and kinematic methods, Plastic design- Design of section for Continuous beams and simple frames.

References:

1. Subramanian, N. *Design of steel structures*. Oxford University Press.
2. Arya, A.S. and Ajmani, J. L. *Design of Steel Structures*.Nemchand& Bros.
3. Dayaratnam, P. *Design of Steel Structures.* Wheeler.
4. Ramachandra.*Design of Steel Structures*. Standard books.
5. Duggal, S.K. *Design of Steel Structures*. T.M.H. Publications.

Use of IS:800 – 2007, IS:801 – 1975, IS:811 – 1987 and structural steel table are permitted in the examination hall.

Type of Questions for End Semester Examination.

Question nos. I and II [with sub sections (a), (b), ...] (15 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), ...] (15 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), ...] (15 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b), ...] (15 marks each with option to answer either VII or VIII) from Module IV.

CE 17P-1503 QUANTITY SURVEYING AND VALUATION

Course Objectives: To impart the basics of calculation of quantities and rates of works, labor and properties so as to enable students to prepare an estimate of a project and as well as valuation of a property.

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

1. Calculate the exact quantities of items of work done for affecting payment especially when direct measurements are difficult and also to determine the quantities of different materials required for various items of work.
2. Assimilate a thorough idea regarding the quality and quantity of materials, required for a project with given specifications.
3. Prepare valuation report of real and landed property.
4. Mouldoneself as an entry level graduate engineer competent to manage any civil engineering project confidently.

MODULE I

Estimate-Types of estimate - Revised estimate, supplementary estimate, maintenance estimate, detailed estimate, approximate estimate - plinth area method, cubic rate method, unit rate method, bay method, approximate quantity from bill method, comparison method, Preparation of detailed estimates and abstracts for RCC single storey buildings - centre line method and long wall - short wall method, Detailed specifications for common building materials and items of work as per I.S specifications.

MODULE II

Estimation of earth work for road works - Preparation of bar bending schedule and estimation of quantities for R C.C footings -Columns – Beams and slabs, Calculation of quantities of materials and analysis of rates for various items of work in building construction-rubble work, brick work, PCC, RCC, plastering, pointing etc., Introduction to data book and schedule of rates, Preparation of abstract of estimate of buildings.

MODULE III

Valuation –purpose – principle, Explanation of different technical terms, Types of values.Gross income – net income – Outgoings, Depreciation – methods of calculating depreciation – straight line method – constant percentage method, sinking fund method – and quantity survey method.

MODULE IV

Methods of valuation of property – rental method – direct comparison with capital cost – valuation based on profit – valuation based on cost – development method – depreciation method valuation of land – comparative method – abstractive method- belting method- valuation of based on hypothetical building schemes..Valuation of agricultural land,Free hold and leasehold properties – gilt edged securities. Different forms of rent and rent fixation.

References:

1. Dutta, B.N. *Estimating and Costing in Civil Engineering*.
2. Chakrabarthi.*Estimating Costing and Specifications in Civil Engineering*.
3. Shah, N.A. *Quantity Surveying and Valuation*.
4. Ranagawala.*Valuation of Real Properties*.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1504 WATER RESOURCES AND IRRIGATION ENGINEERING

Course Objectives: To introduce the students to the concept of soil-plant characteristics and their water requirements, understand the necessity of planning an irrigation system to provide water at the right time and right place and introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

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

1. Analyze hydro-meteorological data.
2. Estimate abstractions from precipitation.
3. Compute yield from surface and subsurface basin.
4. Develop rainfall-runoff models.
5. Analyze and design gravity dams and earth and rock-fill dams.
6. Design spillways and energy dissipation structures.

MODULE I

Hydrologic cycle, scope, application of hydrology, Precipitation: Formation of precipitation –forms of precipitation – type of precipitation - measurement of precipitation –recording and non recording gauges – gauge network - adjustments of precipitation data - average depth of precipitation over an area - Arithmetic mean, Theissen polygon and isohyetal method – Hyetograph – Mass curve - Depth area duration curves. Water Loses: Evaporation, transpiration and infiltration – Factors affecting evaporation-measurement of evaporation - Evaporation formulas – Infiltration, factors affecting infiltration, Determination of infiltration rate - Effect of infiltration on run–off - Recharge of ground water.

Run off : Factors affecting run–off – Empirical formulae-runoff – hydrograph - Components of hydrograph - Separation of base flow - Hydrograph for isolated storm and complex storm - unit hydrograph - derivation of unit hydrograph for isolated and complex storm – Unit hydrograph for different duration – S hydrograph.

MODULE II

Ground water Hydrology : Occurrence, distribution of ground water – Darcy’ s law – Permeability, safe yield - Location and development of ground water supplies - Hydrology of well – Steady flow in confined and unconfined aquifers - open well – yield of an open well – Effect of partial penetration - Interference of wells - Boundary effect - Specific capacity of well – Tube wells –Yield from a tube well - Strainers – Site for a tube well Flow and lift Irrigation –Perennial and Inundation irrigation - Important Crops and crop seasons –Duty and delta – Method of Cultivation - Water requirement – Irrigation efficiency – Multipurpose projects. Reservoirs : Investigation and planning – Selection of site – Engineering, Geological, and hydrological Investigations - Fixation of storage capacity - Contours- Mass curve - operation of reservoirs - reservoirs sedimentation.

