Syllabus and Curriculum

of

B.Tech in Engineering

Common to all branches

(Combined 1st and 2nd semesters)

University of Calicut

(2014 admission)

SCHEME OF COMBINED I & II SEMESTERS B.Tech

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/D	Internal	End Semester		
EN14 101	Engineering Mathematics I	2	1	0	50	100	3	4
EN14 102	Engineering Mathematics II	2	1	0	50	100	3	4
EN14 103	Engineering Physics	2	0	0	50	100	3	3
EN14 103(P)	Engineering Physics Lab.	0	0	1	50	-	-	1
EN14 104	Engineering Chemistry	2	0	0	50	100	3	3
EN14 104(P)	Engineering Chemistry Lab.	0	0	1	50	-	-	1
EN14 105	Engineering Mechanics	2	1	0	50	100	3	6
EN14 106	Basics of Civil and Mechanical Engg.	2	0	0	50	100	3	4
EN14 107	Basics of Electrical and Electronics & Communication Engg.	2	0	0	50	100	3	4
EN14 108	Engineering Graphics	1	0	3	50	100	3	6
EN14 109	Humanities and Communication Skills	2	1	0	50	100	3	2
EN14 110 (P)	Mechanical Workshops	0	0	2	100	-	-	2
EN14 111 (P)	Electrical & Civil Workshops	0	0	2	100	-	-	2
	TOTAL	17	4	9	750	900		42

EN14 101 ENGINEERING MATHEMATICS I

(Common for all B.Tech. programmes)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- *To provide an avenue to scientific knowledge which opens new vistas of mental activity.*

A sound knowledge of engineering mathematics is a "sine qua non" for the modern engineer to attain new heights in all aspects of engineering practice

- *To provide the student with plentiful opportunities to work with and apply the concepts, and to build skills and experience in mathematical reasoning and engineering problem solving.*

Module I: Differential Calculus (18 hours)

Indeterminate forms – L'Hopitals rule – Radius of curvature in Cartesian form (No proof)– Center of curvature (No proof) – Evolute – Functions of more than one variables - Idea of Partial Differentiation – Euler's theorem for Homogeneous functions – Chain rule of Partial differentiation – Jacobians – Maxima and Minima of functions of two variables.

Module II: Infinite Series (18 hours)

Definition of Convergence and Divergence of Infinite series – Ratio test – Comparison test – Raabe's test – Root test – Series of positive and negative terms – Absolute convergence – Test for Alternating series – Power series – Interval of Convergence – Taylor's series expansion of functions (No proof) – Maclaurin's series expansion of functions (No proof) – Leibnitz formula for the n^{th} derivative of product of two functions – Its use in Taylor's and Maclaurin's series expansions.

Module III: Matrices (24 hours)

Rank of a matrix – Reduction of a matrix to Echelon form – System of Linear equations – System of non-homogeneous Linear equations; Consistency of system of non-homogeneous Linear equations – System of Homogeneous Linear equations; Consistency of system of homogeneous Linear equations – Gauss's elimination method – Characteristic equation - Cayley-Hamilton Theorem – Characteristic Values and Characteristic Vectors – Diagonalisation of non-symmetric matrices using similarity transformation – Diagonalisation of real-symmetric matrices using orthogonal transformation – Quadratic forms – Definite, Semi-definite and Indefinite forms – Reduction of Quadratic forms to sum of squares by orthogonal transformation.

Module IV: Fourier series and Harmonic Analysis (18 hours)

Fourier series – Euler Formulae – Even and Odd functions – Fourier series of Even and Odd functions – Functions having arbitrary period – Fourier series of Functions having arbitrary period – Half-range expansions – Numerical method for determining Fourier coefficients.

Reference books

1. Michael D Greenberg, *Advanced Engineering Mathematics,* Pearson Education Asia.
2. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II*., Prentice Hall of India.
3. Ahsan Akhtar, Sabiha Ahsan, *Textbook of Diffrential Calculus*, Prentice Hall of India.
4. Glyn James., *Advanced Engineering Mathematics*, Pearson Education Asia.
5. Dr.ChandraMohan, Dr.Vargheese Philip, *Engineering Mathematics I,II,III & IV* , Sanguine Technical Publishers.
6. Bikas Chandra Bhui, Dipak Chatterjee, Prasun Chatterjee, *Engineering Mathematics Vol.1*, Vikas Publishing House.
7. V.Sundaram, R.Balasubramanian, K.A. Lakshminarayanan, *Engineering Mathematics, 6/e*., Vikas Publishing House.
8. J.P.Singh, *Calculus, 2/e*, Ane Books Pvt.Ltd.
9. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN14 102 ENGINEERING MATHEMATICS II

(Common for all B.Tech. Programmes)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objective

- *To apply the subject at the proper place and time, while keeping him/her aware to the needs of the society where he/she can lend his/her expert service, and also to those who can be useful to the community without even going through the formal process of drilling through rigorous treatment of mathematics.*

Module I: Ordinary Differential Equations (24 hours)

Equations of first order – Separable, Homogeneous, reducible to Homogeneous and Linear, Bernoulli‘s and Exact Equations – Orthogonal trajectories – Linear second order equations – Homogeneous Linear equation of second order with constant coefficients – Non-Homogeneous Linear equation of second order with constant coefficients – Solutions of Linear equations of second order with variable coefficients (Only Cauchy‘s equation) – method of variation of parameters.

Module II: Laplace transforms (18 hours)

Gamma and Beta functions – Definitions and simple properties – Laplace transform – Inverse Laplace transform – shifting theorems – Transforms of derivatives – Transforms of integrals – Differentiation of transforms – Integration of transforms – Convolution theorem (No proof) – Transform of Unit step function – Transform of Impulse function – transforms of periodic functions – Solution of ordinary differential equations using Laplace transform.

Module III: Vector Differential Calculus (18 hours)

Vector function of a Single Variable – Differentiation of vector functions – Scalar and Vector fields – Gradient of Scalar fields – Divergence and Curl of Vector Fields – their properties – Physical meanings – Relations between the vector differential operators.

Module IV: Vector Integral Calculus (18 hours)

Line, Surface and Volume integrals – Line integrals independent of the Path – Green‘s Theorem in the plane – Gauss Divergence Theorem – Stoke‘s Theorem (Proofs of these theorems are excluded).

Reference books

1. Wylie C.R and L.C. Barrent, *Advanced Engineering Mathematics*, McGraw Hill.
2. Kreyzig E., *Advanced Engineering Mathematics*, Wiley eastern.
3. Piskunov N., *Differential and Integral calculus*, MIR Publishers.
4. Ayres F., *Matrices*, Schaum‘s Outline Series, McGraw Hill.
5. Glyn James., *Advanced Engineering Mathematics*, Pearson Education Asia.
6. Peter V O‘Neil, *Advanced Engineering Mathematics*, Thomson India Edition.
7. Bikas Chandra Bhui, Dipak Chatterjee, Prasun Chatterjee, *Engineering Mathematics Vol.1*, Vikas Publishing House.
8. Abhimanyu Singh, *Applied Mathematics II*, Ane Books Pvt.Ltd.
9. Thomas A. Garrity, *All the Mathematics you missed*, Cambridge University Press.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall e bminimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 103: ENGINEERING PHYSICS

(Common to all Branches)

Teaching scheme : 2 hours per week **Credits: 3**

Objectives

- ***To impart the basic concepts and ideas in physics.***
- ***To develop scientific attitudes and enable the students to correlate the concepts of physics with the core* programmes.**

Module-1 (13 hours)

Interference- Basic concepts-Types of interference-Interference in thin films -Plane parallel films-Colours of thin films in reflected and transmitted light- Interference in wedge shaped films-Application in testing of optical flatness- Newton's Rings-Theory and expression for the radii of dark and bright rings in reflected system-Applications- Measurement of wave length of a monochromatic light and refractive index of a liquid.

Diffraction of light-Fresenls and Fraunhoffer classes-Difraction grating-Simple theory of plane transmission grating (normal incidence)-Resolving and dispersive powers of a grating with expressions (no derivation)-Determination of wavelength of monochromatic light using plane transmission grating.

Ultrasonics -Properties of ultrasonic waves- Piezo-electric and magnetostriction effect-Production of ultrasonic waves by piezo-electric effect method. Accoustic grating-Determination of velocity of ultrasonic waves in a liquid using ultrasonic diffractometer.- Important engineering applications of ultrasonic waves.

Module-2. (13 hours)

Polarisation-Basic concepts-Production of polarised light-Double refraction-Optic axis and principle plane-Huyghens explation of double refraction in uniaxial crystals-Positive and negative crysatals-Nicol prism-Construction and working (as polarizer and analiser)-Quarter wave and Half wave plates-Superposition of plane polarised light-Theory (analytical analysis) of elliptical and circularly polarised light- Experimental methods for producing and detecting linearly, elliptically and circularly polarized lights-Polaroids-Optical activity-Biot's laws-specific rotation-Laurent's half shade polarimeter-Determination of concentration of sugar solution-Applications of plane polarised light.
Quantum mechanics-Introduction-Duality of radiation and matter-Uncertainity
principle-Concept of wave packet-Group and phase velocities –Wave function in quantum mechanics and its physical significance-Operators in quantum mechanics (basic concepts only)-Schroedinger equation for a free particle, time dependant and independent (steady/stationary) forms and their derivations –Expectation values-Application-Particle in one dimensional box (potential well) -Eigen values and eigen functions.

Statistical mechanics -Introduction-Macroscopic and microscopic systems -Phase space-Statistical distributions-Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics-Basic postulates and distribution functions (no derivation)-Bosons and fermions.

Module-3. (13 hours)

Laser-Introduction-Spontaneous and stimulated emissions-Population inversion-Optical resonant cavity -Basic component of a laser- Characteristics of laser-Intensity, spatial and temporal coherence-

coherence length-monochromaticty-convergence-Einstein coefficients and the analysis of lasing conditions-Different laser system-Construction, working and features of Ruby, He-Ne, Nd:YAG and Semi conductor lasers Application of lasers in medicine-industry, science and communications-Holography-Basic principle-Construction and reconstruction of hologram-Applications.

Optical fibre-Basic structure-Light propagation through optic fibre-Step index and graded index fibres-Single mode and multi mode fibres-Acceptance angle and numerical aperature of a fibre.Expression for numerical aperature for a step index fibre.-Normalised frequency number (V number) of a fibre-Transmission losses in fibres-Attenuation and distortion-Fibre optic communication system-application of optic fibres

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Nano science-Basic ideas –Nano clusters-variation of properties of nano materials –Carbon nano tubes- -Applications of nano materials and nano technology (qualitative ideas only).

Module-4. (13 hours)

Semi conductor physics-Formation energy bands in solids and their classifications-Intrinsic and extrinsic semi conductors-Density of states functions of electrons and holes in the energy bands (expressions only)- Concentration of electrons in the conduction band and holes in valence band-Fermi energy - Fermi level in intrinsic and extrinsic semiconductors-Donor and acceptor levels-Variation of Fermi level with temperature and doping

Semi conductor devises-P-N junction characteristics and applications- Zener diode-Zener breakdown and avalanche breakdown- Zener diode as a voltage regulator-Working and uses of tunnel diode and varactor diode-Light emitting diode -Solar cell-Applications-Bipolar junction transistor-Characteristics of npn/pnp in CE modes-Current amplification factor.

Superconductivity-Introduction-Transition temperature-Effect of magnetic field (magnetic field and critical current density)-Meissner effect-Type I and type II super conductors-Isotopic effect-Persistent current-Flux quantization-Josephons effects-SQUID-High temperature super conductivity-Applications of super conductivity.

Text Books

1. Physics for Engineers-M.R.Seenivasan-New Age Publishers 2009 Edition.
2. A Text book of Engineering Physics-A.S.Vasudeva S.Chand Publishers 2008 Edition
3. A Text book of Electronics-S.L.Kakani and K.C. Bhandari-New Age International (p) Publishers 2000 Edition
4. Nanoscience and Technology-VS Muralidharan& A.Subramania-Ane Books Pvt.Ltd.2009 Edition
5. Engineering Physics-P.K.Palanisamy-Scitech Publishers(India) Pvt Ltd, Chennai

Reference books.

1. Fundamentals Optics- Jenkins F.A. and White H.E. Mc Graw Hill Publication
2. Optics-Ajoy Ghatak- Tata McGraw-Hill Publishing CompanyLtd
3. Introduction to solid state physics- Charles Kittel-Wiley Eastern
4. Concepts of Modern Physics –Arthur Beiser- Tata McGraw-Hill Publishing company Ltd
5. Lasers and non linear optics-B.B.Laud-Wiley Eastern

6. Introduction to Semi conductor materials and Devices-Tyagi M.S. John Wiley and Sons.
7. Nano: The essentials-T. Pradeep-Tata McGraw-Hill Publishing companyLtd.
8. Optical Fibres and Fibre Optic Communication Systems-Subir Kumar Sarkar- S. Chand Publishers.
9. Engineering Physics - G.S.Raghuvanshi - Printice Hall of India
10. Book of Optics - Brijlal and Subramanyam - S.Chand publishers
11. Modern Physics - Murukesan R- S.Chand and Co.
12. Engineering Physics - G.Aruldas, PHI Learning Private Limited.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 103 (P): ENGINEERING PHYSICS LAB

(Common for all branches)

Teaching scheme: 1 hour practical per week **Credit:** 1

Objectives

- *To develop scientific and experimental skills of the students*
- *To correlate the theoretical principles with application based studies.*

List of experiments:

1. Young's modulus of a bar by non-uniform bending
2. Rigidity modulus – Torsion pendulum
3. Study of surface tension of liquids (capillary method)
4. Characteristics of a solar cell
5. Study of Zener characteristics
6. Voltage regulation using Zener diode
7. LED characteristics
8. Determination of band gap energy in semi conductor using a reverse baised p-n junction.
9. Wave length measurement of a monochromatic source of light using Newton's Rings method.
10. Diameter of a thin wire or thickness of a thin strip of paper using air wedge method.
11. Determination of the refractive indices of ordinary and extra ordinary rays in quarts/calcite prism using spectrometer.
12. Determination of spectral lines of a composite source using diffraction grating and spectrometer.
13. Determination of resolving power of a plane transmission grating.
14. Determination of dispersive power of a plane transmission grating.
15. Determination of specific rotatary power or concentration of cane sugar solution using polarimeter.
16. Wave length and velocity measurement of ultrasonic waves in a liquid using ultrasonic diffractometer
17. Wave length measurement of laser using plane transmission grating standardized by sodium light
18. Static characteristics of a transistor in common emitter configuration.
19. Frequency of electrically maintained tuning fork (transverse and longitudinal modes)
20. Measurement of numerical aperture of an optical fibre

(Any 10 experiments should be done at the minimum)

Only one record need to be written by the students and there is no need of separate rough record and fair record.

Reference books:-

1. Practical physics with viva voce, Dr. S.L. Gupta and Dr. V. Kumar, Pragati Prakashan publishers
2. Experiments in Engineering Physics
   M.N. Avadhanulu, A.A. Dani and R.M. Pokley, S. Chand & Co.

Internal Continuous Assessment (Maximum Marks-50)

50% - Laboratory practical and record
40% - Test
10% - Regularity in the class

EN 14 104: ENGINEERING CHEMISTRY

(Common for all branches)

Teaching scheme **Credits:** 3

2 hours lecture per week

Objectives

- *To familiarize the students on application oriented themes like the chemistry of materials used in engineering discipline*
- *To focus the students on the chemistry of compounds resulting from pollution, waste generation and environmental degradation and to apply the knowledge in solving these current environmental problems effectively.*

Module I (15 hours)

Organo Metallic Compounds: Definition – classification based on the nature of metal-carbon bond. Metal carbonyls – 18 electron rule – Mononuclear and polynuclear carbonyls (give examples of Fe, Co, Ni). (3 Hrs.)

Bio-Inorganic chemistry: Metal ions in biological system – trace and bulk metal ions – Haemoglobin and myoglobin (elementary idea only). (3 Hrs.)

Green chemistry – Goals of green chemistry – Limitations.Twelve principles of green chemistry with their explanations and examples – Designing a green synthesis – Prevention of waste / byproducts – Atom economy (maximum incorporation of materials used in the process) – Minimization of hazardous / toxic products – prevention of chemical accidents – Green synthesis (9 Hrs.)

Module II (15 hours)

Polymers – classification – Types of polymerization – addition, condensation, co-polymerisation, co-ordination polymerization. Polymerisation techniques – Bulk, solution, suspension and emulsion. Concept of Tg, Factors affecting Tg, Crystallinity in polymers, physical and mechanical properties (density, tensile, tear, abrasion resistance, resilience). (9 Hrs.)

Lubricants – Theories of friction – Mechanism of lubrication Thick film, thin film, extreme pressure. Classification – solid, liquid, semisolid – properties – viscosity, flash point, fire point, cloud and pour point, Aniline point, corrosion stability.(3 Hrs.)

Fuels: Classification-Calorific Value -Cracking and Reforming-Petrol Knock and octane number-Diesel knock and cetane number. Bio-Diesel. (3 Hrs.)

Module III (11 hours)

Electrochemistry – single electrode potential – Helmholtz double layer – Nernst equation – derivation – types of electrodes (S.H.E, Calomel, Quinhydrone, glass electrode), pH measurements using glass electrode, Electrochemical cells, concentration cells - salt bridge –emf measurement – Poggendorf's compensation method – Electrochemical series – applications – storage cells – Lead acid accumulator – alkaline cells – Nickel cadmium – fuel cells – H_2/O_2 fuel cell – solar cells .

Module IV (11 hours)

Corrosion and its control – theories of corrosion – dry corrosion and wet corrosion – galvanic series - corrosion of iron in acidic, neutral and basic conditions – Differential aeration corrosion, stress corrosion – galvanic corrosion – Factors influencing corrosion. Corrosion control methods – protection by sacrificial anode – Impressed current- self protecting corrosion products – Pilling Bed worth rule- Coatings – Organic (Paints and polymers) Inorganic – Metallic (galvanizing, tinning, electroplating, cementation) Nonmetallic (phosphate, chromate, anodising, chemical oxide).(8 Hrs)

Water – Hardness, alkalinity– determination of hardness- EDTA method –softening – lime soda, Ion exchange methods – purification of water for domestic use. Water pollution – BOD, COD, DO (3 Hrs.)

Reference Books.

1. Industrial Chemistry – B K Sharma
2. Seymour R.B. Introduction to Polymer Chemistry, McGraw Hill, New York, 1971.
3. Billmeyar, F.W. Text book of Polymer Science, Wiley Interscience, New York, 1971.
4. Gowarikar V.R., Viswanathan N.V., Polymer Science, Wiley Eastern Limited, New Delhi, 1986.
5. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouer, Fundamentals of Analytical Chemistry, 8th edition.
6. A.K. Dey, Environmental Chemistry, 6th Edn., New Age International.
7. P.K. Goel, Water Pollution, Causes, Effects and Control, New Age International.
8. Cotton and Wilkinson, Advanced Inorganic Chemistry, Wiley India Pvt. Ltd., 2008. 38
9. J.E. Huheey, E.A. Keiter and R.L. Keiter , Principles structure and reactivity of Inorganic Chemistry, Derling Kindersley (India) Pvt. Ltd., 2006.
10. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, 2008.
11. V. Kumar, Introduction to Green Chemistry, Vishal Publishing House.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 104 (P): ENGINEERING CHEMISTRY LAB

(Common for all branches)

Teaching scheme
1 hour practical per week **Credit:** 1

Objectives

- *To equip the students with the working knowledge of chemical principles, nature and transformation of materials and their applications.*
- *To develop analytical capabilities of students so that they can understand the role of chemistry in the field of Engineering and Environmental Sciences*

1. Estimation of iron in Mohr's salt using standard $K_2Cr_2O_7$
2. Estimation of iron in a sample of iron ore
3. Estimation of copper in a given sample of brass
4. Estimation of total hardness in a given sample of water using EDTA.
5. Estimation of chloride ions in domestic water
6. Determination of dissolved oxygen present in a given sample of water (Winkler's Method)
7. Determination of available chlorine in a sample of bleaching powder
8. Determination of flash point and fire point of an oil using Pensky Martens flash point apparatus
9. Determination of EMF of a cell by Poggendorf's compensation method
10. Preparation of buffers and standardization of pH meter
11. Estimation of iron, chromium, lead and Cadmium in water – Colorimetrically
12. Preparation of urea –formaldehyde and phenol formaldehyde resin

- **Minimum 8 experiments should be completed.**
- **Only one record need to be written by the students and there is no need of separate rough record and fair record.**

Reference Books

1. A.I. Vogel, A Text Book of Quantitative Analysis, ELBS, London.
2. Dr. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria and Sons, New Delhi.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Laboratory practical and record
40% - Test
10% - Regularity in the class

EN 14 105: ENGINEERING MECHANICS

(Common for all branches)

Teaching scheme **Credits:** 4

2 hours lecture and 1 hour tutorial per week

Objectives

- *To acquaint with general approach of solving engineering problems.*
- *To illustrate the application of the theory learned in Mechanics in practical engineering problems.*
- *To lay clear fundamentals to core Engineering Subjects*

Units: *System International*

Module I (20 hours)

Introduction to engineering mechanics - units - dimensions - vector and scalar quantities - laws of mechanics - elements of vector algebra - important vector quantities - equivalent force systems – translation of a force to a parallel position - resultant of a force system - simplest resultant of special force systems - distributed force systems - equations of equilibrium - free body diagrams - free bodies involving interior sections - general equations of equilibrium - problems of equilibrium - static indeterminacy. (Both vector and scalar formulations are to be introduced to solve problems.)

Module II (20 hours)

Friction – laws of friction – simple contact friction problems. Introduction to structural mechanics - trusses - analysis of simple trusses - method of sections – method of joints. Properties of simple and composite plane areas and curves – first moment and centroid– theorems of Pappus-Guldinus - second moment of plane and composite areas – parallel and perpendicular axis theorems – polar moment of inertia of area – product of inertia and principal axis (conceptual level treatment only).

Moment of inertia of a rigid body and lamina (derivation of MI for cylinder, rod and sphere).

Module III (18 hours)

Kinematics of particles - rectilinear motion - curvilinear motion – motion of a projectile - tangential and normal acceleration

Kinetics of particles - rectilinear motion – curvilinear motion - Newton‘s second law– D‘Alembert‘s principle – motion on horizontal and inclined surfaces – motion of connected bodies.

Work, power and energy –work-energy equation – transformation and conservation of energy – impulse and momentum.

Module IV (20 hours)

Kinematics rigid bodies - rotation of a rigid body about a fixed axis - plane motion of a rigid body - instantaneous center Kinetics of rigid bodies - equations of motion of a rigid body rotating about a fixed axis – rotation under the action of a constant moment - D‘Alembert‘s principle – equations of motion for general plane motion - principle of work and energy.

Application of Graphical Methods in Mechanics – Force Poligons – Applications in truss analysis, centriod and moment of inertia

Text Books

1. Shames I.H, *Engineering Mechanics - Statics and Dynamics*, 4th ed.,Pearson Prentice, New Delhi, 2013
2. Timoshenko S. and Young D. H., *Engineering Mechanic*s, 4th ed., McGraw Hill InternationalEdition, Singapore, 1956.
3. B a s u d e b Bhattacharya., Engineering Mechanics ,Oxford University Press,2008
4. V. Jayakuumar, M Kumar, Engineering Mechanics, Prentice Hall Of India

Reference Books

1. Beer F.P and Johnston E.R., *Vector Mechanics for Engineers - Vol.1 Statics and Vol.2*
2. *Dynamics*, 3rd ed., Tata McGraw Hill, New Delhi, 2000.
3. Meriam J.L and Kraige L.G., *Engineering Mechanics - Vol.1 Statics and Vol.2 Dynamics*, 5th ed., Wiley Student Edition, Kundli, 2004
4. Hibbeler R. C. , Engineering Mechanics- Statics & Dynamics, 11 th ed., Pearson
5. Education, Delhi, 2013.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 106: BASICS OF CIVIL AND MECHANICAL ENGG.

(Common for all branches)

Teaching scheme **Credits:** 4

2 hours lecture

SECTION 1: BASICS OF CIVIL ENGINEERING

1 hour lecture per week

Objective

- *To give a basic knowledge of the topics in Civil Engineering.*

(In - depth treatment is not required)

Module I (13 hours)

Scope of Civil Engineering- Role of Civil Engineers in nation building.

Brief description of Engineering properties and applications of the following construction

Timber, Iron & steel. (Study on laboratory tests not expected, detailed manufacturing processes of materials not expected).

Stone and brick masonry construction- bonds used in general constructions- Cement mortar and Cement Concrete - Properties and applications- Reinforced Cement Concrete Fundamentals - points to be observed during masonry construction and concreting (Only brief description is expected).

Module II (13 hours)

Introduction to Surveying - brief description of the following instruments (i) chain and accessories (ii) Dumpy level (iii) Theodolite. Use of levelling instrument for determining reduced levels of various stations- Simple problems on levelling - use of theodolite for measuring horizontal angles – Simple problems on horizontal distance and plane area. (Only brief description is expected).

Building drawing- plan, section and elevation of a single room building with RCC roof (sketching in the paper/note book only is expected).

Type and functions of the following structural components of buildings

(i) Foundation (ii) Wall (iii) Column (iv) Beam (v) Slab (vi) Arch & Lintels (vii) Plane Trusses. (viii) Cross Sectional elements of Roads and Dams.

Text Books

1. L.S.Jayagopal and R. Rudramoorthy-—Basic Civil and Mechanical Engineering- Vikas Publishing house Pvt Ltd, New Delhi -110014.
2. Punmia. B.C —Basic Civil Engineering. Laxmi Publications
3. PC Varghese-—Building materials, Prentice Hall, India
4. PC Varghese-—Building Construction, Prentice Hall, India

Reference Books

1. Mimi Das saikia, Bhargab Mohan Das, Madan Mohan Das-—Elements of Civil Engineering‖-Prentice Hall, India
2. Rangwala. S. - Engineering Material, Charator book stall, Anand
3. Arora. K.R. Surveying Vol I and Vol II, Standard Book house,
4. Punmia. B.C - Building Constructio, Laxmi Publications
5. Rajput. R.K.- Engineering Materials, S. Chand and Company
6. Balagopal. T.S. Prabhu et.al - Building Drawing and Detailing, Spades.
7. Satheesh Gopi - Basic Civil Engineering, Pearson
8. Shibu Nalpat - Basic civil Engineering, 7th edition Nalpat publishers, Ernakulam, 2011

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART A: Analytical/problem solving SHORT questions 4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

Note: Section 1 and Section 2 are to be answered in separate answer books Maximum 50 marks each for Section 1 and Section 2

SECTION 2: BASICS OF MECHANICAL ENGINEERING

Teaching scheme
1 hour lecture per week

Objectives

- *Gives an introduction as well as an overview on the concepts and applications of Mechanical Engineering*

Module I (13 hrs)

Sources of Energy: Introduction – Classification – Non renewable energy – Fossil fuels – solid, liquid and gaseous – Calorific value. Renewable Energy – Hydroelectric, solar, wind, biomass, biogas, ocean thermal, tidal, wave and geothermal energy.

