Curriculum and Syllabus for B.Tech Degree Program in Civil Engineering

April 2019

Department of Civil Engineering
National Institute of Technology Puducherry
Karaikal – 609 609

PROGRAMME OBJECTIVES

1. Graduates of the Programme will contribute to the development of infrastructure that is sustainable.
2. Graduates of the Programme, as part of an organization or as Entrepreneurs, will continue to learn to harness evolving technologies.
3. Graduates of the Programme will be professional Civil Engineers with ethical and societal responsibility.

PROGRAMME OUTCOMES

Graduates of the Civil Engineering Programme will be able to:

1. Apply the knowledge of mathematics, science, engineering fundamentals, and Civil Engineering principles to the solution of complex problems in Civil Engineering.
2. Identify, formulate, research literature, and analyse complex Civil Engineering problems reaching substantiated conclusions using first principles of mathematics and engineering sciences.
3. Design solutions for complex Civil Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions related to Civil Engineering problems.
5. Create, select, and apply appropriate techniques, resources, and modern engineering tools such as CAD, FEM and GIS including prediction and modelling to complex Civil Engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional Civil Engineering practice.
7. Understand the impact of the professional Civil Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the Civil Engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex Civil Engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage Civil Engineering projects and in multidisciplinary environments.
12. Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B.Tech Degree Program in Civil Engineering

FRESHMAN YEAR						
SEMESTER-I						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	
HM151	Functional English	3	0	0	3	
MA151	Differential Calculus and Algebra	3	0	0	3	
CH151	Engineering Chemistry	3	0	0	3	
EE151	Basics of Electrical Engineering	2	0	0	2	
ME151	Basics of Mechanical Engineering	2	0	0	2	
CE101	Engineering Mechanics I: Statics	3	0	0	3	
HM155	Basics of Human Life Sciences	2	0	0	2	
CH153	Chemistry Laboratory	0	0	3	2	
CE103	Engineering Drawing and Graphics	1	0	3	3	
	Total	19	0	6	**23**	
Semester-II						
HM152	Technical English	2	0	2	3	
MA152	Integral Calculus and Solutions of Ordinary Differential Equations	3	0	0	3	
PH152	Engineering Physics	3	0	0	3	
CS152	Basics of Programming and Laboratory	2	0	3	4	
HM154	Energy, Environment & Agricultural Engineering	3	0	0	3	
CE102	Engineering Mechanics II: Dynamics	3	0	0	3	
PH154	Engineering Physics Laboratory	0	0	3	2	
ME152	Workshop Practice	0	0	3	2	
	Total	16	0	11	**23**	
SOPHOMORE YEAR						
Semester-III						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
MA251	Probability and Statistics	3	0	0	3	
CE201	Mechanics of Solids	3	0	0	3	DC-1
CE203	Mechanics of Fluids	3	0	0	3	DC-2
CE205	Concrete Technology	3	0	0	3	DC-3
CE207	Building Materials and Construction	3	0	0	3	DC-4
CE209	Engineering Surveying	3	0	0	3	DC-5
CE211	Material Testing Laboratory	0	0	3	2	
CE213	Concrete Technology Laboratory	0	0	3	2	
CE215	Engineering Surveying Practical	0	0	3	2	
	Total	18	0	09	**24**	
Semester-IV						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
MA252	Numerical Techniques and Computer Programming	3	0	1	3	
CE202	Structural Analysis I	3	0	0	3	DC-6
CE204	Hydraulics and Hydraulic Machinery	3	0	0	3	DC-7
CE206	Soil Mechanics	3	0	0	3	DC-8
CE208	Highway and Pavement Engineering	3	0	0	3	DC-9
CE210	Water Supply Engineering	3	0	0	3	DC-10

CE212	Fluid Mechanics Laboratory	0	0	3	2	
CE214	Soil Mechanics Laboratory	0	0	3	2	
CE216	Highway Engineering Laboratory	0	0	3	2	
	Total	18	00	10	**24**	
JUNIOR YEAR						
Semester-V						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
CE301	Structural Analysis II	3	0	0	3	DC-11
CE303	Design of Reinforced Concrete Structures	3	0	2	4	DC-12
CE305	Wastewater Engineering	3	0	0	3	DC-13
CE307	Water Resources Engineering	3	0	0	3	DC-14
CE309	Foundation Engineering	3	0	0	3	DC-15
	Global Elective-I	3	0	0	3	GE-1
CE311	Structural Engineering Laboratory	0	0	3	2	
CE313	Environmental Engineering Laboratory	0	0	3	2	
	Total	18	0	8	**23**	
Semester-VI						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
CE302	Design of Steel Structures	3	0	2	4	DC-16
	Department Elective-1	3	0	0	3	DE-1
	Department Elective-2	3	0	0	3	DE-2
	Global Elective-II	3	0	0	3	GE-2
HM351	Engineering Ethics and Precepts of Constitution of India	3	0	0	0	
CE304	Computer Aided Design Project	0	0	3	2	
CE306	Building Planning and Drawing	0	0	3	2	
CE308	Estimation, Costing and Valuation	2	0	2	3	
	Total	17	0	10	**20**	
Summer Term						
CE405	Industrial Training	0	0	90	**1**	TP
SENIOR YEAR						
Semester-VII						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
CE401	Construction Management	3	0	0	3	DC-17
CE403	Railways, Airways and Waterways Engineering	3	0	0	3	DC-18
	Department Elective-3	3	0	0	3	DE-3
	Global Elective-III	3	0	0	3	GE-3
CE491	Project Work Phase I	0	0	9	2	
	Total	12	0	09	**14**	
Semester-VIII						
CODE	**COURSE OF STUDY**	**L**	**T**	**P**	**C**	**Type**
	Department Elective-4	3	0	0	3	DE-4
	Department Elective-5	3	0	0	3	DE-5
	Department Elective-6	3	0	0	3	DE-6
CE492	Project Work Phase II	0	0	18	4	
	Total	9	0	18	**13**	

Total Credits (SemI-23+SemII-23+SemIII-24+SemIV-24+SemV-23+SemVI-20+Summer Term-1+SemVII-14+SemVIII-13) = 165

List of Electives					
Electives Offered in VI Semester					
CE321	Advanced Reinforced Concrete Design	3	0	0	3
CE322	Prestressed Concrete Structures	3	0	0	3
CE323	Stability of Structures	3	0	0	3
CE324	Finite element Analysis	3	0	0	3
CE325	Earth and Earth Retaining Structures	3	0	0	3
CE326	Advanced Foundation Engineering	3	0	0	3
CE327	Engineering Geology	3	0	0	3
CE328	Solid and Hazardous Waste Management	3	0	0	3
CE329	Industrial Waste Management	3	0	0	3
CE330	Pollution Control Engineering	3	0	0	3
CE331	Hydrology	3	0	0	3
CE332	Irrigation and Hydraulic Structures	3	0	0	3
CE333	Traffic Engineering and Safety	3	0	0	3
CE334	Advanced Surveying	3	0	0	3
CE335	Lab Oriented Mini Project	0	0	6	3
Electives Offered in VII Semester					
CE421	Advanced Design of Steel Structures	3	0	0	3
CE422	Advanced Composite Structures	3	0	0	3
CE423	Structural Dynamics	3	0	0	3
CE424	Ground Improvement Techniques	3	0	0	3
CE425	Rock Mechanics	3	0	0	3
CE426	Environmental Impact Assessment	3	0	0	3
CE427	Irrigation Management	3	0	0	3
CE428	Pavement Analysis and Design	3	0	0	3
CE429	Remote Sensing and GIS	3	0	0	3
CE430	Coastal Engineering	3	0	0	3
CE431	Modern Construction Materials	3	0	0	3
CE432	Urban Planning				
Electives Offered in VIII Semester					
CE433	Seismology and Earthquake Resistant Structures	3	0	0	3
CE434	Bridge Engineering	3	0	0	3
CE435	Design of Offshore Structures	3	0	0	3
CE436	Design of Shell Structures	3	0	0	3
CE437	Failure Analysis of Structures	3	0	0	3
CE438	Soil Structure Interaction	3	0	0	3
CE439	Earthquake Geotechnical Engineering	3	0	0	3
CE440	Environmental Risk Assessment	3	0	0	3
CE441	Ecological Engineering	3	0	0	3
CE442	Groundwater Hydrology	3	0	0	3
CE443	Hydro Power Engineering	3	0	0	3
CE444	Transportation Planning	3	0	0	3
CE445	Transportation Infrastructure Design	3	0	0	3
CE446	Ocean Wave Mechanics and Marine Structures	3	0	0	3
CE447	Contract laws and Regulations	3	0	0	3
CE448	Fundamentals of Nanoscience	3	0	0	3

CE449	Repair, Rehabilitation and Retrofitting of Structures	3	0	0	3
CE450	Engineering Economics	3	0	0	3
Global Electives Offered by Civil Engineering in III year					
CE351	Architectural Heritage of India	3	0	0	3
CE352	Global Warming and Climate Change	3	0	0	3
CE353	Design of Sustainable Building	3	0	0	3
Global Electives Offered by Civil Engineering in IV year					
CE451	Environmental Management	3	0	0	3
CE452	Disaster Management	3	0	0	3

FRESHMAN YEAR

SEMESTER-I

HM151 FUNCTIONAL ENGLISH

Course Objective:

1. To Prepare Students in use of the Basics of the English Language.

Writing Skills: Paragraph Writing-Report writing, Technical writing -Unity-Plain English

Technical Writing Skills: Business Proposals- Business Correspondence: Enquiry, complaint, sales letters - Precise writing-Para phrasing, summary writing on graphs, tables, charts etc..,.

Functional Skills: Technical Presentation Skills- Inter personal Communication- Group Discussions-Pamphlet and brochure designing

Soft Skills: Relationship between Soft skills and Communication Skills- Leadership Skills-Team management Skills-Lateral thinking-Negotiation skills –Telephone etiquettes.

Prose or Poetry: Collection of two to three prose or poetry pieces at the discretion of the teacher for enhancing the literary sensibility of the students.

Activities for Practice

Virtual Course: Presentations, letter writing practice, soft skills practice, Mock interviews, Group discussions, Writing skills practice

Text Books

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication, OUP Publication, 2005.
2. John Sealy. The Oxford guide to effective writing and Speaking, OUP publication, 2007.
3. K. Alex. Soft Skills, S. Chand Publication, 2010.

Reference Book

1. David Lindsay, A Guide to Scientific Writing, Macmillan, 1995

Course Outcome

1. The students will have knowledge of the various uses of English in their professional environment and they will be able to communicate themselves effectively in their chosen profession

MA151 DIFFERENTIAL CALCULUS AND ALGEBRA

Course Objectives:

1. To learn mathematical concepts and methods.
2. To acquire fundamental knowledge and apply in engineering disciplines.

Matrix Theory: Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Consistency and solutions of systems of linear equations using elementary operations, linear dependence and independence of vectors, Characteristic roots and vectors of a matrix, Caley - Hamillton theorem (statement only) and its applications, canonical form by linear and orthogonal transformations.

Sequences: Sequences of real numbers – Limit of a sequence – Convergent and divergent sequences–sub sequence- Cauchy's sequence – monotone convergence theorem (without proof)- Sequence with recurrence relations.

Infinite series: Convergence Tests for positive term series – Comparison, Root, Ratio and Raabe's tests- Alternating series – Leibnitz's rule – Absolute and Conditional Convergence.

Differential Calculus: Rolle's theorem; Mean value theorem; Taylor's and Maclaurin's theorems (without proof) with remainders, Functions of several variables, Partial Differentiation, Total Differentiation, Euler's theorem and generalization, maxima and minima of functions of several variables (two and three variables) – Lagrange's method of Multipliers, Change of variables, Jacobians.

Integral Calculus: Fundamental theorem of integral calculus and mean value theorems, Beta and Gamma integrals, Elementary properties, Differentiation under integral sign.

Text Books:

1. Erwyn Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition.

Reference Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publications, 2002.
2. M.D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education Inc., 2002.

Course Outcomes:

1. After completion of the course, students are able to solve industrially applicable problems.

CH151 ENGINEERING CHEMISTRY

Course Objectives:

1. Enabling the Students to learn the basic principles of electrochemistry, Corrosion studies, Organic Chemistry, Cement Chemistry, Spectroscopy and Nanomaterials.

Electrochemistry and Corrosion: Introduction to Electrochemistry, Electrolytic and galvanic cells - EMF, Reference Electrode - Weston standard cell, hydrogen electrode, calomel electrode, glass electrode, reversible and irreversible cells, concentration cell – Hydrogen-Oxygen fuel cells. Corrosion: Dry and wet corrosion - General mechanism, Types of

corrosion, Factors affecting corrosion - Corrosion protection – Electro and Electroless Plating.

Organic Chemistry: Carbon-carbon bond properties, homolytic and heterolytic cleavage of carbon-carbon bonds, SN1 and SN2, E1and E2reactions, aromatic nucleophilic substitution, aromatic electrophilic substitution, Baeyer-Villiger oxidation, MPV reduction.

Cement Chemistry – Chemical Ingredients of cement - Cement–Water Reaction, Hydration process and products – heat of hydration - Principles and Applications of Tools for analysing materials – Scanning Electron Microscope – X-Ray Diffraction – Elemental Analysis.

Fuels and Lubricants: Fuels - classification, examples and relative merits, types of coal, determination of calorific value of solid fuels - Bomb calorimeter - Theoretical oxygen demand, proximate and ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems, Lubricants – definition, theories of lubrication, characteristics of lubricants – viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point and carbon residue, additives to lubricants.

Nanomaterials: Introduction - Properties at nanoscale (optical, mechanical, electronic and magnetic), Classification based on dimensionality - Carbon - based nanomaterials (buckyballs, nanotubes, graphene) – Metal based nanomaterials (nanogold, nanosilver and metal oxides) – Nanocomposites – Nanopolymers – Nanoglasses – Nanoceramics.

Text books:

1. P.C. Jain and M. Jain, Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2015.
2. J. March, Advanced Organic Chemistry, Wiley Eastern, New Delhi, 2012.
3. W. Kemp, Organic Spectroscopy, Palgrave, New York, 2008.
4. Alain Nouailhat, An Introduction to Nanoscience and Nanotechnology, John Wiley, 2008.
5. Taylor H. F. W., Cement Chemistry, Thomas Telford Publishing, 2004.

References:

1. R. Gopalan, D. Venkappayya and N. Sulochana, Engineering Chemistry, Vikas Publishing House, New Delhi, 2017.
2. J.C. Kuriacose, J. Rajaram, Chemistry in Engineering and Technology, Vol I & II, Tata McGraw Hill publishing Company Ltd, New Delhi, 1984.
3. P.W. Atkins, Physical Chemistry, Oxford University Press, 2006.
4. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry - Principles of Structure and Reactivity, Harper Collins College Publishers, New York, 2011.
5. Czernin Wolfgang, Cement Chemistry and Physics for Civil Engineers,

Course Outcome:

1. Able to have idea about basics in chemistry and also related to civil engineering field

EE151 BASICS OF ELECTRICAL ENGINEERING

Course objectives:

1. To enable the students to gain knowledge about the fundamentals of Electrical and Mechanical engineering.

Definition of Voltage, Current, Power & Energy, circuit parameters, Ohm's law, Kirchoff's law. Series and Parallel DC circuits. Concepts of AC Circuits- rms value, average value, form and peak factors. Simple RL, RC and RLC series and parallel circuits Concept of real and reactive power – Power factor. Introduction to three phase systems - types of connections, relationship between line and phase values.

Definition of mmf, flux and reluctance, leakage flux, fringing, magnetic materials and B-H relationship. Faraday's laws of electromagnetic induction. Basic Working principle and construction of electrical Machines. Introduction to electrical measuring instruments.

Types of wiring-staircase & corridor wiring, wiring accessories. Basic safety measures at home and industry- earthing. Electrical tariff, energy audit and importance of energy saving. Simple layout of generation-various energy resources, transmission & distribution of power. The Laws of Illumination-Electric lamps.

Text books:

1. Muthusubramanian.R, Salivahanan.S, Muraleedharan.K.A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw - Hill, 1999.
2. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering‖, PHI, 2nd Edition, 2010.

References:

1. Kothari D P and Nagrath I J, Basic Electrical Engineering , Tata McGraw Hill,1991.
2. Huges, ―Electrical and Electronics Technology‖, Pearson, 10th Edition, 2011.

Course outcomes:

1. Able to understand the basics of electric circuits
2. Able to understand the basics of electromagnetic laws
3. Able to understand the basic working principle of DC and AC machines
4. Able to understand the concepts of power generation, energy saving, illumination, electric lamps, protective devices for safety

ME151 BASICS OF MECHANICAL ENGINEERING

Course objectives:

1. To enable the students to gain knowledge about the fundamentals of Mechanical engineering.

Introduction - Energy conversion and efficiencies - System, property and state - Thermal equilibrium - Temperature - Zeroth law of Thermodynamics. First law of thermodynamics - Kelvin-Planck statement of second law of thermodynamics

Introduction - Classification of Power Plants – Working principle of Steam, Gas, Diesel, Coal – Merits and Demerits – Boilers, Classification of Boilers - Fire tube and Water Tube Boilers.