MODULE III

Head works : Storage and diversion works- Layout of head works - Selection of site – Weirs- Types of weirs – Weirs on permeable foundation – Uplift and piping –

Bligh’ s creep theory - Lane’ s weighted creep theory – Khosla’ s theory of independent variables - Design of aprons- Body wall – vertical drop weir - design of sloping glacis weir. River regulators - Silt excluder -Silt vane,Surplussing Arrangements: Spillways – Type and Functions – design of Ogee Spillway and Siphon Spillway - energy dissipation below spillways – stilling basin – spillway crest gates. Distribution works : Classification of canals – design of canals – erodible canals - canals in alluvial soils – regime theory – Kennedy, Lacey traction theories – Manning’ s formula - Design. Non–erodible canals - Friction formula—Chezy,Manning’s formula, Silting in canal and prevention – Scour-protection against scour.

MODULE IV

Storage works: Type of dams-Gravity dams –Forces acting on a gravity dam-Elementary profile-Single step method of design –Method of stability analysis-Zonal method of designsafety criteria-Galleries in dams. Arch dams – Types-Thin cylinder theory. Earth and rockfill dams-Types of earthern dams.

References:

1. Subramanya, K. Engineering *Hydrology*, Tata McGraw-Hill.
2. Punmia, B. C. andLal.*Irrigation and Water Power*.Laxmi Publications Pvt Ltd.
3. Modi, P. N.*Irrigation Water Resources and Water Power*, Standard Book House.
4. Sahasrabudhe, S. F.*Irrigation Engineering and Hydraulic Structures*.Kataria Publications.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1505 ELECTIVE -I

CE 17P-15L1 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - I

Course Objectives: To practice the students in a computer package for building drawing and train the students to use the total station.

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

1. Familiarize with a civil engineering drawing software.
2. Draw all the relevant views of buildings using CAD software.
3. Acquaint one with the existing rules and regulations of buildings, stipulated by the National Building code and state building rules.
4. Plan a survey appropriately using Total station, take accurate measurements, field booking and plotting with the skill to understand the surroundings.

MODULE I

Introduction of a Popular Drafting Package:Basic Commands and simple drawings.

From the given line sketch and specification, develop working drawings (plan, elevation

and section) of the following buildings using CAD.

• Single storied residential building with flat and tiled roof (2drawings).

• Public buildings like office, dispensary, post office, bank etc. (1drawing).

• Factory building with trusses supported on Brick walls and pillars (1drawing).

Planning of Buildings(2 drawings)

Technical terms in building planning, Building rules, preparation of site plans and service plans as per building Rules.Planning and designing of residential buildings from given requirements of areas and specifications and preparation of working drawing.

MODULE II

Total station and Survey camp

Survey camp is conducted at the end of the semester. The use of total station is compulsory for survey work.

References:

1. National Building Code of India
2. Kerala Municipal Building Rules
3. Shaw andKale.*Building Drawing*.
4. Prabhu, B. T. S.*Building Drawing and Detailing*, Spades, Calicut.
5. Malik, R. S.and Meo, G. S. *Civil Engineering Drawing*.
6. Verma, B. P. *Civil Engineering Drawing and House Planning*. Khanna Publishers,Delhi.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 45 %minimum in the end semester examination for a pass.

SEMESTER VI

CE 17 P-1601 ARCHITECTURE AND TOWN PLANNING

Course Objective: Student will be able to design and to do functional planning of buildings with respect to the town planning rules and regulation

Course Outcomes: On completion of this course a student will be able to gain knowledge

1. In traditional and modern architecture.
2. In doing functional planning of buildings.
3. About evolution of towns, surveys, zoning, and planning town/city leading towards the development of a modern town.
4. In land use planning and prepare master plan with respect to planning regulations.

MODULE I

Principles of Architectural Design: Definition of Architecture – factors influencing architectural development, Qualities of Architecture, Creative and Design Principles in architecture Characteristic features of a style –historical examples from Neolithic, Egyptian, Roman and Gothic architecture.

MODULE II

Functional Planning of Buildings: Occupancy classification of buildings – general requirements of sites and building- building codes and rules – licensing of building works.
Functional planning of buildings such as institutional, public, commercial and industrial buildings.

Consideration of comfort factors such as acoustics, lighting, ventilation and thermal aspects.

MODULE III

Town Planning Theory: Evolution of towns – problems of urban growth-beginning of town planning acts – ideal towns –garden city movement – concept of new towns -comprehensive planning of towns. Re- planning of existing towns.

Survey –Necessity- Collection of data- types-uses-Methods-drawings-reports.

Zoning-Objects- principles-importance-advantage-transition zone-economy of zoning-zoning powers.

MODULE IV

Housing- classification of residential buildings- Agencies for housing- Housing finance agencies- problems of housing in India

Slums – causes- Characteristics- Effects-slum clearance schemes –Re-housing

Master Plan – Objects- –Necessity- Collection of data- drawings- features- Planning standards- Report

Neighborhood planning- Principles- importance- features, Public utility services, Green belt

Town Planning Legislations: Laws relating to land acquisition; urban land ceiling,UDPFI guidelines, disaster mitigation management; Environmental and Pollution Control Acts.

References:

1. Fletcher, B.*A History of world Architecture*.
2. Pickering, E.*Architecture Design*.
3. Hiraskar, G.K. *Great Ages of World Architecture*.
4. Rangwala, S. C.*Town Planning*. Charotar Publishing House.
5. Agarwala, S. C.*Architecture & Town Planning*. DhanpatRai& Co (P) Ltd.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1602 DESIGN OF STRUCTRES-II

CE 17P-1602 DESIGN OF CONCRETE STRUCTURES – II

Course Objectives:To give an introduction to pre-stressed concrete, special structural forms and detailing of RCC structural members.

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

1. Design footings and retaining walls.
2. Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing.
3. Analyze a Pre-stressed Concrete section and Estimate losses of pre-stressing.
4. Design water retaining structures.