Power Plants: Introduction – Layout and working of Diesel, Nuclear and Hydel power plants

Manufacturing process – Introduction – Elementary ideas of rolling and extrusion
Machining operations – Turning, shaping, milling and drilling

Power transmission – introduction – belt, rope, chain and gear drives, terminology, classification; advantages, disadvantages and applications

Module II (13 hrs)

Thermodynamic processes – isobaric, isochoric, isothermal, adiabatic and polytropic – workdone, P-V diagrams.

Otto cycle, Diesel cycle (derivation not required) – IC Engines – SI and CI engines, 4S and 2S engines, comparison; MPFI & CRDI Engines

Refrigeration: Introduction – working of vapour compression refrigeration system, Ton of refrigeration, COP

Hydraulic turbines – Pelton, Francis and Kaplan turbines (applications only).

Pumps – Introduction, classification – reciprocating and centrifugal – (brief description and working only).

Text Books

1. P.Balachandran –Basic Mechanical Engineering – Owl Books - Thiruvananthapuram
2. J.Benjamin – Basic Mechanical Engineering – Pentx
3. Pravin kumar – Basic Mechanical Engineering – Pearson
4. R.K. Purohit – An introduction to Mechanical Engineering – Scientific Publishers
5. Roy and Choudhary – Elements of Mechanical Engineering – Standard Publications Ltd
6 V. Prabhuraja – Basic Mechanical Engineering – Scitech Publishers

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern for Section 2

PART A: Analytical/problem solving SHORT questions *4x 5 marks=20 marks*

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

Note: Section 1 and Section 2 are to be answered in separate answer books

Maximum 50 marks each for Section 1 and Section 2

EN14 107: BASICS OF ELECTRICAL, ELECTRONICS & COMMUNICATION ENGINEERING

(Common for all branches)

Teaching scheme **Credits:** 4

2 hours lecture per week

SECTION 1 - BASIC ELECTRICAL ENGINEERING

Objective

- *This course provides a quick overview of the concepts and results in Basic analysis that may be useful in engineering. Also it gives an introduction to Very basic concept and theory of Electrical Engineering.*

Module I: Basic Laws in Electrical Engineering (13 Hours)

What is electrical Engineering? Kirchhoff's Laws, Solution of series and parallel circuits with DC excitation. Voltage and current division rule. (2Hrs)

Magnetic circuits – MMF, Flux, Reluctance. Comparison of electric and magnetic circuits. (2 Hrs)

Faradays laws, Lenz's Law, Thump rules. Statically and dynamically induced EMF, Self and Mutual Inductance, Coefficient of Coupling. (2 Hrs)

AC circuits: - Single phase AC circuits – generation of sinusoidal EMF, cycle, frequency, time, period. Average, RMS value and Maximum value, Form factor, peak factor of sine wave only. Analysis of simple R, L, C, RL, RC, LC, and RLC circuits (Equations and waveforms in AC only). Reactance and Impedance, active, reactive and apparent power (Phasor diagram), Power factor. (4Hrs)

Three phase circuits – generation of 3 phase wave form, star and delta connection, voltage and current relationship in star and delta (Balanced case only), star to delta and delta to star conversion. (3Hrs)

Module II: Basic Concepts of Transformers and Machines (13 Hours)

Single Phase Transformer – Construction (Core & Shell), principle of operation, EMF equation, Transformation Ratio, Ideal Transformer. (3Hrs)

DC Generators and Motors: - Constructional details, Types and Configurations, EMF equation. Application of DC Motors. (3Hrs)

3 Phase Induction Motors – Parts of Induction machine (squirrel cage and Wound rotor type), Concept of Rotating magnetic field, principle of operation, slip, synchronous frequency. Application. (3Hrs)

Synchronous generator – construction, salient pole, cylindrical rotor type, principle of operation. (3Hrs)

Basic structure of power system (block diagram only). (1Hr)

Text Books:

1. Edward Hugs – Electrical & Electronic Technology, Pearson Education
2. Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education
3. SK Bhattacharya, Basic Electrical & Electronics Engineering, Pearson
4. M.S Sukhija and T.K Nagsarkar,Basic Electrical and Electronics Engineering, Oxford University press, 2012

Reference:

1. Kothari and Nagrath, Theory & problems of Basic Electrical engineering. Tata McGraw Hill
2. JB Gupta, A course in electrical engg. SK. Kataria & Sons
3. BL Theraja, Electrical Technology Vol. 1,
4. K Uma Rao, Basic Electrical Engineering, Pearson

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project etc.

10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART A: Analytical/problem solving SHORT questions 4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

University Examination Pattern – for Section 1

Note: Section 1 and Section 2 are to be answered in separate answer books Maximum 50 marks each for Section 1 and Section 2

SECTION 2: BASICS OF ELECTRONICS AND COMMUNICATION ENGINEERING

Objectives

- *To impart knowledge about basic electronic and digital systems*
- *To give basic ideas about various communication systems (Only system level block diagram approach, no analysis required)*

Module I (13 hours)

Amplifiers**:** Principle of electronic amplifiers – Block diagram representation – Classification – Significance of input impedance, output impedance, output power, power gain, voltage gain and frequency response – noise in amplifiers – cascaded amplifiers – concept of differential amplifiers and operational amplifiers –concept of oscillators. (6 Hours)

Digital Systems **:** Logic gates – logic states – Boolean algebra – algebraic logic minimisation – generating logic diagram from Boolean expression – introduction to TTL and CMOS logic – programmable logic devices .(4 Hours)

Measurements and Data Acquisition Systems**:** Working and block diagram of CRO – sensors – actuators – principle of digital voltmeter –principle of ADC and DAC.(3 Hours)

Module II (13 hours)

Radio Communication **:** Modulation – Principle of AM & FM – block diagrams of transmitters – waveforms – band width – principle of AM & FM demodulation - comparison of AM & FM – principle of super heterodyne receiver – block diagram**.** (4 Hours)

Radar and Navigation**:** Principle of Radar – Radar equation [Derivation not required] – block schematics of pulsed Radar and continuous wave Radar – applications of Radar – introduction to navigational aids. (3 Hours)

Communication Systems **:** Principle of microwave communication- block diagrams – principle of satellite communication systems– block diagram of optical communicational systems – principle of light transmission through fibre – advantages of optical communication – basic principles of cellular communications –principle of GSM , CDMA, GPRS technologies.
(6 Hours)

Text Books

1. Neil Storey, ‗Electronics: A Systems Approach', Pearson Education, 2nd Ed., New Delhi.
2. Santhiram Kal, ‗Basic Electronics-Devices, Circuits & IT fundamentals', PHI., NewDelhi.
3. Louis E. Frenzel, ‗Principles of Electronic Communication systems', Tata McGraw Hill, New Delhi.
4. William Stallings, ‗Wireless Communications & Networks', Pearson Education, New Delhi.
5. David A. Bell, ‗Electronic Instrumentation & Measurements', PHI, New Delhi.

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART A: Analytical/problem solving SHORT questions 4x 5 marks=20 marks

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 2 x 15 marks=30 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2

EN14 108: ENGINEERING GRAPHICS

(Common for all branches)

Teaching scheme **Credits:** 6

1 hour lecture and 3 hours practical/ drawing per week

Objectives

By going through the contents student will be able to:

- Understand systems of drawing.
- Produce orthographic drawing of points, lines and solids.
- Produce isometric views of any object.
- Develop skill to produce perspective views of any object.
- Develop skill to convert the pictorial views of simple engineering objects into orthographic views.

Module – I (8 Hours; 2Drawing Exercises)

Drawing instruments and their use - Different types of lines - Lettering and dimensioning – Scales - Familiarization with current Indian Standard Code of practice for general engineering drawing - Construction of Conic sections - Construction of Cycloid, Involutes and Helix (For internal work assessment only, not for University Examination)

Module-II (27 Hours; 5 Drawing exercises)

a) Introduction to projections - Systems of projections - Vertical, Horizontal and Profile planes - Principles of first and third angle projections - Projections of points in different quadrants - Orthographic projections of straight lines parallel to both reference planes - Perpendicular to one of the reference planes - Inclined to one and parallel to other reference plane - Inclined to both the reference planes and occupied in one quadrant - Traces of lines - True length and inclination of a line with reference planes - Line occupied in more than one quadrant - Line inclined to the two reference planes but parallel to the profile plane.

b) Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.

Module- III (24 Hours; 5 Drawing exercises)

a) Projections of Polyhedra, Solids of revolution and Frustums - Projections of solids with axis parallel to one and inclined to the other reference plane - Axis inclined to both the reference planes - Projections of solids on auxiliary planes (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder)

b) Sections of solids - Sections by cutting planes parallel to the reference planes - Cutting plane inclined to one and perpendicular to other reference plane - True shape of the section by projecting on auxiliary plane (Solids to be drawn: Cube, Prisms, Pyramids, Tetrahedron, Cone and Cylinder)

Module- IV (18 Hours; 4 Drawing exercises)

a) Development of surfaces of solids - Method of parallel line and radial line developments - Development of Polyhedra, Cylinder, Cone and sectioned solids - Development of solids having hole or cut

b) Introduction to isometric projection - Isometric scale - Isometric views - Isometric projections of Prisms, Pyramids, Cylinder, Cone, Spheres, sectioned solids and combination of them.

Module- V (19 Hours; 4 Drawing exercises)

a) Introduction to perspective projections - Classification of perspective views - Visual ray and vanishing point method of drawing perspective projection - Perspective views of plane figures such as polygons and circles - Perspective views of solids like Prisms, Pyramids and Cube.

b) Introduction to multiview projection of objects - The principle of the six orthographic views - Conversion of pictorial views of simple engineering objects into orthographic views.

c) Conventional representation of threaded fasteners - Drawing of nuts, bolts, washers and screws - Locking arrangements of nuts - Bolted and screwed joints - Foundation bolts.

Module- VI (8 Hours; 2 Drawing exercises)

a) Introduction to Computer Aided Drafting (CAD) - Preparation of engineering drawings by using any software capable of drafting and modelling - Creation of simple figures like polygon and general multiline figures - Drawing of front view and top view of solid like Prism, Pyramid and Cylinder and dimensioning - Drawing of front view and top view of objects from pictorial view.

(For internal work assessment only, not for University Examination)

NOTE: All drawing exercises mentioned above are for class work. Additional exercises where ever necessary may be given as home assignments

Text Books

1. Bhatt.N.D, Elementary Engineering Drawing, Charotar Publishing House, Delhi
2. John.K.C, Engineering graphics, PHI Learning Pvt, Ltd. 2009
3. P.I.Varghese, Engineering Graphics, VIP Publications, Thrissur
4. K.N.Anilkumar, Engineering Graphics- 5th edn,2010, Adhuth Narayanan Publishers, Kottayam

Reference Books.

1. M. B. Shah, B. C. Rana " Engineering Drawing"2nd edition – Pearson Education 2009
2. Narayana & Kannaiah, Engineering Graphics, Scitech Publishers, 2002
3. Luzadder.W.J, Foundamentals of Engineering Drawing, Prentice Hall of India

Internal Continuous Assessment (Maximum Marks-50)

60% - Drawing exercises (Best 15 sheets)

40% - Tests (minimum 2)

University Examination Pattern

No question from modules I and VI

PART A

Q 1 Two questions (a) and (b) of 20 marks each from module II, one from module II (a) and one from module II(b), with choice to answer any one.

Q II Two questions (a) and (b) of 20 marks each from module III, one from module III(a) and one from module III(b), with choice to answer any one.

Q III Two questions (a) and (b) of 20 marks each from module IV, one from module IV(a) and one from module IV(b), with choice to answer any one.

PART B

Q IV 3 Questions (a), (b) and (c) of 20 marks each from module V, one from module V(a), one from module V(b) and one from module V(c), with choice to answer any two.

EN14 109: HUMANITIES AND COMMUNICATION SKILLS

(Common to all branches)

Teaching scheme **Credits:** 2

2 hour lecture and 1 hour tutorial per week

A minimum of 12 Tutorial hours can be utilized for Language lab/extra mural lectures on communication and other topics of social and technical importance.

Objectives

- *To identify the most critical issues that confronted particular periods and locations in history;*
- *To identify stages in the development of science and technology;*
- *to understand the purpose and process of communication;*
- *to produce documents reflecting different types of communication such as technical descriptions, proposals ,and reports;*
- *To develop a positive attitude and self-confidence in the workplace; and*
- *To develop appropriate social and business ethics.*

Module I (16 hours)

Humanities, Science and Technology: Importance of humanities to technology, education and society- Impact of science and technology on the development of modern civilization. Contributions of ancient civilization: Chinese, Indian, Egyptian and Greek. Cultural, Industrial, Transportation and Communication revolutions. Advances in modern India: Achievements in information, communication and space technologies.

Module II (23 hours)

Concept of communication: The speaker/writer and the listener/reader, medium of communication, barriers to communication, accuracy, brevity, clarity and appropriateness Reading comprehension: Reading at various speeds, different kinds of text for different purposes, reading between lines.

Listening comprehension: Comprehending material delivered at fast speed and spoken material, intelligent listening in interviews

Speaking: Achieving desired clarity and fluency, manipulating paralinguistic features of speaking, task oriented, interpersonal, informal and semi formal speaking, making a short classroom presentation.

Group discussion: Use of persuasive strategies, being polite and firm, handling questions and taking in criticisms on self, turn-taking strategies and effective intervention, use of body language.

Module III (23 hours)

Written Communication: Note making and taking, summarizing, notes and memos, developing notes into text, organization of ideas, cohesion and coherence, paragraph writing, ordering information in space and time, description and argument, comparison and contrast, narrating events chronologically. Writing a rough draft, editing, proof reading, final draft and styling text.

Technical report writing: Synopsis writing, formats for reports. Introductory report, Progress report, Incident report, Feasibility report, Marketing report, Field report and Laboratory test report

Project report: Reference work, General objective, specific objective, introduction, body, illustrations using graphs, tables, charts, diagrams and flow charts. Conclusion and references Preparation of leaflets, brochure and C.V.

Module IV (16 hours)

Human relations and Professional ethics: Art of dealing with people, empathy and sympathy, hearing and listening. Tension and stress, Methods to handle stress

Responsibilities and rights of engineers- collegiality and loyalty – Respect for authority – Confidentiality – conflicts of interest – Professional rights, Rights of information, Social responsibility

Senses of ethics – variety of moral issues – Moral dilemma – Moral autonomy – Attributes of an ethical personality – right action – self interest

Reference Books

1. Meenakshi Raman and Sangeeta Sharma, *Technical Communication- Principles and Practice* Oxford University press, 2006
2. Jayashree Suresh and B S Raghavan, *Professional Ethics*, S Chand and Company Ltd, 2005
3. Subrayappa, *History of Science in India*, National Academy of Science, India
4. R C Bhatia, *Business Communication*, Ane Books Pvt. Ltd, 2009
5. Sunita Mishra and C Muralikrishna, *Communication Skills for Engineers*, Pearson Education, 2007.
6. Jovan van Emden and Lucinda Becker, *Effective Communication for Arts and Humanities Students*, Palgrave macmillam, 2009
7. W C Dampier, *History of Science*, Cambridge University Press
8. Vesilind, *Engineering, Ethics and the Environment*, Cambridge University Press
9. Larson E, *History of Inventions*, Thompson Press India Ltd.
10. Bernal J.D, *Science in History*, Penguin Books Ltd
11. Encyclopaedia Britannica, *History of Science, History of Technology*
12. Subramanian.R,*Professional Ethics,Oxford University Press,2013*
13. .Sanjay Kumar and Pushpalata,*Communication skills,Oxford University Press,2011*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 110 (P): MECHANICAL WORKSHOPS

(Common for all branches)

Teaching scheme **Credits:** 2
2 hours practical per week

Objectives

- To inculcate engineering aptitude, confidence and experience towards technical skills
- To train the students mentally and physically for industries
- To impart knowledge and technical skills on basic manufacturing methods

A. **Carpentry**: study of tools and joints – planing, chiselling, marking and sawing practice, different joints , use of power tools

B. **Fitting**: study of tools, chipping, filing, cutting, drilling, tapping, male and female joints, stepped joints

C. **Smithy**: study of tools, forging of square prism, hexagonal bolt

D. **Foundry:** study of tools, sand preparation, moulding practice

E. **Sheet Metal work**: study of tools, selection of different gauge sheets, types of joints, trays and containers

F. **Welding**: study of tools, different types of joints, practice

At least 3 models should be completed by the student in each section.

Internal Continuous Assessment (Maximum Marks-100)

50% - Laboratory practical and record
40% - Test
10% - Regularity in the class

EN 14 111(P) ELECTRICAL AND CIVIL WORK SHOPS

(Common for all branches)

Teaching scheme **Credits:** 2

2 hours of practical per week

SECTION 1: ELECTRICAL ENGINEERING WORK SHOP

Objective

- *To impart a basic knowledge of electrical circuits, machines and power systems.*

List of experiments

1. Familiarization of various types of Service mains – Wiring installations – Accessories and house hold electrical appliances.
2. Methods of earthling- Measurement of earth resistance- Testing of electrical installations- Precautions against and cure from electric shock
3. Practice of making different joints (Britannia, Married and T- Joints) on copper/ aluminium ba
4. Wiring practice of a circuit to control two lamps by two SPST switches.
5. Wiring practice of a circuit to control one lamp by two SPDT switches.
6. Wiring practice of a circuit to control one fluorescent lamp and one three pin plug socket.
7. Wiring practice of a main switch board consisting of ICDP switch, DB, MCB‘s and ELCB‘s.
8. Familiarization of various parts of electrical motors and wiring of three phase and single phase motor with starter.
9. Familiarization of energy meter and measurement of energy consumption by a single phase load.
10. Familiarization of various electrical and electronic components such as transformers, resistors, AF and RF chokes, capacitors, transistors, diodes, IC‘s and PCB.
11. Assembling and soldering practice of single phase full wave bridge rectifier circuit with i) capacitor circuit ii) regulator IC

Internal Continuous Assessment (Maximum Marks-50)

50% - Laboratory practical and record

40% - Test

10% - Regularity in the class

SECTION 2: CIVIL ENGINEERING WORK SHOP

Objectives

- *To provide experience on plotting, measuring/determining horizontal distances, level differences between stations and horizontal angles*
- *To provide experience on setting out for small buildings, masonry construction, plumbing work and model making.*

1. Chain Surveying - Study of chain and accessories, Plotting one side of a building/ Five or six points in the field using chain and cross-staff
2. Compass surveying (Study of compass, Plotting one side of a building/Five or six points in the field using compass
3. Levelling - Study of levelling instruments, Determination of reduced levels of five or six points in the field.
4. Theodolite - Study of Theodolite, Measuring horizontal angles
5. Setting out practice
6. Brick Masonry
7. Plumbing - Demonstration of plumbing fixtures-Exercise in joints
8. Model making of simple solids

Internal Continuous Assessment (Maximum Marks-50)

50% - Laboratory practical and record
40% - Test
10% - Regularity in the class

SYLLABUS & CURRICULUM

of

B.Tech.

CIVIL ENGINEERING
(3rd to 8th semesters)

UNIVERSITY OF CALICUT

(2014 admission)

2014 SCHEME FOR CIVIL ENGINEERING (CE) BRANCH

3rd Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/D	Internal	End Semester		
EN14 301	Engineering Mathematics III	3	1	0	50	100	3	4
EN14 302	Computer Programming in C	2	0	2	50	100	3	4
CE14 303	Mechanics of Solids	3	1	0	50	100	3	4
CE14 304	Building Technology I	3	1	0	50	100	3	4
CE14 305	Surveying I	3	1	0	50	100	3	4
CE14 306	Engineering Geology	3	1	0	50	100	3	4
CE14 307 (P)	Surveying Lab I	0	0	3	50	100	3	2
CE14 308 (P)	Materials Testing Lab I	0	0	3	50	100	3	2
	TOTAL	17	5	8				28

Note: For EN 14 302 Computer Programming in C, the end semester examination will be held by the University as a theory paper.

4th Semester

Code	Subject	Hours/ Week			Marks		Duration of End semester examinations	Credits
		L	T	P/D	Internal	End Semester		
EN14 401	Engineering Mathematics IV	3	1	0	50	100	3	4
EN14 402	Environment Science	3	1	0	50	100	3	4
CE14 403	Fluid Mechanics	3	1	0	50	100	3	4
CE14 404	Structural Analysis I	3	1	0	50	100	3	4
CE14 405	Engineering Economics & Principles of Management	3	1	0	50	100	3	4
CE14 406	Surveying II	3	1	0	50	100	3	4
CE14 407 (D)	Civil Engineering Drawing I	0	0	3	50	100	3	2
CE14 408 (P)	Surveying Lab II	0	0	3	50	100	3	2
	TOTAL	18	6	6				28

e: ▪Even though the subject CE 14 407 (D) Civil Engineering Drawing I is considered as a practical, the end semester examination will be conducted by the University.

5th Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credi-ts
		L	T	P/D	Internal	End Semester		
CE14 501	Structural Design I	3	1	0	50	100	3	4
CE14 502	Building Technology II	3	1	0	50	100	3	4
CE14 503	Transportation Engineering I	3	1	0	50	100	3	4
CE14 504	Structural Analysis II	3	1	0	50	100	3	4
CE14 505	Geotechnical Engineering I	3	1	0	50	100	3	4
CE14 506	Open Channel Hydraulics & Hydraulic Machinery	3	1	0	50	100	3	4
CE14 507(D)	Civil Engineering Drawing II	0	0	3	50	100	3	2
CE14 508(P)	Fluid Mechanics Lab	0	0	3	50	100	3	2
	TOTAL	18	6	6				28

Note:

- Even though the subject CE 14 507 (D) Civil Engineering Drawing II is considered as a practical, the end semester examination will be conducted by the University.

6th Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/D	Internal	End Semester		
CE14 601	Structural Design II	3	1	0	50	100	3	4
CE14 602	Transportation Engineering II	3	1	0	50	100	3	4
CE14 603	Hydrology & Irrigation Engineering	3	1	0	50	100	3	4
CE14 604	Structural Analysis III	3	1	0	50	100	3	4
CE14 605	Geotechnical Engineering II	3	1	0	50	100	3	4
CE14 606	Computational Methods and Operations Research	3	1	0	50	100	3	4
CE14 607 (P)	Geotechnical Engineering Lab	0	0	3	50	100	3	2
CE14 608 (P)	Materials Testing Lab II	0	0	3	50	100	3	2
	TOTAL	18	6	6				28

7th Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/ D	Internal	End Semester		
CE14 701	Structural Design III	3	1	0	50	100	3	4
CE14 702	Design of Hydraulic Structures	2	0	2	50	100	3	4
CE14 703	Environmental Engineering I	3	1	0	50	100	3	4
CE14 704	Elective I	3	1	0	50	100	3	4
CE14 705	Elective II	3	1	0	50	100	3	4
CE14 706 (P)	Computer Applications Lab	0	0	3	50	100	3	2
CE14 707 (P)	Environmental Engineering Lab	0	0	3	50	100	3	2
CE14 708 (P)	Project	0	0	4	100	-		4
	TOTAL	14	4	12				28

Elective I

CE14 704(A) Advanced Structural Design I
CE14 704(B) Advanced Geotechnical Engineering I
CE14 704(C) Highway Pavement Design

CE14 704(D) Experimental Stress Analysis (G)
CE14 704(E) Concrete Technology

Elective II

CE14 705(A) Structural Dynamics & Seismic Design
CE14 705(B) Soil Exploration, Testing and Evaluation
CE14 705(C) Ecology and Environmental Chemistry
CE14 705(D) Ground Water Hydrology
CE13 705(E) Finite Element Methods (G)

8th Semester

Code	Subject	Hours/ Week			Marks		Duration of End Semester examination	Credits
		L	T	P/D	Internal	End Semester		
CE14 801	Environmental Engineering II	3	1	0	50	100	3	4
CE14 802	Quantity Surveying & Valuation	3	1	0	50	100	3	4
CE14 803	Construction Engineering & Management	3	1	0	50	100	3	4
CE14 804	Elective III	3	1	0	50	100	3	4
CE14 805	Elective IV	3	1	0	50	100	3	4
CE14 806 (P)	Seminar	0	0	3	100			2
CE14 807 (P)	Project	0	0	7	150			4
CE14 808 (P)	Viva Voce	0	0	0		100	3	4
	TOTAL	15	5	10				30

Elective III

CE14 804(A) Advanced Structural Design II
CE14 804(B) Advanced Geotechnical Engineering II
CE14 804(C) Surface Hydrology and Water Power
CE14 804(D) Urban Transportation Planning
CE14 804(E) Remote Sensing and GIS (G)

Elective IV

CE14 805(A) Industrial Structures
CE14 805(B) Advanced Construction Engg: and Management
CE14 805(C) Coastal Engineering & Marine Structures
CE14 805(D) Ground Improvement Techniques
CE14 805 (E) Environmental Pollution Control Engineering (G)

3rd Semester

EN 14 301: Engineering Mathematics III

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

This course provides a quick overview of the concepts and results in complex analysis that may be useful in engineering. Also it gives an introduction to linear algebra and Fourier transform which are wealths of ideas and results with wide area of application.

Module I: Functions of a Complex Variable (13 hours)

Functions of a Complex Variable – Limit – Continuity – Derivative of a Complex function – Analytic functions – Cauchy-Riemann Equations – Laplace equation – Harmonic Functions – Conformal Mapping – Examples: e^z, sinz, coshz, $(z+1/z)$– Mobius Transformation.

Module II: Functions of a Complex Variable (13 hours)

Definition of Line integral in the complex plane – Cauchy's integral theorem (Proof of existence of indefinite integral to be omitted) – Independence of path – Cauchy's integral formula – Derivatives of analytic functions (Proof not required) – Taylor series (No proof) – Laurent series (No proof) – Singularities - Zeros – Poles - Residues – Evaluation of residues – Cauchy's residue theorem – Evaluation of real definite integrals.

Module III: Linear Algebra (13 hours) – (Proofs not required**)**

Vector spaces – Definition, Examples – Subspaces – Linear Span – Linear Independence – Linear Dependence – Basis – Dimension– Orthogonal and Orthonormal Sets – Orthogonal Basis – Orthonormal Basis – Gram-Schmidt orthogonalisation process – Inner product spaces – Definition – Examples – Inequalities ; Schwartz, Triangle (No proof).

Module IV: Fourier Transforms (13 hours)

Fourier Integral theorem (Proof not required) – Fourier Sine and Cosine integral representations – Fourier transforms – transforms of some elementary functions – Elementary properties of Fourier transforms – Convolution theorem (No proof) – Fourier Sine and Cosine transforms – transforms of some elementary functions –Properties of Fourier Sine and Cosine transforms.