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines.

Text books:

1. Venugopal K. and Prahu Raja V., ―Basic Mechanical Engineering‖, Anuradha Publishers, Kumbakonam, (2000).
2. Nag, P. K., "Engineering Thermodynamics", 4th edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi,1995
3. Wark, K., "Thermodynamics", 4th edition ,Mc Graw Hill, N.Y.,1985
4. Hans Ziegler, An Introduction to Thermodynamics, North-Holland Publishing Company, 1983 - Reprint

References:

1. El.Wakil, M.M., Power Plant Technology, Mc Graw Hill Book Co.,1985.
2. Hajra Choudhry, et. al., Workshop Technology Vol I and II, Media Promoters Publishers Pvt. Ltd., Bombay, 2004.
3. Nagpal, Power Plant Engineering, Khanna Publishers, Delhi, 1998.
4. Shantha Kumar S R J., ―Basic Mechanical Engineering‖, Hi-tech Publications, Mayiladuthurai, (2000).

Course outcomes:

1. Able to understand the basic of thermodynamics

CE101 ENGINEERING MECHANICS I: STATICS

Course Objectives:

1. To know the basics of force systems
2. To study frictional laws and theorems
3. To understand the static equilibrium of particles and rigid bodies in two dimensions
4. To introduce the techniques for analyzing the forces in the bodies.

Statics of rigid bodies: Classification of force systems- principle of transmissibility of a force Composition and resolution- Resultant of a coplanar force systems and conditions of equilibrium, free body diagrams.

Moment of a force, couple, properties of couple- Varignon's theorem

Beams: Types of loading, Support reactions of simply supported and overhanging beams under different types of loading. Concurrent and parallel forces in space, conditions of equilibrium.

Friction: Laws of friction-angle of friction- cone of friction- ladder friction- wedge friction. Properties of surfaces: centroid of simple and composite areas- Theorems of Pappus – Guldinus.

Moment of inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration, moment of inertia of simple and composite areas.

Virtual Work: Degree of freedom, Virtual displacement and virtual work; Principle of virtual work.

Text Books:

1. K. L. Kumar: Engineering Mechanics: Tata McGraw Hill
2. J.L.Meriam & L.G.Kraige: Engineering Mechanics -Statics & Dynamics: John Wiley&Sons,Inc
3. F. P. Beer & E. R. Johnston: Vector Mechanics for Engineers- Statics & Dynamics: Tata McGraw Hill

Reference:

1. R.C. Hibbeler: Engineering Mechanics - Statics & Dynamics: Pearson Education Asia
2. S. Timoshenko and D. H. Young: Engineering Mechanics: McGraw Hill
3. Nelson: Engineering Mechanics: TMH

Course Outcomes:

1. Able to identify and analyze the problems by applying the principles of engineering mechanics, and to proceed to advanced study on mechanical systems.

HM155 BASICS OF HUMAN LIFE SCIENCES

Course Objectives:

1. To understand human psychology and intelligence
2. To know to manage people
3. To know the professional ethics

Fundamentals of cognitive psychology — perception — attention —memory systems — remembering/forgetting events — memory distortions

Knowledge representation — language. Problem solving — reasoning and decision making.

Managing people — empathic listening — managing change — achieving excellence — influencing people — balancing work and life (stress) — making presentations — time management

Emotional intelligence — social intelligence. Phantoms in the brain — creativity — lateral thinking — innovation — transactional analysis — team working — Personality development

Introduction to professional ethics — human values — work and environmental ethics.

Text Books:

1. Dale Timple A, creativity, Jaico publishing house, 2005.
2. Dalip Singh, Emotional intelligence at work, SAGE publication Inc, 2007. DK book series, 2008.
3. Harris A Thomas, I am ok-you are ok, Arrow Books, 2012.

References:

1. Harris Jr. E. Charles, Engineering ethics, concepts, and cases, Thomas Wordsworth, 2003.
2. Kellog T Ronald, Fundamental of cognitive psychology, SAGE publication Inc, 2012.
3. Ramachandran V. S. and Sandra Blakeslee, phantoms in the brain, Hopper Collins, 2012.

Course Outcomes:

1. Able to understand human psychology and intelligence
2. Able to know professional ethics

CH153 CHEMISTRY LAB

1. Percentage purity of bleaching powder

2. pH metric titration

3. Conductometric titration

4. Potentiometric titration

5. Determination of corrosion rate of mild steel in acid medium by weight loss method

6. Estimation of total alkalinity in the given water sample

7. Estimation of carbonate, noncarbonated and total hardness in the given water sample

8. Estimation of dissolved oxygen in waste water

9. Estimation of Fe2+ by external indicator

10. Estimation of proximate analysis of Coal.

References:

1. Laboratory Manual, Department of Chemistry, NITT

CE103 ENGINEERING DRAWING AND GRAPHICS

Course Objectives:

1. Enable the students to possess efficient drafting skill.
2. Provide neat structure of industrial drawing.
3. Enables the knowledge about position of the component and its forms and interpretation of technical graphics assemblies.

Fundamentals Drawing standard - BIS, dimensioning, lettering, type of lines, scaling conventions. Geometrical constructions: Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and hexagon – conic sections – ellipse – parabola – hyperbola – cycloid – trochoid.

Orthographic projection: Introduction to orthographic projection, drawing orthographic views of objects from their isometric views - Orthographic projections of points lying in four quadrants, Orthographic projection of lines parallel and inclined to one or both planes Orthographic projection of planes inclined to one or both planes. Projections of simple solids – axis perpendicular to HP, axis perpendicular to VP and axis inclined to one or both planes.

Sectioning of solids: Section planes perpendicular to one plane and parallel or inclined to other plane. Intersection of surfaces: Intersection of cylinder & cylinder, intersection of cylinder & cone, and intersection of prisms.

Development of surfaces: Development of prisms, pyramids and cylindrical & conical surfaces. Isometric and perspective projection: Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection, perspective projection of simple solids prisms, pyramids and cylinders by visual ray method and vanishing point method.

Computer aided drafting: Introduction to computer aided drafting package to make 2-D drawings. 2D drafting commands for simple shapes – Dimensioning (Based on the assignment, student will be evaluated for this unit)

Text books:

1. Natarajan, K. V., A text book of Engineering Graphics, Publication: Dhanalakshmi Publishers, Chennai, 2006.
2. Venugopal, K. and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, Pub. New Age International, 2009.

References:

1. Jolhe, D. A., Engineering drawing, Publication: Tata McGraw Hill, 2008
2. Shah, M. B. and Rana, B. C., Engineering Drawing, Pub.: Pearson Education, 2009.
3. Basant Agarwal and Agarwal C.M., ―Engineering Drawing‖, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

4. Luzzader, Warren.J. and Duffjohn M., ―Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5. Bhatt,N. D and Panchal,V.M.,Engineering Drawing, Publication: Charotar Publishing House, 2010.

Course Objectives:

1. On completion of the course the student will be able to
2. Perform free hand sketching of basic geometrical constructions and multiple views of objects.
3. Do orthographic projection of lines and plane surfaces.
4. Draw projections and solids and development of surfaces.
5. Prepare isometric and perspective sections of simple solids.
6. Demonstrate computer aided drafting.

SEMESTER-II

HM152 TECHNICAL ENGLISH

Course Objective:

1. To train students in Soft skills and Technical Communication Skills.

Listening Skills: Importance of Listening skills in Technical World – Types of Listening- Listening for information, inference and evaluation-Note Making.

Reading Skills: Importance of Reading Skills- Reading strategies- Reading for information, inference and evaluation. (News papers, Scientific Research, Desired reading materials), Note Making.

Reading for Research Proposes: Reading Technical Reports- How to read a Journal article.

Use of Soft Skills: Discussion- Interview- Presentation.

Reference Skills: Using a Dictionary, graphs, glossary, index, bibliography etc.

Outcome: The students will be able to express themselves in a meaningful manner at different levels of people in their academic and social domains.

Activities for Practise:

1. Activities designed on Speaking and listening Skills based on the theory syllabus. Like Pair work
2. Activities, role plays, Jam sessions, Debates, Movie clips to illustrate non verbal communication,
3. Varieties of English practice, Skits, Mock interview sessions, grammar games and practice, etc..,

Text Books:

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication, OUP Publication, 2005.
2. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill,2005

Reference Books:

1. David Lindsay,‖ A Guide to Scientific Writing‖, Macmillan, 1995

Course Outcomes:

1. The students will be able to express themselves in a meaningful manner at different levels of people in their academic and social domains.

MA152 INTEGRAL CALCULUS AND SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Course Objectives:

1. To acquire fundamental knowledge of mathematics and apply in engineering disciplines.

Multiple Integrals: Double and triple integrals, surface areas by double integrals. Volumes by double and triple integrals change of variables in double and triple integrals.

Vector Calculus: Scalar and Vector fields; Vector Differentiation; Level surfaces directional derivative, Gradient of scalar field, Divergence and Curl of a vector field, Laplacian, Line and surface integrals, Green's theorem in plane, Gauss Divergence theorem, Stokes' theorem (without Proof).

Ordinary differential equations of first order: Separable equations, equations reducible to separable form, exact equations, integrating factors, linear first order equations, Bernoulli's equation, Orthogonal trajectories, Newton's law of cooling, Law of Natural growth and Decay.

Higher order Ordinary differential equations: Higher order linear equations with constant coefficients. Euler and Cauchy's equations, method of variation of parameters, system of linear Differential equations with constant coefficients.

Laplace Transformations: Laplace transform, Inverse Laplace transform, properties of Laplace transforms, Laplace transforms of unit step function, impulse function and periodic function, convolution theorem, Solution of ordinary differential equations with constant coefficients and system of linear differential equations with constant coefficients using Laplace transform.

Text Books:

1. Erwyn Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2012.

Reference Books:

1. T.M. Apostol, Calculus, Volume I & II, 2nd Edition, John Wiley & Sons (Asia), 2005.
2. M.D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education Inc. (First Indian reprint), 2002.

Course Outcomes:

1. After completion of the course, students are able to solve industrially applicable problems.

PH152 ENGINEERING PHYSICS

Course Objectives:

1. To enable the students to refresh their basics of Physics and orient themselves in implementation of concepts in engineering
2. To give an exposure on basics of quantum mechanics and statistical physics
3. To provide fundamentals of Solid state physics, which give foundation for engineering Physics and Materials Science
4. To enable the students to get exposure on different types advanced materials in engineering, properties and application in the field of engineering

Waves and Oscillations: Wave motion- Travelling wave in one dimension-Wave equation examples-Superposition of waves and standing waves-Simple harmonic motion - energy of SHM examples: Simple pendulum, LC circuit-damped oscillations-forced oscillations and resonance conditions; Absorption coefficient-reverberation-reverberation time -Sabine's formula-Acoustics of buildings. Theory of interference of light- Newton's rings, Diffraction-Grating,-Polarization-Applications.

Statistical Mechanics: A Simple thermodynamic System, Thermodynamic processes, Second law of thermodynamics; entropy and temperature, The Boltzmann distribution, Classical averages, Quantum distributions-FD and BE, the quantum gas.

Solid state Physics: Crystalline and amorphous solids-system of crystals symmetry operation single crystal-defects in solids-Miller indices-atomic radius coordination number- Atomic packing factor calculation-Bragg's law. Drude theory of electrical conductivity, Free electron theory (classical and quantum), band theory of solids, semiconductors, superconductivity-types, Meissner effect, applications; Magnetism-types 4 and properties- Hard and soft magnetic materials, applications; Dielectrics-types of polarization, internal fields, Claussius Mosotti equation; Introduction to advanced materials.

Lasers and fiber optics Spontaneous and stimulated emissions-Einstein's coefficients-Population inversion and lasing action, Coherence-Properties and types of lasers-Applications; Fermat's principle and Snell's law-Optical fiber-Numerical aperture-Types of fibers- Fiber optics communication principle- Fiber optic sensors.

Text books:

1. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi (2014).
2. R.K. Gaur and S.L. Gupta ,Engineering Physics, DhanpatRai Publications (P) Ltd., 8thedn., New Delhi (2001)
3. V. Rajendran, Materials Science, Tata McGraw-Hill-2011
4. R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers, 9th edition, Cengage Learning.2014
5. Anthony R. West, Solid State Chemistry and its Applications, John Wiely and sons 2nd Edition. 2014
6. Arthur Beiser, Concepts of Modern Physics., Tata McGraw-Hill, New Delhi (2010).

References:

1. Halliday, Resnic and Walker, Fundamentals of Physics, 9th Ed., John Wiley & sons (2011).
2. Walter Greiner, Ludwig Neise, Horst Stocker and D. Rischke, Thermodynamics and Statistical Mechanics, Springer (1997).
3. Richard P. Feynman ,The Feynman Lectures on Physics - Vol. I,II and III: The New Millennium Edition (2012).
4. Rolf. E. Hummel, Electronic Properties of Materials, Springer (2001).

Course Outcomes:

1. Fundamental knowledge of students obtained in school will get refreshed while handling topics with mathematical approach.
2. Students will also get an exposure on topics of modern physics and connectivity of thermodynamics, statistical physics and quantum physics providing.
3. Student will get exposure on physics of materials science for the advancements in the materials science.

CS152 BASICS OF PROGRAMMING AND LABORATORY

Course Objectives:

1. To learn the fundamentals of computers
2. To learn the problem solving techniques in writing algorithms and procedures
3. To learn the syntax and semantics for C programming language
4. To understand the constructs of structured programming such as conditions, iterations, arrays, functions and pointers
5. To analyze complex engineering problems to develop suitable solutions

Fundamentals of Computer - Introduction to computers – Computer Organization – Characteristics – Hardware and Software –Modes of operation – Types of programming languages – Developing a program.

Algorithms and Structured Programming - Algorithms – Characteristics – Flowcharts - Principles of Structured programming – Sequential, Selective structures - Repetitive structures –Bounded, Unbounded and Infinite iterations.

Overview of C or FORTRAN and Branching - Introduction – character set – Identifiers and Keywords – Data types – Constants – Variables – Declarations – Expressions – Statements – Symbolic constants – Operators– Library functions . Data input and output: Single character input and output – Entering input data – Writing output data – gets and puts functions. Control statements: Conditional- Branching- Looping- unconditional: Break- continue-goto.

Functions & Arrays - Functions: Overview- Defining a Function- Accessing a Function- Function Prototypes- Passing Argument to a Function- Recursion- Storage Classes: Automatic Variables- External (Global) Variables-Static Variables- Register variables. Arrays: Defining an Array- Processing an Array- Passing Array to function- Multidimensional Arrays.

Strings & Pointers - Strings: Defining a String- NULL Character- Initialization of Strings- Reading and Writing a String- Processing Strings- Character Arithmetic- Library Functions for Strings. Pointers: Pointer Declaration-Passing Pointers to a Function-Pointers and One-dimensional Array- Dynamic Memory Allocation- Operations on Pointers- Pointers and Multidimensional Arrays- Array of Pointers- Command line arguments.

Programs:

1. Programs using sequence construct
2. Programs using selection construct
3. Programs using Iterative construct
4. Programs using nested for loops
5. Programs using functions with Pass by value
6. Programs using functions with Pass by reference
7. Programs using recursive functions
8. Programs using one dimensional Array
9. Programs using two dimensional Arrays
10. Programs using Pointers and functions
11. Programs using Pointers and Arrays
12. Programs using Pointers and structures
13. Programs using structures and arrays
14. Programs to perform I/O operations on files.
15. Programs to perform error handling during I/O operations on files.
16. Programs to perform random access to files.

Outcomes

- Ability to write program in C and FORTRAN language
- Ability to test and debug the programs for critical errors
- Ability to analyze and optimize programs

Text Books:

1. Byron Gottfried, ―Programming with C‖, Third Edition, Tata McGraw Hill Education, 2010.
2. R.G. Dromey, ―How to Solve it By Computers?‖, First edition, Prentice Hall, 2001 .
3. Robert Lafore, Object Oriented Programming in Microsoft C++, Walte Group Press, 2009 - Reprinted

Reference Books:

1. J.R. Hanly and E.B. Koffman, ―Problem Solving and Program Design in C‖, Sixth Edition, Pearson Education, 2009.
2. Paul Deital and Harvey Deital, ―C How to Program‖, Seventh Edition, Prentice Hall, 2012.
3. YashavantKanetkar, ―Let Us C‖, Twelth Edition, BPB Publications, 2012.

HM154 BASIC ENERGY, ENVIRONMENT & AGRICULTURAL ENGINEERING

Course Objectives:

1. To know the present energy scenario in India
2. To introduce the production of electricity
3. To know the effects and control measures of pollution
4. To know the basics of irrigation and agriculture

Present energy resources in India and its sustainability - Advantage and disadvantage of all sources - Energy demand scenario in India.