MODULE I

Footings- Design of Isolated footings- axial and eccentric loading- Design of Combined footings- rectangular and trapezoidal footings.

Retaining walls – Design of cantilever retaining walls with horizontal and inclined surcharge- counterfort retaining walls.

MODULE II

Pre-stressed Concrete – General principles- systems of prestressing- materials for prestressing - **Loss of prestress**: Significance – Lump sum estimate – elastic shortening of concrete – time dependent losses – loss due to creep of concrete – loss due to shrinkage of concrete – loss due to steel relaxation – loss due to anchorage take up – loss or gain due to bending of members – practical considerations for frictional loss – theoretical considerations for frictional loss – total amount of losses elongation of tendons.

MODULE III

Analysis of sections for flexure: Stresses in concrete due to prestress – stresses in concrete due to loads – stresses in steel due to loads – discussion on moment curvature relationship of a prestressed concrete beam **Design of sections for flexure**: Preliminary design – general concepts of elastic design – elastic design with no tension in concrete – elastic design allowing tension – elastic design allowing and considering tension – ultimate design – arrangement of steel and prestressing in stages.

MODULE IV

Water tanks – design of circular, square and rectangular water tanks at ground level- design of overhead water tank (excluding supporting structure).

References:

1. Varghese, P. C.*LimitState Design of Reinforced Concrete*. PrenticeHall of India Ltd.
2. Ashok K Jain, A. K. *Reinforced Concrete Limit State Design*. Nem Chand Brothers, Roorkee.
3. Pillai, U. andMenon, D.*Reinforced Concrete Design*. Tata McGraw- Hill.
4. Krishnaraju, N. *Prestressed Concrete*. Tata McGraw- Hill.
5. Lin, T.Y.and Burns, N.H.*Design of prestressed concrete structures*. John Wiley & Sons, New York.

Type of Questions for End Semester Examination.

Question nos. I and II [with sub sections (a), (b), ...] (15 marks each with option to answer either I or II) from Module I.

Question nos. III and IV [with sub sections (a), (b), ...] (15 marks each with option to answer either III or IV) from Module II.

Question nos. V and VI [with sub sections (a), (b), ...] (15 marks each with option to answer either V or VI) from Module III.

Question nos. VII and VIII [with sub sections (a), (b), ...] (15 marks each with option to answer either VII or VIII) from Module IV.

CE 17P-1602 CONSTRUCTION SAFETY AND FIRE ENGINEERING

Course Objectives: To have a broad understanding of cause of accidents during construction due to improper work methods and prevention and codal provisions for fire protection of buildings.

Course Outcomes: On completion of this course,a student will be able to:

1. Recognize the importance of managing safety and health in construction and key legislation.
2. Report workplace accidents.
3. Understand correct working procedures and employee welfare provisions.
4. Identify types of hazards and ways to prevent accidents in different types of construction.
5. Understand the chemistry of fire and fire prevention methods.
6. Understand various standards to protect building and human life from fire hazards.

MODULE I

Introduction to Construction Industry and Safety: Basic concepts – accident – injury –lost time accidents, reportable accident, frequency rate, severity rate, incidence rate.

Technological, Organization and Behavioral Aspects of safety in construction, Human factors that are Impediments to safety in construction, Roles of different groups in ensuring safety, health, welfare and social security, Steps to be taken in construction sites in case of accidents, Introduction to ergonomics and its relevance to construction.

MODULE II

Safety in various construction operations such as soil excavation, rock blasting, dewatering, piling, demolition, working at heights-ladders and scaffolds, working in confined spaces, Safety in electrical works at construction site.

Safety in storage, stacking and handling of construction materials-cement, lime, aggregates, bricks and blocks, steel, glass, paint and varnish, flammable and hazardous materials used at sites.

Safety in the operation of construction equipments- excavators, trucks, tower cranes, mobile cranes, lifting tackles, chain and pulley, Personal protective equipment’s for construction.

MODULE III

Classification of fire. Effect of high temperature on the properties of concrete, steel, masonry, wood, Fire damage to concrete, steel, masonry and timber, Repair techniques to the fire damaged reinforced concrete columns, beams, slabs and to the steel structural members.

MODULE IV

Design principles of fire resistant walls.

Classification of buildings based on occupancy, types of construction as per National Building code of India; Fire zones; General Requirements of fire protection for all individual occupancies.

Life safety aspects of building fires – Exit Requirements as per NBC of India. Requirements other than general requirements for buildings of different occupancy classification.

References:

1. Vaid, K. N. *Construction Safety Management*.
2. Smith and Harmathy.*Design of Buildings for Fire Safety*.
3. National Building Code of India, Part –IV and VII
4. Linger, L. *Modern Methods of Material Hand ling*.
5. Merchant, E. W. *A Complete Guide to Fire and Buildings*.
6. Jain, V. K.*Fire Safety in Buildings*. New Age International (p) Ltd., New Delhi.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1604 CONSTRUCTION MANAGEMENT

Course Objectives: To enable the students to develop an ability to influence project planning and to manage pre-construction activities andto inculcate how to control project schedule, cost, quality and risk.

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

1. Understand principles of effective leadership.
2. Read and interpret construction documents and specifications.
3. Create schedules; bar charts, critical path networks.
4. Identify types of float and the use of float to manage projects.
5. Correlate manpower and cost loading to schedule.
6. Understand the uses and working of various equipments involved in construction.
7. Identify all activities and issues related to planning, financing, procuring, constructing, and managing the built environment.