Text Books

Module I:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 12.3, 12.4, 12.5, 12.6, 12.7, 12.9

Module II:

Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 13.1, 13.2, 13.3, 13.4, 14.4, 15.1, 15.2, 15.3, 15.4

Module III:

Bernaed Kolman, David R Hill, *Introductory Linear Algebra, An Applied First Course,* Pearson Education.
Sections: 6.1, 6.2, 6.3, 6.4, 6.8, Appendix.B.1

Module IV:

Wylie C.R and L.C. Barrett, *Advanced Engineering Mathematics*, McGraw Hill.
Sections: 9.1, 9.3, 9.5

Reference books

1. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach,* Ane Books India.
2. B V Ramana, *Higher Engineering Mathematics,* McGrawHill.
3. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
4. J K Sharma, *Business Mathematics, Theory and Applications,* Ane Books India.
5. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
6. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
7. Abhimanyu Singh, *Applied Mathematics I,* Ane Books India.
8. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
9. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II.*, Prentice Hall of India.
10. Lary C Andrews, Bhimsen K Shivamoggi, *Integral Transforms for Engineers*, Prentice Hall of India.
11. K B Datta, *Matrix and Linear Algebra, 2e*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

EN 14 302 Computer Programming in C

(Common for all branches)

Teaching scheme Credits: 4

2 hours lecture and 2hours lab per week

Objectives

- *To impart the basic concepts of computer and information technology*
- *To develop skill in problem solving concepts through learning C programming in practical approach.*

Module I (13 hours)

Introduction to Computers: CPU, Memory, input-output devices, secondary storage devices Programming and problem solving-Basic computer organization,Developing -High level and low level Languages-Compilers,Assemblers and interpreters-Writing ,Compiling and executing a program -Debugging a program- Latest trends and technologies of storage ,memory ,Processors, Printing etc. Developing Alogorithms- Flow charts

Module II (13 hours)

Basic elements of C: Structure of C program – Numerical constants-Variables- Data types-Arithmetic Operators – Arithmetic expressions –Increment and Decrement operators- format specifications – Bit level operators and applications –Relational operators- Relational expression -Logical operators Logicalk expressions –Conditional operators- Precedence and associativity of operators Procedure and order of evaluation – Input and Output functions. Simple programming examples.

Module III (13 hours)

Compound statements –conditional statements - if, if-else, switch, break, continue, goto, and labels ,while, do-while and for statements, Example problems

Functions -user defined functions –Library functions –Header files declaring, defining, and accessing functions - parameter passing methods – extern, auto, register and static. – Example programs.

Arrays: Defining and processing arrays – passing arrays to functions – two dimensional and multidimensional arrays – application of arrays. Example programs.

Module IV (13 hours)

Structures – declaration, definition and initialization of structures, unions,

Pointers: Concepts, declaration, initialization of pointer variables simple examples

Concept of a file – File operations File pointer, simple examples

Object-Oriented Programming – Basic concepts, Declaration of classes and objects-Calling a member function- constructor and destructor-Operator Overloading-Inherittance and levels of inheritance.(only concepts and programming using these concepts is not expected)

Text Books

1. P. Norton, *Peter Norton's Introduction to Computers*, Tata McGraw Hill, New Delhi.
2. E. Balaguruswamy, *Programming in ANSI C*, 3rd ed., Tata McGraw Hill, New Delhi, 2004
3. E.Balaguruswamy,*Object-Oriented Programming with C++*, Tata McGraw Hill, New Delhi.

Reference Books

1. B. Gottfried, *Programming with C*, 2nd ed, Tata McGraw Hill, New Delhi, 2006
2. B. W. Kernighan, and D. M. Ritchie, *The C Programming Language*, Prentice Hall of India, New Delhi, 1988
3. K. N. King. *C Programming: A Modern Approach*, 2nd ed., W. W. Norton & Company, 2008
4. P. Norton, *Peter Norton's Computing Fundamentals*, 6th ed., Tata McGraw Hill, New Delhi, 2004.
5. S. Kochan, *Programming in C*, CBS publishers & distributors
6. M. Meyer, R. Baber, B. Pfaffenberger, *Computers in Your Future*, 3rd ed., Pearson Education India
7. P B Mahapatra,T*hinking in C including Object Oriented Programming with C ++*, Wheeler Publishing ,New Delhi.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Lab Practical Tests
20% - Assignments
20% - Main Record
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 303: Mechanics of Solids

Teaching scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objectives

• *To study the internal effects produced and deformations of bodies caused by externally applied forces.*

• *To understand the strength characteristics of different materials and structural members subjected to axial load, shear, torsion and bending.*

Module I (13 Hours)

Tension, compression & shear **:** Types of external loads - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants – working stress - stress strain diagrams - elongation of bars of constant and varying sections – statically indeterminate problems in tension and compression –Temperature and Prestrain effects – strain energy and complementary energy-strain energy due to tension, compression and shear.

Module II (13 Hours)

Bending Moment & Shear force**:** Different types of beams- various types of loading – Relationship connecting intensity of loading , shearing force and bending moment- shear force and bending moment diagrams for cantilever beams, Simply supported and overhanging beams for different types of loading.

Stresses in beams of symmetrical cross sections:

Theory of simple bending –assumptions and limitations – Normal stresses in beams – Stresses in nonprismatic beams-moment of resistance - beams of uniform strength - beams of two materials – strain energy due to bending - shearing stresses in beams.

Module III (13 hours)

Analysis of stress and strain on oblique sections:

Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette

Thin and Thick Cylinders**:** Stresses in thin cylinders – thick cylinders - Lame's equation – stresses in thick cylinders due to internal and external pressures

Torsion: Torsion of solid and hollow circular shafts.-Pure shear- strain energy in pure shear and torsion.

Springs: Close coiled and open coiled helical springs.

Module IV (13 hours)

Deflection of statically determinate beams: Differential equation of the elastic curve - Method of successive integration, Macaulay's method, Method of superposition, moment area method, conjugate beam method.

Theory of columns**:** Direct and bending stresses in short columns- Kern of a section. Buckling and stability-Euler's buckling/crippling load for columns with different end conditions- Rankine's formula - Eccentric loads and the Secant formula-Imperfections in columns.

Text Books

1. Timoshenko , *Strength of Materials Vol. I & Vol. II* , CBS Publishers & Distributers, New Delhi
2. James M Gere & Stephen P Timoshenko , *Mechanics of Materials* , CBS Publishers & Distributers, New Delhi
3. Egor P Popov , *Mechanics of solids*, Prentice Hall of India, New Delhi.
4. S.S Bhavikatti , *Structural analysis Vol I* , Vikas Publications (P) Ltd.
5. S.B Junnarkar & H.J Shah, *Mechanics of Structures Vol II* ,Charotar publishing House.

Reference books

1. Hearn E.J., *Mechanics of Materials*, Pergamon Press, Oxford
2. Warnock F.V., *Strength of Materials*, Isaac Pitman
3. Nash W.A., *Strength of Materials*, Schaum's Outline Series, McGraw Hill
4. Wang C.K., *Statically Intermediate Structures*, McGraw Hill
5. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India
6. Dibabrata Nag & Abhijit Chanda, Strength of Materials, Wiley India Publishers

Internal work assessment *(Maximum Marks – 50)*

60%- Tests (minimum 2)

30%- Assignments (minimum2) such as home work, quiz, literature survey, seminar, term-project..

10%- Regularity in the class.

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 304: Building Technology I

Credits: 4

Teaching scheme
3 hours lecture and 1 hour tutorial per week
Objectives:
To study (i) Details regarding properties and testing of building materials, (ii) Details regarding the construction of building components (iii) Properties of concrete and concrete mix design. (iv) Basic concepts in planning of buildings

Module I (13 hours)
General Requirements of Construction Materials – factors considered during selection. **Building stones** – Classification of rocks – Quarrying of stones. Dressing – Properties and uses of common stones – Tests conducted on stones. **Timber** – Classification – seasoning -defects in Timber –– decay – preservation – Manufacture, properties and uses of plywood, fibre board, particle board. **Clay** products – Bricks and tiles – manufacture – BIS specifications properties and testing.
Lime – BIS Classification – manufacture – properties and uses. **Cement** – Manufacture – types of cement – uses – Properties and testing. **Mortar** – Types – Sand – properties – uses. **Iron and Steel** – Reinforcing steel – types – specifications. **Structural steel** – specifications – **Miscallaneous materials** (only properties, classifications and their use in construction industry): Glass, Plastics, A.C.Sheets, Bitumen, Adhesives, Aluminium

Module II (13 hours)
Concrete – Aggregates – Mechanical & Physical properties and tests – Grading requirements – Water quality for concrete –Admixtures – types and uses – plasticizers – accelerators – retarders – water reducing agents – batching – mixing – types of mixers – transportation – placing – compacting – curing.

Properties of concrete – fresh concrete – workability – segregation and bleeding - factors affecting workability & strength – tests on workability – tests for strength of concrete in compression, tension & flexure – stress –strain characteristics and elastic properties – shrinkage and creep.

Durability of concrete – permeability – sulphate attack - alkali aggregate reaction – exposure to marine environment. Concrete quality control – statistical analysis of results – standard deviation – acceptance criteria – mix proportioning (B.I.S method) – nominal mixes.

Module III (13 hours)

Building construction - Preliminary considerations – site clearing and drainage – Excavation – Timbering – Function and requirements of foundations Bearing capacity of soils-methods of improving bearing capacity – Settlement of foundations and precautions – shallow and deep foundations – description of spread, grillage, raft and pile foundation.

Masonry – Types of stone masonry – Bonds in brickwork – advantages and limitations of masonry construction - corbels, cornice and copings – composite walls - cavity walls and partition walls – construction details and features – scaffoldings.

Lintels and arches – types and construction details. Floors and flooring – different types of floors and floor coverings. Roofs and roof coverings – different types of roofs – suitability – types and uses of roofing materials. Doors, windows and ventilators – Types and construction details.

Stairs – types - layout and planning. Finishing works – Plastering, pointing, white washing, colour washing, distempering, painting. Methods of providing DPC. Termite proofing.

Module IV (13 hours)
Functional planning of buildings - occupancy classification of buildings - building codes and rules - functional requirements of residential and public buildings as per the relevant building rules and NBC- Planning principles - checking for circulation, ventilation, structural requirements and other constraints - sketch plans, working drawings and site plan.

Text books
1.Rangwala S C., Engineering Materialals, Charotar Publishers
2.Shetty M.S., Concrete Technology, S. Chand & company.
3.Arora and Bindra, Building construction, Dhanpath Rai and Sons.

Reference Books
1. Punmia B.C. Building Construction, Laxmi Publications.
2. Gambhir M L, Concrete Technology, Tata McGrawHill.
3. Krishna Raju N, Design of Concrete Mixes, CBS publishers.
4. Neville A.M.and Brooks.J.J, Concrete Technolgy, Pearson Education.
5. Akroyd T.N.W, Concrete: Properties & Manufacture, Pergamon Press.
6. Huntington W.C., Building Construction, John Wiley
7. National Building Code.
8. Kerala Building Rules

Internal work assessment *(Maximum Marks – 50)*
60%- Tests(minimum 2)
30%- Assignments (minimum2) such as home work, quiz, literature survey, seminar, term-project..
10%- Regularity in the class.

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 305: Surveying – I

Teaching Scheme **Credit : 4**
3 hours lecture and 1 hour tutorial per week

Objective: To acquaint with basic principles & basic instruments related with surveying & leveling.

Module I (13 hours)

Introduction - classification of surveys - reconnaissance - principles - provision of control - conventional signs.
Chain survey - instruments - principles of chain survey - field book - plotting - tie line and check line - chaining and ranging - obstacles - chaining on sloping ground - errors - uses of cross staff and optical square.
Compass survey - prismatic compass - surveyor's compass - whole circle and reduced bearing - true and magnetic bearing - dip and declination - local attraction - traversing - plotting - error of closure - graphical and analytical adjustments.

Module II (13 hours)
Plane table survey - instruments and accessories - different methods - orientation - advantages and disadvantages of plane tabling - two point problem - three point problem – errors.
Levelling - definition of level surfaces - mean sea level - reduced level - bench marks - levelling instruments - temporary and permanent adjustments - fly leveling - booking - reduction of levels - corrections for refraction and curvature - reciprocal leveling - longitudinal levelling and cross sectioning - contour survey - definition - characteristics of contour - uses of contour - methods of contouring - direct and indirect interpolation – plotting.

Module III (13 hours)
Areas and volumes - trapezoidal rule - simpson's rule - area from latitude and departure - uses of planimeter - volumes - trapezoidal and prismoidal formula
Minor instruments - hand levels - clinometer - ceylon ghat tracer - hypsometer - pantagraph - ediograph - box sextant - telescopic alidade – introduction to modern instruments (Total station, GPS etc).
Theodolite surveying - study of theodolite - temporary adjustments - measurement of horizontal angles - method of repetition and reiteration - measurement of vertical angles - theodolite traverse - calculation of co-ordinates - corrections - traverse table - omitted measurements.

Module IV (13 hours)
Curves – Types of curves – elements of a curve – simple curves – different methods for setting out of simple curves - Linear, angular methods – setting out of compound curves – transition curves – characteristics – methods of setting out – super elevation - vertical curves – types – characteristics – setting out.

Text Books
Kanetkar T.P. & Kulkarni S.V., Surveying Vol. I &II, Vidyarthigriha Prakasan
Venkatramiah C., "Text book of Surveying", Universities Press, 2011.

Reference books
1. Punmia B.C., Surveying Vol. I &II, Laxmi Publishers
2. Arora K.R., Surveying Vol. I & II, Standard Book House

Internal work assessment ***(Maximum Marks – 50)***
60%- Tests(minimum 2)
30%- Assignments (minimum2) such as home work, quiz, literature survey, seminar, term-project..
10%- Regularity in the class.

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE14 306: Engineering Geology

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives: To make the students familiar with physical and structural geology as well as the basics of mineralogy and petrology.

Module I (13 hrs)

Physical Geology and Environmental Geology

The Earth Science and its sub divisions- scope of Engineering Geology
Geological works of rivers, oceans and wind
Weathering of rocks: products of weathering - influence of climate and lithology on weathering.
Volcanoes: types and causes of volcanism - volcanic products - types of volcanic eruptions and their distribution.
Elements of Engineering Seismology:
Causes of earthquakes - plate tectonics - earthquake mechanism
Earthquake phenomenon – focus, epicentre, seismic waves, magnitude, intensity, intensity scale, and its correlation with ground acceleration - characteristics of strong ground motions and attenuation
Earthquake recording instruments
Secondary effects – land and rock slides, liquefaction, fires, tsunamis, floods, release of poisonous gases and radiation.
Earthquake occurrence - seismic zoning map of India and its use – case studies of important Indian earthquakes - major world earthquakes - earthquake catalogue - assessment of damage - measures for protection of life and property – earthquake resistant structures
Landslides : terminology - classification - causes and controls of landslides

Module II (13 hrs)

Mineralogy and Petrology

Megascopic characters of the important rock forming mineral groups - quartz, feldspar, pyroxene, amphibole, mica and carbonates only
Classification and distinguishing features of igneous, sedimentary and metamorphic rocks- brief description of granite, basalt, dolerite, gabbro, sandstone, shale, limestone, slate, phyllite, schist, gneiss, quartzite and marbles only
Engineering properties of rocks - rocks as construction materials – qualities required for building, dimensional and decorative/ ornamental stones.

Module III (13 hrs)

Structural Geology, Hydrogeology and Exploration Geology

Geological structures and their significance in Civil Engineering projects - folds, faults, joints and unconformities

Origin and occurrence of groundwater – geological formations as aquifer, aquicludes, aquitards and aquifuges - artificial recharge of ground water - quality of ground water – saline water intrusion in coastal aquifers

Importance of ground water investigation in civil engineering projects – ground water exploration – electrical, electromagnetic, gravimetric, radioactive and seismic exploration techniques.

Module IV (13 hrs)

Geoinformatics and Engineering Geology

Remote sensing: Basic principles - role of remote sensing in Civil Engineering - various interpretation techniques in remote sensing

Geographical Information Systems.

Applications of geological knowledge in Civil Engineering projects - dams, bridges, roads, tunnels and multi-storied buildings - geological factors in the design of buildings.

Text books:

1. Kueffer and Lillesand : Remote sensing and Image interpretation
2. Read H.H. , Rutleys :Elements of Mineralogy, CBS Publishers
3. Singh. P : Engineering and General Geology.
4. S.K. Kataria, Todd, D.K : Ground water Hydrology. John Wiley
5. Tyrrel .G.W. : Petrology
6. Understanding GIS : ISRI Publications.
7. D.Venkat Reddy : Engineering Geology,Vikas Publishing House Pvt. Ltd

Reference books:

1. Billings.M.P. : Structural Geology. Asia Publishing House.
2. Holmes, A :Principles of Physical Geology. Thomas Nelson
3. Judds, W.R : Principles of Engineering Geology and Geotechniques. Mc Graw Hill
4. Keshavalu, C.N. :Text book of Engineering Geology. Mc Millan India Ltd.
5. Pandey,S.N. :Principles and Applications of Photogeology Wiley Eastern
6. Reddy. V :Engineering Geology for Civil Engineers. Oxford &IBH
7. Sabins F.F. :Remote Sensing – Principles and Interpretation.W Freeman & Co., SanFranscisco
8. Sathya Narayanaswami.B.S : Engineering Geology, Dhanpat Rai & Co (P) Ltd
9. Strahler :Environmental Geology
10. Valdiya K.S :Environmental Geology in Indian Context –Tata Mc Graw Hill
11. Toby Waltham :Foundations of Engineering Geology, 3rd Edn., University Press
12. Vasudev Kanithi : Engineering Geology, Universities Press

Internal work assessment *(Maximum Marks – 50)*

60%- Tests(minimum 2)

30%- Assignments (minimum2) such as home work, group discussions, quiz, literature survey, seminar, term-project..

10%- Regularity in the class.

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 307(P) Surveying Lab – I

Teaching Scheme **Credits : 2**

3 hours practical per week

Objective: To impart training in Chain, Compass, Plane table surveying & Leveling.

List of exercises

1. Chain & Compass Traversing — Traversing and plotting of Details
2. Plane table Survey — Method of Radiation and intersection
3. Plane table Survey — Solving Two Point Problem
4. Plane table Survey — Solving Three Point Problem
5. Plane table Survey — Traverse
6. Leveling — Fly leveling
7. Leveling — Longitudinal and cross sectioning
8. Leveling — Contour surveying
9. Setting out of building plans
10. Theodolite : study of instrument, temporary adjustments, measurement of horizontal and vertical angles.
11. Theodolite traversing
12. Study of Minor instruments: Planimeter, pantagraph, clinometer, hand levels, Quick setting level, Cylon Ghat Tracer, sextent

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

CE 14 308 (P): Materials Testing Lab I

Teaching scheme **Credits: 2**

3 hours practical per week (Minimum 39 hrs)

Objective:

To study various properties of building materials

List of experiments

1.Tests on cement

a) Fineness b) Normal consistency and Setting time c) Soundness d) Compressive strength

2.Test on bricks -

a) Water absorption b) Efflorescence c) Compressive strength

3.Tests on aggregate for concrete

a) Physical Properties

i) Grain size distribution ii) Specific gravity iii) Density iv) Void ratio v) Bulking of sand

b) Aggregate crushing value

4.Properties of fresh concrete – workability tests

a) Flow & vee- bee tests b)Slump & Compaction factor test

5.Tests on Timber

a) Compressive strength –parallel to grain & perpendicular to grain b) Bending tests

4.Test on tiles

(i) Transverse strength, (ii) Water Absorption of a) Flooring tiles b) Roofing tiles.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Semester End Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

4th Semester

EN 14 401 (A): Engineering Mathematics IV
(Common for ME, CE, PE, CH, BT, PT, AM, and AN)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective

The use of probability models and statistical methods for analyzing data has become common practice in virtually all scientific disciplines. Two modules of this course attempt to provide a comprehensive introduction to those models and methods most likely to be encountered and used by students in their careers in engineering. A broad introduction to some important partial differential equations is also included to make the student get acquainted with the basics of PDE.

Module I: Probability Distributions (13 hours)

Random variables - mean and variance of probability distributions - binomial distribution - poisson distribution - poisson approximation to binomial distribution - hyper geometric distribution - geometric distribution - probability densities - normal distribution - uniform distribution - gamma distribution.

Module II: Theory of Inference (13 hours)

Population and samples - sampling distribution - sampling distribution of mean (σ known) - sampling distribution of mean (σ unknown) - sampling distribution of variance - interval estimation - confidence interval for mean - null hypothesis and tests of hypotheses - hypotheses concerning one mean - hypotheses concerning two means - estimation of variances - hypotheses concerning one variance - hypotheses concerning two variances - test of goodness of fit.

Module III: Series Solutions of Differential Equations (13 hours)

Power series method for solving ordinary differential equations - Frobenius method for solving ordinary differential equations - Bessel's equation - Bessel functions - generating functions (No proof) - relation between Bessel functions - orthogonality property of Bessel functions (proof not required).

Module IV: Partial Differential Equations (13 hours)

Introduction - formation of PDE - complete solution - equations solvable by direct integration - linear PDE of first order, Legrange's equation: $Pp + Qq = R$ - non-linear PDE of first order, $F(p,q) = 0$, Clairaut's Form: $z = px + qv + F(p,q)$, $F(z,p,q) = 0$, $F_1(x,q) = F_2(y,q)$ - classification of linear PDE's - derivation of one dimensional wave equation and one dimensional heat equation - solution of these equation by the method of separation of variables.

Text Books

Module I:
Richard A Johnson, CB Gupta, *Miller and Freund's Probability and statistics for Engineers, 7e*, Pearson Education - Sections: 4.1, 4.2, 4.3, 4.4, 4.6, 4.8, 5.1, 5.2, 5.5, 5.7

Module II:
Richard A Johnson, CB Gupta, *Miller and Freund's Probability and statistics for Engineers, 7e*, Pearson Education - Sections: 6.1, 6.2, 6.3, 6.4, 7.2, 7.4, 7.5, 7.8, 8.1, 8.2, 8.3, 9.5

Module III:
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.-
Sections: 4.1, 4.4, 4.5

Module IV:
N Bali, M Goyal, C Watkins, *Advanced Engineering Mathematics, A Computer Approach, 7e,* Infinity Science Press, Fire Wall Media- Sections: 16.1, 16.2, 16.3, 16.4, 16.5, 16.6, 16.7, 16.8, 16.9
Erwin Kreysig, *Advanced Engineering Mathematics, 8e,* John Wiley and Sons, Inc.
Sections: 11.2, 11.3, 9.8 Ex.3, 11.5

Reference books

1. William Hines, Douglas Montgomery, avid Goldman, Connie Borror, *Probability and Statistics in Engineering*, 4e, John Wiley and Sons, Inc.
2. Sheldon M Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, 3e, Elsevier, Academic Press.
3. J.S.Chandan, *Statisitcs for Business and Economics*, Vikas Publishing House.
4. Anthony Croft, Robert Davison, Martin Hargreaves, *Engineering Mathematics*, Pearson Education.
5. H Parthasarathy, *Engineering Mathematics, A Project & Problem based approach*, Ane Books India.
6. B V Ramana, *Higher Engineering Mathematics*, McGrawHill.
7. Sarveswara Rao Koneru, *Engineering Mathematics*, Universities Press.
8. J K Sharma, *Business Mathematics, Theory and Applications*, Ane Books India.
9. John bird, *Higher Engineering Mathematics*, Elsevier, Newnes.
10. M Chandra Mohan, Vargheese Philip, *Engineering Mathematics-Vol. I, II, III & IV.*, Sanguine Technical Publishers.
11. Wylie C.R and L.C. Barret, *Advanced Engineering Mathematics*, McGraw Hill.
12. V R Lakshmy Gorty, *Advanced Engineering Mathematics-Vol. I, II.*, Ane Books India.
13. Sastry S.S., *Advanced Engineering Mathematics-Vol. I and II.*, Prentice Hall of India.
14. Michael D Greenberg, *Advanced Engineering Mathematics*, Pearson Education.
15. Babu Ram, *Engineering Mathematics Vol.I & II*, Pearson Education.
16. S.Palaniammal, *Probability and Random Processes*, Prentice Hall of India.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

EN 14 402 Environmental Science

(Common for all branches)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- *To understand the problems of pollution, deforestation, solid waste disposal, degradation of environment, loss of biodiversity and other environmental issues at local and global levels.*
- *To create awareness among the students to address these issues and conserve the environment in a better way.*

Module I (13 hours)

The multidisciplinary nature of environmental science - definition - scope and importance - need for public awareness-natural resources-renewable and non-renewable resources: natural resources and associated problems - forest resources: use and over-exploitation, deforestation, case studies. timber extraction, mining, dams and their effects on forests and tribal people - water resources: use and over utilization of surface and ground water, floods, drought, conflicts over water, dams - benefits and problems.- mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, case studies.- food resources: world food problems, changes caused by agriculture over grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - energy resources: growing energy needs, renewable and non-renewable energy resources, use of alternate energy resources, land resources: land as a resource, land degradation, man-induced landslides, soil erosion and desertification.

Module II (13 hours)

Ecosystems - concept of an ecosystem-structure and function of an ecosystem - producers, consumers, decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - introduction, types, characteristics features, structure and function of the following ecosystems: forest ecosystem- grassland ecosystem - desert ecosystem - aquatic ecosystem (ponds, streams, lakes, rivers, oceans , estuaries)

Biodiversity and its consideration: introduction - definition: genetic, species and ecosystem diversity -bio-geographical classification of India - value of biodiversity: consumptive use, productive use, social ethical, aesthetic and option values - biodiversity at global, national, and local level - India as mega-diversity nation - hot spot of biodiversity - threats to biodiversity: habitat loss, poaching of wild life, man- wild life conflicts - endangered and endemic species of India - conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Module III (13 hours)

Environmental pollution: definition, causes, effects and control measures of: air pollution - water pollution - soil pollution - marine pollution - noise pollution - thermal pollution - nuclear hazards -Solid waste management: causes, effects and control measures of urban and industrial wastes; e-waste management-role of an individual in prevention of pollution - pollution case studies - disaster management: floods , earth quake, cyclone and landslides - environmental impact assessment

Module IV (13 hours)

Environment and sustainable development - Sustainable use of natural resources - conversion of renewable energy resources into other forms - case studies - problems related to energy and energy auditing - water conservation, rain water harvesting, watershed management - case studies - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust - waste land reclamation - consumerism and waste products - reduce, reuse and recycle concept of products - value education for environment conservation, global conservation movements and agreements, green economy, carbon foot print, carbon trading.

Text Books:

1. Daniels & Krishnaswamy, Environmental studies, Wiley India Pvt Ltd, 2009

2. Raman Sivakumar, Introduction to environmental science and engineering, 2nd edn, . Tata McGraw Hill, 2010

3. Anindita Basak, Environmental Studies, Pearson Education, 2009

4. Suresh K.D, Environmental Engineering and Management, Katson Books, 2007

5. Benny Joseph, Environmental studies, 2nd edn, McGraw Hill, 2009

References:

1. Raghavan Nambiar, K Text book of Environmental Studies, Scitech Publishers(India) Pvt. Ltd

2. S.P Misra, S.N Pandey, Essential Environmental studies, Ane books, Pvt Ltd, 2009

3. P N Palanisamy, P Manikandan, A Geetha, Manjula Rani, Environmental Science, Pearson Education, 2012

3. D.L. Manjunath, Environmental Studies, Pearson Education, 2011

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

Note: Field work can be visit to a local area to document environmental assets-river/forest/grass land/mountain or visit to local polluted site-urban/rural/industrial/agricultural etc. or study of common plants, insects, birds etc. or study of simple ecosystems-pond, river, hill slopes etc. or mini project work on renewable energy and other natural resources , management of wastes etc.