Basics of Solar Energy- Solar thermal and Solar photovoltaic systems - Power and energy from wind turbines - Types of wind turbines – Hydro Power plants – Nuclear Power plants.

Introduction to geothermal energy and tidal energy – Biomass Resources – Feedstock Pre-processing and Treatments – Biomass conversion Technologies.

Sources, Effects and Control Measures for Air, Noise and Water pollution – Drinking water Quality - Municipal solid waste generation and management.

Greenhouse gases and global warming - climate change – Impacts of Fossil fuels – Impacts of Industrial and Transport Emissions.

Introduction to agriculture engineering -Major crops of India–Types and categories of crops-Types of farming and cultivation procedures-Different monsoon seasons-Types of irrigation systems-Major draughts-Agricultural machinery-Dairy farming and its economic importance.

Text books:

1. B. H. Khan, Non-Conventional Energy Resources-The McGraw –Hill Second edition, 2009.

Reference:

1. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Prentice Hall, 2nd Edition, 2003.

Course Outcome:

1. Will be having basic idea about energy production, pollution effects and basics of agriculture.

CE102 ENGINEERING MECHANICS II: DYNAMICS

Course Objectives:

1. To study the principles of dynamics and kinematics.
2. To study translation and rotation of rigid body

Kinematics of Particles: Differential equations of kinematics – rectilinear and curvilinear motions; Cartesian co-ordinate system; Normal and tangent co-ordinate system, projectile motion.

Kinetics of Particles: Equation of motion, D'Alemberts Principle, Work, energy and power, Principle of impulse and momentum. Impact: Direct and oblique impact.

Rotation of Rigid Bodies: Moment of inertia of material bodies, Kinematics and Kinetics of rotation equation of motion, Principle of work and energy; Principle of impulse and momentum.

Plane motion of Rigid Bodies: Translation of a rigid body in a plane; Kinematics of plane motion; Instantaneous centre of rotation; Kinetics of plane motion – equation of motion, principle of work and energy; Principle of impulse and momentum.

Text Books:

1. K. L. Kumar: Engineering Mechanics: Tata McGraw Hill
2. J.L.Meriam & L.G.Kraige: Engineering Mechanics -Statics & Dynamics: John Wiley&Sons,Inc
3. F. P. Beer & E. R. Johnston: Vector Mechanics for Engineers- Statics & Dynamics: Tata McGraw Hill

Reference:

4. R.C. Hibbeler: Engineering Mechanics - Statics & Dynamics: Pearson Education Asia
5. S. Timoshenko and D. H. Young: Engineering Mechanics: McGraw Hill
6. Nelson: Engineering Mechanics: TMH

Course Outcomes:

1. Able to identify and analyze the problems by applying the principles of engineering mechanics and to proceed to advanced study on mechanical systems.

PH154 ENGINEERING PHYSICS LAB

1. Simple harmonic motion.

2. Sonometer- frequency of tuning fork/AC (Melde's technique).

3. Determination of Young's modulus- Searle's dynamical method.

4. Modulus of rigidity using torsion pendulum.

5. Thermal conductivity of poor conductor –Lee's disc method.

6. Measurement of temperature using thermocouple.

7. Specific heat of liquids by Newton's law of cooling.

8. B-H curve of ferromagnetic materials.

10. Determination of magnetic field along the axis of a circular coil.

11. (i) Conversion of Galvanometer into ammeter and voltmeter.

(ii) Calibration of voltmeter-Potentiometer.

12. Series LCR circuit-resonance phenomenon.

13. Newton's rings- determination of radius of curvature of a lens.

14. Determination of wavelength, spot size and divergence of laser.

15. I-V Characteristics of a PN junction diode and Zener diode.

16. Determination of resistivity and band gap of a semiconductor.

17. Charge-discharge characteristics of RC circuit.

18. Introduction to CRO- Lissajous figures.

19. Determination of Planck's constant

20. Verification of Photo-electric effect.

References:

1. C.L Arora, B.Sc. Practical Physics, S. Chand & Co. (2012).
2. Singh Harnam and Hemne P.S., B.Sc. Practical Physics, S. Chand & Company (2002)
3. J.D. Wilson and Cecilia A. Hernandez-Hall, Physics laboratory experiments, 7th edition, Cengage Learning (2009).
4. R.A. Dunlap, Experimental Physics: Modern Methods, Oxford University Press (1997).

ME152 Workshop Practice

Carpentry - Wood sizing exercise in planning, marking, sawing, chiselling and grooving to make Half lap joint and Cross lap joint

Welding - Exercise in arc welding for making Lap joint and Butt joint

Foundry - Preparation of sand mould for Flange and Anvil

Fitting - Preparation of joints, markings, cutting and filling for making V-joint, Square Fitting

Sheet metal - Making of small parts using sheet metal - Tray/ Dust Pan and Funnel

Smithy Work - Reforming the shape using Smithy work - Round rod to Square rod and Round rod to Hook

Plumbing - Making Series and Parallel PVC pipe connection for checking the flow rate

Assembling and Dismantling - Dismantling of front and back wheel, Assembling of bicycle back wheel and Dismantling of Pumps

Demonstration of Bearing, Pulley and Hydraulic Jack

SOPHOMORE YEAR

SEMESTER-III

MA 251 PROBABILITY AND STATISTICS

Course Objectives:

1. To understand the concepts of Probability and Statistics which arise in engineering applications
2. To study the defects arising in any of the engineering products.
3. To study the quality of the components purchased for the projects.

Definitions of Probability, Basics of Combinatorial Analysis, Posing Probability problems mathematically – Examples, Conditional Probability, Baye's theorem.

Random variable, Probability mass function, Density function, Distribution Function, Bernoulli Trials, Binomial Distribution, Poisson Approximation, Poisson Distribution, Normal Distribution, Moment Generating Functions.

Joint Probability Density Function, Marginal and Conditional Densities, Function of Random Variable, Chebyshev Inequality, Law of Large Numbers, Central Limit Theorem, Estimation, Point Estimation, Bayesian Estimation.

Testing of Hypothesis, Z-test for single mean and difference of means, t-test for single mean and difference of means, F-test for comparison of variances, Chi-square test for goodness of fit.

Curve Fitting, The method of least squares, Karl Pearson's coefficients of correlation, Rank correlation, Regression and correlation.

Text Books:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand, 2000.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 6th Ed. 2001.

Reference:

1. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 2, 3rd edition, Wiley Eastern, New Delhi. 2008.
2. R. A. Johnson, Miller and Freund's, Probability and Statistics for Engineers, Pearson Publishers, 9th Edition, 2017.

Course Outcomes:

Upon completion of the course, the student will be able to

1. Understand the basics of Probability theory.
2. Apply the principles and techniques learnt in this course for solving the practical problems which arise in the industry.
3. Apply Probability in reliability and life testing machine tools in Civil Engineering.

CE201 MECHANICS OF SOLIDS

Course Objectives:

1. To learn about the concept of stress, strain and relation between them
2. To know the concepts of principal stress and principal planes
3. To learn the bending moment, shear force, bending stress and their stress distribution
4. To know the deflection of beams and buckling of columns
5. To learn the failure theories, thin and thick cylinders
6. To understand the theory of torsion

Simple Stresses and Strains- Tension, compression and shear stresses - Hooke's law – Poisson's Ratio- Principle of Superposition- Stresses due to impact- composite bars - Volumetric Strain- elastic constants-thermal stresses.

Compound Stresses- Principal stress and principal strain- Mohr's circle- Thin and Thick Cylinder

Bending Moment and Shear Force Beams and support conditions -Types of supports and loads - shear force and bending moment - their diagrams for simply supported beams, cantilevers and overhanging beams.

Bending Stress and Shear Stress - Theory of simple bending – Stress distribution at a cross section due to Bending Moment and Shear Force.

Theories of failure - Criteria for Failure - Different failure theories for ductile and brittle materials

Deflection of Beams- Slope and Deflection for determinate structures using Moment Area and Conjugate Beam Method

Torsion of Circular Shafts Equation of Torsion-Strength and Stiffness - Torsional Rigidity-Polar Modulus-Power Transmitted by shaft of solid and hollow circular sections.

Analysis of Thin and Thick cylinders under internal and external pressure.

Elastic Stability of Columns Short and Long Column, Euler's Theory of Columns, Derivation of Buckling Load for different end conditions, Rankine's Formula
Unsymmetrical Bending and Shear Centre.

Text Books:

1. Elements of Strength Timosenko, S.P. Affiliated East-West of Materials and Young, D.H. Press Pvt. Ltd
2. Strength of Materials Srinath, L.S, Tata McGraw-Hill. Desai. P.
3. Engineering Mechanics Popov, E.P. PHI of Solids
4. Solid Mechanics Kazimi Tata McGraw-Hill

5. Introduction to Solid Shames, H PHI Mechanics
6. Strength of Materials Shaneloy, F.R McGraw Hill
7. Strength of Materials Timoshenko, S McGraw Hill Vol. I
8. Strength of Materials Belyaeb,N.M. Moscow.

References:

1. Advanced Mechanics Of Solids Srinath, L.S. Tata McGraw-Hill
2. Mechanics & Solids & Benham, P.P., & Structures Warnock, F.V
3. Mechanics & Solids & Benham, P.P Pitman Publishing Structures Warnock, F.V
4. Advanced Mechanics Seely, F.B.& Tokyo,Toppan, of Materials Smith, J.O
5. An introduction to the S.H.Crandall McGraw Hill, Mechanics of solids N.C. Dahal, T.J. Lardener

Course outcomes:

1. Able to determine the strength parameters of the materials
2. Able to solve principal stress and principal plane problems
3. Able to determine deflection of beams and buckling of columns
4. Able to determine shear force, bending moment, bending and shear stress distribution
5. Able to analyze members subjected to torsion, thin and thick cylinders

CE203 MECHANICS OF FLUIDS

Course Objectives:

1. To understand the properties of fluid – statics and dynamics
2. To know the concepts of Continuum, Bernoulli's theorem and continuity equation and Navier – Stoke's equation of motion
3. To know the losses in pipe
4. To know the basics of boundary layer theory

Continuum concept - CGS, MKS and SI systems - Properties of fluids - Ideal and real fluid - Pressure in a fluid – Pressure variation - Pressure measurement-Hydrostatic forces on plane and curved surfaces - Buoyancy and equilibrium - Metacentric height and its determination.

Kinematics - Types of flow - Continuity equation for one, two and three dimensional flows - Stream function and velocity potential - Flow net and its properties - Convective and local acceleration

Dynamics - Pressure, kinetic and datum energy - Bernoulli's theorem and proof - Euler's equations of motion for a three dimensional flow and along a streamline - Deduction of Bernoulli's theorem- Momentum equation – Applications – Discharge measurement of Venturi meter, mouthpiece, orifice meter, nozzle meter, bend meter and rotameter - Reynold's experiment - Laminar and turbulent flow - Reynold's number - Critical flow

Navier Stoke equations of motion - Shear stress and pressure gradient - Laminar flow between parallel plates - Couette flow - Friction factor - Smooth and rough pipes - Moody diagram - Flow through noncircular pipe -Minor losses - Pipes in series and parallel - Equivalent length - Introduction to water hammer phenomena.

Boundary layer - Displacement and momentum thickness - Energy thickness - Flow in circular pipes - Von Karman momentum equation - Laminar and turbulent boundary layers on flat plates - Drag in flat plates, cylinders and spheres - Drag coefficients -Boundary layer control - Hagen Poiseuille equation for flow through circular pipes - Turbulence - Semi empirical theories – Major losses – Darcy Weisbach equation for flow through circular pipe

Text Book:

1. Nagaratnam, S., Fluid Mechanics, Khanna Publishers, 1995.
2. Rajput R.K., Fluid Mechanics And Hydraulic Machines, S. Chand Ltd, 1998
3. Philip J. Pritchard, Fluid Mechanics, Wiley India Pvt. Ltd, New Delhi, 2015

References

1. Natarajan, M.K. Principles of Fluid Mechanics, Oxford & IBH Publishing Co, 1994.
2. JagdishLal, Hydraulics and Fluid Mechanics, Tata McGraw Hill, 2001.
3. Streeter V.L., Fluid mechanics, Tata McGraw Hill, 1998.

Course Outcomes:

1. Able to understand the principles of fluid mechanics
2. Able to analyse the fluid flow and their energy level
3. Able to do discharge measurements and the losses
4. Able to find shear stress on drag and drag coefficient by boundary layer theory

CE205 CONCRETE TECHNOLOGY

Course Objectives:

1. To understand the properties, manufacture and types of concrete
2. To know the application and types of admixtures
3. To learn the durability properties of concrete
4. To design the concrete mixes of various grades used in the construction

Concrete- Introduction- Ingredients – Cement- tests on cement – Aggregates - Tests on fine aggregates- Test on coarse aggregate- Water- Quality of Water for mixing and curing - Use of sea water for mixing concrete – Concrete Manufacturing- Batching - Mixing - Transportation - Placing of concrete - curing of Concrete- Types of Concrete - Normal Strength Concrete, High Strength Concrete and High Performance Concrete – Self compacting Concrete –Ready Mix Concrete.

Mortar and concrete- Properties of cement – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Properties of fresh concrete – Consistency and Workability – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture.

Admixtures - accelerating admixtures - Retarding admixtures - water reducing admixtures - Air entraining admixtures - colouring agent - Plasticizers.

Durability of Concrete - Shrinkage and temperature effects - creep of concrete - permeability of concrete - Corrosion - Causes and effects - remedial measures- Thermal properties of concrete - Micro cracking of concrete.

Mix Design - factors influencing mix proportion - Mix design by ACI method and I.S. code method -Design of high strength concrete.

Text Books:

1. Shetty, M.S., Concrete Technology, Theory & Practice, S.Chand and Co, 2004.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill, 2004.

References:

1. Nevile, Properties of Concrete, Longman Publishers, 2004.
2. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.

Course Outcomes:

1. Able to test all the concrete materials as per IS code
2. Able to design the concrete mix using ACI and IS code methods
3. Able to determine the properties of fresh and hardened of concrete
4. Able to ensure quality control while testing/ sampling and acceptance criteria

CE207 BUILDING MATERIALS AND CONSTRUCTION

Course Objective:

1. To know about different building materials and their properties
2. To know about the basic principles of building construction

Introduction to Building Materials – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks –Bricks for special use – Refractory bricks – Concrete – types – properties – Solid and Hollow concrete blocks - Lightweight concrete blocks- – Pozzolanic Materials – fly ash, rice husk ash, Ground Granulated Blast Furnace Slag.

Tiles – ceramic, terrazzo and clay tiles – types and uses – Glass-Ceramics – Fibre glass reinforced plastic – Fibre textiles- Mats and pads for earth reinforcement- Polymers and resins for building repair – Pavement Grade bitumen – Asphalt – cut back bitumen – Bituminous Emulsion – Mastic Bitumen – Bituminous felt – Modified Bitumen

Timber – Plywood – Veneer – Thermacole – Panels of laminates – Steel - Aluminium composite panel – Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Weathering coarse

Lintels- Doors and windows location and size specifications-types-fixtures and fastenings for doors and windows-ventilators – Construction Joints-Expansion joints- Vertical Joints – Pointing- temporary sheds- basements.

Acoustics of buildings – sound absorbent material and sound insulation – Ventilation, air conditioning and thermal insulation- Air conditioning-purposes and classification- systems of

air conditioning. Thermal insulation-principles-heat insulating materials and methods of heat insulation

Vertical transportation-stair cases-types – Lifts-ramps – escalators. Temporary structures-form work-scaffolding- shoring-underpinning – General Construction procedure.

Text Book:

1. R.K. Gupta, Civil Engineering Materials and Construction Practices, Jain brothers, New Delhi, 2009.
2. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd, New Delhi, 2005.
3. Bhavikatti. S.S., Building Construction, Vikas Publishing House Pvt. Ltd., 2012.

References

1. M. Gambhir, NehaJamwal, Building Materials Products, Properties and Systems, Tata McGraw Hill Publishers, New Delhi, 2011.
2. National Building Code of India 2005,Bureau of Indian Standards, 2005.
3. Tech. Teachers Training Institute, Civil Engineering Materials, Tata McGraw Hill, 1992.

Course Outcomes:

1. Able to know the building materials and general construction procedure

CE209 ENGINEERING SURVEYING

Course Objectives:

1. To understand the importance of surveying in the field of civil engineering
2. To get introduced to different plane and geodetic surveying applications
3. To understand the significance of each method in civil engineering and master the skill to carry out the proper surveying method in the field.
4. To design numerical solutions for carrying out surveying in civil engineering field.

Introduction and principles of surveying – Classification – Brief introduction to chain surveying – Chaining and ranging - Compass surveying – Prismatic compass – Instruments – Bearing of survey lines – Systems and conversions – Local attraction – Latitude and departure – Traversing – Traverse adjustment of closing errors.

Plane table surveying – instruments and accessories – advantages and disadvantages of plane table surveying – methods – radiation, intersection, traversing, resection – Two and three point problems – errors in plane table surveying.