MODULE I

Organization and Management:Concept of organization, characteristics of organization,elements of organization, organizational structures, organization charts,

Types of organization formal line, military or scalar organization, functional organization, line and staff organization, project organization, matrix organization, management by objectives.
Organizational conflict, group Dynamics, Organizational change, motivation and leadership, Authority and responsibility, span of control, Delegation of authority. – Centralization and decentralization.

MODULE II
Construction Planning:Objects of planning – stages of construction – Construction team – resources of construction industry – planning and scheduling – scheduling using bar charts - limitations of bar chart – Material, Labour, Equipment, Financial schedules.
Construction Contracts- Contracting procedure-Types of contracts-tenders– prequalification procedure - earnest money deposit – security deposit - contract document

MODULE III
Network Techniques– Difference between CPM and PERT – development of a network – representation of various activities and events in a CPM network – Network logic – network calculation-Float- Slack –Critical path– Crashing the programme – Time cost trade off – Resource Smoothing-leveling.

MODULE IV
Construction Equipments: Earth Moving and Excavating– Bull dozer, Scraper, power shovel, dragline, Clam shells, – Hauling and Conveying equipments – Trucks , Cranes, Pile driving Equipment, Aggregate crushers.
Introduction to Equipment Economics:Owning and Operating Costs, Factors for selection of equipment.

References:

1. Srinath, L. S. (1995).*An Introduction to Project Management*. Tata McGraw Hill publications.
2. Arora and Bindra.*Building construction Planning Techniques and methods of construction*. Dhanpatrai& Sons.
3. Peurifoy and Schexnayder.*Construction Planning, Equipment and Methods*. Tata McGraw Hill.
4. Gahlot and Dhir.*Construction Planning and Management*. New Age International.
5. Khanna, O.P.*Industrial Engineering and Management*. DhanapatRai Publications.
6. Mazda, F. (1998). *Engineering management*. Addison Wesley, Longman Ltd.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17 P-1605 ELECTIVE II

CE17P-16L1: SEMINAR & PROJECT PRELIMINARIES

Course Objectives:

To encourage and motivate the students to read and collect recent and relevant information from their area of interest confined to the relevant discipline from technical publications including peer reviewed journals, conferences, books, project reports, etc., prepare a report based on a central theme and present it before a peer audience.

Course Outcomes:

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

1. Identify and familiarize with some of the good publications and journals in their field of study.

2. Acquaint oneself with preparation of independent reports, name them based on a central theme and write abstracts, main body, conclusions and reference identifying their intended meaning and style.

3. Understand effective use of tools of presentation, generate confidence in presenting a report before an audience and improve their skills in the same.

4. Develop skills like time management, leadership quality and rapport with an audience.

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Civil Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and

textbooks and technical reports. The references shall be incorporated in the report following International standards reflecting the state-of-the-art in the topic selected. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

SEMESTER VII

CE 17P-1701 EARTHQUAKE ENGINEERING

Course Objectives: To introduce the response of structures to the most vulnerable hazard to them, earthquakes and the principles of seismology and design of structures to lessen the ill-effects of earthquakes.

Course Outcomes: On completion of this course a student will be able to

1. Develop an insight into the causes for the occurrence of earth quakes, characteristics of earth quake ground motion and how the strong motion data help generating design earth quake motions.
2. Assimilate the importance of the structural configuration of buildings to make it earth quake resistant and thereby mitigate the damages caused.
3. Analyze the response of a structure due to earth quake ground motion.
4. Practice guidelines for an efficient seismic resistant design and construction.

MODULE I

Earthquake Ground Motion: Causes of earthquake- Seismic waves-Intensity and Magnitude of earthquake-Energy released in an earthquake-earthquake frequency- seismic zones in India-**strong motion**-source effect-path effect-site effect-use of strong motion data; strong motion characteristics-**Response spectrum**-types of response spectra-design spectrum.

MODULE II

Seismic Resistant Building Architecture: Seismic effects on structures-Inertia forces-deformations-horizontal and vertical shaking-Importance of architectural features-effects of irregularity-Lateral load resisting systems-**Building Characteristics**-Mode shapes and fundamental period, Building frequency and ground period, Damping, Ductility, Seismic weight, Hyperstaticity, Non structural elements, foundation soil/Liquefaction, foundations-Quality of construction and materials.

MODULE III

Structural Dynamics: Dynamic analysis, Types of dynamic loading, Structural vibrations, Free vibrations and forced vibrations- Response of the system towards loading, Degrees of freedom, SDOF and MDOF systems-Vibration analysis of SDOF systems- Free vibration of un-damped SDOF system- free vibration of viscously damped SDOF systems - Forced vibration of SDOF systems-harmonic excitation-base motion-principles of vibration isolation-determination of damping coefficient, Vibration measuring instruments, Response of a system to support motion.

MODULE IV

Lateral Loads: IS 1893 based determination of design lateral forces in multi-storey RC buildings.

Soil structure interaction effects: direct approach-sub structure approach (description only).

Ductility requirements of RC buildings: displacement ductility-rotational ductility-considerations based on IS13920 in flexural members, columns, joints of frames (description only).

References:

1. Agarwal, P. and Shrikhande, M.*Earthquake Resistant Design of Structures*. Prentice Hall of India Pvt Ltd, New Delhi.
2. Duggal. *Earthquake Resistant Design of Structures*. Oxford University Press.
3. Park, R. and Paulay, T.*Reinforced Concrete Structures*. John Wiley.
4. Chopra, A. K.*Dynamics of Structures*. Pearson Education Pvt. Ltd.
5. Paz, M.*Structural Dynamics: Theory and Computation*. CBS Publishers & Distributors, New Delhi.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

CE 17P-1702 ELECTIVE III

CE17P-17L1 COMPUTER APPLICATIONS IN CIVIL ENGINEERING - II

Course Objectives: To introduce certain commonly used software in civil engineering, especially for structural design and construction management so as to motivate the students to use them judiciously after thorough comparison of typical results with manual calculations and develop independent computer programs for civil engineering applications.