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 403: Fluid Mechanics

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- *This course gives an introduction to the fundamentals of fluid flow and its behavior so as to equip the students to learn related subjects and their applications in the higher semesters.*

Module I (13 hours)
Fluid - definition - types of fluids - fluids as a continuum - fluid properties - density - specific gravity - surface tension and capillarity - vapour pressure - viscosity and compressibility - classification of fluids - fluid statics - fluid pressure - absolute and gauge pressure - measurement of pressure - fluid static force on immersed surfaces - buoyant forces - stability of floating and submerged bodies - hydraulic press, cranes, lifts - fluid kinetics - methods of describing fluid flow - Lagrangian and Eulerian approaches - types of fluid flow - rotational and irrotational flows - vorticity and circulation - velocity and acceleration - local and convective acceleration - potential flows - velocity potential and stream function - laplace equation - flownets - uses and limitations - methods of analysis of flow net

Module II (13 hours)
Fluid dynamics - forces influencing fluid motion - types of forces - body and surface forces - energy and head - equations of fluid dynamics - Euler equation and application - integration of Euler equation to get Bernoullis' equation - momentum equation - vortex motion - free and forced vortex - application of Bernoullis' equation in measurement of flows - stagnation pressure - pitot tube, prandtl tube, venturi meter, orifice plate - flow nozzles, orifices, mouthpieces, notches and weirs.

Module III (13 hours)
Pipe flow - transition from laminar flow to turbulent flow - problems in pipe flow - losses in pipe flow - major and minor losses - losses in transition - losses in fittings and valves - friction loss in pipe - coefficient of friction - commercial pipes in use - different arrangements of pipes - pipes open to atmosphere - pipe connecting reservoirs - branching pipes - pipes in parallel and series - equivalent lengths - power transmission in pipes - waterhammer - cavitation - syphons - laminar flow in pipes - Hagen Poisuille's equation.

Module IV (13 hours)
Dimensional analysis - scope of dimensional analysis - dimensions - dimensional homogeneity - dimensional groups - dimensional analysis using Buckingham's π theorem method - examples on pipe

flow - flow over weirs and orifices - model testing - similitude - special model laws - Froude, Reynold, Weber, Cauchy and Mach.laws - problem solution using Froude and Reynold laws- Introduction to boundary layer (introduction only, No numerical problem solving expected)- examples of drag on immersed bodies.

Text books:

1. Modi P.N. & Seth S.M., *Hydraulics & Fluid Mechanics*, Standard Book House
2. Bensal R K A Text Book of Fluid Mechanics and Hydraulic Machines, Laxmi Publications

Reference books:

1. Streeter V.L., Fluid Mechanics, McGraw Hill
2. Garde R.J., Fluid Mechanics Through Problems, Wiley eastern
3. Subramanya K., Theory and Applications of Fluid Mechanics, Tata McGraw Hill
4. Duncan, Tom & Young, Fluid Mechanics, ELBS
5. N Narayana Pillai, Principles of fluid mechanics and fluid machines, Universities Press (India) Private Limited 2009.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

Note: Students shall be encouraged to solve problems using software like spreadsheet, MATLAB etc.)

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 404: Structural Analysis - I

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.*

Module 1 (13 hours)

Displacement response of statically determinate structural systems using energy methods:

Elastic theorems and energy principles - strain energy due to axial load, bending moment, shear and torsion - principle of superposition - strain energy method, Castigliano's method, and unit load method.

Principle of virtual work - Castigliano's theorem for deflection - theorem of complementary energy - Betti's theorem - Maxwell's law of reciprocal deflections - principle of least work - application of unit load method and strain energy method for determination of deflection of statically determinate frames - pin jointed trusses - temperature effects, lack of fit.

Module II (13 hours)

Statically indeterminate structures:

Degree of static and kinematic indeterminacies - force and displacement method

Strain energy method

Analysis of beams, frames and trusses with internal and external redundancy - effect of prestrain, lack of fit, temperature changes, support settlement.

Method of Consistent deformations:

Analysis of beams frames and trusses with internal and external redundancy - effect of prestrain, lack of fit, temperature changes, support settlement.

Module III (13 hours)

Moving loads and influence lines.

Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams - Muller Breslau principle - application to propped cantilevers - influence lines for forces in beams and trusses analysis for different types of moving loads - single concentrated load - several concentrated loads uniformly distributed load shorter and longer than the span.

Module IV (13 hours)

Cables, suspension bridges and arches.

Statically determinate suspension bridges and arches

Analysis of forces in cables - temperature effects - suspension bridges with three hinged stiffening girders - theory of arches - Eddy's theorem - analysis of three hinged arches.

Statically indeterminate suspension bridges and arches.

suspension bridges with two hinged stiffening girders - analysis of two hinged arches - settlement and temperature effects.

Text books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers
2. Wilbur J.B. and Norris C.H., Elementary structural Analysis, McGraw Hill
3. Wang C.K., Intermediate Structural Analysis, McGraw Hill
4. Hibbeler., Structural Analysis, Pearson Education
5. Daniel L Schodak, Structures, Pearson Education/Prentice Hall India
6. Devdas Menon, Structural Analysis, Narosa Publications
7. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India
8. D.S. Prakash Rao, Structural Analysis –A Unified Approach, Universities press,(INDIA) Ltd.

References:

1. Kinney S., Indeterminate Structural Analysis, Oxford & IBH
2. Coates, Coutie and Kong , Structural Analysis, ELBS Publishers
3. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill
4. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill
5. Harry H West & Louis F Geschwindner, Fundamentals of Structural Analysis, Wiley India Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE14 405 Engineering Economics and Principles of Management

(Common for CE, EE, EC, AI and BM)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Section 1: Engineering Economics

Teaching scheme

1hour lecture and 1 hour tutorial per week

Objective

The prime objective of the *Engineering Economics* course is to make students familiar with the economic way of thinking. This course provides the students with the foundations of economic theory, tools and techniques for use in the process of efficient economic decision-making in their engineering and managerial profession.

Module I (13 hours)

Introduction to engineering economics - technical efficiency, economic efficiency - cost concepts: elements of costs, opportunity cost, sunk cost, private and social cost, marginal cost, marginal revenue, profit maximisation, break-even analysis.

Supply and demand: determinants of demand, law of demand, determinants of supply, law of supply, market equilibrium - elasticity of demand - types of elasticity, factors affecting the price elasticity of demand.

National income concepts: GDP and GNP, per capita income, methods of measuring national income. inflation and deflation: concepts and regulatory measures - monetary policy and fiscal policy.

Module II (13 hours)

Value Analysis - time value of money - interest formulae and their applications: single-payment compound amount factor, single-payment present worth factor, equal-payment series compound amount factor, equal-payment series sinking fund factor, equal-payment series present worth factor, equal-payment series capital recovery factor, effective interest rate.

Investment criteria: payback period, net present value, internal rate of return, benefit-cost ratio.

Text Books

1. Panneer Selvam, R, "*Engineering Economics*", Prentice Hall of India Ltd, New Delhi, 2001.
2. Dwivedi, D.N., "*Managerial Economics, 7/E"*, Vikas Publishing House, 2009.

Reference Books

1. Sullivan, W.G, Wicks, M.W., and Koelling. C.P., "*Engineering Economy 15/E*", Prentice Hall, New York, 2011.
2. Chan S. Park, "*Contemporary Engineering Economics*", Prentice Hall of India, 2002.
3. Prasanna Chandra, "*Financial Management: Theory & Practice, 8/E"*, Tata-McGraw Hill, 2011.

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Attendance and Regularity in the class

University Examination Pattern for Section 1

PART A: Analytical/problem solving SHORT questions *4x 5 marks=20 marks*

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *2 x 15 marks=30 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 50

University Examination Pattern – for Section 1
Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2

Section 2: Principles of Management

1 hour lecture and 1 hour tutorial per week

Objective

- *To provide knowledge on principles of management, decision making techniques, accounting principles and basic management streams*

Module I (13 hours)

Principles of management - evolution of management theory and functions of management organizational structure - principle and types - decision making - strategic, tactical & operational decisions, decision making under certainty, risk & uncertainty and multistage decisions & decision tree human resource management - basic concepts of job analysis, job evaluation, merit rating, wages, incentives, recruitment, training and industrial relations.

Module II (13 hours)

Financial management - Time value of money and comparison of alternative methods - costing - elements & components of cost, allocation of overheads, preparation of cost sheet, break even analysis - basics of accounting - Principles of accounting, basic concepts of journal, ledger, trade, profit &loss account and balance sheet. Marketing management - Basic concepts of marketing environment, marketing mix, advertising and sales promotion. Project management - Phases, organisation, planning, estimating, planning using PERT & CPM

Reference Books

1. F. Mazda, *Engineering management*, Addison Wesley, Longman Ltd., 1998
2. Lucy C Morse and Daniel L Babcock, *Managing engineering and technology*, Pearson, Prentice Hall
3. O. P. Khanna, *Industrial Engineering and Management*, Dhanpat Rai and Sons, Delhi, 2003.
4. P. Kotler, *Marketing Management: Analysis, Planning, Implementation and Control*, Prentice Hall, New Jersey, 2001
5. Venkata Ratnam C.S & Srivastva B.K, *Personnel Management and Human Resources*, Tata McGraw Hill.
6. Prasanna Chandra, *Financial Management: Theory and Practice*, Tata McGraw Hill.
7. Bhattacharya A.K., *Principles and Practice of Cost Accounting*, Wheeler Publishing
8. Weist and Levy, *A Management guide to PERT and CPM*, Prantice Hall of India
9. Koontz H, O'Donnel C & Weihrich H, *Essentials of Management*, McGraw Hill.
10. Ramaswamy V.S & Namakumari S, *Marketing Management : Planning, Implementation*.

Internal Continuous Assessment *(Maximum Marks-25)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Attendance and Regularity in the class

University Examination Pattern for Section 2

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.	*4x 5 marks=20 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*2 x 15 marks=30 marks*

Maximum Total Marks: 50

University Examination Pattern – for Section 2
Note: Section 1 and Section 2 are to be answered in separate answer books
Maximum 50 marks each for Section 1 and Section 2

CE14 406: Surveying II

Teaching Scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objective:

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

Module I (13 hours)

Permanent adjustments of theodolite

Tacheometric surveying - stadia system - fixed and movable hair methods - staff held vertical & normal - instrument constants - anallactic lens - tangential system - subtense bar

Trigonometric leveling - observations for heights & distances

Hydrographic survey - scope - shoreline survey - soundings - sounding equipment - methods - ranges - locating sounding - plotting - three point problem

Module II (13 hours)

Triangulation - principle - reconnaissance - selection of site for base line - selection of stations - orders of triangulation - triangulation figures - scaffolds and signals - marking of stations - intervisibility and heights of stations - satellite stations - base line measurement - equipment and corrections - adjustment of observations - laws of weight - probable error - most probable value - station adjustment - figure adjustment .

Module III (13 hours)

Field astronomy - definitions - solution of an astronomical triangle - co-ordinate systems - time - solar, siderial and standard equation of time - sundial - determination of time, azimuth, latitude and longitude.

Photogrammetry - fundamental principles of ground and aerial photogrammetry - analytical and graphical methods - field work - photo-theodolite and its use - methods of aerial surveying - interpretation of air photographs.

Module IV (13 hours)

Introduction to remote sensing & geographic information system - classification of remote sensing-idealised RS system - basic principles of remote sensing - remote sensing platforms & sensors (types only) - applications of remote sensing (listing only). *[Text Book: Punmia, Vol II Ch 16]* Fundamentals of GIS - map projections - Raster & Vector data - definition of GIS - components of a GIS - Geospatial data - GIS operations - GIS models & modelling. (only brief descriptions of all these items) *[Text Book: Kang - tsung Chang, Ch 1&2, GIS]*

Introduction of modern instruments - electronic distance measuring - total station - types, working principles, measurement techniques and error corrections - automatic levels.

Text books:

1. Kanetkar T.P. & Kulkarni S.V., *Surveying Vol. I &II*, Vidyarthigriha Prakasan
2. Punmia B.C., *Surveying Vol. I &II*, Laxmi Publications
3. Arora K.R., *Surveying Vol. I & II*, Standard Book House
4. Kang – tsung Chang *Introduction to Geographic Information System*, Tata McGraw – Hill, New Delhi.
5. Yeung Albert K. W. & Lo C. P. Concepts & Techniques of GIS, Prentice Hall India.

Reference books

1. Anji Reddy M., *Text book of Remote sensing & Geographic Information System*, BS Publications, Hyderabad.
2. Thomas M. Lillesand & Ralph W. Kiefer *Remote sensing & Image Interpretation*, John Wiley & Sons Inc.
3. Satheesh Gopi,Sathikumar R and Madhu N, *Advanced Surveying – Total Station, GIS and Remote Sensing*, Pearson Education, 2007.
4. Narayan Panigrahi, *Geographical Information Science*, University Press, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer FOUR questions out of FIVE. There shall be minimum of TWO and maximum of THREE questions from each module with total FIVE questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 407(D): Civil Engineering Drawing I

Teaching scheme **Credits: 2**

3hours per week (39 hrs)

Objectives

- *To make the students aware about the basic principles of Building Drawing*
- *To make the students to know Basic commands of a popular drafting package*
- *Make the students to draw plan, elevation and section of buildings*

Module 0: Introduction of a Popular Drafting Package (6 Hours)

- Basic Commands and simple drawings

Module 1: Detailed drawing of Components (15 Hours)

- Panelled doors, glazed windows and ventilators in wood (2 Sheets)
- Steel windows (1 Sheet)
- Roof truss in structural steel sections (2 sheets)
- Reinforced Concrete staircase (2 sheets)

Module II: From given line sketch and specification, develop Working drawings (plan, elevation and section) of the following buildings (18 Hours)

- Single storied residential building with flat and tiled roof (4 Sheets)
- Public buildings like office, dispensary, post office, bank etc. (3 sheets)
- Factory building with trusses supported on Brick walls and pillars (2 sheets)

Assignment: Preparing drawings (plan, section and elevation) in any popular drafting package.

Reference Books:

Balagopal T.S. Prabhu, Building drawing and detailing, Spades Publishers
Shah & Kale ,Building Drawing, Tata McGraw Hill
B.P. Verma, Civil Engineering Drawing and housing Planning, Khanna Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

Any 5 sheets in Module 1- 5 x 2 = 10 marks
Any 6 sheets in Module II – 6 x 2 = 12 Marks
Assignment - 8 marks
Test - 15 marks
Regularity - 5 marks
Total - 50 marks

University Examination pattern: *(Maximum Marks-100)*

No Questions from Module 0
Part A:
3 Questions of 15 marks each, from Module I, with Choice to answer any two (2 x 15 = 30 marks)
Part B:
One compulsory question of 70 marks from Module II (1 x 70=70 marks)
Total - 100 marks

CE 13 408 (P): Surveying Lab II

Teaching Scheme **Credits: 2**
3 hours practical per week (Minimum 39 hrs)
Objective
• *To give a practical knowledge in different aspects of Theodolite Surveying, Tacheometry & Total Station*

List of exercises

1. Theodolite surveying - horizontal angle by repetition & reiteration methods.
2. Determination of tacheometric constants
3. Heights and distances by stadia tacheometry
4. Heights and distances by tangential tacheometry
5. Heights and distances by solution of triangles
6. Vertical Plane Method
7. Setting out of simple curves - linear methods
8. Setting out of simple curves - angular method
9. Study of modern instruments - Automatic levels and Electronic theodolite, GPS
10. Total station - Horizontal and vertical angles, Horizontal distance, Level difference, traversing & Area calculation.
11. Contour Map preparation using Total Station
12. Curve Setting using Total Station

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s and term project
10%- Regularity in the class

Semester End Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

5th Semester

CE 14 501: Structural Design I

Teaching Scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objective

- *To provide the students with the knowledge of the behaviour of reinforced concrete structural elements in flexure, shear, compression, tension and torsion, and to enable them to design such elements under various loads.*

Module I (13 Hours)

Material strength and properties – stress- strain characteristics of concrete and steel – grades of concrete and steel, fatigue effects. Types of loads and load combinations. Factor of Safety. Evolution of different design philosophies on design of RCC sections.

Working Stress Method of design of RCC beam sections - principles, assumptions - strength and working stress- durability and fire resistance – IS codal provisions. Moment of resistance of singly and doubly reinforced rectangular and flanged beam sections - deflection criterion for flexural members.

Module II (13 Hours)

Limit State Method of design of RCC beam sections - principles and assumptions - characteristic strength and characteristic loads - partial safety factors – limit states-comparison with Working Stress Method, advantages - moment of resistance of singly and doubly reinforced rectangular and flanged beam sections- design of singly and doubly reinforced rectangular and flanged beam sections subjected to flexure, shear and torsion using Limit State Method - flexural and anchorage bonds, development length,

Module III (13 Hours)

Design and detailing of simply supported, cantilever and continuous RCC beams- IS Code coefficients for continuous beams - design and detailing of one way simply supported and continuous RC slabs - design and detailing of two way RCC slab with various support conditions using IS Code coefficients.

Module IV (13 Hours)

Design of stairs - general principles - design and detailing of various types of stairs - stairs with waist slab, stringer beam stairs, and stairs with cantilever steps - dog legged and folded plate stairs. Design and detailing of RC columns by Working Stress Method - general principles - axially loaded short and long columns – helically reinforced columns –design and detailing of RC tension members by Working Stress Method.

Text Books

1. Pillai S. U. and Menon D., Reinforced Concrete Design, Tata McGraw Hill
2. Sinha S. N., Reinforced Concrete Design, Tata McGraw Hill
3. Varghese P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India
4. Punmia B. C., Jain A. K. and Jain A. K., Limit State Design of Reinforced Concrete, Laxmi Publications (P) Ltd., 1st Edition, 2007.

Reference Books

1. Park and Paulay, Reinforced Concrete
2. Mallick S. K. and Gupta A. K., Reinforced Concrete, Oxford and IBH.
3. Jain A. K., Reinforced Concrete- Limit State Design, Standard Book House.
4. Jain and Jaikrishna, Plain and Reinforced Concrete Vol I, Nemchand
5. Sinha N. C. and Roy S. K., Fundamentals of Reinforced Concrete, S. Chand and Company Ltd.
6. Purushothaman, Behaviour, Analysis and Design of Reinforced Concrete Elements, Tata

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
15% - Assignments (minimum 2) such as home work, problem solving, quiz, seminar, software exercises, etc.
15% - assignment/ term project to familiarise the SP: 34 code
10% - Regularity in the class

University Examination Pattern

8x 5 marks=40 marks

PART A: *Analytical/problem solving SHORT questions*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 502: Building Technology –II

Teaching Scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per week

Objective:

• *To impart the basic concepts in functional requirements of building and building services.*

• *To develop understanding about framed construction, building failures and earth quake resistant construction.*

Module I (13 hours)

Multi-storeyed Buildings – Framed building – steel and concrete frame – structural systems – erection of steel work – bolting, riveting, welding –concrete framed construction – reinforcement – concreting of columns, beams, slabs and stairs – formwork – contraction and expansion joints – introduction to prefabricated construction – slip form construction.

Vertical transportation – Elevators – types – terminology – passenger, service and goods elevators – design considerations for passenger elevators – handling capacity – arrangement and positioning of lifts – escalators – features –use of ramps.

Module II (13 hours)

Fire safety – Fire resistant construction – fire load – fire resisting properties of materials – precautionary measures against origin and spread of fire – Alarm systems – hydrants – sprinklers- fire escape – requirements of high rise construction

Plumbing services – Typical details of water supply and sewage disposal for single and multistoreyed buildings – systems of plumbing - standard requirements.

Module III (13 hours)

Thermal control – Thermal comfort of human beings –human body's thermal balance and heat loss; Thermal control of buildings- insulation – principles - materials – methods of thermal insulation – insulation by orientation and shading – Features of tropical climate.

Ventilation – functions – provisions for ventilation – orientation – external features – cross ventilation – openings - mechanical ventilation systems – summer and winter air conditioning – introduction to different types of air-conditioning systems.

Lighting – photometric quantities – types of visual tasks -lighting requirements of various buildings- day lighting -day light factor – need for artificial lighting .

Acoustics – Introduction – criteria for acoustic environment – sound – control, insulation, and isolation – Acoustic materials and methods of fixing – acoustic requirement of auditorium.

Module IV (13 hours)

Introduction to Cost-effective construction - principles of filler slab and rat-trap bond masonry

Building failures – General reasons – classification – Causes of failures in RCC and Steel structures – Foundation failure – failures by alteration, improper maintenance, overloading – Fire, Wind and Earthquake.

Earthquake resistant construction (Reference no. 7 and 8) – (only construction aspects are to be covered and detailed designs not contemplated) – principles – lightness – continuity – suspended parts. Building configuration – strength in various directions – foundations – ductility. Seismic strengthening of masonry and earthen structures – band reinforcing-buttressing.

Text books:

1. Koenigsberger. Manual of tropical housing and building Part I – Climate Design. Orient Longman.
2. Punmia B.C,Building construction. Laxmi Publications
3. Arora and Bindra, Building construction, Dhanpath Rai and Sons.
4. Rangwala, S C Building Construction, Charotar Publishing House

References:
1. Smith P & Julian W. Building services, Applied Science Pub.
2. Mcking T.M, Building Failures, Applied Science Pub.
3. Huntington W.C., Building construction, John Wiley.
4. Narasimhan V, Introduction to Building Physics.
5. Adler R, Vertical Transportation for Building, American Elsevier Pub.
6. Bureau of Indian Standards , National Building Code of India, 2005
7. Code of practice for earthquake resistant design and construction of buildings, IS:4326-1993
8. Hand book on building construction practices – BIS, SP 62 (S&T) – 1997
9. Tall building systems & concepts, Monograph on planning and design of Tall building, council on Tall buildings and Urban Habitat.
10 Patil, S.M., Building Services, Sachin Printers, Mumbai

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

8x 5 marks=40 marks

PART A: Analytical/problem solving SHORT questions
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 503: Transportation Engineering I

Teaching Scheme **Credits: 4**

3 hours lecture and 1 hour tutorial per weak

Objective:

To build a strong, stable and deep concept on different means of transportation and to equip the students to plan, and design various structures and traffic control devices coming under two modes of transportation viz: Highways and Airports

Module I (15 hours)

Introduction – Role of transportation in society- Different modes of transport- Importance of roads in India- classification of roads - road patterns -typical cross sections of roads in urban and rural areas - requirements and factors controlling alignment of roads - engineering surveys for highway location.

Highway geometric design - pavement surface characteristics - camber and width requirements – sight distances - stopping and overtaking sight distances - overtaking zone requirements - design of horizontal alignment – speed – radius - super elevation - methods of providing super elevation - extra widening of pavements - transition curves - design of vertical alignment - gradient - grade compensation – summit curves and valley curves - worked out problems

Module II (13 hours)

Traffic Engineering:

Introduction - road user, vehicle and traffic characteristics - traffic engineering studies – speed – speed and delay - volume - origin and destination - parking and accident studies - worked out problems –

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 – signal co-ordination- design of isolated signals by Webster's method

Module III (12 hours)

Highway materials-Desirable properties and testing of highway materials –subgrade soil, road aggregates and bituminous materials

Design of flexible and rigid pavements - IRC methods - worked out problems

Construction -- bituminous concrete and cement concrete pavements

Failures in pavements - flexible and rigid pavements

Module IV (12 hours)

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

Text books:

1. Khanna.S.K and Justo.C.E.G., Highway Engineering, Nemchand and Bros.
2. Khanna.S.K and Arora.M.G., Airport Planning and Design, Nemchand&Bros.

References:
1. Kadiyali.L.R., Traffic Engineering and Transportation planning, Khanna Publishers, New Delhi
2. Kadiyali.L.R., Principles of Highway Engineering, Khanna Publishers, New Delhi
3. Yoder and Witenzak, Principles of Pavement design, John Wiley and sons, New York
4. IRC 37-2012-Guide lines for flexible pavement design
5. National Transport Policy Committe Report, Planning Commission, New Delhi.
6. Vision 2021, Road Development Plan, IRC, New Delhi,
7. IRC 58-2011 Guide lines for rigid pavement design
8. O'Flaherty.C.A, Highway - Traffic Planning and Engineering, Edward Arnold London
9. Horonjoff. R, Planning and Design of Airports, Mcgraw Hill book

Internal work assessment *(Maximum Marks – 50)*
60%- Tests(minimum 2)
30%- Assignments (minimum2) such as home work, group discussions, quiz, literature survey, seminar, term-project..
10%- Regularity in the class.

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

Note:-
While preparing the question paper of university examination, relevant IRC Charts for solving the set problem shall be printed in the question paper.

CE 14 504 Structural Analysis II

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- *To equip the students with the force and displacement methods of structural analysis with emphasis on analysis of rigid frames and trusses*

Module I (16 Hours)

Slope Deflection Method and Moment Distribution Method
Review of force method and displacement methods of analysis
Slope Deflection method - analysis of continuous beams- beams with overhang- analysis of rigid frames - frames without sway and with sway - different types of loads -settlement effects
Moment Distribution method – analysis of beams and frames – non sway and sway analysis – frames with sloping legs – gabled frames

Module II (13 Hours)
Clapeyrons Theorem (Three Moment Equation) and Kani's Method
Derivation of three moment equation - application of three moment equation for analysis of continuous beams under the effect of applied loads and uneven support settlement.
Kani's Method of analysis applied to continuous beams and rigid frames of different geometry - frames without sway and with sway.

Module III (13 Hours)
Approximate Methods of Analysis of Multistoried Frames
Analysis for vertical loads-substitute frames-loading condition for maximum hogging and sagging moments in beams and maximum bending moment in columns- wind load analysis of multistoried frames – portal method and cantilever method for lateral load analysis.
Beams curved in plan-Analysis of cantilever beam curved in plan - analysis of circular beams over simple supports.

Module IV (10 Hours)
Plastic Theory
Introduction – plastic hinge concept – plastic modulus – shape factor – redistribution of moments – collapse mechanisms – plastic analysis of beams and portal frames by equilibrium and mechanism methods.