Levelling – Definitions – Levelling instruments – Temporary and permanent adjustments – Booking – Reduction to levels – Correction for Curvature and refraction – Classification of levelling – Profile levelling – Differential levelling – Reciprocal levelling – longitudinal and cross sectioning - Contours – Contour interval – Methods of contouring – uses.

Theodolite surveying – Vernier theodolite – Temporary and permanent adjustments – Measurement of horizontal and vertical angles – Methods of repetition and reiteration – errors in theodolite surveying – elimination of errors - Area and volume computation – area from latitude and departure Simpson's rule and Trapezoidal rule.

Tachometric surveying – Principles – Methods – Stadia system – Fixed and movable hair methods – Methods with staff held vertical and normal – Analytic lens – Subtense bar – Tangential method.

Introduction to Advanced Surveying equipments - EDM – Total station - Remote Sensing – GPS

Text Book

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.
2. James M. Anderson and Edward M. Mikhail, Surveying: Theory and Practice, The McGraw-Hill Companies, 1998.

References

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 1994.
2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 1996

Course Outcomes:

1. Able to plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse
2. Able to understand the use of Theodolite and tacheometry in practical applications
3. Able to understand the concepts of geodetic surveying in plan a large scale survey
4. Able to calculate area and volume

CE211 MATERIAL TESTING LAB

1. Test on springs
2. Torsion test
3. Tension test
4. Stiffness test
5. Creep and Fatigue Test
6. Hardness test
7. Tests on bricks
8. Tests on concrete cubes
9. Tests on wood
10. Impact test

CE213 CONCRETE TECHNOLOGY LAB

1. Consistency of cement
2. Setting time of cement
3. Specific gravity test on aggregates
4. Fineness modulus test on aggregates
5. Percentage of voids test on aggregates

6. Bulk density test on aggregates
7. Slump cone test for fresh concrete
8. Flow table test for fresh concrete
9. Compaction factor test for concrete
10. Vee Bee test for concrete
11. Compressive strength of concrete – Cubes and Cylinders
12. Tensile strength of concrete
13. Flexure test of concrete
14. Concrete mix design
15. Non-Destructive tests on concrete

CE215 ENGINEERING SURVEYING PRACTICAL

1. Compass Survey
2. Longitudinal and Cross – Sectioning and Plotting
3. Theodolite surveying
4. Trignometrical levelling
5. Tachometric Survey
6. Experiment on Total station
7. Plane table survey - Demo

SEMESTER-IV

MA252 NUMERICAL TECHNIQUES AND COMPUTER PROGRAMMIMG

Course Objectives:

1. To learn different numerical methods and apply to engineering problems

Solution of linear system -Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method -Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence-Power method to find the dominant eigenvalue and eigenvector.

Solution of nonlinear equation -Bisection method -Secant method -Regula falsi method - Newton-Raphson method for $f(x) = 0$ and for $f(x,y) = 0$, $g(x,y) = 0$ - Order of convergence - Horner's method -Graeffe's method -Bairstow's method.

Newton’s forward, backward and divided difference interpolation – Lagrange’s interpolation–Numerical Differentiation and Integration –Trapezoidal rule –Simpson’s 1/3 and 3/8 rules.

Numerical Solution of Ordinary Differential Equations-Taylor's method - Euler's method - Euler's modified method and Runge-Kutta method - Milne's and Adams’ methods.

Basic operations, Mathematical functions, Operations on Iterative methods, linear systems, Numerical Solution of Ordinary Differential Equations using any Programming Languages or software packages.

Text Books:

1. Erwyn Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition, 2010.
2. M. K. Jain, S. R. Iyengar, R. K. Jain, Numerical Methods for Scientific and Engineering Computation, Wiley Eastern, 1991.

Reference:

1. C. F. Gerald, P. O. Wheatley, Applied Numerical Analysis, Addison - Wesley, 1989.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 42nd Edition, 2013.

Course Outcomes:

1. Able to understand the various methods of solving linear and non-linear equations.
2. Able to solve ordinary differential equations numerically.
3. Able to apply the knowledge to real life engineering problems.

CE202 STRUCTURAL ANALYSIS –I

Course Objectives:

1. To understand the concepts of Principle of virtual work and strain energy
2. To know the concepts of rolling and influence loads
3. To study the behaviour of cables, arches and suspension bridges
4. To analyze plane truss, curved beams and indeterminate structures

Introduction: Classification of Structures, Stress resultants, Degrees of freedom per node, Static and Kinematic Indeterminacy.

Analysis of Plane Truss: Classification of Pin jointed Determinate Trusses, Analysis of determinate plane Trusses by Method of Joints and Sections and Method of tension coefficient.

Strain Energy: Strain energy due to axial load, bending and shear, theorem of minimum potential energy, principle of virtual work, law of conservation of energy, 1st and 2nd Castigliano's Theorem, Betti's & Maxwell's reciprocal theorem, Deflection of Beams using Strain Energy Method and Unit load method.

Rolling Load and Influence Lines: Rolling loads, influence lines for beams and trusses, Absolute maximum bending moment.

Analysis of Arches and Cables: Analysis of Arches, Linear Arch, Eddy's theorem, three hinged parabolic arch, Spandrel braced arch, moving loads & influence lines. Analysis of Cables under point loads and UDL

Suspension Bridge: Suspension Bridges, Basics of two and three hinged stiffening girders, influence line for bending moment and shear force in stiffening girders.

Indeterminate structure: Compatibility Methods Analysis of Fixed beam, Continuous beam and simple frames with and without translation of joints by Method of Consistent Deformation and Three moments Theorem. Analysis of Propped Cantilever, Two-hinged Arches. ILD for Continuous beam.

Curved Beams: Introduction, Bending of Curved bars in plane of bending, stresses in bars of small and large initial curvatures.

Text Books:

1. Basic Structural Analysis Reddy, C. S. Tata McGraw Hill
2. Elementary Structural Analysis Norris and Wilbur Tata McGraw Hill
3. Theory & Analysis of Structures Jain, O. P. Nem Chand & Bors., Roorkee, Vol. I&II and Jain B. K India
4. Structural Analysis Coates, R. C., English Language & Coutie, M. G. & Book Society & Nelson Kong, F.K

References:

1. Structural Analysis Ghali, A & Neville, M. Chapman & Hall Publications
2. Advanced Structural Analysis Jain, A.K Nem Chand & Bors., Roorkee, India
3. Theory of Structures, Vol. II Jain, O.P. & Arya A. S Nem Chand & Bors., Roorkee, India
4. Indeterminate Structural Analysis Kinney, J.S. McGraw Hill Book Company 9. Indeterminate Structural Analysis Wang, C. K McGraw Hill Book Company.

Course Outcomes:

1. Able to demonstrate the concepts of qualitative influence line diagram for continuous beams and truss.
2. Able to apply the methods of indeterminate structure analysis.
3. Able to analyze the behavior of arches, cables and suspension bridges.

CE204 HYDRAULICS AND HYDRAULIC MACHINERY

Course Objectives:

1. To study about specific speed and performance characteristics of different turbines and pumps and thier efficiency.
2. To do dimensional analysis
3. To study the behaviour of open channel flow
4. To study impulse-momentum equation

Open Channel Flow - Classification - Terminology - velocity distribution in open channels - Chezy, Manning and other formulae - Best hydraulic section - Specific energy -

Specific force - Hydraulic jump and its characteristics - Gradually varied flow - Computation of surface profiles.

Velocity measurement with Pitot tube, Prandt Pitot tube and current meter - Discharge measurement in open channel flow - All types of notches and weirs, venture flume - Critical depth meter - Basic principles.

Dimensional Analysis – Rayleigh's method, Buckingham's Pi theorem, Dimensionless numbers, Laws of similitude, Model Analysis, Distorted models

Impulse momentum equation, Hydrodynamic forces of jets on vanes, velocity Triangles, Angular momentum principle.

Turbines: Classification, impulse and reaction turbines, characteristic curves, draft tubes, governing of turbines, specific speed, unit quantities concept, similarity, cavitation, application to radial flow turbines.

Pumps: Centrifugal pumps - classification, work done, minimum starting speed, losses and efficiencies,specific speed, multistage pumps, specific speed, characteristic curves, Net Positive Suction Head, Cavitation in pumps.Reciprocating pumps - types, effects of acceleration and frictional resistance, separation, Air vessels, work saved by fitting air vessels - Submersible pump-Jet pump-Gear pump-Screw pump.

Text Book:

1. Nagaratnam, S. Fluid Mechanics, Khanna Publishers, 1989.
2. RajputR.K., Fluid Mechanics And Hydraulic Machines, S. Chand Ltd, 1998
3. Bansal R.K, Fluid Mechanics And Hydraulic Machines, Laxmi Publications (P) Ltd, 2008.
4. Modi, P.N., and Seth, S.M., Hydraulics, Fluid Mechanics and Hydraulic Machines, Standard Book Home, New Delhi, 2005.

References

1. Streeter, V.L. Fluid Mechanics, Tata McGraw Hill, 1998.
2. Chow, V.T. Open Channel Hydraulics, Tata McGraw Hill, 1975.

Course Outcomes:

1. Able to do dimensional analysis
2. Able to find velocity triangles for jets on vanes
3. Able to draw characteristic curves of pumps and turbines
4. Able to design hydraulic section for open channel flow

CE206 SOIL MECHANICS

Course Objectives:

1. To explain how three phase system is used in soil and how are soil properties estimated using three phase system
2. To explain the role of water in soil behaviour and how soil stresses, permeability and quantity of seepage including flow net are estimated
3. To emphasise the importance of soil stress distribution and stress influence due to varies loads
4. To explain how soil shear parameters are affected by drainage conditions
5. To estimate the magnitude and time-rate of settlement due to consolidation

Historical development of Soil Engineering - Origin and general types of soils - soil structure, clay minerals – Index and Engineering Properties - Three phase system- Identification and classification of soils.

Capillary phenomena concept of effective and neutral stresses - Permeability- Determination of coefficient of permeability in the laboratory - Seepage flow - Head, gradient, pressure - Steady state flow - Two dimensional - Flow net - Soil water.

Vertical stress distribution in soil - Boussinesq and Westergaard's equation - Newmark's influence chart - Principle, construction and use - Equivalent point load and other approximate methods - Pressure bulb – Compaction.

Compressibility and consolidation - One dimensional consolidation theory - Pressure void ratio relationship - Preconsolidation pressure - Total settlement and time rate of settlement - Coefficient of consolidation - Curve fitting methods - Correction for construction time.

Shear strength - Mohr-Coulomb failure criterion - Shear strength tests - Different drainage conditions - Shear properties of cohesion less and cohesive soils - Use of Mohr's circle - relationship between principal stresses and shear parameters.

Text Book:

1. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Murthy, V.N.S., A text book of Soil Mechanics and Foundation Engineering, UBS Publishers Distributors Ltd., New Delhi, 1999.
3. Arora K R, Soil Mechanics and Foundation Engineering, Standard Publishers, 2008

References

1. GopalRanjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi, 2002.
2. Braja M. Das, Fundamentals of GeotechnicalEngineering, Thomson AsiaPvt. Ltd., Singapore, 2005.

Course Outcomes:

1. Able to understand the importance of geotechnical engineering in civil engineering and do proper soil classification and three phase system to solve the problems
2. Able to solve any practice problems related to soil stresses estimation, permeability, seepage including flow net diagram.
3. Able to do proper stress estimation under any system of foundation loads
4. Able to estimate appropriate soil strength parameters with respect to the drainage conditions
5. Able to solve any practical problems related to consolidation

CE208 HIGHWAY AND PAVEMENT ENGINEERING

Course Objectives:

1. To understand the importance of transportation, characteristics of road transport, highway planning, alignment and surveys
2. To know the geometric design of highways
3. To study the traffic characteristics and principles of intersection design
4. To know about the pavement materials and design
5. To understand the pavement construction, distresses in pavements and maintenance options
6. To learn the characteristics, properties and testing procedures of aggregate and bitumen

Introduction: Importance of transportation, Different modes of transportation, Characteristics of road transport, Scope of highway and traffic engineering

Highway development and planning: Importance, classification of roads, road patterns, planning surveys; highway alignment and surveys - Highway geometric design: Cross section elements, sight distance, design of horizontal and vertical alignment

Design of Curves – Horizontal, Transition, Valley and Summit Curve – Setback distance

Traffic Engineering: Traffic characteristics - Traffic studies-speed, Volume, speed and delay, origin destination, parking and accident studies; Capacity of urban roads and highways - Traffic operations regulation and control; Design of intersections

Grade and grade separated Pavement materials and design: Specifications and tests on pavement materials, pavement design factors, design of flexible and rigid pavements as per IRC.

Text book

1. Khanna, S.K and Justo, C.E.G., Highway Engineering, New Chand and Bros,2001.

References

1. Kadiyali, L.R, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 1987
2. Kadiyali LR and NB Lal, Principles and Practise of Highway Engineering, Khanna Publishers, 1984

Course Outcomes:

1. Able to carry out surveys involved in planning and highway alignment
2. Able to design cross section elements, sight distance, horizontal and vertical alignment
3. Able to implement traffic studies, traffic regulations and control, and intersection design
4. Able to determine the characteristics of pavement materials
5. Able to design flexible and rigid pavements as per IRC

CE210 WATER SUPPLY ENGINEERING

Course Objectives:

1. To make the students conversant with sources of water and its demand
2. To understand the basic characteristics of water and its determination
3. To expose the students to understand components of water supply lines
4. To provide adequate knowledge about the water treatment processes and its design
5. To have adequate knowledge on distribution network and water supply to buildings

Requirements of water supply - Quantitative studies - Types of demand and their contribution - Rate of consumption - Forecasting the population- variation in demand pattern - Sources of water – Intakes – Forms of Underground sources – Sanitary well protection

Qualitative studies - Physical, chemical and biological characteristics of water - water analysis- IS and WHO Drinking Water standards – quality for trade purpose and swimming pool water

Process of treatments - mixing, aeration, sedimentation, coagulation, filtration, disinfection, softening - advanced water treatment.

Pipes- hydraulic design of pressure pipe- Materials - laying- joining- testing - pipe appurtenances- Pumps and pumping stations – Pipe corrosion and prevention

Distribution systems – analysis of distribution networks. Operation and maintenance of water supply to buildings - Rural water supply - Protected water supply -Saline water intrusion Channels and pipes for conveying water.

Text Book

1. Duggal, K.N. Elements of Environmental Engineering, S.Chand& Co, 2002.

References

1. Manual on Water supply and Treatment - CPHEEO, 1999
2. Birdie, G.S. and Birdie, Water Supply and Sanitary Engineering, DhanpatRai& Sons, 1992.
3. Punmia B.C, Ashok Jain &Arun Jain, Water Supply Engineering, Laxmi Publications, Pvt. Ltd., New Delhi, 2004.

Course Outcomes:

1. Able to analyze various water quality parameters
2. Able to forecast the population and estimate water demand
3. Able to differentiate various intake structures and select suitable pipe material for water conveyance

CE212 FLUID MECHANICS LAB

1. Determination of pipe friction
2. Calibration of flow meters - Venturimeter and Orifice meter
3. Determination of discharge coefficients for notches
4. Determination of minor losses
5. Application of Bernoulli's Theorem
6. Pressure gauge calibration
7. Centrifugal pump
8. Submersible pump
9. Reciprocating pump
10. Jet pump
11. Gear pump
12. Screw pump
13. Francis Turbine
14. Pelton Wheel Turbine
15. Kaplan Turbine

CE214 SOIL MECHANICS LAB

1. Grain Size analysis
2. Consistency limits
3. Specific gravity
4. Permeability tests
5. Unconfined compression test
6. Direct shear test
7. Core cutter and sand replacement
8. Compaction test
9. California bearing ratio test
10. Vane shear test
11. Triaxial test
12. Consolidation test

CE216 HIGHWAY ENGINEERING LAB

1. Determination of crushing value of aggregates.
2. Determination of abrasion value by Los Angle's and Deval's Abrasion Machine.
3. Determination of Impact Value of aggregates.
4. Angularity Number and Water Absorption of coarse aggregate.
5. Determination of Elongation and Flakiness Index of Aggregate.
6. Determination of Softening Point of Bitumen.

7. Determination of Ductility Value of Bitumen.
8. Determination of Viscosity Value of Bitumen.
9. Determination of Penetration Value of Bitumen.
10. Flash and Fire Point Test.
11. Study of Marshal Stability Test.
12. Study of Benkelman Beam.
13. Study of bump Integrator
14. Study of Field CBR

JUNIOR YEAR

SEMESTER-V

CE301 STRUCTURAL ANALYSIS II

Course Objectives:

1. To analyse structure by both force and displacement methods
2. To know the concept of plastic analysis

Slope Deflection Method: Introduction, Development of slope-deflection equations and analysis of fixed beam, continuous beam and simple frame with and without translation of joints.

Moment Distribution Method: Introduction, Definition of terms-Distribution factor, Carry over factor, Development of method of analysis of fixed beam, continuous beam and simple frame with and without translation of joints.