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

1. Identify the available open source software tools used for specific problems in Civil Engineering.
2. Familiarize with a structural design software and develop capabilities to undertake analysis and design works with the help of such software.
3. Familiarize with a construction management software and develop capabilities to plan and schedule construction activities with the help of such software.
4. Interpret the results available through computer output with the theory learnt in classrooms.

Using STAAD of Equivalent package

1) Analysis & Design of truss system
2) Analysis & Design of steel frames
3) Analysis & Design of RC frame
4) Analysis & Design of combined steel truss and RC frame (Auditorium)
5) Design of footings

Using Primavera or MS project or equivalent package

Identification of activities and preparation of bar chart and

Network diagram of following projects

1) Construction of multi-storey building
2) Installation of new water supply scheme
3) Construction of high way

References:

1) STAAD Reference Manual / Equivalent package reference manual.

Note: 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and* 45 %*minimum in the end semester examination for a pass.

CE 17P-17L2 PROJECT

Course Objectives: To enable students to apply any piece of theory and experiments which they have learned to a specific problem related to industry / research which is identified with the help of a guide in Phase I and solve it.

Course Outcomes: On completion of this course a student will be able to

1. Realize various steps involved in conducting a project work, like literature survey, methodology adopted – field study / survey / experiments / numerical work, analysis of the data to arrive at final results and conclusions, etc.
2. Initiate a habit of proper report writing with all of its major components, proper style of writing and preparation of a distinct abstract and carved out conclusions.
3. Conceive the pros and cons of working in a team and the wonderful results which could evolve through team-work.
4. Present and defend self-prepared and corrected report (with the help of project guide) of a self-created work to a peer audience.

Each batch of students shall develop the project started during the VII semester.

- A detailed project report in the prescribed formal shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report.
- The work shall be reviewed and evaluated periodically.

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide and shall include the following.

- Presentation of the work
- Oral examination
- Quality and content of the project report

Guidelines for evaluation:

i. Regularity and progress of work	50	
ii. Work knowledge and involvement	50	
iii. End semester presentation and oral examination		50
iv. Project Report – Presentation style and content		50
	Total	200 marks

Note: Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(iv) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

CE 17P-17L3: COMPREHENSIVE VIVA - VOCE

Course Objectives:

To test the student's learning and understanding of the theory and applications of the various concepts taught during the entire course of their programme and to prepare the students to face interviews in both the academic and industrial sectors.

Course Outcomes:

The student will be able to:

1. Refresh all the subjects covered during the programme

2. Gain good knowledge of theory and practice

3. Develop oral communication skills and positive attitude

4. Face technical interviews with confidence

Each student is required to appear for a comprehensive viva-voce examination at the end of the complete course work. The examination panel shall comprise of a minimum of one internal examiner and one external examiner, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the entire course of study and practical/analysis skills in the field.

ELECTIVES

E1 FINITE ELEMENT METHOD

Course Objectives: To introduce the students in to the realm of the most versatile, highly practiced and thoroughly researched numerical method in engineering and mathematics, the finite element method systematically, in the domain of solid mechanics.

Course Outcomes: On completion of this course a student will be able to

1. Conceive the requirement of approximate solution in engineering and the concepts of one-dimensional finite element formulation.
2. Understand clearly two-dimensional finite element formulation in the domain of linearly elastic and isotropic solid mechanics and convergence requirements.

3. Practice various numerical integration procedures which are essential part of the FEM and convince about the assembly and imposition of boundary conditions in the FEM.
4. Extend the basics of the FEM to three-dimensional problems and to higher order elements and their employment in the method.

MODULE I

Fundamental Concepts: Mathematical model of an engineering problem – boundary value and initial value problems, Requirement of approximate solution, the basic procedure of the finite element method explained through the problem of total elongation of a tapering bar, the idea of approximation and interpolation, concept of finite elements.

One-dimensional finite element procedure: Weighted residual problem with special mention to Galerkin method, Strong and weak formulation of the governing equations, Essential and natural boundary conditions, One-dimensional elements – two-noded and three-nodedLagrangian bar elements, Beam element (Hermitian element), development of shape functions, application to cable problem, column buckling problem, General truss element, solution of a truss problem.

MODULE II

Two-dimensional finite element procedure through elastic solid mechanics: Revisiting the equilibrium equations, compatibility equations, strain-displacement equations and constitutive equations (assuming isotropy) for plane stress and plane strain problems, Displacement function, Convergence and compatibility requirements, Finite element formulation through the principle of stationary potential energy.

Element properties: Three-noded triangular elements, area co-ordinates, development of shape functions, 4-noded square element in the natural coordinate system, shape functions, iso-parametric, sub-parametric and super-parametric elements, the concept of mapping in FEM, Serendipity elements, computation of nodal load vector.

MODULE III

Numerical integration: Importance of numerical integration in the FEM, Trapezoidal rule, Simpson's rule, Error term, Newton-Cotes rule, Gauss-Legendre rule, Changing limits of integration, Multiple integrals (integration in two and three dimensions), Numerical integration over quadrilateral elements, Numerical integration over triangular elements.

The concept of Assembly in the FEM: Degrees of freedom in element level and global level, Element stiffness matrices, global stiffness matrices, algebraic equations involving the matrices, assembly procedure explained through with one and two-dimensional examples.