Text Books:
1. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd.
2. Hibbeler, RC, Structural analysis, Pearson Education
3. Daniel L Schodak, Structures, Pearson Education
4. Devdas Menon, Structural Analysis, Narosa Publications
5. Reddy . C.S., Basic Structural Analysis, Tata McGraw Hill
6. S.S. Bhavikatti, Structural Analysis, Vikas Publication Houses (P) Ltd

Reference Books:
1. Wang C. K., Intermediate Structural Analysis, Tata McGraw Hill
2. Wilbur J. B. & Norris C. H., Theory of Structures, McGraw Hill
3. Timoshenko S. P. and Young D. H., Theory of Structures, McGraw Hill
4. Kinney J. S., Indeterminate Structural Analysis, Oxford & IBH
5. Negi L. S. and Jangid R. S, Structural Analysis, Tata McGraw Hill
6. Rajasekaran S. and Sankarasubramanian G., Computational Structural Mechanics, PHI
7. SP:6 (6): Application of Plastic Theory in Design of Steel Structures
8. Ghali A. and Neville A. M, Structural Analysis – A Unified and Matrix Approach, Chapmen and Hall, 3rd edition 1989
9. Prakash Rao D. S., Structural Analysis – A Unified Approach, Universities Press

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A:
Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
PART B:
Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.
Maximum Total Marks: 100

CE14 505: Geotechnical Engineering I

Teaching Scheme **Credits: 4**
3 hours lecture and 1 hour tutorial per week

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

Module I (13hours)
Nature of soil and functional relationships: Formation of soils - Soil type - 3 phase system - void ratio - specific gravity - dry density - porosity - water content - saturated unit weight - submerged unit weight - degree of saturation – Soil Structure: single grained, honey combed, flocculated and dispersed structure and their effects on the basic soil properties.
Laboratory and field identification of soils: Determination of water content by oven drying – Specific gravity using pycnometer and specific gravity bottle - Grain size analysis by sieve analysis, hydrometer analysis and pipette analysis - Atterberg limits and indices – Visual identification by simple field tests – Field density by core cutter, sand replacement and wax coating methods
Classification of soils: Necessity - Principles of classification - I.S. classification – Plasticity charts
Module II (13 hours)
Soil water: Modes of occurrence – adsorbed and capillary water types - Total stress - Effective stress – Pore pressure - Pressure diagrams
Permeability: Definition - Darcy's law - Factors affecting permeability – Laboratory determination - Stratified soils : average permeability.
Shear Strength: Definition - Mohr's strength and stress circles - origin of planes - Mohr's envelope - Mohr- Coulomb strength theory –Direct shear test – triaxial shear test - drainage conditions – UU, CU and CD tests - Measurement of pore pressure -Total and effective stress strength parameters - UCC test - Vane shear tests - Choice of test conditions for field problems.
Module III (13 hours)
Consolidation: Definition –Spring analogy for primary consolidation - Terzaghi's theory of one dimensional consolidation – Concepts of coefficient of compressibility - Coefficient of volume change and compression index – Laboratory consolidation test - e-log p curves - pre-consolidation pressure - Time rate of consolidation - difference between consolidation and compaction

Compaction: Definition and objectives of compaction – Standard and Modified Proctor tests - Concept of OMC and maximum dry density - Zero air voids line - Factors influencing compaction - Effect of compaction on soil properties - Field compaction methods - Proctor needle for field control.

Module IV (13 hours)

Earth pressure: Earth pressure at rest - Active and passive earth pressure for cohesionless and cohesive soils - Rankine's and Coulomb's theories - Point of application of earth pressure for cases of with and without surcharge in cohesionless and cohesive soils - Culmann's and Rebhan's graphical construction for active earth pressure-

Stability of slopes: Slope failure, base failure and toe failure - Swedish circle method – $\Phi = 0$ analysis and $c = 0$ analysis - Friction circle method - Taylor's stability number -Stability charts.

Text Books

1. Arora K. R., *Soil Mechanics & Foundation Engineering*, Standard Publications, 1987.
2. Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications, 1988
3. Murthy V. N. S., *Soil Mechanics & Foundation Engineering*, Dhanpat Rai, 1996

Reference Books

1. Terzaghi K. & Peck R.B., *Soil Mechanics in Engineering Practice*, John Wiley & Sons, US, 1967.
2. Venkatramiah C., *Geotechnical Engineering*, New Age International Publishers, 2006
3. Gopal Ranjan & Rao A. S. R., *Basic & Applied Soil Mechanics*, New Age International Publishers, 2000
4. Khan I.H., *Text Book of Geotechnical Engineering*, Prentice Hall of India
5. Cudoto, *Geotechnical Engineering Principles and Practices*, Pearson Education, 2007

Internal work assessment *(Maximum Marks – 50)*

60%- Tests(minimum 2)
30%- Assignments (minimum2) such as home work, group discussions, quiz, literature survey, seminar, term-project..
10%- Regularity in the class.

University Examination Pattern

PART A:
Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
PART B:
Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.
Maximum Total Marks: 100

CE 14 506: Open Channel Hydraulics and Hydraulic Machinery

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

• *To learn, understand and develop concepts regarding the types of free surface flow and their applications in order to have adequate background for the design of various hydraulic structures.*

Module I (13 hours)

Introduction: Difference between open channel flow and pipe flow. Types of channels- types of flow .Velocity distribution in open channels. Geometrical parameters of a channel. Condition for uniform flow –Computation of uniform flow – Chezy's and Manning's equations . Determination of normal depth - Algebraic & Graphical method. Most efficient cross section- Rectangular – trapezoidal – triangular, circular cross section not flowing full. Conveyance – Hydraulic exponent N for uniform flow computation

Energy and Momentum Principles: Concept of specific energy, specific force, critical flow, critical depth critical velocity- hydraulic exponents M for critical flow. Application of specific energy principle - transitions in rectangular channel – problems. Metering flumes- venturi - standing wave - par shall.

Module II (13 hours)

Non uniform flow: gradually varied flow - basic assumptions - dynamic equation for gradually varied flow - different forms of the dynamic equation - characteristics of flow profiles in prismatic channels.

Back water curve: computation of length of back water curve - Standard step method- direct step method – computation of backwater profile using spreadsheet.

Stream flow measurement - gauges and recorders - determination of velocity of flow - measurement of discharge in rivers - area-velocity method - stage - discharge relation

Module III (11 hours)

Rapidly varied flow: characteristics of the flow - hydraulic jump - initial and sequent depths – nondimensional equation - practical application of hydraulic jump - types of jump in horizontal floor – basic characteristics of the jump - energy loss - efficiency - height of jump - jump as energy dissipater – stilling basins - jump position - tail water conditions - jump types - stilling basins of generalized design – rapidly varied unsteady flow – introduction to surges and types of shallow water waves (Numerical examples not expected)

Module IV (15 hours)

Impact of free jets: forces on plates – fixed and moving – flat and curved – equation for work done – velocity triangle.

Hydraulic machines

Turbines: - classification – components, efficiency & work done- Pelton, Francis and Kaplan turbines (Design is not expected) – Draft tube theory - specific speed - selection of turbines – Brief description of penstock, surge tanks and governing of turbines.

Pumps: classification - Reciprocating pumps – types - work done - effect of acceleration and frictional resistance, slip, coefficient of discharge- separation in suction and delivery pipes - Introduction to air vessels

Rotodynamic pumps: types, advantages - working - volute and whirl pool chambers - velocity triangle for pumps – least starting speed – NPSH - specific speed.

Deep well pumps: submersible, jet and airlift pumps - general principle of working -

(Numerical examples based only on velocity triangle are expected in the case of pumps and turbines)

Text book:

Modi P.N. & Seth S.M., Hydraulics & Fluid Mechanics, Standard Book House
Subramanya K., Flow in Open Channels, Tata McGraw Hill

Reference books:

1. Hanif Choudhary M., Open Chanel Flow, Prentice Hall of India
2. Chow V.T., Open Channel Hydraulics, McGraw Hill
3. Richard French H., Open Channel Hydraulics, McGraw Hill
4. Addison H., A Treatise on Applied Hydraulics, Asia Publishing House
5. Michael, Wells and Pumping Machinery
6. Narayana Pillai N., Fluid Mechanics and Fluid Machines, Universities Press, 2009.

Internal work assessment ***(Maximum Marks – 50)***
60%- Tests(minimum 2)
30%- Assignments (minimum2) such as home work, group discussions, quiz, literature survey, seminar, term-project..
10%- Regularity in the class.

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 507(D): Civil Engineering Drawing II

Teaching scheme **Credits : 2**
3hours / week (39 hrs)

Objective
• To make the students to be able to plan and draw different views of Building according to State Building rules.
• To make the students to draw different views of Building in drafting packages.
• (The student is expected to know the local building rules and National Building Code provisions. After the course, the student should be in a position to prepare building sketches for the clients and submission drawings for approval. Each student shall complete a term project in tracing paper)**.**

Module 1: (6 Hours)
- Review of principles of building planning, building rules and building codes

.
Module 2: (24 hours) Planning from given requirements of areas and specifications and preparation of Sketch & working drawings for :
• Different types of residential buildings- Single and two storied with RCC (flat & sloped) roof, Two storied Flats. (4 sheets)
• Planning of simple tile roof building. (2 sheets)
• Variety of Public Buildings- Small public utility shelters, dispensaries, libraries, schools, banks, hostels, offices, factories etc. (5 sheets)

Module 3: (9 hours)
1. Preparation of site plan and service plans as per building rules. (2 sheets)
2. Building Services (for single and two storied buildings only). (1 sheet)
3. Septic tanks and soak pit detailed drawing. (1 sheet)

Term Project:
Plan and Prepare drawings of Double storied RCC building of at least 300 sq.m. carpet area, as per prevailing building rules, on any fictitious plot, with all detailed specifications in any popular drafting package.

Reference Books:
1. National Building Code of INDIA
2. Kerala Building rules
3. Balagopal T.S. Prabhu, Building drawing and detailing, Spades Publishers
4. Shah and Kale ,Building Drawing, Tata McGraw Hill

Internal assessment
Any 10 Sheets – 20 marks
Term Project- 15 marks
Test - 10 marks
Regularity - 5 marks
Total - 50 marks

University Examination Pattern

Part A:
One compulsory question from Module 2 – 1 x 70 = **70** marks
Note:- Marks for this question might be apportioned as follows:
Aspects of planning : 25 marks
Plan, Section, Elevation : 15 marks each = 15 x 3 = 45

Part B:
Candidates have to answer TWO questions out of THREE. All the three questions shall be from Module 3. 2 x 15 = **30 marks**
Total Marks : 100

CE14 508 (P): Fluid Mechanics Laboratory

Teaching scheme **Credits:** 2
3 hours practical per week (Minimum 39 hrs)

Group A
1. Study of instruments: pressure gauge - piezometer - manometer-pressure transducers - pilot tubes - current meter.
2. Demonstration: Bernoulli's theorem - phreatic lines - fluming horizontally and vertically
3. Steady flow through pipes: determination of friction factor for various types of pipes
4. Orifices and mouthpieces: various types-steady case
5. Notches and weirs: various types-steady case
6. Time of emptying: unsteady flow
7. Discharge measurements: venturimeter - venturi flume - orifice meter - water meter

Group B
8. Open channel flow: determination of Manning's coefficient
9. Plotting the specific energy curve
10. Tracing back water profiles / draw down profiles

11. Hydraulic jump parameters

Group C

12. Study of pelton wheel - Francis-Kapalan turbines
13. Study of centrifugal - reciprocating - jet and deep well pumps
14. Calibration of pressure gauge.
15. Air flow measurement using air blowers.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

6th Semester

CE14 601: Structural Design II

Teaching Scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- To provide the students with the requisite knowledge and skill in structural steel design so as to enable them to carry out design of various structural elements and their connections as per the latest Code of Practice, and to help them appreciate the various advantages of structural steel in design and construction.

Module I (13 hours)

Review of concepts of plastic analysis of beams and frames. Structural steel sections and products, grades and mechanical properties of steel, advantages of steel as structural material, types of steel structures. Introduction to Limit State Method of design of steel structures - failure criteria for steel, limit states of strength and serviceability, structural stability, durability, corrosion, fatigue and fire resistance. Loads and load combinations, characteristic strength and loads, partial safety factors.

Structural steel connections – classification of connections, simple, rigid and semi rigid connections, types of fasteners. Bolts and bolting - grades of bolts, design strength of ordinary and HSFG bolts, bolt groups, net and gross areas of plate, design strength of plate, analysis and design of bolted (ordinary and HSFG) connections, pins – analysis and design of pinned connections under axial loads. Welds - welding process, grades of electrodes, types and properties of welds, effective areas of welds, design strength of welds, weld groups, analysis and design of welded connections under axial loads.

Module II (13 hours)

Tension members – types, behavior and modes of failure of tension members, design of tension members of single angle, double angle and other sections, tension rods, lug angles, splices, gussets.

Compression members – local buckling of plates, cross section classification, behavior of compression members, effective length, analysis and design of single angle and double angle struts, other single sections and built-up sections - design of battens and lacings, analysis and design of eccentrically loaded columns of single and built-up sections.

Column bases – types of bases, design of slab base and gusseted base, column caps.

Module III (13 hours)

Flexural members and beams – beam types, section classification, lateral stability, lateral torsional buckling of beams of symmetric sections, behavior of beams in bending, design strength of laterally supported and laterally unsupported beams in bending, shear strength of steel beams, allowable deflection of beams, web buckling and web crippling, analysis and design of laterally restrained & unrestrained beams of single and built up sections.

Column-beam connections – types of moment connections, moment resistant connections with bolts and welds for in-plane and out-of-plane moments

Module IV (13 hours)

Design of roof trusses - types of roof trusses, selection of trusses, design loads and load combinations, assessment of loads due to wind, design principles, design of purlins, design of joints, design of members.

Gantry girders - special loads in gantry girders, maximum load effects, fatigue effects, bracings, analysis and design of gantry girders considering moment and shear capacities, web buckling, web crippling, deflection and fatigue strength.

Note:
All designs shall be done as per the current specifications and standards of Bureau of Indian Standards
Special importance shall be given to detailing in designs
S.I. units shall be followed
IS: 800, IS: 875 and SP: 6 shall be permitted in the examination hall.

Text Books:

1. Subramanian, N., 'Design of Steel Structures', *Oxford University Press*.
2. Duggal, S. K., 'Limit State Design of Steel Structures', *Tata McGraw-Hill Education Pvt. Ltd*.
3. Shiyekar, M. R., 'Limit State Design of Structural Steel', *Printice Hall of India*.
4. Bureau of Indian Standards, 'IS 800: 2007, Indian Standard General Construction in Steel – Code of Practice'
5. Bureau of Indian Standards, 'IS 875: 1987 (Parts 1 to 3), Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures'
6. Bureau of Indian Standards, 'SP: 6 (1) - 1964, 'Handbook for Structural Engineers, 1, Structural Steel Sections'

Reference Books:

1. Ramchandra and Virendra Gehlot, 'Limit State Design of Steel Structures', *Scientific Publishers (India) Pvt. Ltd*.
2. Bhavikatti, S. S., 'Design of Steel Structures by Limit State method as per IS: 800 – 2007', *I. K. International Publishing House Pvt. Ltd*.
3. INSDAG (Institute for Steel Design and Growth), 'Design Manual for Designing Steel Structures According to New IS: 800', *Available Online from http://www.steel-insdag.org/*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 602: Transportation Engineering II

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective*:*

To provide a strong base in planning, designing, construction and maintenance of structures coming under railways, waterways and tunnelling and to introduce the basic principles of economic analysis of projects.

Module I (15 hours)
Permanent way: functions and requirements of permanent way - components - typical cross sections - gauges - functions and requirements of components of permanent way - sleeper density - coning of wheels creep and wear in rails - rail fasteners - defects, failures and joints in rails - material assessment for unit length of track – Geometric design of railway track - horizontal curves - super elevation - cant deficiency - negative super elevation - safe speed on curves - gradients and grade compensation - worked out problems

Module II (15 hours)

Signalling and interlocking - signal control systems - points and crossings - track junctions – track circuiting - track alignment - construction of railway track - railway stations and yards.
Railway construction and maintenance:- Construction of railway track- earth work plate laying and packing-maintenance of track - alignment - gauge-renewal of component parts-drainage - modern methods of track maintenance.
Tunneling: - Location survey and factors to be considered - different sections - shafts - transferring of centre line - methods of tunneling in hard rocks and soft soils - different methods for lining, ventilation, lighting and drainage

Module III (11 hours)
Elements of harbour - ports - various design considerations of a harbour - classifications - site selection factors - wet and dry docks - lock and lock gates - site selection, configuration and types of breakwaters - details of quays, piers, fenders, dolphins, slipways - transit shed and warehouse - navigational aids

Module IV (11 hours)

Transportation Planning
Classification of transport technologies-inter modal co-ordination - ITS and automated highways – salient features of first, second and third and forth road development plans in India - planning surveys and master plan preparations - Expressways - case studies-
Highway Economics- Principles of economic evaluation – road user benefits - highway cost – economic evaluation by annual cost, benefit cost ratio and net present value method - worked out problems

Text books:
1. Antia K.F., Railway Track, New Book Company Pvt. Ltd.
2. Subhash C Saxena and Satyapal Arora, A Text Book of Railway Engineering, Dhanapat Rai and Sons, NewDelhi
3 Quinn A.D., Design and Construction of Ports and Marine Structures, McGraw Hill.

References:
1. Agarwal. M.M., Railway Engineering, Prabha & Co. New Delhi, 1998
2. J.F Mundrey Railway track Engg. Tata Mc Graw Hill, New Delhi
3. P. Sreenivasan, Dock and Harbour Engineering,

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14: 603 Hydrology And Irrigation Engineering

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
Students are expected to realize the importance of water resources and its application in irrigation engineering

Module I (13 hours)
Introduction: hydrologic cycle - application of hydrology in engineering - water balance equation - water resources of India.
Precipitation: Types, forms and measurement of precipitation –network design- presentation of data - average precipitation over an area - mass curve and hyetograph – double mass curve - depth-area-duration and intensity - duration-frequency analysis - probable maximum precipitation.
Precipitation Abstractions
Evaporation – factors affecting evaporation – measurement and control of evaporation
Evapotranspiration – measurement of evapotranspiration – estimation of evapotranspiration – Penman's Equation – Blaney Criddle Equation (No numerical problems are expected).
Infiltration Process – measurement using infiltrometers – infiltration capacity – infiltration indices.
Runoff - Characteristics of runoff - factors affecting runoff - yield from a catchment.

Module II (13 hours)
Irrigation - necessity - advantages - disadvantages – types- flow and lift irrigation - perennial and inundation irrigation –methods of irrigation-flooding, furrow, sprinkler and drip- important crops and crop seasons - duty and delta - water requirement - irrigation efficiency - direct and storage irrigation - multipurpose projects
Reservoir-types -investigation and planning - selection of site - fixation of storage capacity - flow duration curves - flow mass curve - reservoir sedimentation

Head works:- storage and diversion works-selection of site – Component and layout of Diversion head works – Head regulator and cross regulator (no design) - silt excluder and silt extractor - weirs - types of weirs- seepage theories – Biligh's and Khosla's theory –method of independent variables.

Module III (13 hours)

Distribution works: classification of canals - alignment of canals - considerations for fixing longitudinal slopes of canals - cross section of canals - burrow pits - spoil banks - service roads - back berm - counter berm – off take alignment - maintenance of irrigation canals - design of canals - erodible canals - canals in alluvial soils - regime theory - Kennedy's theory and Lacey's theory - silting in canal and prevention - scour - protection against scour - losses in irrigation canals - lining of irrigation canals - necessity and advantages of lining - disadvantage of lining - types of lining- water logging - causes of water logging - measures for prevention of water logging - drainage - benefits of drainage - types of drains - design and maintenance of open drains - tile drains - layout of tile drain system -.

Familiarization of canal structures – Canal falls, canal outlets, canal escapes, cross drainage works (Description Only).

Module IV (13 hours)

Hydrograph analysis - components of hydrograph - base flow separation - rainfall- run off relations - unit hydrograph theory - derivation of unit hydrograph - applications and limitations of unit hydrograph - S hydrograph.

Floods - estimation of peak discharge - rational method - unit hydrograph method – frequency analysis.

River training and flood control works- river behaviour - control and training of rivers- objectives of river training- types of training works – guide banks – groynes - levees - flood banks - Flood control by regulating reservoirs - flood storage basin - flood warning –flood plain zoning.

Text books

1. Subramanya K., Engineering Hydrology, Tata McGraw Hill
2. *Punmia B.C. & Lal P.B., Irrigation and Water Power, Lexmi Publications*
3. Dr. Modi P.N., Irrigation Water Resources & Water Power, Standard publishers
4. Asawa, Irrigation Engineering, Wiley Eastern

Reference books

1. Regunath H.M., Hydrology, Prentice Hall
2. Chow V.T et. al., Applied Hydrology, McGraw Hill
3. Priyani V.B., The Fundamentals Principles of Irrigation Engineering, Charotar
4. Sahasrabudhe S.R., Irrigation Engineering & Hydraulic Structures
5. Varshney R.S., Theory & Design of Irrigation structures Vol. I & II, Nem Chand
6. Michael A.M., Irrigation - Theory & Practice, Vikas Publishing House
7. S.K Garg, Irrigation Engineering and Hydraulic structures, Khanna publishers
8. IS: 5968 (1987) – Guide for the planning and layout of canal system for irrigation
9. Larry W Mays – Water Resources Engineering - 2nd Edition, Wiley Publications

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE14 604: Structural Analysis III

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

- To enable the students to have a comprehensive idea of matrix structural analysis with emphasis on the relative advantages of the flexibility method and the stiffness method
- To enable the students to visualize structural dynamics problems with a proper blend of structural analysis and vibration theory

Module I (16 hours)

Matrix analysis of structures: static and kinematic indeterminacy-force and displacement method of analysis-definition of flexibility and stiffness influence coefficients-development of flexibility matrices by physical approach

Flexibility method: flexibility matrices for truss and frame elements-load transformation matrix-development of total flexibility matrix of the structure-analysis of simple structures-plane truss and plane frame-nodal loads and element loads-lack of fit and temperature effects

Module II (10 hours)

Stiffness method: Development of stiffness matrices by physical approach-stiffness matrices for truss and frame elements-displacement transformation matrix-analysis of simple structures-plane truss and plane frame-nodal loads and element loads-lack of fit and temperature effects

Module III (12 hours)

Introduction to direct stiffness method-Rotation of axes in two dimensions, stiffness matrix of elements in global co- ordinates from element co-ordinates- assembly of load vector and stiffness matrix, solution of two span continuous beam-single bay single storey portal frame.

Module IV (14 hours)

Structural dynamics-introduction-degrees of freedom-single degree of freedom-linear systems-equation of motion, D'Alembert's principle-damping-free response of damped and undamped systems-logarithmic decrement-transient response – Vibration isolation – Introduction to two degree of freedom systems (Numerical problems not expected to be solved for two DOF system)

Text books:

1. Gere, J.M. and William Weaver, Matrix Analysis of framed structures, CBS Publishers

2. Clough R.W. and Penzein, J., Dynamics of structures, Tata McGraw Hill
3. Anil. K. Chopra, Dynamics of structures, Pearson Education/ Prentice Hall India
4. Beaufait. F.W., Basic concepts of structural analysis,
5. Denhartog, Mechanical Vibration
6. Rajasekharan.S. and Sankarasubramanian G., Computational structural Mechanics, PHI
7. Devas Menon, Advenced Structural Analysis, Narosa Publishers.
8. Reddy C.S., Basic structural analysis, Tata McGraw Hill
9. D.S. Prakash Rao, Structural Analysis –A Unified Approach, Universities press,(INDIA) Ltd.

Reference books:

1. Wang C.K., Matrix method of structural analysis, International Text book company
2. Przemeineicki J.S., Theory of Matrix structural analysis, Tata McGraw Hill
3. Meivovitch L., Elements of vibration analysis
4. Thimoshenko.,Vibration problems in Engineering
5. Biggs, Structural Dynamics
6. Coates.R.C, and Coutie M.G., Structural Analysis
7. Madhujith Mukhopadhyay and Abdul Hamid Sheikh, Matrix and Finite Element Analysis of Structures, Ane Books India

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 605: Geotechnical Engineering II

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- To impart knowledge in behaviour and design aspects of various types of foundations

Module I (13 hours)

1. Stresses due to applied loads: Introduction- Boussinesque's equations for vertical pressure due to point loads, uniformly distributed loads and strip load - assumptions and limitations - pressure bulb – Newmark's charts and their use – Westergaard's formula for point loads-Approximate methods for vertical stress-distribution of contact pressure beneath footings.
2. Site investigation and soil exploration: objectives - planning - reconnaissance - depth and lateral extent of explorations -methods of subsurface exploration - test pits - Auger borings - rotary drilling – Types of soil samples-split spoon samplers- Standard penetration test- hand cut samples- boring log - soil profile- geophysical methods (in brief).

Module II (13 hours)
3. Foundation - general consideration: functions of foundations - definition of shallow and deep foundation - different types of shallow and deep foundations- selection of type of foundation - advantages and limitations of various types of foundations.
4. Bearing capacity of shallow foundations: Ultimate and allowable bearing capacity- net bearing pressure- Allowable soil pressure –Types of shear failure. Terzaghi's equation for bearing capacity for continuous, circular, rectangular and square footings -- bearing capacity factors and charts - - effect of water table on bearing capacity- Skemption's formulae, –bearing capacity based on SPT.

Module III (13 hours)
5. Settlement analysis: Introduction- causes of settlement – immediate, consolidation and total settlement – loads for settlement analysis-estimation of immediate and consolidation settlement - Allowable settlement-Maximum and differential settlements as per Indian standard- net safe settlement pressure based on SPT- cracks due to settlements- plate load test.
6. Footings: types of footings - depth of footing- foundation loading- principles of design of footings – strip/continuous, individual and combined (Rectangular, trapezoidal and strap only) footings - footings subjected to eccentric loading - conventional procedure for proportioning footings for equal settlements.
7. Open excavation: Open foundation excavations with unsupported slopes-supports for shallow excavations-stress distribution in sheeting and bracing of shallow excavations.

Module IV (13 hours)
8. Raft foundations: Types –Principles of design of raft foundation- bearing capacity equations- for raft on sand based on SPT results (Teng's equation,– raft on clay (Skempton's formula) - design methods - floating foundations - conventional design procedure for rigid mat.
9. Pile foundations: uses of piles - classification of piles - determination of type and length of piles - determination of bearing capacity of axially loaded single vertical pile – static (Meyerhof's formula) and dynamic (Engineering News Record formula and Hiley's formula) - pile load tests (IS methods) - negative skin friction – pile group - group action, pile spacing and efficiency of pile groups.
10. Introduction to well foundation: components-forces acting

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

Text Books
1. Arora K.R., *Soil Mechanics & Foundation Engineering*. Standard Publications
2. Joseph E. and Bowles, *Foundation Analysis & Design*, McGraw Hill
3. Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications

Reference books

1. Gopal Ranjan and Rao A.S.R., *Basic and applied soil mechanics*, New Age International Publishers
2. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
3. Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited, New Delhi.
4. Leonards G.A., *Foundation Engineering*, McGraw Hill
5. Teng W.C., *Foundation Design*, PHI
6. Tomlinson M.J., *Foundation Design & Construction*, Pitman
7. Murthy V.N.S., *Soil Mechanics & Foundations*
8. Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 606: Computer Applications And Operations Research

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives:

- To enable the students to familiarize with mathematical models and numerical tools for solving and optimizing engineering problems.