Kani's Method: Introduction, Basic Concept, Analysis of Continuous beams and analysis of rigid jointed no sway plane frames.

Column Analogy Method: Introduction, Development of method, Analysis of fixed beam, and frame.

Analysis of beams and frames – Flexibility matrix method and Stiffness method.

Plastic Analysis: Basics of Plastic Analysis, Application of Static and Kinematic theorem for plastic analysis of beams and plane frames.

Text Books:

1. Basic Structural Analysis Reddy, C. S. Tata McGraw Hill
2. Elementary Structural Analysis Norris and Wilbur Tata McGraw Hill
3. Theory & Analysis of Structures Jain, O. P. Nem Chand & Vol. I&II and Jain B. K Bros.Roorkee
4. Structural Analysis Coates, R. C., English Language & Coutie, M. G. & Kong, F.K Book Society & Nelson
5. Structural Analysis Ghali, A & Neville, M. Chapman & Hall Publications

Reference:

1. Advanced Structural Analysis Jain, A.K Nem Chand & Bors., Roorkee, India
2. Theory of Structures, Vol. II Jain, O.P. & Arya A. S em Chand & Bors., Roorkee, India
3. Indeterminate Structural Analysis Kinney, J.S. McGraw Hill Book Company
4. Indeterminate Structural Analysis Wang, C. K McGraw Hill Book Company
5. Matrix Analysis of framed Structures Weaver, W. CBS Publishers & Gere, J. M. & Distributors, Delhi.
6. Plastic Method of Structural Neal, B. G Chapman and Hall

Course Outcomes:

1. Able to analyze the structures by force and displacement methods
2. Able to understand and apply the plastic moment concept

CE303 DESIGN OF REINFORCED CONCRETE STRUCTURES

Course Objectives:

1. To study the design of different structural members
2. To know the methods of design – working stress and limit state

Stress strain behaviour of steel and concrete- Introduction to working stress method - Permissible stresses. Limit state method-Limit states - Characteristic strength and load - Partial safety factor - Bond stress – Anchorage and Splicing

Design of singly and doubly reinforced beams, T and L beams - Design for Shear and Torsion.

Slabs – one way and two way slabs for different edge conditions - Yield line theory - Flat slab - Continuous slabs.

Columns - axially loaded and eccentrically loaded columns - Interaction Diagrams.

Footings - Isolated footings - square, rectangular and circular footings - Combined footing- Raft Footing - Pile and pile cap.

Design of different types of Stair cases.

Design Practice in lab:

The problems solved during lectures must be drafted in details using AutoCad software.

Text book:

1. PC Varghese, Limit state design of concrete, Oxford IBH, 2000.
2. Ashok, Kumar Jain, Reinforced Concrete Limit State Design, Nem Chand Brothers, 1990.

References:

1. Sinha. S.N. Reinforced Concrete Design, Tata McGraw Hill, 2002.
2. IS456-2000 Code of practice for Plain and reinforced concrete code of practice.
3. Pillai and Menon , Concrete Structures, TMH,2000
4. SP-34 : Handbook on Concrete Reinforcement and Detailing

Course Outcomes:

1. Able to design different structural members

CE305 WASTE WATER ENGINEERING

Course Objectives:

1. To learn the basics of sewage composition and its characteristics
2. To have adequate knowledge about various sewage treatment processes and its design
3. To provide the adequate information on various disposal standards for industrial effluents

Sewerage - domestic Sewage - Sewage treatment – Disposal of sewage.

Sewage Characteristics- Quality parameters: BOD, COD, Total Organic Carbon, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards.

System of sewerage: Separate, combined and partially separate, components of sewerage systems, systems of layout, Quantity of sanitary sewage and variations, quantity of storm water, rational method, shapes of sewer, circular and egg shaped, Hydraulic design of sewers: diameter, self cleansing velocity and slopes.

Sewage Treatment - Various units: Their purposes sequence and efficiencies, Preliminary treatment: Screening and grit removal units, oil and grease removal, Primary treatment – Skimming Tank, Sedimentation, Secondary Treatment: activated sludge process, Slow and rapid sand filter, Sludge disposal. Stabilization pond, Septic tank, Recent trends in sewage treatment.

Wastewater Disposal and Reuse - Disposal of sewage by dilution, self purification of streams - Streeter Phelps equation - oxygen sag curve - sewage disposal by irrigation & sewage farming, wastewater reuse, landfills.

Text Book:

1. Duggal, K.N., Elements of Environmental Engineering, S.Chand and Co., New Delhi, 2002.

References

1. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi, 1992.
2. Metcalf and Eddy, Waste Water Engineering, Collection, Treatment and Disposal, Tata McGraw Hill, Inc., New York, 2005.
3. Manual of Sewage and Sewage Treatment - CPHEEO, 1999.

Course Outcomes:

1. Able to determine the various characteristics of sewage
2. Able to design various sewage treatment units
3. Able to predict the quality of water in river, using mass balance approach and specific models
4. Able to select suitable treatment units for specific industries

CE307 WATER RESOURCES ENGINEERING

Course Objectives:

1. To understand the various physical processes in the hydrologic cycle and the methods of estimation
2. To study well behaviour and land drainage

Hydrologic cycle - rainfall and its measurement - computation of mean rainfall over a catchment area using arithmetic mean, Theissen polygon and Isohyetal methods - Runoff - infiltration indices - Storm Hydrograph and unit hydrograph.

River regions and their characteristics - classification of rivers on alluvial plains - meandering of rivers -river training - Reservoir planning - Investigations - zones of storage in a reservoir - single purpose and multipurpose reservoir.

Determination of storage capacity and yield - reservoir sedimentation - Reservoir life -Sediment prevention - Flood estimation- Flood forecasting - Flood routing Ground water - types of aquifers - storage coefficient - coefficient of transmissibility.

Steady radial flow into a well located in an unconfined and confined aquifers - Tube wells and Open wells - yield from an open well. Water logging - causes and effects of water logging - remedial measures - land reclamation.

Land drainage - benefits - classification of drains - surface drains - subsurface drains - design principles and maintenance of drainage systems.

Text book

1. Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001.

References

1. Ragunath. H.M., Hydrology, Willey Eastern Limited, New Delhi, 2000.
2. Subramanya, Engineering Hydrology, Tata-McGraw Hill, 2004.

Course Outcomes:

1. Able to estimate rainfall, flood and storage capacity
2. Able to design drains

CE309 FOUNDATION ENGINEERING

Course Objectives:

1. To provide the students with a basic understanding of the essential steps involved in a geotechnical site investigation.
2. To introduce the principal types of foundations and the factors governing the choice of the most suitable type of foundation for a given solution.
3. To study the procedures used for bearing capacity estimation and Pile carrying capacity.
4. To familiarize the concepts of earth pressure
5. To determine stability of slopes.

Soil exploration - Planning - Augur boring - Soundings - Sampling - static and dynamic penetrations tests - Geophysical explorations.

Slope Stability – failure of slopes – stability of infinite slope – finite slope analysis – Swedish circle method – stability number.

Lateral Earth Pressure - Plastic equilibrium - Rankine's theory - Active and passive earth pressure for cohesion less and cohesive soils - Earth pressure at rest - Coloumb's wedge theory - Rebhann's and Culmann's graphical solutions - Stability analysis.

Foundation - Functions and requisites- Different types - Choice of foundation type – General principles of design - Bearing capacity - Types of failures - Prandtl's, Terzaghi's and IS code methods of Bearing capacity analysis - Plate load test.

Shallow foundation - Spread footings - Combined footings - Trapezoidal and strap footings - Raft foundation- Contact pressure distribution - Settlement analysis - Types of settlement - Bearing capacity based on settlement and building codes.

Deep foundation - Piles - Types - Load carrying capacity of pile - Static and dynamic formula - Pile load test - Penetration test - Pile groups - Efficiency - Feld's rule - Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction – Well foundation - Caisson.

Text Book:

1. Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 1995.
2. Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi 1999.

References

1. Gopal Ranjan and Rao, Basic and Applied Soil Mechanics, New Age International (P) Limited, New Delhi, 2002.
2. Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, 2005.
3. Braja M. Das, Shallow Foundation – Bearing Capacity and Settlement, CRC Press LLC, USA, 1999

Course Outcomes:

1. To develop an understanding of the behavior of foundations for engineering structures
2. To gain knowledge of the design methods that can be applied to practical problems.

CE311 STRUCTURAL ENGINEERING LAB

1. Testing of simply supported RCC beams for flexural failure
2. Testing of simply supported RCC beams for shear failure
3. Testing of RCC column
4. Non-destructive test of concrete
5. Permeability of concrete
6. Vibration analysis of plates

7. Analysis of Thin and Thick cylinders
8. Examination of deflection and forces on beams

CE313 ENVIRONMENTAL ENGINEERING LAB

1. Physical characteristics of water
2. Chemical characteristics of water
3. Bacteriological tests
4. Jar test
5. Chlorine demand and residual test
6. Total solids and settle able solids.
7. Organic and inorganic solids.
8. Determination of pH and chemical constituents like Cl-Fe2+etc
9. Turbidity of water
10. Test for Manganese
11. Test for Iron

SEMESTER-VI

CE302 DESIGN OF STEEL STRUCTURES

Course Objectives:

1. To know about the standard steel members available
2. To study the strength of bolted and welded connections
3. To understand the load considerations and roof truss design principles
4. To study about built up beams and design of compression, tension and flexural members

Introduction to steel structures and IS800 -2007- Material specifications - Rolled sections – Section classifications - Permissible stresses in tension, compression, bending and shear.

Compression members - Slenderness ratio – Design - Simple and built- up sections - Lacings and battens - Tension members.

Bolted connections - types of bolts - Resistance of bolted connections under various failure modes – Design of beam splice, seated shear connections at the supports.

Welded connections - types - Strength of welds - Design of fillet and butt welds - Shear and moment resistant joints - Design and detailing of connections.

Flexural members – Rolled sections - built-up beams - Design for strength and serviceability, web crippling, web yielding, bearing stiffeners. Roof trusses - components - Loads - Design of purlins for truss members - End connections at the supports.

Industrial Buildings – Loads, General arrangement and stability considerations – industrial building frames design

Bridge – types – general arrangements – design for highway and railway loading – design of truss bridge for railway loading

Design Practice in lab:
The problems solved during lectures must be drafted in detail using AutoCad software.

Text Book

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain.Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., New Delhi 2000.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi 2008.
3. Negi L.S., Design of Steel Structures, Tata McGraw Hill.
4. Ramachandra, Design of Steel Structures Vol – I, II, III, Standard Book House, Delhi
5. Duggal S.K., Limit State Design of Steel Structure, Tata McGraw Hill.

References

1. Dayaratnam P, Design of Steel Structures, S. Chand & Co., New Delhi, 2003.
2. Arya, A.S and Ajmani, A.L., Design of Steel Structures, Nemchand and brothers, Roorkee, 1992.
3. IS 800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.

Course Outcomes:

1. Able to design bolted and welded sections
2. Able to design compression, tension and flexural members
3. Able to understand the load considerations

HM351 ENGINEERING ETHICS AND PRECEPTS OF CONSTITUTION OF INDIA

Course Objectives:

1. To know the engineering ethics and its values
2. To study the importance of safety
3. To have an idea about Indian Constitution

Engineering Ethics - Senses of 'Engineering Ethics' – Variety Of Moral Issues – Types Of Inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional Roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories. Valuing Time – Co-operation – Commitment.

Engineering As Social Experimentation - Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study.

Safety, Responsibilities And Rights - Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl Case Studies.

Global Issues - Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership.

Constitution of India – Preamble – Fundamental Rights and Duties- Role of Parliament and Legislatures in Federal Setup, Law and Justice – Human Rights and Protection of Human rights- Place of Official Languages and Education pertinent to Concurrent List – Perspectives of Indian issues on Trade and Commerce - Role parliament to impose restriction of Trade, Commerce and Intercourse.

References:

1. Magbook Indian Polity And Governance, Arihant Experts, 2018 Edition.
2. S.K.Kapoor, Human Rights Edition:Seventh,Year Of Publication: 2017
3. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

Course Outcomes:

1. Able to understand the engineering ethics and its values
2. Able to have responsibility towards society by knowing safety measures
3. Able to know about Indian Constitution

CE304 COMPUTER AIDED DESIGN PROJECT

Students can use any of these commercial softwares given below to perform a whole design in anyone of the Civil Engineering field.

List of Commercial Softwares:

1. Building & bridges design using STADD Pro
2. Highway and railway design using BENTLEY Road Analysis & Design Software
3. Pipe networks and canal design using WaterNET-CAD
4. GIS – Mapping Software
5. Water distribution system modeling software - EPANET
6. Analysis of structural members using ABAQUS
7. Analysis of soil structure using PLAXIS
8. Analysis of traffic flow and drainage design INFRAWORK 360
9. Air Modelling Software - AERMOD

The course is designed to develop the software skills of the students in innovative research areas of the department. This project course follows a method of learning and, therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. A maximum of three students can pursue this project together under one supervisor. Work progress must be updated to their respective supervisor regularly.

Every student / group has to design; model; plan and analyse the work using software package (not restricted to the above list) according to their project and interest in any of the civil engineering field. Further, they should define the title and study plan. They should work towards their objective of the study plan.

Evaluation Procedure

At the end of the course, the student / group should submit a report on outcomes of the project along with the power point presentation. The evaluation will recognize this aspect by demanding day-to-day productivity of the student. Final Evaluation will be conducted by the department faculties.

CE306 BUILDING PLANNING AND DRAWING

Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio, open spaces - Orientation of buildings - Lighting and Ventilation- Planning and preparing sketches and working drawings of Residential buildings (Flat and sloping roof), Schools, Hostels, Hospitals, Factory buildings with trusses. Detailed working drawings of the component parts - Doors and Windows - Roof Trusses – Staircases – Layout for Electrical lines, Plumbing Lines and other services.

References

1. Shah M.G. Kalec. M. &Patki SY Building Drawing, Tata Mcgraw Hill, New Delhi, 2000

CE308 ESTIMATION, COSTING AND VALUATION

Course Objectives:

1. To study the types of estimation
2. To study the analysis of rates and types of specification
3. To study the method of valuation

Estimation and modes of measurement - Estimating - Types of estimate and data required - Overhead charges, contingencies, water charges, provisional sum, prime cost, provisional quantities, spot items, day work. General rules for the measurements and its units of different items of civil engineering work.

Specifications of Civil works - Importance specifications-Types of specification-Principle of writing specification- Specification of earthwork in excavation, cement concrete, Brick masonry, R.C.C. work, Plastering Work, Painting, Flooring

Rate analysis of Civil Works - Task work and factors affecting it. Labour required for different works and labour rates - Market rates of construction materials - Schedule of Rates (SOR)-Rate analysis and factors affecting it rate analysis - Rate analysis for earthwork in excavation, P.C.C Work, Brick masonry work, R.C.C. work, Plastering, Flooring work.

Estimation of Civil works - Methods of detailed estimation – One/ two room building - Two storied buildings (RCC footings, Column, beams, slab)- RCC retaining wall/ Culverts - Methods of calculating earthwork quantities for roads and canals

Valuation of Civil Engineering projects - Cost, price and value - Types of property and objects of valuation - Depreciation and obsolescence. - Different forms of value - Valuation tables and valuation methods for property and land - Types of rents and fixing standard rents

Text Book

1. Dutta B.N., Estimating and Costing in Civil Engineering, S. Datta& Co, 2002.

References

1. Bhasin, P.L., Quantity Surveying, 2nd Edition, S.Chand& Co., 2000.
2. CPWD Hand Book

Course Outcomes:

1. Based on PWD PSR & CPWD plinth area rates, the student should be able to prepare the detailed estimate and valuation of given building.

CE405 INDUSTRIAL TRAINING

An industrial training has to be pursued by the students for about 90 hours (3 weeks) in any construction / research institute / related software industry and a detailed report should be submitted at the beginning of 7th semester. Upon evaluation of the report, grade of the course will be awarded. The grades are satisfactory (C), good (B) and excellent (A).

SENIOR YEAR

SEMESTER-VII

CE401 CONSTRUCTION MANAGEMENT

Course Objectives:

1. To know the managerial duties and responsibilities
2. To learn about man power planning and estimation of equipment cost
3. To understand project planning and scheduling concepts
4. To know the types of construction contracts and their drafting

Construction Planning: Basic concepts in the development of construction plans - choice of Technology and Construction method - Defining Work Tasks – Definition - Precedence relationships among activities - Estimating Activity Durations - Estimating Resource Requirements for work activities - coding systems.

Scheduling Procedures And Techniques - Relevance of construction schedules - Bar charts - Critical path method - Calculations for critical path scheduling - Activity float and schedules-Presenting project schedules - Critical path scheduling for Activity-on-node and with leads, Lags and Windows - Calculations for scheduling with leads, lags and windows - Resource oriented scheduling - Scheduling with resource constraints and precedence - Use of Advanced Scheduling Techniques - Scheduling with uncertain durations - Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software.