Imposition of boundary conditions and solution: The method of imposing boundary conditions in an FE formulation, Solution of equations – Gauss elimination and Gauss-Siedel methods, Newton-Raphson method.

MODULE IV

Three-dimensional finite element formulation: Galerkin formulation of linearly elastic problems, basic three-dimensional elasticity equations, three-

dimensional linear finite elements – rectangular prism, triangular prism, tetrahedron, element properties.

Higher order 2D and 3D elements in the FEM: Six-noded triangle, nine and eight-noded quadrilateral, static condensation, twenty-noded brick element, applicability of the elements.

Reference:

1. Reddy, J. N.(2005).*An Introduction to the Finite Element Method*, Tata McGraw-Hill.
2. Cook, R. D., Malkus, D. S., Plesha, M. E. and Witt, R. J.*Concepts and Applications of Finite Element Analysis*, John Wiley & Sons, Inc.
3. Zienkiwicz, O. C., Taylor, R. L. and Zhu, J. Z., (2006).*The finite element method: Its basis and fundamentals*. Elsevier.
4. Krishnamoorthy, C. S. (1994), *Finite Element Analysis – Theory and Programming*.Tata McGraw-Hill, New Delhi.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

E2 DESIGN OF SPECIAL STRUCTURES

Course Objectives: To introduce special concrete and steel structures like, shear walls, folded plates, shells, deep beams, bunkers, silos, space trusses, power transmission towers, etc. so that students can appreciate the effort behind design and construction of such structures and to motivate students to take up such designs, confidently.

Course Outcomes: On completion of this course a student will be able to

1. Assimilate the basics of design of special RC structures, flat slabs and folded plates and appropriate use of them in building construction.
2. Conceive the importance of shell geometry and associated theory and design certain spatial structures.
3. Enter in to the world of design of power plant and power transmission structures.
4. Design concrete members reinforced with non corrosive FRP bars in place of steel as conventional bars.

MODULE I

Design of Special RC Elements
Design of RC walls - Ordinary walls and shear walls - Design of Corbels - Deep beams and grid floors.
Design of Flat Slabs and Folded Plates
Design of flat slabs. Design of folded plates- Folded Plate structures - structural behaviour - Types - Design by ACI - ASCE Task Committee method

MODULE II

Design of Shell Structures
Membrane theory of shells-Classification of shells - Types of shells - Structural action- Membrane theory - Shells of revolution and shells of translation - Examples - Limitations of membrane theory.
Design of Spatial Structures
Space frame - design philosophy-Space frames - configuration - types of nodes – general principles of design Philosophy – Behavior. Analysis of space frames - Formex Algebra, FORMIAN - Detailed design of Space frames.

MODULE III

Design of Power Plant Structures
Bunkers and Silos - Chimneys and Cooling Towers - High Pressure boilers and piping design – Nuclear containment structures.
Analysis and Design of Power Transmission Structures
Analysis and design of Transmission Line Towers, Types of bracing patterns - Sag and Tension calculations. Substation Structures, Tower foundations-Design of foundations for towers - Structural design of supports for foundation excavation design of ground anchors

MODULE IV

Structural design with FRP bars
Fibre Reinforced Polymer (FRP) bars-Introduction- Materials and manufacturing-Properties of FRP reinforcing bars-Design basis for FRP reinforced concrete, under reinforced section, over reinforced section, Design of FRP reinforced flexural members, Design procedure for Serviceability, design for shear and FRP reinforcement detailing.

References:

1. Purushothaman, P.(1986). *Reinforced Concrete Structure Structural Elements: Behavior Analysis and Design*.TataMcGraw Hill.
2. Krishnaraju, N. (1986). *Advanced Reinforced Concrete Design*. CBS Publishers and Distributors.
3. Ramasamy, G. S.(1986). *Design and Construction of Concrete Shells Roofs*. CBS Publishers.
4. Subramanian, N.(1999). *Principles of Space Structures*. Wheeler Publishing Co.
5. Santhakumar, A. R. and Murthy, S. S.(1992). *Transmission Line Structures*. Tata McGraw Hill.
6. Raina, V.K. (1991). *Concrete Bridge Practice.* Tata McGraw Hill Publishing Company, New Delhi.
7. Krishnaraju, N.(1988). *Design of Bridges*. Oxford and IBH Publishing Co., New Delhi.
8. Ponnuswamy, S. (1989). *Bridge Engineering*. Tata McGraw Hill.
9. Thomlinson, M.J. and Boorman, R.(1995). *Foundation design and construction*. 4th edition, ELBS Longman.

Note: *Relevant IS codes are permitted during the Examination.*

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

E4 GROUND IMPROVEMENT TECHNIQUES

Course Objectives: To impart knowledge regarding the various ground improvement techniques that an engineer has when encountered with problematic soils at a site.

Course Outcomes: On completion of this course a student will be able to

1. Understand the ground conditions and suggest ground improvement techniques.
2. Design sand drain as per field requirements**.**
3. Understand and suggest different grouts / grouting techniques for various field conditions.
4. Gain knowledge regarding reinforced earth and its application areas including geo-synthetics.

MODULE I

Introduction to Ground improvement techniques: Role of ground improvement in foundation engineering- Factors affecting choice of ground improvement techniques- Geotechnical problems in alluvial, lateritic and black cotton soils

Drainage and Dewatering: well point system, shallow & deep well system, vacuum dewatering, electro osmosis

Chemical and Thermal Methods of stabilization: cement stabilization-types of soil cement-factors affecting soil cement mixing

Lime stabilization-effect of lime on soil properties – Brief description of Electrical and Thermal methods.