A. Numerical methods in civil engineering

Module I (16 hours)

Introduction to numerical methods in civil engineering: importance of numerical methods in civil engineering - sources of errors in numerical methods - number representations - fixed and floating

point numbers - significant digits - round off errors - development of computer algorithms - pseudo code

Solution of algebraic and transcendental equations in one variable: bisection method - method of false position - Newton-Raphson method - successive approximation method - development of computer algorithms for each of the above methods

System of linear algebraic equations: solution of linear algebraic equations using Gauss elimination method and LU decomposition method - solution by iterative method - conditions of convergence-III conditioned system of equations - applications in civil engineering problems – matrix structural analysis

Module II (12 hours)

Eigen value problems: examples of formulation of structural stability and structural dynamics problems as Eigen value problems in civil engineering - principal stresses and strains - free vibration of multi degree of freedom systems - determination of Eigen values and Eigen vectors by power method and Jacobi's method

Interpolation: Newton's formulae - Gauss' formulae - lagrangian interpolation - cubic spline interpolation

Module III (12 hours)

Numerical differentiation and integration: numerical differentiation using Newton's and Gauss' formulae - maximum and minimum values of tabulated functions - Newton Cote's integration formulae - numerical integration using trapezoidal formula - Simpson's formulae and Gauss quadrature - development of computer algorithms for numerical integration

Numerical solution of ordinary differential equations: Taylor's series method - Euler's method - Runge-Kutta method - finite difference method for the solution of boundary value problems

B. Optimisation methods in civil engineering

Module IV (12 hours)

Linear programming problems: statement of an optimisation problem - linear and nonlinear programming problems - standard form of linear programming problems - simplex algorithm - degeneracy, duality, transportation problem, assignment problem- applications of linear programming problems in civil engineering - limit design of steel portal frames

Introduction to Genetic Algorithms- basic concept - problem formulation - operations-convergence criteria.

Text Books

1. Sastry S.S., Introductory Methods of Numerical Analysis, Prentice Hall of India
2. Scarborough J.B., Numerical Mathematical Analysis, Oxford and IBH
3. Rao S.S., Engineering Optimization-Theory and Applications, New Age International

Reference books:

1. Krishnamoorthy E.V. and Sen S.K., *Numerical Algorithms,* Affiliated East West Press
2. Kirsch U., *Optimum Structural Design*, McGraw Hill
3. Fox R.L., *Optimization Methods for Engineering Design*, Addison Wesley
4. Singiresu S. Rao, Engineering Optimization (Theory and Practice) 3rd Edition, New Age International (P) Ltd.
5. Press W.H., et al. Numerical Recipes in C – The art of Computation, Cambridge Press
6. Goldberg D.E., Genetic Algorithms in Search, Optimisation and Machine Learning, Addison Wesley Publishing Company.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 13 607(P): Geotechnical Engineering Lab

Teaching scheme **Credits:** 2

3 hours practical per week (Minimum 39 hrs)

List of Experiments

1. Specific gravity of coarse and fine grained soils
2. Grain size analysis (a) Sieve analysis
3. Atterberg limits and indices
4. Determination of field density (a) sand replacement method (b) core cutter method
5. Determination of coefficient of permeability by
   (a) Constant head method (b) variable head method
6. Consolidation test
7. Compaction test (a) IS light compaction test (b) IS heavy compaction test
8. California bearing ratio test
9. Direct shear test
10. Unconfined compressive strength test
11. Triaxial shear test
12. Tests on aggregates: Los Angeles abrasion test, Shape test, Aggregate Impact value.
13. Tests on bitumen: Penetration test, Softening test, Ductility test & Specific Gravity.

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-50)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

CE13 608(P): Material Testing Lab -II

Teaching scheme **Credits:** 2

3 hours practical per week (Minimum 39 hrs)

Objective:

To study strength aspects of concrete & Metals

List of Experiments

1. Tension test on mild steel specimens using Universal Testing Machine (UTM) and suitable extensometer
2. Shear test on mild steel rod
3. Torsion test on metal rods
4. Torsion test on metal wires – torsion pendulum
5. Spring test
    a) Open coiled spring
    b) Close coiled springs
6. Impact test
    a) Izod test
    b) Charpy test
7. Hardness test
    a) Brinell Hardness test
    b) Rockwell Hardness test
    c) Vickers Hardness test
8. Casting of concrete cubes & cylinders with specified proportions/mix
9. Split tensile strength of concrete cylinders
10. Compression test on concrete cubes & cylinders – Determination of Modulii of elasticity
11. Flexural test on concrete beams
12. Study/demonstration on Electrical resistance strain gauges, load cell

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

7th Semester

CE14 701: Structural Design III

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objectives

- To provide knowledge in the structural Design of selected advanced structures of concrete and steel

Part A: Reinforced Concrete
Module I (16 hours)
Design of columns subjected to axial load, uni-axial and bi-axial eccentrically loaded short and slender columns using SP 16 of BIS by limit state method.
Different types of foundations-Design of isolated footing for axially loaded & eccentrically loaded columns, combined footing.

Module II (12 hours)
Design of cantilever and counter fort retaining walls
Design of R.C.C. Slab Bridge for IRC loading –Detailing
Design of rectangular and circular water tanks using IS code coefficients (IS 3370).
Design of spherical and conical domes-detailing

Module III (11 hours)
Prestressed Concrete fundamentals -Materials, principles – methods of prestressing- pre and post tensioning -losses of prestress. Analysis of stresses in pre and post tensioned beams (rectangular and I sections) at stages of transfer and service-cable profiles (principles only), concept of Type I, II and III PSC structures as per IS. Stresses in anchorage zone in post-tensioned beams (description only; no design expected)

Part B: Steel & Timber
Module IV (13 hours)
Design of plate girders-design of section for flexure, shear and deflection-connections-horizontal and vertical stiffeners-curtailment of flange plates - design of bearing stiffener, web splices. Plate girder Railway Bridges- Types, structural configurations, Assessment of loads and stresses, design principles of bridge bearings.
Design of timber beam and column.

Note:
All designs shall be done as per current I.S. code specifications and practice
Special importance shall be given to detailing in designs
S.I. units shall be followed
Limit state design shall be practiced wherever possible as per codes
Use of IS 3370 (1 to 4), IRC 21(1, 2, 3, 7, 9), IS 13743, IS 800, IS 875 and SP 6 and SP16 shall be permitted in the examination hall.

Text Books:
1. Pillai S.U. & Menon D., Reinforced Concrete Design. Tata McGraw Hill
2. Punmia .B.C., Jain A. K., Reinforced Concrete Structures, Lexmi Publications
3. Johnson D. Victor, Essentials of Bridge Engineering, Oxford & IBH

4. Krishnaraju, Prestressed Concrete, Tata McGraw Hill
5. Subramanian N, Design of steel Structures, Oxford University Press
6. Ram Chandra., Design of steel Structures, Standard Book House
7. Jagadeesh & Jayaram: Design of Bridg structures, Printice Hall of India
8. Punmia .B.C., Jain A. K., Design of Steel Structures, Lexmi Publications

Reference Books:

1. Park & Paulay, Reinforced Concrete, McGraw Hill
2. Varghese P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India
3. Varghese P.C., Advanced Reinforced Concrete Design, Prentice Hall of India
4. Mallick S.K, and Gupta A.K., Reinforced Concrete. Oxford & IBH
5. Jain. A.K., Reinforced Concrete-Limit state Design, Standard Book House
6. Jain and Jaikrishna, Plain and Reinforced Concrete Vol I & II, Nemchand
7. Winter and Nelson, Design of concrete Structures.. Tata McGraw Hill
8. Lin. T.Y. and Burns, Design of Prestressed Concrete Structures., John Wiley
10. Libby J., Prestressed concrete structures, CBS Publishers
11. Krishnaraju N., Sructural Design and Detailing, Reinforced concrete and steel, University Press
12. Gaylord and Stallmeyer, Steel structures, McGraw Hill
13. Sinha,N.C., Sujit Kumar Roy, Fundamentals of Prestressed concrete, S Chand

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 702: Design of Hydraulic Structures

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour drawing per week

Objective:

- Students are expected to know the details of major and minor irrigation structures and their design. A student, who successfully completes the course, should be able to carry out design of various hydraulic structures in the given field conditions. Also to make the students familiarize with the relevant I.S codes and to enhance the capability of reading the working drawings.

Module I (13 hours*)
Storage Head Works;
Types of dams - gravity dam - selection of site - forces acting on dams - drainage gallery - joints in dams - elementary profile - limiting height of gravity dam - high and low dam - practical profile of a high gravity dam- design methods and design by gravity analysis only- arch dam – design methods – design by cylinder theory only. spillways and their types

Module II (13 hours*)
Tank structures
Surplus works – types of surplus works- surplus weir –surplus escapes, core wall type – flush escape
Outlet works - tank sluice with tower head
Canal structures
Canal outlets-review of requirements and types-modular, semi modular, non-modular outlets- design of direct sluice
(Detailed design and drawing of surplus weir, tank sluice and direct sluice are expected)

Module III (13 hours*)
Diversion head works- Types – design of surface and subsurface weirs - design of regulator cum Road Bridge
Canal falls- design of trapezoidal notch canal fall - design of syphon well drop-
(Detailed designs and drawings of canal regulator cum road bridge, trapezoidal notch fall and siphon well drop are expected.)

Module IV (13 hours*)
Cross drainage works - necessity - types of cross drainage works - selection of suitable type of cross drainage works - types of aqueducts- design of aqueduct - syphon aqueduct (type II and III) super passage and canal syphon
(Detailed designs and drawings of aqueduct and syphon aqueduct (Type II) are expected).
* Hours are inclusive of drawing classes.

Text books:

1. Asawa, Irrigation Engineering, Wiley Eastern Publication

2. Sathyanarayana Murthy, Water Resources Engineering, Wiley Eastern

3. S. K Garg, Irrigation Engineering and Hydraulics, Khanna Publishers

Reference books:

1. Varshney R.S., Theory & Design of Irrig. Structures, Nem Chand
2. Punmia B.C., Irrigation & Waterpower Engg., Laxmi Publications

3. Serge Liliavsky, Irrigation & Hydraulic Design, Chapman and Hall
4. IS: 6512 (1984) – Criteria for design of storage gravity dams
5. IS 7784 (Part I (1993), Part II Section 1 to 5 (1995)) Design of cross drainage works – Code of Practice
6. IS: 6966 Part I (1989) – Hydraulic design of barrages and weirs – Guidelines
7. IS: 11130 (1984) – Criteria for structural design of barrages and weirs
8. IS:6531 (1972) – Criteria for design of canal head regulator
9. IS:7114(1973) – Criteria for hydraulic design of cross regulator for canal
10. IS:6936 (1992) – *Guide for location ,selection and hydraulic design of canal escapes*
11. IS:12331 – *General requirement of canal outlets*

Internal Continuous Assessment *(Maximum Marks-50)*

Tests (minimum 2) – 22 Marks
Assignments (8 Drawing Sheets) – 24 Marks
Regularity in the class – 4 Marks
Note: Since drawing shall be given more importance in this subject apportioning of marks are kept different.

University Examination pattern
PART A: *Questions for Short answers* *4×5 marks=20 Marks*
Candidates have to answer four questions out of five. There should be at least one question from each module and not more than two questions from any module.
PART B: *1×15 marks=15 Marks*
Candidates have to answer one question out of two. Both questions shall be from module I.
PART C: questions for presenting *Design and drawing* *1×65 marks= 65 Marks*
Two questions from any module other than Module I, with choice to answer one question. Both the questions shall be from two different modules.
Maximum Total marks: 100

CE 14 703 Environmental Engineering I

Teaching scheme **Credits: 4**
3 hours lecture and 1 hour tutorial per week

Objective:
- To provide detailed understanding regarding usage of water for drinking purpose - from identification of source, planning the treatment systems, distribution of treated water with development of distribution of layout and necessity of maintenance.

Module I (10 hours)
Water supply Engineering – Importance and necessity of community water supply schemes – essentials of water supply engineering – quantity of water – forecasting population – rate of consumption for various purposes – factors affecting consumption – fluctuations in demand.

Module II (14 hours)
Sources of water – surface water sources – suitability of the source with respect to quantity and quality – intakes of various surface water sources – design of intakes – ground water sources -

development and protection of groundwater sources – estimation of yield from various ground water sources – construction of tube wells – maintenance.
Quality of water – drinking water standards – physical, chemical and bacteriological analysis of water.

Module III (14 hours)
Treatment of water – aeration – coagulation – flocculation – sedimentation – filtration – disinfection – design of all the units – miscellaneous treatments – removal of colour, taste and odor, iron and manganese, hardness – fluoridation and deflouridation.

Module IV (14 hours)
Water supply schemes – gravitational, pumping and combined schemes – transmission of water – classification of conduits – shape and strength of conduits – location of conduits – materials of conduits – design of gravity and pumping main - distribution systems – different layout of pipe networks – analysis of pipe networks – house connection from mains – laying and joining of pipes – appurtenances – different valves – meters and hydrants – detection and prevention of leaks in distribution system – cleaning and maintenance of distribution system.

Text Books:

1. Garg S. K., *Environmental Engineering Vol I*, Khanna Publishers.
2. Birdie G.S & Birdie J.S, *Water Supply and Sanitary Engineering*, Dhanpat Rai & Sons.
3. Duggal K N, *Elements of Environmental Engineering*, S Chand & Co Ltd.

Reference Books:

1. Mark J Hammer Mark J Hammer Jr., *Water and Waste Water Technology*, Prentice Hall of India Pvt. Ltd.
2. Fair, Gayer and Okun, *Water and Waste water Engineering*, John Wiley.
3. Ernest W Steel, *Water Supply and sewerage*, McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 706 (P): Computer Applications Laboratory

Teaching scheme **Credits : 2**

3 hours practical per week (Minimum 39 hrs)

Objective:

To familiarize and give hands-on training to students in the following areas of civil engineering application software:

1. **Surveying** - Terrain mapping, computation of areas and volumes – Estimation of earth work, GIS
2. **Structural Engineering –** Analysis and design of Plane and space frames (steel and R.C.C), spread sheet development for design of R.C.C/ steel structural elements.
3. **Water resources** –Circular Pipe Analysis / Trapezoidal Channel Analysis, analysis of pipe network for water distribution
4. **Geotechnical engineering** –stability analysis of slopes, computation of foundation settlement and stresses on layered soils, Geotechnical design of anchored and free retaining walls, Analysis and design of pile foundations.
5. **Road/railway system –** Fixation of vertical / horizontal alignment of highways, Design of rigid and flexible pavements.
6. **Environmental engineering**- Pipe Network Analysis
7. **Estimation and costing** - Use spread sheet / any standard software for estimation.
8. **Project management –** PERT and CPM**,** project scheduling, managing and documentation, Network Analysis.

Notes:

1. **Students are supposed to document each tutorial with drafting after each session.**
2. **At least five of the above eight areas shall be covered.**

Recommended software packages: The following packages or their equivalent are recommended for the above listed exercises:

- AutoCAD, Microstation, MS-Office, Matlab, Grapher/Sigmaplot
- Autocivil, SAP, StAAD, ANSYS, NISA, GTSTRUDL
- WaterCAD, FlowMaster, EPA NET, Geo4, Inroads, ArcGIS
- MS-Project

Internal Continuous Assessment *(Maximum Marks-50)*

60%-Laboratory practical and record
30%- Test/s
10%- Regularity in the class

Note: Students shall be encouraged to take up a term-project on any of the above listed areas and complete it within the semester

End Semester Examination *(Maximum Marks-100)*

70% - Procedure, conducting experiment, results, tabulation, and inference
20% - Viva voce
10% - Fair record

CE 14 707(P): Environmental Engineering Laboratory

Teaching scheme **Credits: 2**
3 hours practical per week (Minimum 39 hrs)

Objective

- To make students familiar with laboratory tests for water quality assessment.

List of Experiments

1. Determination of Solids (Total, dissolved and suspended) in water.
2. Determination of Turbidity of water and estimation of optimum coagulant dosage by jar test.
3. Determination of alkalinity of water.
4. Determination of hardness of water by EDTA titrimetric method.
5. Determination of chlorides in water.
6. Determination of iron and manganese in water
7. Determination of sulphates and sulphides in water.
8. Determination of dissolved oxygen in water.
9. Determination of available chlorine in bleaching powder and test for residual chlorine.
10. Determination of pH of water (by various methods).
11. Determination of B.O.D and C.O.D of wastewater sample.
12. Determination of MPN (demonstration only)

Reference Books:

1. Standard methods for the examination of water and wastewater, 1995, ALPHA, AWWA, WPCF Publication.
2. Sawyer and Mc Carty, Chemistry for Environmental Engineering, McGraw Hill.
3. P.R. Sreemahadevan Pillai, Comprehensive Laboratory Manual for Environmental Science and Engineering, 2009, New Age International Pvt. Ltd. Publishers, New Delhi.

Internal Continuous Assessment *(Maximum Marks-50)* 60%-Laboratory practical and record 30%- Test/s 10%- Regularity in the class **Note:** Students shall be made aware of Computer integrated test methods for water quality assessment.
End Semester Examination *(Maximum Marks-100)* 70% - Procedure, conducting experiment, results, tabulation, and inference 20% - Viva voce 10% - Fair record

CE 14 708 (P): Project

Teaching scheme **Credits: 4**
4 hour per week

Objective

- ***To develop the capacity of the students in converting the theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to Civil Engineering domain.***

Project work is of duration of two semesters and is expected to be completed in the eighth semester. Each student group consisting of not more than five members is expected to design and develop a complete system or make an investigative analysis of a technical problem in the relevant area. The project work can be a planning and / or design project, experimental project, computer application based project on any of the topics of civil engineering interest. HOD will frame the rules for forming batches. If required, HOD can combine project hours of many weeks together and allot a maximum of 2 weeks exclusively for project. The project batches are expected to fix their topics, complete preliminary studies like literature survey, field measurements, data collection, etc. in the seventh semester. Also they are expected to finish about 40% of their work in 7^{th} semester.

Each project group should submit project synopsis within three weeks from start of seventh semester. Project evaluation committee consisting of guide and three or four faculty members specialised in various fields of civil engineering, shall study the feasibility of each project work before giving consent.

As far as possible, students should execute the project work using the facilities of the institute. However, external projects can be taken up in government departments/institutions, reputed construction industries, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work and there must be an internal guide for such projects.

The assessment of all the projects should be done at the end of the seventh semester by the project evaluation committee formed as mentioned earlier. The students will present their project details and progress of their project to the committee. The complete project report is not expected at the end of the seventh semester. However, a typed interim report based on the work done should be submitted by each student batch to the assessing committee. The assessment committee and project guides will award the marks for the individual students in a project as follows:

50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment:
20% - Technical relevance of the project
40% - Literature survey and data collection
20% - Progress of the project and presentation
10% - Report
10% - Regularity in the class

ELECTIVES

CE 14 704 (A): Advanced Structural Design I

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- To equip the students to assess the loads on some important types of structures, choose the method of appropriate analysis according to the situation and perform design

Module-1 (13 Hours)
Design of Deep beams & Corbels
Design of Ribbed Slabs
Yield line theory of slabs – Design of Square, Rectangular & Circular slabs for UDL and point load at centre

Module –II (13 Hours)
Design of flat slabs by direct design method and equivalent frame method as per IS 456-2000.
Design of multi-bay multi storied portal frames for gravity loads, Pattern loading - Use of SP 16 (Substitute Frame method of analysis may be followed)

Module III (13 Hours)
Design of Light Gauge members – compression and flexural members
Design of Self Supporting & Guyed steel Chimney (design for wind dynamics not expected)

Module – IV (13 Hours)
Basic principles of analysis of Base-excited SDOF and MDOF systems - formulation of basic equation– concepts of pseudo acceleration, velocity and displacement - Earthquake response spectra (concept only) .
Lumped mass modelling of multi-storey shear building and modes of vibration (concepts only- demonstration with example- students are not expected to solve numerical problem on evaluation of modes during examination)-modes superposition- SRSS and CQC (Introduction only)-Concept of design spectrum for earthquake- use of IS 1893.

Design of Multistoried framed structures for wind and Earthquake Loads- Equivalent static load method of IS 1893.
Ductility detailing for earthquake forces- IS 13920

Note

1. All designs shall be done as per current I.S. specifications.
2. Special importance shall be given to detailing in designs.
3. Limit state design shall be practiced wherever possible
4. Use of I.S. codes (IS 456, IS 801, IS 811, IS 1893) and SP16 (Design Aids) shall be permitted in the examination hall.

Text books

1. Varghese P.C., Advanced Reinforced Concrete Design , PHI
2. Winter and Nelson, Design of Concrete Structures, Tata McGraw Hill
3. Arya and Ajmani, Design of Steel Structures, Nemchand & Bros.
4. Anil K Chopra, Dynamics of structures-theory and applications to earthquake engineering, Pearson Education
5. R W Clough and J Penzien, Dynamics of structures, McGraw Hill
6. Jaykrishna, Elements of earthquake engineering, Saritha Prakasan, Naunchandi, Meerut.

Reference books

1. Krishnaraju.N., Advanced Reinforced Concrete Design, CBS Publishers
2. Mallick S.K. & Gupta A.P., Reinforced Concrete, Oxford & IBH Publishing Co.
3. Jain and Jaikrishna, Plain & Reinforced Concrete Vol.I & 11, Nem Chand
7. Ferguson, Reinforced Concrete, Wiley Eastern
8. Ramchandra, Design of Steel Structures Vol. II, Standard Book House
9. Park and Paulay, Reinforced Concrete Structures
10. Pankaj Agarwal and Manish Shrikandhe, Earthquake Resistant Design of Structures, PHI

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 704 (B): Advanced Geotechnical Engineering I

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module I (12 Hours)

Clay mineralogy: Introduction-Gravitational and surface forces-Electrical charges on clay minerals-bonds-basic structural units of clay-isomorphs substitution-base exchange capacity-common clay minerals (Kaolinite, Montmorillionite and illite only)-Diffuse double layer-thixotrophy-activity of soils-capillary water – soil suction-capillary potential-capillary siphoning.

Module II (12 Hours)

Flow of water through porous media: Introduction- Permeability of soil-aquifers-seepage of water – upward flow-effective stresses under steady seepage conditions-quick sand condition-failure of hydraulic structures by piping-Two dimensional flow-Laplace's equation-flow net and it's uses-construction of flownet for sheet pile wall and earth dams-phreatic lines-flow net for anisotropic soil.

Module III (14 Hours)

Shear strength of soil-Introduction-Mohr-Coulomb failure criteria-modified failure envelope-total stress and effective stress analysis-stress vs. strain curves for soil-volumetric strain vs. axial strain-pore pressure vs. axial strain-critical void ratio-modified failure envelope-pore pressure parameters-choice of shear test and test conditions-liquefaction of sands-behaviour of over consolidated and normally consolidated soil during shearing-introduction to shear strength of partially saturated soil.

Module IV (14 Hours)

Earth and earth retaining structures- Introduction-Earth pressure theories-Types of retaining walls-Design of retaining walls-Gravity and cantilever retaining walls(only)-sheet pile walls-Types-Pressure distribution diagrams for cantilever and anchored sheet pile walls in cohesion less and cohesive soils.

Reference books

1. Arora K.R., *Soil Mechanics & Foundation Engg.,* Standard Publications
2. Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
3. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
4. James K. Mitchell, Fundamentals of soil behavior, John Wiley and Sons, Inc.
5. Shashi K. Gulhati and Manoj Dutta, Geotechnical Engineering, Tata McGraw-Hill Publishing Compay Limited,New Delhi.
6. Terzaghi & Peck, *Soil Mechanics in Engineering Practice*, Asia Publishing
7. Murthy V.N.S., *Soil Mechanics & Foundations*
8. Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 704 (C) Highway Pavement Design

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

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

Note: IRC 37 2001 and 58-2002 and design charts are permitted for University Examinations

Module I (12 hours)

Introduction: types and component parts of pavements - 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 (14 hours)

Stress analyses and methods of flexible pavement design: stresses and deflections in homogeneous masses - burmister 2 layer and 3 layer theories - wheel load stresses - ESWL of multiple wheels - repeated loads and EWL factors - empirical, semi - empirical and theoretical approaches for flexible pavement design - group index, CBR, triaxial, mcleod and burmister layered system methods

Module III (14 hours)

Stresses analysis and methods of rigid pavement design: types of stresses and causes - factors influencing
stresses, general conditions in rigid pavement analysis - ESWL- wheel load stresses - warping stresses – friction stresses - combined stresses - functions of various types of joints in cement concrete pavements - design and detailing of slab thickness ; longitudinal, contraction and expansion joints by IRC recommendations

Module IV (12 hours)

Pavement evaluation: structural and functional requirements of flexible and rigid pavements - pavement distress - evaluation of pavement structural condition by Benkelman beam rebound deflection and plate load tests - introduction to design of pavement overlays
Problems of highway rehabilitation – pavement rehabilitation programming.

Text Book:
Khanna S.K. and Justo, CEG, *Highway Engineering*, NemChand and bros.

References:
1. Yoder and W Nitezak, *'Principles of Pavement Design'*, John Wiley
2. Yang, *'Design of Functional Pavements'*, McGraw Hill
3. IRC: 37 - 2001, *'Guidelines for the Design of Flexible Pavements'*
4. IRC: 58 - 2002, *'Guidelines for the Design of Rigid Pavements'*
5. David Croney, *'The Design and Performance of Road pavements'*, HMSO publications
6. Hass and Hudson, *'Pavement Management System*', McGraw Hill Book Co.
7. IRC 81-1981- '*Tentative Guidelines for Strengthening of Flexible Pavements by Benklman Beam Deflections Techniques'.*

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 704 (D): Experimental Stress Analysis

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective
To make students aware of various measurement techniques and experimental planning and procedures adopted in laboratory

Module I (14 hours)
Strain gauges - definition of gauge length - sensitivity and range - characteristics of an ideal strain gauge - different types of mechanical strain gauges, optical strain gauge - acoustic strain gauge - pneumatic strain gauge - merits and demerits - electrical strain gauges - inductance, capacitance and piezo electric gauges - bonded and unbonded resistance gauges and their application in stress analysis - fixing techniques and measurement of strains - rosettes - determination of principal stress - construction of stress, strain circles - analytical solution

Module II (12 hours)
Photo elasticity - basics of optics, stress optic law - plane and circularly polarized light and their use in photos elasticity - polariscopes - diffusion type - lens type polariscopes - isoclinics and isochromatics

Module III (14 hours)
Model materials - calibration methods for finding material fringe values - model fringe values - examples of beam flexure and diametrically loaded circular plates.
Non Destructive Testing Methods – Ultrasonic Methods – Hardness methods – Rebound Hammer – Detection of embedded reinforcement.
Computer based data acquisition systems.

Module IV (12 hours)
Model analysis - direct and indirect models - laws of structural similitude - choice of scales - limitation of model studies - buckingham pi-theorem - dimensional analysis - model materials - Begg's deformater and its use - simple design of direct and indirect models

Text Books
1. Dally, J. W. and Raliey W.F., Experimental Stress Analysis, McGraw Hill.
2. Srinath L.S., Experimental Stress Analysis, Tata McGraw Hill
3. Roy, T.K., Experimental Analysis of stress and strain

Reference Books
1. Dove and Adams, Experimental Stress Analysis and Motion measurement, Prentice Hall
2. Hetenyi M., Hand book of Experimental Stress Analysis, John Wiley
3. Bently JP – Principles of Measurement Systems, Longman, 1983
4. Nakra & Chowdhary – Instrumentation Measurement & Analysis – Tata McGraw Hill, 1995

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE14 704 (E) Concrete Technology

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objectives

To understand in detail the behaviour of fresh and hardened concrete.
To aware recent developments in concrete technology
To understand factors affecting the strength, workability and durability of concrete

Module I (13 hrs)

Cements: Review of cements including blended cements, chemical composition; tests on chemical and physical properties; process of hydration.