Cost Control Monitoring and Accounting - The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

Quality Control and Safety during Construction Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

Organization and Use of Project Information Types of project information-Accuracy and Use of Information-Computerized organization and use of Information - Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

Text-Book

1. Chitkara, K.K. “Construction Project Management Planning”, Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.

References

1. Srinath,L.S., "Pert and CPM Priniples and Applications ", Affiliated East West Press, 2001
2. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.

Course Outcomes:

1. Able to perform the role of a manager efficiently with precise knowledge of the roles and responsibilities
2. Able to estimate the man power requirement and can recruit suitable candidates for construction jobs
3. Able to analyse and compare the cost estimates of different construction equipment
4. Able to compute construction schedules, network diagrams and time estimates of projects
5. Able to evaluate and make tenders and contract documents of their own

CE403 RAILWAYS, AIRWAYS AND WATERWAYS ENGINEERING

Course Objectives:

1. To study about the types and functions of track, junctions and railway stations
2. To learn about the aircraft characteristics, planning and components of airport
3. To study about the types and components of harbours

Indian railways: Development and organization of Indian Railways. Rails: Rail gauges, types of rails, defects in rails, rail failure, creep of rail. Rail Fastenings: Fish plates, spikes, chairs, keys, bearing plates. Sleepers: Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density. Ballast: Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast.

Railway Track Geometry: Location surveys and alignment - Permanent way - Gauges - Components -Functions and requirements - Gradients, horizontal curves, super-elevation, safe speed on curves, cant deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power.

Points & Crossings : Elements of a simple turn-out, details of switch, details of crossings, number & angle of crossings, design of turn-out. Rolling Stock - Railway sections and yards. Signalling - interlocking

Airport Engineering - Aircraft characteristics and classification - Airport obstructions and zoning – Airport Elements- Runway - taxiways and aprons - Airport planning and layout- Site selection, Imaginary surface, Approach, Horizontal, conical and Transitional surfaces

Visual ground aids- Airport lighting and marking - Terminal Building - Airport pavement and design.

Harbour Planning (Technical) Site investigation – harbour entrance - Navigational Channel – Depth of harbour – Turning basin – Anchor basin – berthing area – Storage area - Shipping terminal facilities –Essentials of passenger, dry and liquid bulk cargo and container terminals. Construction and operation of Lock gates - navigation aids

Text Books:

1. Khanna, S.K. and Arora, M.G. Airport Planning and Design, Nemchand and Bros. 1999.
2. Oza and Oza, Elements of Dock and Harbour Engineering, Charotar Publishing House, 1996.
3. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.
4. Saxena, S.C. and S.P. Arora, Railway Engineering, DhanpatRai and Sons, New Delhi, India, 1997.

References:

1. Rangwala, Airport Engineering, Charotar Publishing House
2. S. Narasimhan & S. Kathiroli, Harbour and Coastal Engineering (Indian Scenario0 Vol – I & Vol – II, NIOT – Chennai
3. Agarwal, M.M., Indian Railway Track,Prabha and Co., New Delhi, India, 1988.
4. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.

Course Outcomes:

1. Able to plan the layout of railway terminals
2. Able to apply principles of airport planning
3. Able to know the basic planning of layout of harbours

CE491 PROJECT WORK PHASE I

The objective of this course is to impart and improve the research capability of the student. This course conceives purely a research problem in any one of the disciplines of Civil Engineering; e.g., Behaviour of Beams, Assessing Land Slides, Analysis of Intelligent Traffic Intersection etc. The research problem can be pursued by an individual student or a group of students comprising of not more than three. Every student / student group has to find a research gap according to their interest by doing good amount of literature survey. They should be monitored by a faculty. Further, they should define the title and research problem. They should also start the work towards their objective of the research work. At the end of the course, the student / student group should submit a report on literature survey, research problem identification, expected outcomes and work done (if any).

Evaluation procedure

The method of evaluation will be as follows: I Evaluation: 20 marks on finding research area (Decided by conducting a review by the department faculties) II Evaluation: 20marks on literature collection and presentation (Decided by conducting a review by the department

faculties). Final Evaluation: 60 marks on report for problem identification, literature survey and early works and expected outcomes (Decided by conducting final review by the department faculties).

SEMESTER-VIII

CE492 PROJECT WORK PHASE II

With continuation to the course, CE700 PROJECT WORK PHASE I, the same group of students should pursue further research in the same original problem statement reported earlier. At the end of this CE800 Project Work Phase II course, the group should submit a full-length research investigation report consisting of the data collection, the analysis and design calculations, and outcomes if any along with required tables, pictures and figures.

Evaluation procedure

The method of evaluation will be as follows: I Evaluation: 20 marks on further works (Decided by conducting a review by the department faculties) II Evaluation of Project Report: 20 marks on balance works (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks on complete research work (Decided by conducting final review by the department faculties along with an external expert appointed by the Institution).

ELECTIVES COURSES OFFERED IN VI SEMESTER

CE321 ADVANCED REINFORCED CONCRETE DESIGN

Course Objectives:

1. To study the design of retaining walls and water tanks
2. To study the design of bunkers and chimneys
3. To study the design of bridges

Earth Retaining structures - Retaining walls- types - cantilever and counter fort - design - drainage and other construction details.

Liquid Retaining structure - Water tanks - types - square, rectangular, circular - Design of underground and elevated tanks - design of staging - spherical & conical roof for circular tanks.

Material storage structures - Determination of lateral pressure on side walls of bunker -Rankine's theory - design of bunker - design of circular silo using Jansen's theory.

Environmental Structures - Chimneys - Principles and Design - Design of long columns.

Transportation structures - Bridges - Slab Bridge - Design of single span slab bridge - Tee Beam Bridge - Design of Tee Beam Bridge with stiffness - Tee beam bridge with cross girders.

Text book

1. Dayaratnam, P., Design of Reinforced Concrete Structures, Oxford & IBH Publishers & Co., New Delhi, 2005.
2. Krishna Raju N. Advanced reinforced Concrete Design, CBS Publishers & Distributors Pvt. Ltd., 2017.

References

1. Vazirani, V.N., and Ratwani, Concrete Structures, Vol. IV, Khanna Publishers, New Delhi, 1995.
2. Victor, D.J., Essentials of Bridge Engineering, Oxford & IBH Publishers Co., Newdelhi, 1990.
3. IS456-2012 Code of practice for Plain and reinforced concrete code of practice
4. SP 16: Design Aids for Reinforced Concrete to IS 456:1978

Course Outcomes:

1. Able to design water tanks, bunkers, chimneys, bridges and retaining walls

CE322 PRESTRESSED CONCRETE STRUCTURES

Course Objectives:

1. To learn the principles, materials, methods and systems of pre-stressing
2. To know the different types of losses and deflection of pre-stressed members
3. To learn the design of pre-stressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam
4. To learn the design of anchorage zones, composite beams, analysis and design of continuous beam

Principles of pre-stressing - Materials of pre stressing - Systems of pre-stressing - Loss of pre-stress - Deflection of Pre-stressed Concrete members.

Slabs - Pre-tensioned and Post-tensioned beams - Design for flexure, bond and shear - IS code provisions - Ultimate flexural and shear strength of pre-stressed concrete sections Analysis and Design of end anchorage zones using IS code method.

Composite beams - Analysis and design - Partial pre-stressing - non-pre-stressed reinforcements.

Analysis of Continuous beams - Cable layout - Linear transformation - Concordant cables.

Design of compression members and tension members. Circular pre-stressing - Water tanks - Pipes - Analysis and design - IS Codal provisions.

Text Book:

1. Krisnaraju, Prestressed Concrete, Tata Mcgraw Hill Publishing Co Ltd
2. Lin. T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley & Sons, 1982.

References:

1. Raja Gopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.

Course Outcomes:

1. Able to design a prestressed concrete beam accounting for losses
2. Able to design the anchorage zone for post tensioned members
3. Able to design composite members
4. Able to design continuous beams
5. Able to design water tanks

CE323 STABILITY OF STRUCTURES

Course Objectives:

1. To know the theories of stability
2. To study the energy principle and other methods to find stability
3. To study about buckling of beams, columns, frames and plates

Buckling of columns - Introduction – concepts of stability – methods of Neutral Equilibrium – Euler column – Eigen value problem –Axially loaded column – Eccentrically loaded column

Energy principle - Raleigh Ritz method – Galerkin method – Numerical methods (New mark's Finite Difference and matrix methods)

Beams and Beam columns - Introduction – lateral buckling of beams – Beam column with concentrated and distributed loads – effect of axial load on bending stiffness

Buckling of frames - Introduction – modes of buckling – Critical load using various methods Neutral equilibrium – slope deflection equations, matrix method.

Buckling of plates - Differential equation of plate buckling – Critical load on plates for various boundary conditions – Energy method –Finite difference method – Shear deformation of plates.

Text Books:

1. S.P. Timoshenko and J. M. Gere, Theory of Elastic Stability , MC Graw Hill,
2. Alexander Chajes, Principle of structural Stability Theory, Prentice Hall, New Jersey, 1980

References:

1. Iyengar N.G.R, structural Stability of Columns and Plates, Affiliated East West Press Pvt. Ltd., 1990
2. F.Bleich, Buckling strength of Metal structures,Mc Graw Hill Book co.,1991

Course Outcomes:

1. Able to analyze the buckling of beams, columns, frames and plates by various methods

CE324 FINITE ELEMENT ANALYSIS

Course Objectives:

1. To study the strain – displacement and linear constitutive relation
2. To understand the numerical techniques applied in FEM
3. Establishment of element stiffness and load vector
4. To study about the 2-D isoparametric concepts
5. To analyze the 2-D frame elements using FEM techniques

Differential equilibrium equations - strain displacement relation - linear constitutive relation - special cases - Principle of stationary potential energy - application to finite element methods - Some numerical techniques in finite element Analysis

Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

Assemblage of elements – Direct stiffness method. Special characteristics of stiffness matrix -Boundary condition & reaction - Gauss elimination and LDLT decomposition. Basic steps in finite element analysis.

Analysis of framed Structures: 2D – truss element - 2D - beam element. Analysis of plate bending displacement functions - plate bending Elements. Plane stress and plane strain analysis: Triangular elements - Rectangular elements

Text Books:

1. Krishnamoorthy, C.S, Finite Element Analysis Theory & Programming, McGraw-Hill, 1995.
2. Desai C.S and Abel, J.F., Introduction to the finite element Method, Affiliated East west Press Pvt. Ltd. New Delhi 2000.

References:

1. Rajasekarn S, Finite Element Analysis, S. Chand Publishers, 2006.

Course Outcomes:

1. Able to demonstrate the differential equilibrium equations and their relationship
2. Able to apply numerical methods to FEM
3. Able to demonstrate the displacement models and load vectors
4. Able to compute the stiffness matrix for isoperimetric elements
5. Able to analyze plane stress and plane strain problems

CE325 EARTH AND EARTH RETAINING STRUCTURES

Course Objectives:

1. To explain the concept of earth dam design including stability analysis under seepage
2. To evaluate stability of slopes under different drainage conditions using different methods including slope protection and quality control
3. To estimate active and passive earth pressure using different earth pressure theory including graphical method
4. To explain design principles of retaining structures and coffer dams

Introduction - Earth dams – types of dams – selection of type of dam based on material availability – foundation conditions and topography - Design details – crest, free board, upstream and downstream slopes, upstream and downstream slope protection – central and inclined cores – types and design of filters - Seepage analysis and control – seepage through dam and foundations – control of seepage in earth dam and foundation

Stability analysis – critical stability conditions – evaluation of stability by Bishop's and sliding wedge methods under critical conditions Construction techniques – methods of construction –quality control - Instrumentation – measurement of pore pressures

Earth pressure theories – Rankine's and Coulomb's earth pressure theories for cohesion less and cohesive backfills – computation of earth pressures for various cases – inclined – with surcharge – submerged and partly submerged – stratified backfills - Rigid retaining structures – active and passive earth pressures against gravity retaining walls – Surcharge - computation of earth pressures by Trial wedge method –

Mathematical approach for completely submerged and partly submerged backfills – importance of capillarity tension in earth pressure. Graphical methods of earth pressure computation – trial wedge method for coulomb's and Rankine's conditions, for regular and irregular ground and wall conditions – Rebhan's construction for active pressure – friction circle method – logarithmic spiral method. Design of gravity retaining wall – cantilever retaining walls

Flexible retaining structure – type and methods of construction – design strength parameters – safety factor for sheet pile walls – computation of earth pressures against cantilever sheet piles in cohesion less and cohesive soils – anchored sheet piles – free earth method – fixed earth method – Rowe's moment reduction method – stability of sheet piling Diaphragm walls and coffer dams – type of diaphragm walls and their construction techniques in various soil types – earth pressure on braced cuts and coffer dams – design of coffer dams

Text Books:

1. Clayton, Milititsky and Woods, Earth Pressure and Earth-Retaining Structures, Taylor and Francis, 1996
2. Huntington, Earth pressure on retaining walls, John Wiley and Sons, 1957.
3. Bowles, Foundation Analysis and Design, 1968.

References:

1. Jones, Earth Reinforcements and Soil structures, 1996.
2. Prakash, Ranjan and Saran, Analysis and Design of Foundations and Retaining structures, SarithaPrakashan, Meerut, 1977.

Course Outcomes:

1. Able to do earth dam design and stability analysis for all kind of drainage conditions
2. Able to do stability analysis of any kind of slope and its protection
3. Able to understand the earth pressure theories and calculate lateral earth pressure for different conditions
4. Able to do retaining structure design and its stability analysis

CE326 ADVANCED FOUNDATION ENGINEERING

Course Objectives:

1. To know the design of sheet pile, cofferdams and well foundation
2. To know the design criteria of foundations subjected to vibrations
3. To study the factors influencing swelling in expansive soil
4. To analyze the stability of slopes

Sheet pile structures - cantilever sheet pile walls in granular and cohesive soils - Anchored bulk heads - Free earth support and fixed earth support methods - Anchors.

Cofferdams - types - cellular cofferdam - uses - Design by Tennesse Valley Authority method and Cumming's method. Well foundations - Types of caissons - Analysis of well foundations - determination of scour depth - steining thickness - well sinking.

Foundations subjected to vibrations - elements of vibrations - Free, damped, free and forced vibrations - Design criteria - Pauw's analogy - IS Code of practice for impact and reciprocating machines.

Foundation drainage and water proofing - Dewatering well points system, sand drains. Foundations in expansive soils - Mechanism - factors influencing swelling - Use of Geosynthetics.

Stability analysis of slopes - infinite slopes in sand and clays - finite slope - Swedish circle - stability of earth dam slope during steady and sudden draw down - friction circle method - Taylor's stability number.

Text Books:

1. Bowles, J.E., Foundation Analysis and Design, McGraw Hill., 1996.
2. Shamsher Prakash, Soil Dynamics, McGraw - Hill Book Company, 1985.

References:

1. Braja M. Das, Principles of Foundation Engineering, Thomos Asia Pvt. Ltd., Singapore, 2005.

Course Outcomes:

1. Able to analyse and design foundation subjected to vibrations
2. Able to analyse slope stability
3. Able to design sheet pile and well foundations

CE327 ENGINEERING GEOLOGY

Course Objectives:

1. To familiarize the various types of minerals and rocks, their geological characteristics and their behavior/performance
2. To impart hands on training in determination of properties of rocks
3. To provide the knowledge on interpretation of data to arrive the solution

General Geology: Scope in Civil Engineering - earth, its structure and environment - physiographic, stratigraphic and tectonic divisions of India - geomorphological (surface) processes – weathering – types , weathered products, assessment of degree of weathering , Fluvial processes, glaciation, wind action, and their significance – earthquake, its causes, classification, earthquake zones of India, Geological considerations for construction of buildings.

Mineralogy: Physical properties of minerals – classification - study of important rock forming minerals – Quartz family, feldspar family, Augite, Hornblend, Mica family, calcite, Iron oxide minerals, Augite, Hornblend, and Clay minerals and their behaviour and significance in the field of Civil Engineering.

Petrology: Classification of rock - mode of formation - distinction between igneous, sedimentary and metamorphic rocks - Physical and Mechanical properties of rocks - Study of important rocks - role of petrology in the field of construction.

Structural Geology and Geophysical methods: Attitude of beds - out crops, study of structures such as folds, faults, joints, unconformities inlier and outlier - brief classification and their bearing on engineering construction – principles of geophysical methods, electrical resistivity method, seismic method and its applications in civil engineering.

Geology and construction: Role of geology in site investigation, geological considerations in open excavation, tunnels and dam site, reservoir site, buildings, road cuttings, study of air photographs and satellite images and interpretation for civil engineering projects, landslides - its causes, classification and preventive measures, groundwater- types of aquifers , properties of geological formations affecting groundwater and its role as a geological hazard.

Text Books

1. Parbin Singh, "Engineering and General Geology ", Katson Publications House, 2001.
2. Venkata Reddy,D.," Engineering Geology for Civil Engineers", Oxford & IBH , 1995

Reference Books

1. Leggot, R.F.," Geology and Engineers ", McGraw Hill , New York.2002
2. Blyth, F.G.M., " A Geology for Engineers", Arnold, Londo,(2003.
3. Bell.F.G, " Fundamentals of Engineering Geology" Butterworth, 1983.