MODULE II

In-situ densification methods in granular soils: Introduction-mechanical stabilization-deep dynamic compaction-vibro compaction- blasting

In-situ densification methods in cohesive soils: Preloading- Concept of three dimensional consolidation –preloading with sand drains- sand drain design and methods of their installation – prefabricated vertical drains- stone columns & lime piles (installation techniques only).

MODULE III

Introduction to grouts and grouting- basic functions -Classification of grouts -Grout ability Ratio.

Properties of grouts: viscosity, fluidity, stability, rigidity, thixotropy, permeance.

Methods of grouting – Permeation grouting, Compaction grouting, jet grouting, Hydro fracturing.

Grouting technology – ascending and descending stages.

Grouting applications: seepage control in soil and rock under dams- seepage control in soil for cut off walls –stabilization grouting for underpinning.

MODULE IV

Earth Reinforcement- Concept of reinforced earth –Reinforcing materials- Backfill – construction of reinforced earth wall- Stability analysis of reinforced earth retaining walls- external stability analysis, internal stability analysis (brief mention about the methods only) - application areas of reinforced earth structures.

Geosynthetics: Classification- Functions of geotextiles as separators, reinforcement, filters and in drainage- damage and durability of geotextiles- Natural Geotextiles and its application.

Reference:

1. Tomlinson, M.J. *Foundation design and construction*.
2. Koerner, R. M. *Construction and Geotechnical Methods in Foundation Engineering*.McGraw Hill.
3. Jones, C.J.F.P.*Earth Reinforcement and soil structures*. Butterworths.
4. Bell, F.G. (1983).*Foundation Engineering in Difficult Ground*. Butterworth, London.
5. Purushothamaraj, P.*Ground Improvement techniques*. LaxmiPublications(P) Ltd., New Delhi.
6. Gulhati, S. K.andDatta, M.*Geotechnical Engineering*. Tata McGraw Hill.
7. Babu, G.L. S.*An Introduction to Soil Reinforcement and Geosynthetics*.
8. Beena, K.S.*Soil improvement and Coir Geotextiles*. Cochin University Publications.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

E5 PAVEMENT ANALYSIS AND DESIGN

Course Objective: To equip the students to carry out design and evaluation of flexible and rigid pavements in varied field conditions.

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

1. Identify the pavement components and compare highway and airport pavements.
2. Calculate stresses and ESWL in flexible pavements and design the flexible pavement.
3. Calculate the combined stresses due to temperatureand wheel load stress and design rigid pavements by IRC method.
4. Evaluate pavements.

MODULE I

Introduction:types and component parts of pavements - Functions of various layers of pavements-prime coat, tack coat, seal coat- factors affecting design and performance of pavements - comparison between highway and airport pavements – functions and significance of sub grade properties – various methods of assessment of sub grade soil strength for pavement design - cause and effects of variations in moisture content and temperature - depth of frost penetration - design of bituminous mixes by Marshall method.

MODULE II

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - Burmister theory - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi - empirical and theoretical approaches for flexible pavement design - group index, CBR, -IRC method ,triaxial, Mcleod and Burmister layered system methods.

MODULE III

Rigid Pavements:Westergaard's approach-Bradbury's stress coefficients-IRC method of design. Temperature Stresses in Concrete pavements-Warping stress-Frictional Stress-Combination of stresses. Joints in Concrete pavements-Necessity-requirements-Types-Expansion joints-Contraction Joints-Construction joints, Design of joints-dowel bars and tie bars.

MODULE IV

Pavement evaluation:structural and functional evaluation of flexible and rigid pavements - pavement distress - evaluation of pavement structural condition by Benkelman beam rebound deflection, design of flexible pavement overlay using BBD data.

References:

1. Huang, Y.H. *Pavement Analysis and Design*. Second Edition. Dorling Kindersley (India) Pvt. Ltd., New Delhi, India.
2. Khanna, S.K., Justo and Raghavan, V. *Highway Engineering*.NemChand and Bros.
3. IRC: 37-2012 Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi.

4. IRC: 58-2011 *Guidelines for the Design of Plain Jointed Rigid Pavements for Highways*, The Indian Roads Congress, New Delhi.
5. IRC 81-1981 *Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques*.
6. Mallick, R.B. and T. El-Korchi.*Pavement Engineering – Principles and Practice*. CRC Press, Taylor and Francis Group, Florida, USA.
7. Ministry of Road Transport and Highways. *Specifications for Road and Bridge Works*, Fifth Edition, Indian Roads Congress, New Delhi, India.
8. Papagiannakis, A.T. and Masad, E.A. *Pavement Design and Materials*. John Wiley and Sons, New Jersey, USA.
9. Yoder, E.J. and Witczak, M.W. *Principles of Pavement Design*. Second Edition, John Wiley and Sons, New York.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

E6 SOLID WASTE MANAGEMENT

Course Objectives: To gain insight into sustainable technologies for collection, transfer and transport of municipal solid waste and hazardous waste management, and develop ability to design and operate municipal solid waste landfill with an emphasis in cost effective engineering systems for resource and energy recovery.

Course Outcomes: On completion of this course a student will be able to

1. Identify the sources and composition of solid waste and integrated waste management approach which is beneficial for society.
2. Demonstrate an ability to choose sustainable technologies for storage, transport and processing of solid wastes.

3 Identify the types and design of cost effective technologies for landfill disposal and its operation
4 To develop a student's skill in hazardous waste management.