Aggregates: Review of types; production of artificial aggregates; sampling and testing; effects on properties of concrete; special aggregates.

Chemical Admixtures: Review of types and classification; actions and interactions; usage; effects on properties of concrete; methods of test; applications.

Mineral Admixtures: Flyash, ground granulated blast furnace slag, metakaolin, rice-husk ash and silica fume; chemical composition; physical characteristics; effects on properties of concrete; methods of test; applications advantages and disadvantages

Module II (13 hrs)

Special concrete: Lightweight concrete; autoclaved aerated concrete; no-fines concrete; lightweight aggregate concrete and foamed concrete.

High strength concrete; refractory concrete; high density and radiation-shielding concrete;

Polymer concrete; fibre reinforced concrete; Ferro-cement; recycled aggregate concrete; Prepacked concrete.

High-performance concrete, Self compacting concrete, Pumpable concrete, Ready mixed concrete

Module III (13 hrs)

Non-destructive testing of concrete-Surface Hardness, Ultrasonic, Penetration resistance, Pull-out, pull-off and break-off methods, Chemical testing for chloride and carbonation- core cutting - measuring reinforcement cover.

Mix Design : Factors considered in the design of mix design of low and medium strength mixes. BIS Method, Introduction to ACI, FM, Road Note No.4 Methods, Mix design of High strength, High density concrete, Light weight concrete and Ready mix concrete

Module IV (13 hrs)

Elasticity, creep and shrinkage- Elastic properties of aggregates- Modulus of elasticity and strength, dynamic modulus of elasticity, Creep- Measurement of creep, factors affecting creep, effect of creep, shrinkage- Plastic shrinkage, drying shrinkage, factors affecting shrinkage, autogeneous shrinkage, carbonation shrinkage

Durability of concrete- Strength and durability relationship, volume change in concrete, permeability, interaction between, permeability, volume change and cracking

Text *books:*

1. Neville A.M.,'Properties of Concrete', Prentice Hall.
2. R. Santhakumar ' Concrete Technology', Oxford Universities Press.
3. Shetty M.S., 'Concrete Technology', S.Chand &Co.
4. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education.

References:

1. Mehta and Monteiro, 'Concrete-Micro structure, Properties and Materials', McGraw Hill Professional
2. John Newman and Ban Seng Choo , 'Advanced Concrete Technology', Butterworth-Heinemann Ltd.
3.. Satish Chandra ,'Waste materials used for concrete manufacturing', William Andrew Publishing
4.. Malhotra and Ramezanianpour , 'Fly ash in Concrete', Kluwer Academic Publishers
5 . Lea, 'Chemistry of Cement and Concrete', Butterworth-Heinemann Ltd.
6. Aitcin , 'High performance concrete' , E & FPON, NewYork .
7. Bungey, Millard, Grantham – The Testing of Concrete in Structures- Taylor and Francis
8. IRC Highway Research Board – State of the Art: Non-Destructive Testing Techniques of Concrete

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 705 (A): Structural Dynamics and Seismic Design

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

To equip students with the basic knowledge on design of earthquake resistant structures

Module I (10 hours)

Overview of structural dynamics – Fundamental objective of structural dynamic analysis – types of prescribed loadings – essential characteristics of a dynamic problem – method of discretization, lumped mass procedure – generalized displacements – Single degree of freedom system – Components of the basic dynamic system – formulation of the equation of motion – D Alembert's principle - influence of gravitational forces - generalized SDOF system- Rigid body assemblage - expression for generalized system properties.

Module II (13 hours)

Solution of the equation of motion- undamped free vibration- damped free vibration- critical damping- under damped system- over damped system- negative damping-concept of Coulomb damping.

Response to harmonic loading - Undamped system- complementary solutions- particular solution- general solution- response ratio – Viscously damped system- resonant response-dynamic amplification factor- vibration isolation.

Response to periodic loading - Fourier series expression of the loading- Response to the Fourier series loading - Exponential form of Fourier series solutions – concept of four way logarithmic graph paper

Module III (16 hours)

Base-excited SDOF system - formulation of basic equation– concepts of pseudo acceleration, velocity and displacement - Earthquake response spectra (concept only).

Lumped mass modelling of multi-storey shear building and modes of vibration (concepts only- demonstration with example- students are not expected to solve during examination)

Performance of building and structures under earthquakes- Main Causes of Damage- Intensity of earth quake forces, lack of strength and integrity of buildings, quasi resonance – lack of ductility, lack of detailing.

Earth quake effects- On buildings, structures, power plants, switch yards, equipments or other life line structures, soil liquefaction- Assessment of damage

Philosophy and Principles of earthquake.-resistant design- Strength and stiffness- ductility-based design and detailing, concepts of seismic isolation and seismic active control, Building forms and architectural design concepts- Horizontal and vertical eccentricities due to mass and stiffness distribution (Numerical exercises not expected) IS specifications.

Module IV (13 hours)

Equivalent Static Method- Seismic zones and coefficients – response reduction factors -Estimations of fundamental time period, base shear and its distributions using IS: 1893 for multistory buildings (regular shape only).

Use of codes like IS: 4326, IS: 13828, IS: 13827, IS13920, SP:22 with reference to masonry, RCC and steel building Detailing of reinforcement and joints.

Restoration and retrofitting - Methodologies for restoration and retrofitting – For walls, roofs, slabs, columns and foundation of building in stones, brick or reinforced concrete structures

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Text books

1. Anil K Chopra, Dynamics of structures-theory and applications to earthquake engineering, Pearson Education
2. R W Clough and J Penzien, Dynamics of structures, McGraw Hill
3. Jaykrishna, Elements of earthquake engineering, Saritha Prakasan, Naunchandi, Meerut.

References

1. Pillai & Menon, Reinforced concrete design, Tata McGrawHill
2. Park & Paulay, Reinforced concrete, McGrawHill
3. Madhujit Mukhopadhyay, Structural Dynamics – Vibrations and System, Ane Books India

IS Codes:

4. IS:1893 - (Part I), Criteria for Earthquake Resistant structures-General Provisions and Buildings
5. IS:13935 – Repair and Seismic strengthening of buildings
6. IS:4326 - Earthquake Resistant Design and Constructions of buildings

7. IS:13827 – Improving Earthquake Resistance of Earthen buildings
8. IS:13828 - Improving Earthquake Resistance of Low strength Masonry buildings
9. IS:13920 – Ductile detailing of RC Structures subject to Seismic forces.
10. Patrick Paultre, Dynamics of Structures, Wiley India Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 705 (B): Soil Exploration, Testing and Evaluation

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

- To equip students with techniques of exploration, testing and evaluation for soil parameters required for foundation choice and design

Module I (13 hours)

Soil Exploration: objectives-methods-depth, spacing, size and number of boreholes-different methods of boring-bore logs-sample requirements-sampling methods and equipments-handling, preservation and transporting of samples-rock core recovery-rock quality designation-geophysical and seismic methods-preparation of soil investigation reports(Students are expected to know how to choose type of exploration for different type of works, how to carry out the exploration and must be able to prepare soil investigation reports)

Module II (13 hours)

Laboratory Testing of Soil: water content, specific gravity, grain size analysis, Atterberg's limits and indices, Permeability: constant head and variable heads, Compaction: light and heavy, Consolidation: time-settlement, e-log(p) curve- pre-consolidation pressure-Shear Test: direct shear, triaxial, unconfined compression, vane shear –pore pressure measurement
(Students are expected to know the test procedures, computations o properties from observations and correlations and interpretation of results. Theoretical treatment – derivation etc is not required)

Module III (13 hours)

Field Testing of Soil: Plate load test, standard penetration test, static cone penetration test, Dynamic cone penetration test, Pressure meter test, Field Vane shear test, Field permeability test
(Students are expected to know the test procedures, computations o properties from observations and correlations and interpretation of results. Theoretical treatment – derivation etc is not required)

Module IV (13 hours)
Laboratory and Field Testing of Rocks: Laboratory tests: Tension, shear and flexure tests – Elastic Modulus by Brazilian and bending tests.
Insitu tests: Test for deformability, shear tests, strength tests and test for internal stresses.

Text Books
1. Alarm Sing, Soil Engineering- Theory and Practice, Asia Pub

Reference Books
1. Lambe, Soil Testing for Engineers, John Wiley, NewYork
2. Goodman R.E., Rock Mechanics, John Wiley, NewYork
3. Terzaghi, K. and Peek R.B., Soil Mechanics in Engineering Practice, John Wiley
4. Murthy V.N.S., Soil Mechanics anfd Foundation Engineering, DhanpathRai
5. Coduto, Geotechnical Engineering Principlres and Practices, Pearson Education
6. Joseph E., and Bowls, Foundation Analysis and Design, McGraw Hill
7. Tomlinson M J., Foundation Design and Construction, Pitman

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 705 (C): Ecology & Environmental Chemistry

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Introduction - definitions of ecology - subdivisions of ecology - approaches to the study of ecology - scope of ecology - ecology and human welfare - forestry - sericulture - horticulture and arboriculture - aquaculture fisheries and hatcheries - control of pest species - environmental conservation - conservation of natural resources - ecology in national affairs - ecology in education

Module II (13 hours)
Ecosystem - definition - principal steps and components of an ecosystem - tropic levels - food chains and food webs - energy flow in ecosystem - ecological pyramids - productivity of the ecosystem - homeostasis of the ecosystem and cybernetics - significance of ecosystem studies in developing countries - major ecosystems - definition and kinds of biogeo chemical cycles

Module III (13 hours)
Basic concepts from general chemistry - compounds - Avogadro's number - valancy, oxidation static - bonding - oxidation reactions - gas laws - solutions equilibrium and Lechatelier's principle - variation of equilibrium relationship - ways of shifting chemical equilibrium - basic concepts from physical chemistry - heat & work - energy - enthalpy - entropy - free energy - temperature dependence of equilibrium constant - vapor pressure of liquid - surface tension - binary mixture - osmosis - dialysis - principles of solvent extraction - electrochemistry - chemical kinetics - catalysis - absorption

Module IV (13 hours)
Basic concepts from organic chemistry - isomerism - aliphatic compounds - hydro carbons - alcohol - aldehydes - ketons - ester - ethers - alkyl halides - cyclic aliphatic compounds - mercaptans thioalcohols - aromatic compounds - hydrocarbons, phenols, alcohols, aldehydes, ketones, acids - hetero cyclic compounds basic concepts from colloidal chemistry - methods of formation - colloidal dispersion in liquid - colloidal dispersion in air - basic concepts from nuclear chemistry - nuclear theory - stable and radio active nuclides - atomic transmutation and artificial radio activity - nuclear reaction - nuclear fission - effects

Reference books
1. Kotpal R.L. & Bali N.P., Concepts of Ecology
2. Odum E.P., Ecology & Our Endangered Life Support Systems
3. Kudesia V.P., Environmental Chemistry
4. Sawyer, McCarty, Chemistry for Environmental Engineering, McGraw Hill

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 705 (D) Ground Water Hydrology

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:

- To make the students aware of the importance of groundwater resources and to impart strategic background information for its effective and wise utilisation

Module I (14 hours)
Occurrence of ground water: origin - rock properties affecting ground water vertical distribution - geologic formations as aquifers -types of aquifers - aquifer parameters-ground water basins - springs - Laplace equation - potential flow lines - flow net – flownet for anisotropic soils- seepage under a dam -groundwater contours- determination of flow direction- steady unidirectional flows in aquifers- confined and unconfined -aquifer with percolation- steady radial flow towards a well- well in uniform flow - steady flow with uniform discharge- partially penetrating wells- steady flow in leaky aquifer.

Module II (12 hours)
Unsteady flow-general equation- Cartesian and polar coordinate- unsteady radial flow in to a well - confined, unconfined and leaky aquifers -–multiple well system - pumping tests - non equilibrium equation for pumping tests - Thies' method - Jacob method - Chow's method -characteristics well losses –step draw down test- well near aquifer boundaries -determination of boundaries from pumping test .Image wells. for various boundary conditions-
Cavity well and open well- yield tests-pumping and recuperation test.

Module III (14 hours)
Tube wells: design - screened wells - gravel packed wells - well loss-selection of screen size - yield of a well - test holes - well logs - methods of construction - dug wells -shallow tube wells - deep wells - gravity wells - drilling in rocks - screen installation - well completion - well development - testing wells for yield - collector - or radial wells - infiltration galleries - well point system - failure of tube wells

Module 1V (12 hours)
Quality of ground water: ground water samples - measurement of water quality- chemical, physical and bacterial analysis - quality for domestic use - quality for agricultural use - pumps - shallow well pumps - ground water investigation - geographical investigation - electrical resistivity method - seismic refraction method - gravity and magnetic method - test drilling - resistivity logging - potential logging - artificial recharge - recharge by water spreading –
sewage recharge - recharge through pits, shafts and wells-rain water harvesting

Text Book
Raghunath H. M., Ground water Hydrology, Wiley

Reference books:
1. Todd D.K., Ground Water Hydrology, John Wiley
2. Garg S.P., Ground Water & Tube wells, Oxford & IBH
3. Raghunath H.M., Hydrology, Wiely Eastern

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions *8x 5 marks=40 marks*
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions *4 x 15 marks=60 marks*
Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 705 (E) Finite Element Methods (G)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
To make the back ground, basic concepts and basic formulation of finite element method clear to the students

Module I (14 hours)
Introduction to Finite Element Methods: Physical problems, mathematical models and finite element solutions – Mathematical model of Discrete systems – elements and assemblage - matrix formulation – Equations of equilibrium - element assembly and solution for unknowns –Gauss elimination method, LDL^{-T} Method - Basic equations of elasticity – stress–strain and strain-displacement relations - theory of stress and deformation - stress-strain-temperature relations
Review of direct stiffness method: Descretization – element and structure stiffness matrices DOF relationship- assembly of global stiffness matrix and load vector - solution of equations for unknowns - displacement boundary conditions - computation of stress - support reactions.

Module II (12 hours)
Continuous systems: Practical Examples –mathematical models- differential formulation – limitations – Variational formulation – Total potential energy - principle of stationary potential energy - problems having many d.o.f - potential energy of an elastic body - the Rayleigh-Ritz method - piecewise polynomial field - finite element form of Rayleigh-Ritz method - finite element

formulations derived from a functional - interpolation - shape functions for C^0 and C^1 elements - Lagrangian interpolation functions for two and three dimensional elements

Module III (12 hours)

Displacement based elements for structural mechanics: formulas for element stiffness matrix and load vector - overview of element stiffness matrices - consistent element nodal vector - equilibrium and compatibility in the solution - convergence requirements - patch test - stress calculation - other formulation methods

Straight sided triangles and tetrahedral: natural coordinates for lines - triangles and tetrahedral - interpolation fields for plane triangles - linear and quadratic triangle - quadratic tetrahedron

Module IV (14 hours)

The isoparametric formulation: introduction - an isoparametric bar element - plane bilinear element - summary of gauss quadrature - quadratic plane elements - direct construction of shape functions for transition elements - triangular isoparametric elements - consistent element nodal loads - validity of isoparametric elements - appropriate order of quadrature - element and mesh instabilities - remarks on stress computation

Coordinate transformation: transformation of vectors - transformation of stress, strain and material properties - transformation of stiffness matrices - transformation of flexibility to stiffness - inclined support - joining dissimilar elements to one another- rigid links - rigid elements

Text books:

1. Bathe K.J., Finite Element Procedures in Engineering Analysis, Prentice Hall of India
2. Cook R.D., Malkus D.S. & Plesha M.F., Concepts & Applications of Finite Element Analysis, John Wiley
3. Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 2006.

Reference books:

1. Desai C.S., Elementary Finite Element Method, Prentice Hall of India
2. Chandrupatla T.R. & Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India
3. Cook, R.D., Finite Element Modelling for Structural Analysis, John Wiley and sons.
4. Gallaghar R.H., Finite Element Analysis: Fundamentals, Prentice Hall Inc.
5. Rajasekaran S., Finite Element Analysis in Engineering Design, Wheeler Pub.
6. Krishnamoorthy C. S., Finite Element Analysis - Theory and Programming, Tata McGraw Hill
7. Zienkiewics O.C. & Taylor R.L., The Finite Element Method, Vol I & II, McGraw Hill
8. Segrelind., The Finite Element Method.
9. Robert D Cook, David S Malkus, Michael E Plesha & Robert J Witt, Concepts and Applications of Finite Element Analysis, Wiley India Publishers

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions*	*8x 5 marks=40 marks*
	Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	
PART B:	*Analytical/Problem solving DESCRIPTIVE questions*	*4 x 15 marks=60 marks*
	Two questions from each module with choice to answer one question. *Maximum Total Marks: 100*	

8th Semester

CE 14 801: Environmental Engineering II

Teaching scheme Credits: 4
3hours lecture and 1 hour tutorial per week

To expose students to the area of waste treatment – with emphasis on domestic liquid wastes – its characterisation, collection, treatment and disposal at individual household level to community level - rural and urban. To impart the basic concepts of solid waste management and air pollution control.

Module I (14 Hours)
Systems of sewerage – separate, combines and partially combined systems, quantity of storm
Sewage, source of sewage, relation to water consumption, ground water infiltration, fluctuations of sewage flow, quantity of storm sewage , factors affecting storm water sewage, determination of storm water flow, time of concentration, sewers and sewer appurtenances, materials used in the construction of sewers, shape of sewers, hydraulics of sewers, design of sewers, manholes, inlets, catch basins, grease traps, regulators, leaping weirs, side weirs, siphon spillway, inverted siphons,sewage pumps, pumping stations, ejectors, sewer junctions, outlets, maintenance of sewers, cleaning of sewers, ventilation of sewers.

Module II (12 Hours)
Characteristics of sewage – physical, chemical and biological characteristics – physical and chemical analysis –sampling – population equivalent – characteristics of industrial wastes – treatment of wastewater – screens – grit chambers – detritus tank – skimming tanks – sedimentation tanks – oxidation ponds – design, construction and operation of trickling filters, activated sludge treatment units – disinfection of sewage.

Module III (12 Hours)
Sewage disposal, dilution disposal into stream – pollution assimilation capacity of streams,
disposal by irrigation – surface and subsurface irrigation.Sludge treatment and disposal- quality of sludge, characteristics of sludge, sludge elutriation,sludge conditioning, vacuum filtration, sludge digestion, disposal of sludge.
House drainage-system and prctice of plumbing, plumbing fixtures – closets, urinals, wash basins, sinks,baths and cysterns.principles of house drainage – inspection chambers,ventilation,testing of drains, connection of house drains and street sewer.Rural sanitation – conservancy and water carriage systems, sanitary latrines, septic tanks –(Design as per I.S. specification)

Module IV (14Hours)
Solid waste management – solid waste collection – transportation and processing - types and sources of solid waste – solid waste characteristics – automation and mechanism of refuse collection – vehicles for solid waste collection and transportation - solid waste disposal – composting – incineration – sanitary landfill – prevention of malaria incidental to engineering construction. Gaseous waste management (air pollution and control) – air pollution and health – types of pollutants and their source – air pollution control strategy – basic approaches – areas of legal responsibility – source identification – particulate control and control of gases and vapors.

Text Books
1. Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, DhanpatRai& Sons.
2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.
3. Garg S K, Environmental Engineering Vol II, Khanna Publishers.

Reference Books
1. Elhers and Steel, Municipal and Rural Sanitation, McGraw Hill.
2. Sawer and McCarty, Chemistry for Environmental Engineering, McGraw Hill.
3. Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley.

4. Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.

10% - Regularity in the class

University Examination Pattern

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 802: Quantity Survey and Valuation

Teaching scheme Credits: 4

3 hours lecture and 1 hour tutorial per week

Objectives

After studying the subject, the student should be able

1. To set out any civil engineering work which is the primary duty that is to be performed by a civil engineer in the construction field
2. To prepare detailed exact as well as approximate estimates to meet a number of requirements and also to have a clear picture of the project expenditure.
3. To have a thorough idea regarding the quality and quantity of materials, quantity and classes of skilled and unskilled labours and tools and plants required for the project.
4. To 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.
5. To draw up specifications for the different items of civil engineering project and also to prepare the schedule of programming of the project.
6. To prepare valuation report of real and landed property

To mould themselves as entry level graduate engineers competent to manage any civil engineering project confidently either alone or jointly.

Module I (14 Hours)

Basic terms – Administrative sanction, expenditure sanction, technical sanction, contingencies, work charged establishment, provisional sum, lump sum items, centage charges etc. Esimate-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, cost from materials and labour etc. preparation of detailed estimate for buildings - centre line method and long wall - short wall method .

Module II (12 Hours)

Methods of measurements of different items of work - Preparation detailed estimate for sanitary and water supply works –septic tank and pit, water tank, pipe lines and fixtures. Roads, culverts, bridges and retaining walls. Irrigation structures. Steel/woden structures –roofs, doors and windows. R C C Structures - Preparation of bar bending schedule. Detailed specifications for common building materials and items of work as per I.S specifications.

Module III (12 Hours)
Preparation of conveyance statement - Calculation of quantities of materials for various items of work-rubble work, brick work, PCC, RCC, plastering, pointing etc. Introduction to data book and schedule of rate. Analysis of rate for various items of civil engineering works-rubble work, brick work, PCC,RCC beams and slabs, plastering, pointing, doors, windows etc. Preparation of abstract of estimate of civil engineering works.

Module IV (14 Hours)
Valuation - Explanation of terms, types of values, sinking fund, years purchase, Depreciation - Straight line method, constant percentage method, S.F method .Obsolescence. Valuation tables. Valuation of real properties-rental method, profit based method, depreciation method. Valuation of landed properties -belting method, development method, hypothecated building scheme method. Rent calculation. Lease andLease hold property.

Text books
1. M.Chakraborthi, Estimating costing & Specification in Civil Engineering
2. B.M.Dutta, Estimating and costing in civil engineering
3. S.C. Rangawala, Valuation of real properties

References
1. I.S.1200-1968 Methods of measurements of buildings and Civil Engineering works
2. Latest schedule of rates of P.W.D
3. Latest Data book of P.W.D

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PWD Data book and schedule of rate permitted in the examination hall

PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.
Maximum Total Mark 100 mark

CE14 803: Construction Engineering and Management

Teaching scheme Credits: 4
3 hours lecture and 1 hour tutorial per week

Objective:
To make the students familiar with the various facets of construction and its planning like project scheduling, resource and material management, construction procedures and professional ethics

Module I (14 hours)
Construction planning and management: Network Techniques: Introduction – Bar charts – Use of CPM and PERT for planning – Drawing network diagrams – time estimates – slack – critical path –

Crashing and time-cost trade off - resource smoothing – resources levelling - construction, equipment, material and labour schedules. Preparation of job layout.
Codification of the planning system : Codification approach- Work package and activities identification code – Resource codes – Cost and Finance accounting codes – Technical document codes.

Module II (12 hours)
Construction methods and equipment: Factors for selection of equipment – equipment for excavation and transportation of earth – hauling equipment – piles and pile driving equipment – cranes.
Construction disputes and settlement : Types of disputes – Modes of settlement of disputes – Arbitration- Arbitrator - Advantages and disadvantages of arbitration – Arbitration Award.

Module III (13 hours)
Construction procedures: Different methods of construction – types of contract - tenders – prequalification procedure - earnest money deposit – security deposit - contract document – general and important conditions of contract - measurement and measurement book . Inspection and quality control - need, principles and stages.
Construction cost and budget : Construction cost – Classification of construction cost – Unit rate costing of resources- Budget – Types of budget – Project Master budget.

Module IV (13 hours)
Concept of materials management – Inventory – inventory control – Economic order quantity- Safety stock – ABC analysis.
Safety in construction – Safety measures in different stages of construction – implementation of safety programme.
Concept of ethics – Professional ethics – ethical problems – provisions of a professional code – Role of professional bodies.
Project management information system : - PMIS Concept – Information system computerization – Acquiring a system – Problems in information system management - Benefits of computerized information system.

Text books
1. L.S.Srinath – PERT and CPM –Principles and Applications, Affiliated East-West Press
2. Peurifoy and Schexnayder – Construction Planning, Equipment, and Methods, Tata McGraw Hill
3. S.Seetharaman , Construction engineering and management , Umesh publications.

Reference Books
1. Shrivastava, Construction Planning and Management, Galgotia Publications
2. Gahlot and Dhir, Construction Planning and Management, New Age International
3. F. Harris, Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall.
4.K.K. Chitkara, Construction project management , Tata McGraw Hill
5. P.P. Dharwadkar, Management in Construction Industry, Oxford and IBH
6. Charles D Fledderman, Engineering Ethics, Prentice Hall
7. BIS, National Building Code
8. Khanna, O.P., Industrial Engineering and Management., Dhanapat Rai Publications
9. V.N.Vazirani and S.P.Chandola, Heavy Construction
10. Patil B.S., Civil Engineering Contracts and Estimates, 3rd Edition, University Press, 2006

Internal Continuous Assessment *(Maximum Marks-50)*
60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern
PART A: Analytical/problem solving SHORT questions 8x 5 marks=40 marks
Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.
PART B: Analytical/Problem solving DESCRIPTIVE questions 4 x 15 marks=60 marks
Two questions from each module with choice to answer one question.
Maximum Total Marks: 100

CE 14 806 (P): Seminar

Conducting schedule **Credits: 2**
3 hours presentations per week

Objective
To measure as well as flourish the ability of the student to study a topic, in Civil Engineering, of current relevance, from technical literature and present a seminar on that topic. Individual students should be asked to choose a topic in any field of civil engineering, preferably from outside the B. Tech syllabus and give a seminar on that topic for about thirty minutes. It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic. The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report (in two copies), based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members (preferably specialized in various sub-fields of Civil Engineering) will evaluate the seminar. One of the two copies submitted by the student should be returned to him/her after duly certifying it by the staff in charge of the seminar and Head of the department and the other copy shall be kept in the departmental library.

Internal Continuous Assessment
20% - Relevance of the topic and literature survey
50% - Presentation and discussion
20% - Report
10% - Regularity in the class and Participation in the seminar

CE 14 807 (P): Project

Teaching scheme **Credits:4**
7 hour per week

The project work started in the seventh semester will continue in this semester. The students should complete the project work in this semester and present it to the assessing committee (as constituted in the seventh semester). The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through „progress seminars. And demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each student is expected to prepare a report in the prescribed format, for final evaluations based on the project work. Members of the project group will present the relevance, design, implementation, and results of the project to the project evaluation committee. Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library and one by the respective guide. The assessment committee and project guides will award the marks for the individual students in a project as follows: 50% of the marks is to be awarded by the guide and 50% by the evaluation committee.