Course Outcomes:

1. Able to identify minerals/rocks, their characteristics and their bearing on the construction.
2. Able to know attitude of geological formations and preparation of geological sections to address the problems during site investigation process.

CE328 SOLID AND HAZARDOUS WASTE MANAGEMENT

Course Objectives:

1. To know sources and handling of solid and hazardous waste
2. To study the processing and disposal methods of waste

Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management Waste generation rates – Composition- Hazardous Characteristics – TCLP tests – waste sampling - Source reduction of wastes – Recycling and reuse.

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations - labelling and handling of hazardous wastes.

Waste processing – processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies-energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes.

Disposal in landfills - site selection - design and operation of sanitary landfills- secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – closure of landfills – landfill remediation

Legislations on management and handling of municipal solid wastes, hazardous wastes, and biomedical wastes. Elements of Integrated waste management.

Text Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw- Hill, New York, 1993 36

References:

1. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.

Course Outcomes:

1. Able to understand the handling of solid and hazardous wastes
2. Able to know about disposal of waste

CE329 INDUSTRIAL WASTE MANAGEMENT

Course Objectives:

1. To know about management of various industrial waste
2. To study about control techniques and reuse of wastewater
3. To study characteristics of industrial wastewater and its effects on water bodies
4. To know the quality of industrial effluents required before disposal on environment
5. To learn various physico-chemical and biological treatment techniques to treat industrial wastewater
6. To gain knowledge about the reuse of treated industrial effluents
7. To give exposure on common effluent treatment plants

Sources and types of industrial wastewater – Environmental impacts – Regulatory requirements – generation rates – characterization – Toxicity and Bioassay tests.

Prevention Vs Control of Industrial Pollution– Source reduction techniques – Waste Audit- Evaluation of pollution prevention options.

Waste minimization - Equalization - Neutralization – Oil separation – Flotation – Precipitation – Heavy metal Removal – adsorption – Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation

Ozonation – Photo catalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies - Individual and Common Effluent Treatment Plants – Zero effluent discharge systems - Wastewater reuse – Disposal of effluent on land.

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – Metal finishing – Petroleum Refining – Pharmaceuticals – Sugar and Distilleries – Food Processing – Fertilizers – Thermal Power Plants and Industrial Estates, Waste Audit.

Text Books:

1. Eckenfelder, W.W., Industrial Water Pollution Control, McGraw-Hill, 1999.
2. Arceivala, S.J., Wastewater Treatment for Pollution Control, McGraw-Hill, 1998.

References:

1. Frank Woodard, Industrial waste treatment Handbook, Butterworth Heinemann, New Delhi, 2001.

Course Outcomes:

1. Able to recognize various environmental problems due to improper management of industrial wastewater
2. Able to determine appropriate technologies for treatment and management of industrial pollutants
3. Able to recommend different techniques for the safe disposal of industrial effluents
4. Able to analyse the quality requirements for reuse of industrial effluents

CE330 POLLUTION CONTROL ENGINEERING

Course Objective:

1. To study control methods of various pollutions

Introduction: Definition of clean air –air pollutants - Sources and classification Effects of air pollution on man, animal, vegetation and properties -Ambient Air Quality Standards, Air pollution control legislation.

Meteorology and Air pollution – Atmospheric stability – Inversions – Mixing height –Plume behavior – Plume rise estimation – Effluent dispersion theories –Air pollutants Modeling.

Atmospheric diffusion of pollutants and their analysis, Transport, transformation and deposition of air contaminants on a global scale, Air sampling and pollution measurement methods, principles and instruments; Emission factors, regulations, control strategies and policies

Control of Air pollutants: particulates – Filters – Gravitational settling chambers – Centrifugal-multiple type cyclones – Collection efficiency - Electrostatic precipitators – Wet collectors-Centrifugal spray scrubbers - Venturi scrubbers.

Gaseous pollution control – Absorption - Principles – Description of equipment, Adsorption – Principal adsorbents – Equipment descriptions – Condensation – Contact condensers Incineration –Equipment description

Sound and noise - Source of noise pollution - Environmental and industrial noise -Effects of noise pollution - Fundamentals of sound - generation, propagation, etc., Sound measurement, sound level meters – Measures for prevention and control of noise -Environmental and industrial noise - Noise control legislation.

Land pollution – land pollution surveys - ecological aspects of vegetation control

Water pollution laws and regulations - Air pollution control Act of India - Land pollution laws and regulations - The Environment (Protection) Act, 1986.

Text Books:

1. Rao.M.N. et al., Air Pollution, Tata Mc.Graw Hill, 1998.
2. Environmental Pollution Control Engineering By C.S. Rao, New Age International Publishers, 2006

Reference Books:

1. Noel de Nevers, Air Pollution Control Engineering, Mc.Graw Hill, New York. 1995.
2. Stern, A.C., Air Pollution , Vol.I, II and III, Academic Press, 1962.
3. Cunniff, P.F., Environmental Noise Pollution, John Wiley and Sons, New York, 1981

Course Outcomes:

1. Able to know about various pollutants and control methods

CE331 HYDROLOGY

Course Objectives:

1. To build on the student's background in hydrology
2. To develop the skills in modelling of flood flows and flood routing
3. To know the application of unit hydrograph

Precipitation circulation - temperature - Humidity – wind formation and forms of precipitation -Interpretation of precipitation data - snow cover and snow fall.

Factors affecting and methods of determining evaporation, infiltration and evapo-transpiration- Run-off cycle - factors affecting run-off -estimation of run-off by stream gauging - stage - discharge rating curves - Selection of site for a stream gauge station.

Derivation of unit hydrograph from complex storms - unit hydrographs for various duration - Synthetic unit hydrograph - Transposing unit hydrograph - Application of the unit hydrograph.

Linear Regression - Statistical and probability analysis of hydrological data - Flood frequency probability and stochastic methods

Text Books:

1. Ragunath, H.M., Hydrology, Wiley Eastern, 1990.

References:

2. Subramanya, Engineering Hydrology, Tata-McGraw Hill, 2004

Course Outcomes:

1. Able to incorporate the analytical abilities in the planning and design of water resource systems.
2. Able to understand the basics for the study of surface water flows.

CE332 IRRIGATION AND HYDRAULIC STRUCTURES

Course Objectives:

1. To understand the basic types of irrigation, irrigation standards and crop water assessment
2. To study the different aspects of design of hydraulic system
3. To provide knowledge on various diversion structures
4. To understand the Canal Irrigation system

Irrigation - necessity - Types of irrigation - Methods of supplying water - Assessment of irrigation water - Consumptive use and its determination - water requirement of various crops - Duty - Delta - Base period and crop period.

Diversion head work - Function - selection of site - type of weirs on pervious foundations - cause of failure - Bligh's creep theory and Khosla's theory - complete design of a vertical drop weir.

Gravity dams - Non overflow section - forces acting - stability rules - elementary profile - Low and High dams - drainage gallery - Construction joints - Earthen dams - stability of slopes by slip circle method - seepage analysis and its control Types of canals -

Canal alignment - Kennedy's silt theory - Lacey's silt theory - Design of canals using the above theories - economical depth of cutting - canal losses - canal maintenance - lined canals and their design - silt control measures.

Canal falls - Necessity and location - Design of sand type fall - design of a cross regulator - cross drainage works - selection of suitable type of cross drainage work - canal outlets.

Text Book:

1. Garg, S.K., Irrigation and Hydraulics Structures, Khanna Publishers, 1992.

References:

1. Punmia, B.C., Irrigation and Water Power Engineering, Standard Publishers, 2001.
2. Sharma, S.K., Principles and Practice of Irrigation Engg, S.Chand& Co, 1984.

Course Outcomes:

1. Able to assess the crop water requirement for various crops in the command area.
2. Able to understand the complete design of various Canal irrigation system.
3. Able to provide the knowledge in the design of diversion structures.
4. Able to establishe the understanding of land drainage system

CE333 TRAFFIC ENGINEERING AND SAFETY

Course Objectives:

1. To understand the fundamentals of traffic stream characteristics
2. To learn the skills of traffic control and management
3. To learn the methods of safe intersection design
4. To learn the importance and methods of accident investigation and prevention
5. To understand the concepts of road safety audit and safety improvement methods

Traffic Planning and Characteristics - Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – Towards Sustainable approach – land use & transport and modal integration.

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

Traffic Design and Visual Aids - Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

Traffic Safety and Environment - Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

Traffic Management - Area Traffic Management System - Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

Text Books:

1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2013
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications onTraffic Planning and Management.
3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
4. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011

References:

1. Garber and Hoel, Principles of Traffic and Highway Engineering, CENGAGE Learning, New Delhi, 2010
2. SP:43-1994, IRC Specification, Guidelines on Low-cost Traffic Management Techniques for Urban Areas, 1994
3. John E Tyworth, Traffic Management Planning, Operations and control, Addison Wesly Publishing Company , 1996
4. Hobbs. F .D. Traffic Planning and Engineering, University of Brimingham, Peragamon Press Ltd, 2005

5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company, 1998.

Course Outcomes:

1. Able to carry out traffic surveys
2. Able to implement traffic system management
3. Able to carry out intersection design for safety
4. Able to record and analyse accident data and suggest countermeasures
5. Able to carry out road safety audit

CE334 ADVANCED SURVEYING

Course Objectives:

1. To know about the design of curves and calculation of errors
2. To learn the principles of Electromagnetic distance measurement, Total Station and their accuracy
3. To get introduced to the concept of photogrammetry in preliminary identification and map making
4. To get introduced to the field of coordinate systems, Map projections, GPS, its working principle, data collection, data processing and analysis

Curve setting – Horizontal curves - Elements of simple and compound curves – Methods of setting out – Reverse curve – Transition curve – Length of curve – Elements of cubic parabola, true spiral and cubic spiral.

Vertical curve – parabola – Setting out of buildings – Culverts – Tunnels. Triangulation – different networks – orders and accuracies – Intervisibility and height of stations – Signals and towers – Baseline measurement – Instruments and accessories – tape corrections –extension of baseline – satellite stations.

Reduction to centre - Trignometrical levelling – Observations for heights and distances – Geodetic observations –Corrections for refraction, curvature, axis signal – Reciprocal observations. Errors – Types of errors – Theory of least squares.

Weighted observations – Most probable value – Computations of indirectly observed quantities – Method of normal equations – Conditioned quantities, method of correlates, method of differences – Adjustment of simple triangle and quadrilateral network without central station. Electromagnetic distance measurement (EDM).

Principle – Types – Total station - Photogrammetry –Terrestrial and aerial photographs – Photo interpretation – Stereoscopy - Remote sensing – Principle –Idealized remote sensing system – Types – applications - Introduction to GPS – Segments – Principle of working – application.

Text Book

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 2004.

References

1. Punmia, B.C. Surveying Vol.I and II, Standard Publishers, 1994.

2. Arora, K. R. Surveying Vol. I and II, Standard Book House, 1996.
3. SatheeshGopi. Advanced Surveying, Pearson Education, 2007.
4. SatheeshGopi. The Global Positioning System and Surveying using GPS, Tata McGraw, 2005.

Course Outcomes:

1. Able to design curves
2. Able to select the advanced technique which is best suited for a work
3. Able to apply total station and EDM in distance measurement and traversing
4. Able to understand basics of Photogammetry

CE335 LAB ORIENTED MINI PROJECT

The course is specially designed to provide an opportunity to the students for development of their academic skills and logical thinking through open-ended lab oriented activities. As a part of education, this project course follows a method of learning and therefore, the student's actual day-to-day task involvement would constitute the central thread of the learning process. The evaluation will recognize this aspect by demanding day-to-day productivity and punctuality of the students. A maximum of three students can pursue this project together under one guide.

Every student group has to plan an experimental program according to their interest in any one of the civil engineering field. Further, they should define the title and experimental plan. They should work towards their objective of the experimental plan. At the end of the course, the student group should submit a report on experimental program and outcomes.

Evaluation Procedure

The method of evaluation will be as follows: I Evaluation: 20 marks (Decided by conducting a review by the department faculties) II Evaluation of Project Report: 20 marks (Decided by conducting a review by the department faculties). Final Evaluation: 60 marks (Decided by conducting final review by the department faculties along with an external expert preferably from the industry).

ELECTIVES OFFERED IN VII SEMESTER

CE421 ADVANCED DESIGN OF STEEL STRUCTURES

Course Objectives:

1. To analyze the few important steel structures
2. To understand the codal provisions for design of various steel structures.

Eccentrically loaded column - simple and compound section - lacings and battens - column bases – slab base – gusseted base – moment resistant base plate.

Welded plate girders – analysis and design using IS800-2007 - curtailment of flange plates – stiffeners – analysis and design of gantry girder.

Introduction to IS875 Part 3 – assessment of wind load – analysis and design of steel stacks -functional and structural requirements – self-supporting and guyed stacks - base plate and anchor bolt.

Light gauge steel sections-types of cross section - Local and post buckling - Effective width concept Compression and Flexural members.

Introduction to Plastic analysis – ductility – plastic bending of beams – stages of bending – shape factor – plastic hinge – load factor – failure mechanism - upper and lower bound theorems of plastic analysis – collapse load for beams and frames.

Text book

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

References

1. Bhavikatti, S.S., Design of Steel Structures, I.K. International Publishing House Pvt. Ltd., New Delhi, 2010
2. Krishnaraju.N, Structural Design and Drawing, University Press, Hyderabad, 2009.
3. IS 800-2007, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi.
4. IS 875 Part (3) - 1987, Code of Practice for Design Loads (other than earthquake) for buildings and structures: Wind loads., Bureau of Indian Standards, New Delhi.
5. SP6 (1)-1964, IS hand book for structural Engineers, Bureau of Indian Standards, New Delhi.

Course Outcome

1. At the end of the course the students would develop confidence and adequate capability in simple practical design.

CE422 ADVANCED COMPOSITE STRUCTURES

Course Objective:

1. To develop basic knowledge on Composite material.
2. To improve skills on Analysis and design members using FRP.
3. To gain Knowledge in Seismic applications of FRP materials

Introduction to composite materials – Types of FRPs - manufacturing and processing - basic material behaviour – mechanics

Analysis and design of flexural member using FRP materials – definition of under and over reinforced sections - stresses in FRP bars – deflection of FRP reinforced beams

Analysis and design of FRP strengthened columns – Compressive strength of FRP materials – strengthening of RC columns using FRP materials

Flexural and Shear strengthening of RC beams using FRP materials – Analysis and design

Seismic applications of FRP materials in RC structures – Analysis and design of RC members – Seismic Retrofitting of RC members.

Text Book

1. Daniel. M Issac and Ishai Ori, Engineering Mechanics of Composite Materials, Oxford University Press, India, 2013.
2. SB Singh, FRP reinforced concrete structures, Tata McGraw Hill – 2014.

References

1. American Concrete Institute 440 – Committee Guidelines, 2012.

Course Outcome:

1. Able to Understand the basic of Composite material.
2. Able to Improve skills on Analysis and design members using FRP.
3. Able to Have Knowledge in Seismic applications of FRP materials

CE423 STRUCTURAL DYNAMICS

Course Objectives:

1. To introduce the students the principles and methods of dynamic analysis of structures
2. To prepare for designing the structures for wind, earthquake and other dynamic loads.

Theory of Vibrations - Difference between static loading and dynamic loading Equations of motion by equilibrium and energy methods - Free and forced vibration of single degree of freedom systems, Effect of damping, Transmissibility.

Equations of Motion of Two degree of freedom systems- D'Alemberts principles, normal modes of vibration, applications.

Multidegree of freedom systems- Eigen values and Eigen vectors, orthogonality of normal modes, approximate methods. Mode superposition technique, numerical integration procedure.

Free and forced vibration of continuous systems, Rayleigh – Ritz method – Formulation using Conservation of Energy – Formulation using Virtual Work.

Idealisation and formulation of mathematical models for wind, earthquake, blast and impact loading, aerodynamics, gust phenomenon, principles of analysis.

Text Books:

1. Mario Paz, Structural Dynamics: Theory and Computation, Kluwer Academic Publication, 2004.
2. Anil K. Chopra, Dynamics of Structures, Pearson Education, 2001.
3. John M. Biggs, Introduction to Structural Dynamics, McGraw Hill, 1964.
4. Leonard Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1986.

References:

1. Kolousek V, Pirner.M, Fischer.O and Naprstek.J, Wind Effects on Civil Engineering Structures, Elsevier Publications, 1984.

Course Outcomes:

1. Able to know the concepts of dynamic systems
2. Able to identify, formulate and solve dynamic response of SDOF and MDOF

CE424 GROUND IMPROVEMENT TECHNIQUES

Course Objectives:

1. To explain fundamentals of ground modification
2. To Study various ground modification.
3. To explain the Soil nailing
4. To study Geotextiles.

Need and Scope - Principles of Ground Modification - Mechanical Methods and their Suitability.