MODULE I

Solid wastes: Types and sources – need for solid waste management – Elements of integrated waste management – Salient features of Indian legislations on management and handling of municipal solid wastes, Solid Waste generation rates and variation: Composition, physical, chemical and biological properties of solid wastes –waste sampling and characterization plan – Source reduction of wastes – Recycling and reuse – waste exchange

MODULE II

Storage, Collection and Transport of wastes: Handling and segregation of wastes at source – storage and collection of municipal solid wastes – analysis of collection systems – need for transfer and transport – transfer stations - Optimizing waste allocation.

Waste Processing Technologies : Objectives of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of composting – thermal conversion technologies and energy recovery – incineration.

MODULE III

Municipal Solid Waste Disposal : Waste disposal options – Disposal in landfills – Landfill Classification, types and methods – site selection – design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills- landfill remediation

MODULE IV

Household hazardous waste management: Definition and identification of hazardous wastes, sources and characteristics-hazardous wastes in municipal waste-minimization of hazardous waste-compatibility, handling and storage of hazardous waste-collection and transport, Regulatory requirement for identification, characterization and disposal of hazardous, nonhazardous and domestic wastes.

References:

1. Tchobanoglous, G., Theisen, H. and Vigil, S. A.(1993). *Integrated Solid Waste Management*. McGraw-Hill International edition, New York.
2. CPHEEO (2000). *Manual on Municipal solid waste management*. Central public Health and Environmental Engineering Organization, Government of India, New Delhi.
3. Michael, D. LaGrega, Buckingham, P. L.and Jeffrey, C.E.(2011). *Environmental resources Management, Hazardous waste Management*. McGraw-Hill International edition, New York.
4. Peavy, H.S., Rowe, D. R. and Tchobanoglous, G.(1985). *Environmental Engineering*. McGraw Hill, New York.
5. Vesilind, P. A., Worrell, W. and Reinhart, D. (2002). *Solid Waste Engineering*. Brooks/Cole Thomson Learning Inc.
6. Wentz, C. A. *Hazardous waste Management*.MCGraw-HillPublication.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.

E8 REMOTE SENSING AND GIS

Course Objectives: To retrieve the information content of remotely sensed data, analyze the energy interactions in the atmosphere and earth surface features, interpret the images for preparation of thematic maps, apply problem specific remote sensing data for civil engineering applications, introduce the fundamentals and components of Geographic Information System, provide details of spatial data structures and input, management and output processes.

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

1. Understand the concepts and foundations of remote sensing.

2. Learn visual image interpretation.
3. Understand spatial data modeling and analytical modeling
4. Obtain output from new maps.

MODULE I

Remote sensing: Definition-Components of Remote sensing - Energy, Sensor, Interacting Body - Active and passive Remote Sensing – Platforms - Aerial and Space Platforms-Balloons, Helicopters, Aircraft and Satellites - Synoptivity and Repetivity – Electro Magnetic Radiation (EMR) - EMR spectrum-visible, Infra Red (IR), near IR, Middle IR, Thermal IR and Microwave - Black Body Radiation – Planck's law - Stefan-Boltzman law.

EMR Interaction with Atmosphere and Earth Materials : Atmospheric characteristics-Scattering of EMR - Raleigh, Mie, Non–selective and Raman Scattering - EMR Interaction with Water vapour and ozone – Atmospheric Windows – Significance of Atmospheric windows - EMR interaction with Earth Surface Materials, Radiance, Irradiance, Incident, Reflected, Absorbed and transmitted energy -Reflectance – Specular and diffuse reflection surfaces - Spectral Signature – Spectral Signature curves EMR interaction with water, soil and earth surface.

MODULE II

Optical and Microwave Remote Sensing : Satellites – Classification based on orbits - Sun Synchronous and Geo Synchronous - based on purpose - Earth Resources Satellites, communication satellites, weather satellites, spy satellites – Satellite sensors - Resolution-Spectral, Spatial Radiometric and Temporal Resolution, description of Multispectral Scanning, Along and Across Track Scanners - Description of sensors in Landsat , SPOT, IRS series- Current Satellites – Radar-Speckle-Back Scattering – Side Looking Airborne Radar - Synthetic Aperture Radar – Radiometer - Geometrical characteristics.

MODULE III

Geographic Information system (GIS) : GIS – Components of GIS – Hardware, Software and Organizational Context - Data-Spatial and Non – Spatial, Maps - Types of Maps, Projection - Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structure, Analysis using Raster and Vector data-retrieval, Reclassification, Overlaying , Buffering – Data Output – Printers and Plotters.

MODULE IV

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Images, Image enhancement, Filtering , Classification – Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS, Urban Applications – Water resources – Urban Analysis - Watershed Management - Resources Information systems.

References:

1. Lillesand, T. M., Kiefer, R. W.andChipman, J. W.*Remote Sensing and Image Interpretation*. JohnWiley & Sons.
2. Sabinne.*Remote Sensing Principles and Interpretation*.W.H.Freeman& Co.
3. BurroughandMcDonnel.*Principles of GIS*. Oxford University Press.
4. Heywood, J., Cornelius, S.and Carver, S.*An Introduction to GIS*. Pearson Education.

Type of Questions for End Semester Examination.

PART A: Question No. I (a) to (j) – Ten short answer questions of 2 marks each with at least two questions from each of the four modules ($10 \times 2 = 20$ marks).

PART B: ($4 \times 10 = 40$ marks)

Question nos. II and III [with sub sections (a), (b), ...] (10 marks each with option to answer either II or III) from Module I.

Question nos. IV and V [with sub sections (a), (b), ...] (10 marks each with option to answer either IV or V) from Module II.

Question nos. VI and VII [with sub sections (a), (b), ...] (10 marks each with option to answer either VI or VII) from Module III.

Question nos. VIII and IX [with sub sections (a), (b), ...] (10 marks each with option to answer either VIII or IX) from Module IV.