Internal Continuous Assessment
40% - Data collection, Planning/ Design and detailing/Simulation and analysis
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

CE 13 808 (P): Viva Voce

Credits: 4

Objective
To examine the knowledge acquired by the student during the B.Tech. course, through an oral examination

The students shall prepare for the oral examination based on the theory and laboratory subjects studied in the B.Tech. course, seminar, and project. There is only university examination for viva voce. The university will appoint two external examiners and an internal examiner for conducting the viva voce examination. These examiners shall be senior faculty members having minimum five years of teaching experience at engineering degree level. For final viva-voce, candidates should produce certified reports of seminar and project (two interim reports and main report). If he/she has undergone industrial training/industrial visit/educational tour or presented a paper in any conference, the certified report/technical paper shall also be brought for the viva-voce. The examiners shall ask questions from subjects studied for the B.Tech course, project, seminar and reports of industrial visits/trainings conducted by the student. Allotment of marks for viva-voce shall be as given below.
Pass minimum is 50%
Note: A student failed in viva voce but had passed in all other subjects shall be given with an additional chance for appearing the viva voce examination with in three months from the date of examination.
Assessment in Viva-voce *(Maximum Marks – 100)*
40% - Subjects
30% - Project
20% - Seminar
10% - Industrial training/industrial visit/educational tour or Paper presented at National-level

ELECTIVES

CE 14 -804(A): Advanced Structural Design II

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
To familiarize the students with analysis & design aspects of some advanced structures like shell roofs, tall buildings and pre-stressed concrete structures

Module 1 (13 Hours)
Shell Roof – Introduction-Classification of shells, types of stresses, Analysis of cylindrical shells, Design of simply supported circular cylindrical shells using membrane theory, Beam theory and ASCE Manual No.31

Module II (13 Hours)
Folded Plates – Introduction- Analysis using Iteration Method and using equation of three shears. Introduction to analysis using Simpson's Method (principles and steps only) - Design using Beam Method

Module III(13Hours)
Tall Buildings –Introduction, Structural Systems, Principles of analysis, design and detailing of different types of Shear wall . Moment redistribution in beams .

Module IV (13 Hours)
Principles of design of Pre-stressed Concrete Beams –Preliminary design- flexure and shear- Introduction to limit state method as per IS - Principles of design of anchorage zones (Theory only) Principles of design of Pre-stressed Concrete Tension members – Preliminary design.

Note:
1. All designs shall be done as per current I.S. specifications.
2. Special importance shall be given to detailing in designs.
3. Limit state design shall be practiced wherever possible
5. Use of I.S. codes and SP16 shall be permitted in the examination hall.

Text Books :

1. Varghese P.C., Advanced Reinforced Concrete Design , PHI
2. N. Krishnaraju, Advanced Reinforced Concrete Design, CBS Publishers.
3. Jain and Jaikrishna, Plain & Reinforced Concrete Vol. 11, Nem Chand
4. Lin.T.Y.andBurns ,Design of Prestressed Concrete Structures ,John Wiley
5. Libby , Pre stressed Concrete ,CBS Publishers
6. N. Krishnaraju, Pre stressed Concrete, Oxford & IBH
1. Roy &Sinha, Pre stressed Concrete
2. B.S. Taranath, Structural Analysis and design of Tall Buildings, McGraw Hill

Reference books:

1. Park &Paulay, Reinforced Concrete Structures
2. Krishnaraju N, Structural Design and Drawing, University Press
3. IS 2210-1962, Criteria for The Design of R.C.C. Shell Roofs & Folded Plates
4. IS 1343- Code of practice for design of pre-stressed concrete structures
5. ASCE, Manual for Design of Cylindrical Concrete Shell Roofs No. 31
6. Ramaswamy G.S., Design & Construction of Concrete Shell Roofs
7. Advanced Engineering Bulletin No. 14, Design of Combined Frames & Shear Walls, Portland Cement Association
8. Special Publication, Shear Wall Frame Interaction - A Design Aid With Commentary By McLeod I.A., Portland Cement Association

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions*	*8x 5 marks=40 marks*
	Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	
PART B:	*Analytical/Problem solving DESCRIPTIVE questions*	*4 x 15 marks=60 marks*
	Two questions from each module with choice to answer one question.	

Maximum Total Marks: 100

CE 14 – 804 (B): Advanced Geotechnical Engineering II

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module 1 (12 hours)

Well foundations: Introduction- Applications-Different shapes of wells-grip length-scour depth-design depth-forces acting on well foundation-Terzaghi's method of analysis (only general case)-bearing capacity based on N value(only IS recommendation)-design of individual components of well-sinking of wells-measures for rectification of tilts and shifts. Features of Box(floating) caisson and pneumatic caisson.

Module II (14 hours)

Foundation on expansive soils: Introduction to expansive soil- Identification of expansive soils-shrinkage and expansion of clay- -classification of expansive soil-direct measurement of swell and swell pressure-Free swell-swelling potential-Tests for swell pressure(only IS code method)-prediction of swell pressure from index properties-classification of damages in buildings-causes and types of damages in buildings on expansive soils- Damages and cracks in buildings on expansive soils-preventive measures for expansive soils-modification of expansive soils-principles of design of foundations in expansive soil deposits-environmental solutions such as soil replacement techniques and lime columns-structural solutions such as provision of rigid foundation, under reamed piles, T Beams as strip footing for walls (only basic aspects are to be discussed)

Module III(14 hours)

Soil dynamics and Machine foundations: Introduction- Soil behavior under dynamic loads and application-Difference between static and dynamic load behavior-soil properties relevant for dynamic loading- free vibrations and forced vibrations- Types of machines-Types of machine foundations - vibration analysis of a machine foundation-general design criteria for machine foundations- Design criteria for foundation for reciprocating machines(only IS specifications)-design procedure for block foundation for a reciprocating machine-reinforcement and construction details-vibration isolation and control

Module IV (12 hours)

Stability of slope:Introduction- swedish circle method- location of most critical circle-use of N curve and T-curve-use of rectangular plot-stability of slope under steady seepage condition, sudden draw down condition and during construction- Improving stability of slopes.

Introduction to software packages in Geotechnical Engineering- for bearing capacity analysis and stability of slopes (application of a simple case on any one package)

Reference books

1.Joseph E. & Bowles, *Foundation Analysis & Design*, McGraw Hill
2.P.C.Varghese, Foundation Engineering,Prentice-Hall of India Private Ltd, New Delhi
3.Shashi K. Gulhati and ManojDutta, Geotechnical Engineering, Tata McGraw-Hill Publishing CompayLimited,New Delhi.
4.Leonards G.A., *Foundation Engineering*, McGraw Hill
5.Arora K.R., *Soil Mechanics & Foundation Engg.*, Standard Publications
6.Punmia B. C., *Soil Mechanics & Foundations*, Laxmi Publications
7.Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
8.Teng W.C., *Foundation Design*, PHI
9.Tomlinson M.J., *Foundation Design & Construction*, Pitman
10.Coduto, *Geotechnical Engineering Principles and Practices*, Pearson Education

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE14 804(C): Surface Hydrology and Water Power

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective:
To make the students aware of the importance of surface water resources and strategic back ground information for its effective and wise utilization

Module I (13 Hours)
Introduction: Hydrologic cycle- application of hydrology in engineering – water balance equation – water resources of India – review of rainfall measurement and analysis.
Abstraction from precipitation: Evaporation – measurement, estimation and control of evapo-transporation (ET) – estimation of evapo-transpiration – evapo-transpiration and consumptive use – measurement of ET – lysimeters and field pots – potential ET and its computation – pav evaporation-Pennman's method – BlaneyCriddle method – reference crop ET and crop coefficient – interception and depression storage – infiltration processes – measurement using infiltrometers – infiltration capacity – infiltration indices – Hortan's model of infiltration.
Rain water harvesting – water scarcity in Kerala – reasons – manmade alterations in hydrologic cycle – methods of water conservation

Module II (13 Hours)
Characteristics of run off – factors affecting run off – components of hydrograph – base flow separation – rain fall – run off relations – unit hydrograph theory – derivation of unit hydrograph – applications and limitations of unit hydrograph- S hydrograph – instantaneous unit hydrograph – unit hydrograph for ungauged catchments – synthetic hydrograph – conceptual elements – linear reservoirs – Nash model. Yield from a catchment – flow duration curves – flow mass curve.

Module III (13 Hours)
Floods – estimation of peak discharge – rational method- unit hydrograph method. Probabilistic and statistical methods – basic concept of probability and frequency distribution – skewness coefficient – return period discrete distribution – Binomial distribution – continuous distribution – flood frequency analysis – normal, lognormal, Gumbel and Log-Pearson Type III methods.
Flood routing – reservoir routing – Modified pulse method – channel routing – Muskinghum method.

Module IV (13 Hours)
Water power – types of hydro power schemes – runoff river plant- pumped storage plant – tidal power plants – hydro power potentials of India – economic considerations of water power – estimates of available water power – gross and net head – available power – power duration curve – assessment of water power potential - load factor, capacity factor, utilization factor- general layout of hydro power scheme – elements of hydro power scheme – intakes -functions – types – tail race, Penstocks – location – types – economical diameter- penstock accessories – anchor block – water hammer – water hammer equation – Cavitations – Surge Tanks – functions and types – turbines – review of basics – characteristic curves – draft tubes – governing of turbines.

Text books:
Subramanian K., Engineering Hydrology, Tata McGraw Hill
Reghunath H.M., Hydrology, Prentice Hall
Duggel K.N., and J.P. Soni, Elements of water resources engineering, New Age International Publishers.

References:
Chow V.T., Dr.Maidment and L.W. May, Applied hydrology, McGraw Hill Book Co., Singaopre 1988
McCuen R.H, Hydrologic analysis and design, Prentice Hall
Singh V.P., Elementary Hydrology, Prentice Hall of India
Veissman, W. Jr., G L Lewis and J W. Knapp, Introduction to hydrology, Harper and Row, NewYork
Rao K. L., Water resources of India,

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 804 (D) Urban Transportation Planning

Objective:
To equip the students with the basic principles of transportation planning.

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Module I (13 hours)
Urban transportation planning process and concepts: Role of transportation - transportation problems – urban travel characteristics - evolution of transportation planning process - concept of travel demand - demand function - independent variables - travel attributes - assumptions in demand estimation - sequential, recursive and simultaneous process

Module II (13 hours)
Trip generation analysis**:** assumptions in trip distribution analysis- different types of distributionmodelsDefinition of study area - zoning - types and sources of data - road side interviews - home interview surveys - expansion factors - accuracy checks. Trip generation models - zonal models – category analysisworked out problems - household models - trip attractions of work centers–

Module III (13 hours)
Trip distribution analysis**:** trip distribution models – assumptions in trip distribution models - growth factor models - gravity models – calibration of gravity model - opportunity models- conventional travel demand forces- travel demand forces in system engineeringframework. Worked out problems

Module IV (13 hours)
Mode split and route split analysis**:** mode split analysis - mode choice behavior - competing modes - mode split curves - probabilistic models - route split analysis - elements of transportation networks - coding - minimum path trees – worked out problems all-or-nothing assignment - capacity restrained assignment – limitations for the conventional approach to activity based model (basic idea only)– production and attraction models
Captive and choice riders – wadropes criteria – root split analysis – different algorithms for shortest path Dijkstras algorithms - database management and its advantages

Text books
1. Hutchinson B.G., *Principles of Urban Transportation System Planning*, McGraw Hill
2.Kadiyali.L.R., Traffic Engineering and Transportation planning, Khanna Publishers, New Delhi.
3. Bruton M.J., *Introduction to Transportation Planning*, Hutchinson of London.

References books
1. Khisty C.J., *Transportation Engineering - An Introduction*, Prentice Hall
2. Papacostar, *Fundamentals of Transportation Planning*, Tata McGraw Hill
3. Dicky J.W., *Metropolitan Transportation Planning*, Tata McGraw Hill

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

CE 14 804 (E) Remote Sensing and GIS (G)

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Module I (13 Hours)

Remote sensing: definition – components of remote sensing- energy sensor, interacting body – active and passive remote sensing – platforms – arial and space platforms – balloons ,helicopters, aircrafts and satellites – synoptivity and repeativity – electromagnetic radiation (EMR) – EMR spectrum – visible, infrared (IR) near IR, middle IR, thermal IR and microwave – black body radiation – Planck's Law – Stefan –Boltzmann law.

Atmospheric characteristics – scattering of EMR – Raleigh, Mie, Non-selective and Raman scattering – EMR interaction with water vapor and ozone – atmospheric windows – significance of atmospheric windows – EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface.

Module II (13 Hours)

Opticaa 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 multi-spectral scanning – along and across track scanners- description of sensors in IRS series – current satellites – radar – speckle – back scattering- side looking air borne radar – synthetic aperture radar – radiometer radar – geometrical characteristics. Principles of thermal remote sensing - Principles of microwave remote sensing.

Module III (13 Hours)
Geographic information system – 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 structures – comparison of raster and vector data structure – analysis using raster and vector data – retrieval, reclassification, overlaying, buffering - data output – printers and plotters.

Module IV (13 Hours)
Miscellaneous topics: interpretation of satellite images- elements of interpretation – visual interpretation – digital image processing techniques – image enhancement – filtering – image classification – FCC composites - supervised and unsupervised integration of GIS and remote sensing –application of remote sensing and GIS – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

Text books:
1. Anji Reddy, Remote sensing and Geographical systems, BS Publications
2. M G Srinivas (Edited by), remote sensing applications, Nerusa publishing house
3. Lillesand T M and Kuefer R W., Remote sensing and image interpretation, John Wiley and sons
4. Jensan J R, Introductory digital image processing, Prentice Hall of India
5. Sabins, Flyod, F., Remote sensing principles and Interpretation, W H Freman and Co., NewYork

References:
1. Janza F J, Blue H M and Johnston, J E., Manual of remote sensing vol. I., American Society of Photogrammetry, 1975
2. Burrough P A., Principles of GIS for land resource assessment, Oxford
3. Star Jeffrey L (Ed), EstsJoh E and McGwire Kenneth, Integration of geographical systems and remote sensing, Cambridgeuniversity.
4. De Merse, Michael N., Fundamentals of geographic information system, 2nd edn., John Wiley and sons.

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 805 (A): Industrial Structures

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

1. To familiarize with the design of special structures widely used in industrial plants.
2. To reinforce the fundamental courses in structural design in the perspective of industrial applications.

Module 1 (13hrs)

Functional design of industrial buildings: (8 hrs)

Classification of industrial structures-layout planning requirements –Guidelines from factories act – Lighting- Illumination levels – Principles of day lighting /artificial lighting design – Natural / Mechanical ventilation – Fire safety requirements – Corrosion protection – Protection against noise – Cladding systems- vibration isolation techniques - Industrial floors.

Introduction to diverse types of industrial structures: (7 hrs)

General overview of Thermal power plant/Nuclear power plant structures / Process plant steelwork – conveyor structures – Boiler supporting structures-Substation structures.

Module 2 (13 hrs)

Structural Design of Industrial Buildings☹use IS 800 -2007

Braced Industrial buildings – Unbraced Industrial frames – Gantry girders –Design of steel beam connections-Flexible & Rigid (Bolted and welded types). Castellated beams – design subjected to flexure , shear – connections

Module 3 (13 hrs)

Special Industrial Structures:

Machine foundations – Types-Design Requirements-Analysis and design of block type machine foundations (IS 2974 method)

Design of Reinforced concrete bunkers and silos as per IS:4995

Tall Chimneys (RCC) –Types-Chimney sizing parameters- Overview of wind and temperature effects-Design principles of Reinforced concrete chimneys as per IS: 4998.

Module 4 (13 hrs)

Tower Structures:

Cooling Towers –Types and functions- Design principles of RC natural draught cooling towers as per IS: 11504

Transmission line Towers- Types-Design loadings-Analysis and design concepts- Description of TL tower foundations.

Textbooks:

1. Proceedings of an advanced course on industrial structures, SERC – 1982.
2. S.N.Manohar, Tall Chimneys-Design and Construction, Tata McGraw Hill.
3. P.Dayaratnam, Design of steel structures, Wheeler Publishing Co.
4. Ramchandra, Design of steel structures, Vol. 1 and 2, Standard Book house Delhi.
5. Srivasulu and Vaidyanathan, Handbook of machine foundations-Tata McGraw Hill.
6. Murthy and Santhakumar, Transmission Line structures, McGraw Hill

References:

1. SP: 32–1986,Hand book on functional requirements of Industrial buildings (Lighting and ventilation).
2. G.W.Owens, P.R.Knowles and P.J.Dowling- Steel Designers' manual – 5th edition – Blackwell scientific publications.
3. V.Kalayanaraman, Advances in steel structures. Tata McGraw Hill
4. Krishnaraju N., Advanced Reinforced concrete design, CBS Publishers.
5. K.K.McKelvey and Maxey Brooke, The Industrial Cooling Tower, Elsevier Publishing Co.

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 805 (B) Advanced Construction Engineering & Management

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective

To familiarise students with advanced construction methods and management techniques usually adopted in large projects

Module-I (13 hours)

Construction projects - project management – project organization and functions - project development process - main causes of project failure.

Equipment intensive operations and risks - equipment types - selection of equipment–owning and operating cost of equipment – cost optimization – transportation problem and assignment problem - economic life of equipment – depreciation – replacement decisions.

Module –II (13 hours)

Project control methodology – control system framework – parameters to be controlled – performance base lines – performance accounting process – monitoring performance – information communication – control benefits.

Quality management - importance of quality - elements of quality - organisation for quality control - quality assurance techniques – documentation - quality control circles - total quality management – Indian Standards - ISO 9000.

Module – III (13 hours)

Earthwork construction: planning – graphical presentation – earthwork quantities – mass diagram and its use- properties of geotechnical materials – bank, loose and compacted measures - compaction specification and control – soil processing – compaction methods and equipment – stabilisation methods.

Flexible pavement construction : structure and materials – asphalt plants – batch plants, drum mix plants, dust collectors, asphalt storage and heating, reclaiming – paving equipments – compaction equipments. Pavement laying methods – paving practice, laying width, surface dressing, repaving.

Module – IV (13 hours)

Concrete production and placement**:** Significance of proportioning concrete mixtures – use of mineral admixtures in concrete – significance and applications of light weight concrete, high density concrete, polymer concrete composites, fibre reinforced concrete, high performance concrete, vacuum concrete. Handling and batching concrete materials - mixing - types of mixers – ready mixed concrete – transporting and placing methods – equipment for consolidation of concrete – finishing and curing methods – slip form paving - roller compacted concrete – Hot weather and cold weather concreting – under water concreting – shotcreting.

Text Books

1. R.L.Peurifoy and Schexnayder – Construction Planning, Equipments and Methods, Tata McGraw Hill
2. Chitkara, K.K. - Construction Project Management - Planning, Scheduling and Controlling, Tata McGraw Hill Publishing Co., New Delhi.

References books

1. Neville A.M. and Brooks.J.J. - Concrete Technology, Pearson Education.
2. Banga, Sharma, Agarwal. – Industrial Engineering and Management Science, Khanna Publishers.
3. Sharma S.C. - Construction Equipment and Management, Khanna Publishers, New Delhi.
4. Deodhar, S.V. - Construction Equipment and Job Planning, Khanna Publishers, New Delhi
5. Dr. Mahesh Varma - Construction Equipment and its Planning and Application, Metropolitan Book Company, New Delhi
6. F. Harris- Modern Construction and Ground Engineering Equipment and Methods, Prentice Hall.
7. Jagman Singh – Heavy Construction – Planning, Equipment and Methods, Oxford & IBH Publishing Co.
8. James E. Russell - Construction Equipment, Reston Publishing Company, Inc., Virginia.

Internal Continuous Assessment *(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100

CE 14 805 (C) Coastal Engineering and Marine Structures

Teaching scheme **Credits:** 4
3 hours lecture and 1 hour tutorial per week

Objective
To develop basic knowledge on Ocean Engineering and related applications.

Module I (14 Hours)
Introduction: man-ocean interaction-effects of ocean on ecology and climate-ocean as a source of food and means of communication-minerals in ocean-ocean for disposal of wastes- integrated coastal zone management (ICZM) and its importance in India.
Theory of ocean waves: formulation of wave motion problem-assumptions made in two dimensional cases-small amplitude wave theory-orbital motions and pressures- problems-wave energy.

Module II (12 Hours)
Brief introduction to finite amplitude wave theories-mass transport-: Gerstner theory-Stokes theory, solitary wave theory-relationships among wave dimensions-wind and fetches-generation of waves-wave forecasting- S.M.B and P.N.J methods-problems

Module III (12 Hours)
Reflection, refraction and diffraction of waves: clapotis or standing waves-super position of waves-diffraction of waves around semi infinite break waters –detached breakwater of finite length-diffraction through openings. Wave forces on structures: forces on vertical walls due to non-breaking waves, breaking waves and broken waves based on linear theory-Forces on fixed vertical circular cylinder in the Morison regime- problems Introduction to Froude-Krylov force and Diffraction regime- -Tsunami: Generation, propagation-warning systems.

Module IV (14 Hours)
Shores and Shore processes: long term and short term changes of shores –factors influencing beach characteristics-beach wave interaction-beach profile modification-littoral drift-stability of shores-shore erosion due to sea level rise-on shore and off shore transport-long shore transport-interaction of shore structures-shore erosion in Kerala-mud banks

Shore Protection works: description and effects of break waters-sea walls-groynes of various types-beach nourishment, break waters, tetrapod, tribar etc. Hudson's formula and simple design problem.

Text Books:

Ippen A.T, R, Estuary and Coastline Hydrodynamics
.Sarpkaya, T.,Isaacson,M., Mechanics of Wave Forces on Offshore Structures, Van NostrandRenhold Company

Reference Books:

1 Chakrabarti,S.K., Hydrodynamics of Offshore structures, Computational Mechanics Publications, Southampton, Boston
2. Wiegel R.L, Oceanographical Engineering, Prentice Hall.
3. Coastal Engineering Manual (CEM-Department of the Army-US Army Corps of Engineers-2001 or latest revision)

Internal assessment: Maximum marks:50

60% - Tests (Minimum 2)
30% - Assignments (minimum 2) such as homework, problem solving, group discussions, quiz, literature survey, seminar, term project, software exercise etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 805 (D) Ground Improvement Techniques

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Module I (14 hours)

Objective of ground improvement-In-situ ground improvement methods-Introduction to soil improvements without the addition of many material - surface compaction –compaction piles in sand-impact compaction/dynamic compaction of sands – vibratory compaction in sand-vibroflotation in

sand–explosions in sand- Terra probe method- replacement process - vibroflotation in clays--preloading techniques- sand drains-stone columns-introduction to soil improvement by thermal treatment- introduction to bio technical stabilization

Module II(14 hours)

Introduction to soil improvement by adding materials - lime stabilization –Mechanism-optimum lime content-lime fixation point-effect of lime on physical and engineering properties of soil- lime column method - stabilization of soft clay or silt with lime – stabilization with cement-suitability for soils-effect on properties of soils

Grouting-types-desirable characteristics of grouts-grouting methods-grouting pressure-grouting materials - grouting technology-permeation grouting- compaction grouting- soil fracture grouting-jet grouting - application and limitations - slab jacking, grouted columns-application to dams.

Module III (12 hours)

Geosynthetics–Types-applications (only general applications)- types of geotextiles and geo grids - physical and strength properties of geotextiles and geogrids - behaviour of soils on reinforcing with geotextiles and geogrids- - design aspects with geotextiles and geogrid for clay embankments, retaining walls and unpaved roads.

Module IV (12 hours)

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types-reinforcing materials - Reinforced earth retaining walls- reinforced embankments-soil nailing -improvement using natural materials (introduction only).

Reference books:

1. Moseley, Text Book on Ground Improvement, Blackie Academic Professional, Chapman & Hall
2. Purushotham S. Raju, Ground Improvement Technique,Laxmi Publications
3. Shashi K. Gulhati and ManojDutta, Geotechnical Engineering, Tata McGraw-Hill Publishing CompayLimited,New Delhi.
4. Boweven R., Text Book on Grouting in Engineering Practice, Applied Science Publishers Ltd
5. Jewell R.A., Text Book on Soil Reinforcement with Geotextiles, CIRIA Special Publication, Thomas Telford
6. Donald .H. Gray &Robbin B. Sotir, Text Book On Bio Technical & Soil Engineering Slope Stabilization, John Wiley
7. Rao G.V. &Rao G.V.S., Text Book On Engineering With Geotextiles, Tata McGraw Hill
8. Korener, Construction & Geotechnical Methods In Foundation Engineering, McGraw Hill

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A:	*Analytical/problem solving SHORT questions* Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.	*8x 5 marks=40 marks*
PART B:	*Analytical/Problem solving DESCRIPTIVE questions* Two questions from each module with choice to answer one question.	*4 x 15 marks=60 marks*

Maximum Total Marks: 100

CE 14 805 (E) Environmental Pollution Control Engineering (G)

Teaching scheme **Credits:** 4

3 hours lecture and 1 hour tutorial per week

Objective:

- To provide students with balanced information regarding different elements of pollution and its control measures
- To make students aware of statutory controls for pollution control.

Module I (13 Hours)

Environmental pollution – interrelationship between various forms of pollution – surface water pollution surveys – integrated river basin water management – restoration of water bodies – water quality parameters and optimization of treatment – water quality changes by domestic use – radioactive materials – thermal pollution and underground disposal – types of water pollutants and their effects – instrumentation for water quality and treatment – role of wastewater treatment as pollution control measure.

Module II (13 Hours)

Air pollution control strategy – basic approaches – areas of legal responsibility – source identification – particulate control and control of gases and vapours – factors affecting control approach selection – air pollution control technology – settling chambers – filters – electrostatic precipitators – wet scrubbers – entrainment separators – gas adsorption, gas absorption and combustion.

Module III (12 Hours)

Land pollution – pollution cycle – ecological factors in plant site selection – ecological aspects of vegetation control – noise pollution – the physics of sound and hearing – effects of noise – sources – instruments and techniques for noise measurements – light and glare pollution – light and its characteristics - glare – outdoor lighting and glare sources – corrective procedures.

Module IV (14Hours)

Environmental impact analysis – physical, social, aesthetic and economic assessment of highway project, mining and power plants – legislative control – water pollution laws and regulations – Air pollution control act of India – chimney heights – land pollution laws and regulations.

Reference Books:

1. Rao C S, Environmental Pollution Control Engineering, New Age International (P) Ltd.
2. Goel P K, Water Pollution Causes, Effects and Control, New age International (P) Ltd.
3. Birdie G.S & Birdie J.S, Water Supply and Sanitary Engineering, DhanpatRai& Sons.
4. Bethea R.M, Air Pollution Control technology, Van Nostrand Reinhold Co.

5. Flintoff F, Management of solid waste in developing countries, WHO.
6. LiptekBela G &Bouis P.A., Environmental Engineers Handbook Vols I, II, III, Chilton Book Company.
7. Water Pollution Act (1974) passed by Govt. of India.
8. Air pollution Control act of India.
9. Relevant Indian Standards & factory Acts.

Internal ContinuousAssessment*(Maximum Marks-50)*

60% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, group discussions, quiz, literature survey, seminar, term-project, software exercises, etc.
10% - Regularity in the class

University Examination Pattern

PART A: *Analytical/problem solving SHORT questions* *8x 5 marks=40 marks*

Candidates have to answer EIGHT questions out of TEN. There shall be minimum of TWO and maximum of THREE questions from each module with total TEN questions.

PART B: *Analytical/Problem solving DESCRIPTIVE questions* *4 x 15 marks=60 marks*

Two questions from each module with choice to answer one question.

Maximum Total Marks: 100