Hydraulic Modification by Well Point Methods - Electro osmosis and pre loading techniques; Physical and Chemical-Dynamic Consolidation.

Modifications by Using Different Admixtures; Soil Reinforcement Principles and Technology - Ground Anchors – Stone Columns.

Soil Nailing - Soil confinement Applications – Micro Piling.

Reinforced Earth – The mechanisms of the reinforced earth techniques – Design principles – Materials used for construction – Advantages of reinforced earth – Reinforced earth construction techniques.

An overview of Geosynthetics, Description of Geotextiles – Geogrids – Geonets – Geomembranes – Geocomposites – Geocells – Designing with Geotextiles – Geotextile properties and test methods – Functions of Geotextile – Design methods for separation – stabilization – filtration – Drainage.

Text Books:

1. Manfred R. Haussmann, Engineering Principles of Ground Modification, McGraw Hill Pub. Co., New York, 1990.
5. Purushothama Raj, P, Ground Improvement Techniques, Laxmi Publications (P) Limited, 2005.

References

1. Bell, F.G., Engineering Treatment of Soils, Taylor and Francis, New York, 1993.

Course Outcome

2. To develop fundamentals knowledge on ground modification
3. To Study various ground modification.
4. To gain knowledge on Soil nailing
5. To study Geotextiles.

CE425 ROCK MECHANICS

Course Objective:

1. To study the fundamentals of rocks.
2. To develop skill on laboratory and field test of rocks.
3. To Explain the various properties of rocks.
4. To explain the concept of Rock tunnelling.

Formation of rocks, Physical properties, Classification of rocks and rock masses, Static Elastic constants of rock.

Laboratory and Field tests, Discontinuities in Rock Masses: Discontinuity orientation, Effect of discontinuities on strength of rock.

Compression, Tension and Shear, Stress-Strain relationships, Rheological behaviour, Strength/ Failure Criterion: Coulomb, Mohr, Griffith theory of brittle strength and other strength criteria. Stresses in rock near underground openings.

Effect of water on rock strength and rock deformation, effect of flow of water through Rocks, Effect of cracks, faults and folds on engineering behaviour of rock masses.

Rock tunnelling, rock slope stability, bolting, blasting, grouting and rock foundation design. Design of structures in rocks, basic design principles of tunnels in rock, design of pressure tunnel in rock.

Text Books:

1. W. Farmer, Engineering Behaviour of Rocks, Chapman and Hall Ltd.
2. R. E. Goodman, Introduction to Rock Mechanics

References:

1. P.R. Sheorey, Empirical Rock Failure Criteria, Balkema, Rotterdam, 1997
2. L. Obert and W.I. Duvall, Rock Mechanics and the Design

Course Outcome:

1. Able to study the fundamentals of rocks.
2. Able to gain knowledge on laboratory and field test of rocks.
3. Able to study the various properties and effects of rocks .
4. Able to understand the concept of Rock tunnelling

CE426 ENVIRONMENTAL IMPACT ASSESSMENT

Course Objectives:

1. To have a knowledge on the impact of various developmental Projects on environment
2. To decide appropriate technologies to quantify the impact.
3. To have a knowledge on the various mitigation measures.
4. To prepare the EIS and EMP.

Environmental and its interaction with human activities-Strengths and limitations of EIA

Environmental Imbalances - Concept of Environmental Impact Assessment (EIA)-elements of the EIA process

EIA administration and practise - Qualitative Analysis of Environmental Impact-methods-types-stages that follow EIA

Environmental Indicators - Environmental issues of developmental projects – case studies-Role of public participation

Costs and benefits of undertaking EIA- Quantification of Impacts of development-case studies

Text Books:

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis,VanNostrand Reinhold Co., New York, 1991.
2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

References:

1. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.

Course Outcomes:

1. Able to identify and quantify the impacts due to various projects on environment and plan mitigation measures
2. Able to safeguard the environment

CE427 IRRIGATION MANAGEMENT

Course Objective

1. To know the irrigation management practices
2. To study salinity problems

Command Area Development - Canal Irrigation and Management

Drainage of Excess Water – Livelihood and Production Thinking Philosophy

Optimal moisture content - Deficit Irrigation and Scheduling-Methods and Advantages

Salinity problems - Reclamation of salt affected soils- Classification of salt affected soils-Chemistry of salt affected soils-Nature and extent of salt problem in India-Determination of properties of Saline and Alkali soils-Reclamation and management of salt affected soils

Participatory Irrigation Management - Social Cost benefit analysis-Economic and Financial Analysis; Irrigation Project Costs; Study of actual evaluation of Irrigation Project

Text Books:

1. Asawa G.L, Irrigation Engineering, New Age Int., 2004.

References:

1. Chambers R, Canal Management, Oxford IBH, 2002.

Course outcomes

1. Able to understand the salinity problems.
2. Able to understand the participatory irrigation management

CE428 PAVEMENT ANALYSIS AND DESIGN

Course Objectives

1. To study about the types and components of pavements
2. To learn about the stresses in flexible pavements and equivalent single wheel load
3. To study the design of flexible pavements
4. To learn about the stresses in rigid pavements
5. To study the design of rigid pavements

Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airfield pavements, Requirements and desirable properties of

aggregates, bitumen, emulsion and modified bitumen, Characterisation of different pavement materials.

Pavement Design Factors Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure.

Drainage – Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures

Flexible Pavement Design Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC, AASHTO Methods, Mechanistic –Empirical design, applications of pavement design software

Rigid Pavement Design Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design Pavement Management Distresses in pavements, maintenance of highways, structural and functional condition evaluation of pavements, performance prediction models, ranking and optimization in pavement management.

Text Books:

1. Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons, 1975
2. Yang. H. Huang, Pavement Analysis and Design, Second Edition, Prentice Hall Inc, 1993
3. Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering – Principles and Practice, CRC Press, 2008

References:

1. W.Ronald Hudson, Ralph Haas and Zeniswki , Modern Pavement Management, McGraw Hill and Co, 1978

Course outcomes

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

1. Identify the pavement components and compare highway and airport pavements.
2. Calculate the stresses and ESWL in flexible pavements.
3. Design the flexible pavement using empirical, semi empirical and IRC methods.
4. Analyze the warping, friction, wheel load stress and calculate the combined stress.
5. Design rigid pavements by IRC method and evaluate the pavements

CE429 REMOTE SENSING AND GIS

Course Objectives:

1. To know about the principles of remote sensing and spectral signatures
2. To know about satellites, types of remote sensing and digital image processing
3. To study about the history and components of GIS
4. To study about data types and operations.

5. To know the applications of remote sensing and GIS for various fields of Civil Engineering

Remote Sensing – Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface.

Satellites - Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of Remote Sensing - Visual Interpretation of Satellite Images – Digital Image processing – Characteristics of different platforms, Sonar remote sensing systems.

GIS - History of Development - Components of GIS – Hardware, Software and Organizational Context –Data – Spatial and Non-Spatial – Data Input Sources— DBMS – Data Output - Data models - Raster and Vector data structures – Data compression – Raster vs. vector comparison

Analysis using Raster and Vector data – Operations – Overlaying - Buffering – Modelling in GIS - Digital Terrain Modelling, Analysis and application – Products of DEMs and their uses – Sources of errors in GIS and their elimination

Applications of Remote Sensing and GIS – Advanced applications of GIS – Disaster management, Water resource, Land use – Land cover – Urban planning - Intelligent Transport Systems - Development of Resources Information Systems.

Experiments on Total Station

Text Books:

1. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication, 2004.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice- Hall India, 2006.

References:

1. Thomas. M. Lillesand and Ralph. W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, 2003.

Course Outcomes:

1. Able to demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves.
2. Able to apply the concepts of satellite and sensor parameters and characteristics of different platforms.
3. Able to apply the concepts of DBMS in GIS
4. Able to analyze raster and vector data and modeling in GIS
5. Able to apply GIS in land use, disaster management, ITS and resource information system.

CE430 COASTAL ENGINEERING

Course Objectives:

1. To provide basic knowledge on coastal environment, problems.
2. To describe the various types of wave theories.
3. To study the effect of shores and shore processes.
4. To improve the knowledge on mathematical modeling
5. To study coastal zone management and protection methods.

Introduction: Coastal Engineering – Coastal Environment – Problems, Coastal water level fluctuations – Tides- surges and seiches. Waves: Linear wave theory - Irregular and regular waves –Short and long term wave analysis – wind generated waves- wave fore casting

Wave transformations- shoaling- refraction – reflection – diffraction – breaking. Causes of coastal erosion, Shore protection, Type of beaches, Methods of shore protection – structural and non-structural methods. Wave structure interaction – Forces on shore structures due to breaking, broken and non breaking waves.

Shores and shore processes, long term and short term changes, Cross shore and long shore currents – Sediment transport - Onshore offshore movement of sediment – long shore transport - mathematical modelling - factors affecting equilibrium of beaches- Coastal erosion - Dredging – Dredgers - Environmental effects of dredging - Remote sensing and GIS application in coastal engineering.

Coastal zone management: Coastal resource planning and management, Management goals and purposes, Sustainable use of resources, Application of IT in coastal zone management.

Coastal Protection: Methods – Function – Types - Design concepts – Sea walls – Bulkhead – Revetment – Groins – Artificial beach nourishment – Scour.

Coastal ecosystems including mangroves, Activities in coastal areas and environmental problems, mudbanks, Legislation in India including the CRZ and CZMA notifications.

Text Books:

1. Kamphius, J. W., Introduction to Coastal Engineering and Management, World Scientific, 2010.
2. Sorenson, R. M., Basic Coastal Engineering, John Wiley and Sons, 2005.
3. Shore Protection Manual Vol. I and Vol. II, U.S. Army Coastal Engineering Research Center, 1984.
4. John R. Clark, Coastal Zone Management Handbook University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Florida 2440 East Commercial Boulevard, Ft. Lauderdale, Florida 33308, 1996.

References:

1. Dean, R. G., and R.A. Dalrymple, Coastal Processes with Engineering Applications, Cambridge University Press, 2004.

2. Reeve, D., Andrew Chadwick, and Christopher Fleming, Coastal Engineering, Spon Press, 2004.
3. Coastal Engineering Manual, U. S. Army Corps of Engineers, 2006.

Course Outcomes:

1. Able to gain knowledge on coastal environment, problems
2. Able to understand the various types of wave theories.
3. Able to understand shores and shore processes and mathematical modeling.
4. Able to understand coastal zone management and protection methods.

CE431 MODERN CONSTRUCTION MATERIALS

Course Objectives:

1. To introduce various modern construction materials.
2. To improve knowledge on various special construction materials.

High strength and High performance concrete-Fiber Reinforced concrete

New Alloy steels-Aluminium and its products-Other alloys-galvalume

Plastics-Reinforced polymers-FRP-Cellular cores

Water proofing compounds-Non -weathering Materials-Flooring and Facade Materials-False Ceiling and False Flooring

Smart and Intelligent Materials-Brief outline and uses

Text Books:

1. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
2. Mamlouk, M.S. and Zaniewski, J.P. Materials for Civil and Construction Engineers.Prentice Hall Inc., 1999

References:

1. Derucher, K.Korfiatis. G. and Ezeldin, S, Materials for Civil and Highway Engineers Prentice Hall Inc., 1999
2. Aitkens,High Performance Concrete, McGraw Hill, 1999

Course Outcomes:

1. Able to know different special building materials and their applications

CE432 URBAN PLANNING

Course Objectives

1. To develop an awareness about the trends in urbanization
2. To understand the basic principles and concepts of urban planning
3. To learn the laws and regulations related to the planning process existing in the country.

4. To be acquainted with the various stages of the planning process
5. To get introduces to the various agencies and organizations involved in the planning process

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanisation at International, National, Regional and State level.

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights , Special Economic Zones.

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

Text Books:

1. Chennai Metropolitan Development Authority, Second Master Plan for Chennai, Government of Tamil Nadu, Chennai, 2008
2. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai
3. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002

References:

1. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005

Course Outcomes

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

1. Demonstrate the various process involved in urban planning
2. Apply the laws and governmental policies related to the planning process
3. Implement the classical urban planning principles
4. Apply the methods of financing of plans
5. Demonstrate the regulations and by-laws

ELECTIVES OFFERED IN VIII SEMESTER

CE433 SEISMOLOGY & EARTHQUAKE RESISTANT STRUCTURES

Course Objectives:

1. To understand the basics of seismology
2. To know the seismic design concepts
3. To understand the cyclic load behaviour

Elements of Seismology - Elements of Engineering Seismology - Causes of Earthquake – Plate Tectonic theory – Elastic Rebound Theory – Characteristic of earthquake – Estimation of earthquake parameters - Magnitude and intensity of earthquakes – Spectral Acceleration.

Response of Structures to Earthquake - Effect of earthquake on different type of structures – Behaviour of Reinforced Cement Concrete, Steel and Pre-stressed Concrete Structure under earthquake loading – Pinching effect – Bouchinger Effects – Evaluation of earthquake forces - Response Spectra – Lessons learnt from past earthquakes.

Seismic design concepts – EQ load on simple buildings – Load path – Floor and roof diaphragms – Seismic resistant building architecture – Plan configuration – Vertical configuration – Pounding effects – Mass and stiffness irregularities – Torsion in structural system

Design Methodology - Causes of damage – Guidelines for Earthquake resistant design – Earthquake resistant design for masonry and Reinforced Cement Concrete buildings – Lateral load analysis – Design and detailing .

Cyclic loading behaviour of RC steel and pre-stressed concrete elements - Modern concepts – Base isolation – Adoptive systems – Case studies

Text books:

1. Agarwal.P and Shrikhande. M., "Earthquake Resistant Design of Structures", Prentice Hall of India Pvt. Ltd. 2007
2. IS 1893-1 (2002): Criteria for Earthquake Resistant Design of Structures
3. IS 4326 (1993): Code of practice for earthquake resistant design and construction of buildings
4. IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces

References:

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4thEdition, Pearson Education, 2011.

Course Outcomes:

1. Able to design seismic resistant structures
2. Able to know cyclic load behaviour of structural elements
3. Able to understand the basic concepts of seismology

CE434 BRIDGE ENGINEERING

Course Objectives:

1. To know the investigation of Bridges
2. To know the design of Bridge foundation
3. To know the bridge loads
4. To know the Bridge construction and maintenance

Introduction - Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders - Design of deck type steel highway bridges for IRC loading - Design of main girders

Steel Bridges - Design of pratt type truss girder highway bridges - Design of top chord, bottom chord, web members - Effect of repeated loading - Design of plate girder railway bridges for railway loading - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

Reinforced Concrete Girder Bridges- Design of tee beam - Courbon's theory - Pigeaud's curves

Design of balanced cantilever bridges - Deck slab - Main girder - Design of cantilever - Design of articulation.

Analysis and design hanging suspension bridges-analysis and design of cable stay bridges-Applications of commercial software

Text Books:

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.
2. Rajagopalan, N., Bridge Superstructure, Alpha Science International, 2006

References:

1. Phatak D.R., Bridge Engineering, SatyaPrakashan, New Delhi, 1990.
2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 1996.

Course Outcomes:

1. Able to select the type of bridge, design and its construction

CE435 DESIGN OF OFFSHORE STRUCTURES

Course Objectives:

1. To understand the wave theories and wave forces
2. To analyze and design offshore structures
3. To know the corrosion mechanism in offshore structures

Wave Theories - Wave generation process, small and finite amplitude wave theories.

Forces on Offshore Structures - Wind forces, wind forces on vertical, inclined cylinders, structures – current forces and use of Morrison equation.

Analysis of Offshore Structures - Static methods of analysis, foundation analysis and dynamics of offshore structures.

Design of Offshore Structures - Design of platforms, helipads, jacket tower and mooring cables and pipelines - Corrosion and Fatigue Failure.

Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online corrosion monitoring - Corrosion fatigue.

Text Books:

1. Chakrabarti S.K., "Hydrodynamics of Offshore Structures", Computational mechanics, Publications, 1987.
2. Thamas H Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood, Cliffs, N.J. 1983.
3. API Recommended Practice for Planning, "Designing and Constructing Fixed Offshore Platform", American Petroleum Institute Publication, RP2A, Dallas, Texas, 1983.

References:

1. Wiegel R.L, "Oceanographical Engineering", Prentice Hall Inc. Englewood, Cliffs, N.J. 1964.
2. Brebia, C.A Walker.S., "Dynamic Analysis of Offshore Structures", New – Nes Butterworths, U.K 1979.
3. Reddy DV and Arockiasamy M., "Offshore Structures", Vol.1, Krieger Publication Company, Malabar, Florida, 1991.

Course Outcomes:

1. Able to find wave loads
2. Able to design offshore structures
3. Able to know corrosion mechanism and protection from it in offshore structures

CE436 DESIGN OF SHELL STRUCTURES

Course Objectives:

1. To present the foundations of the classical theory of shells.
2. To understand the limitations and differences of shell theories within context of the theory of elasticity

Introduction - Classification of shells - types of shells - Structural action - shells of revolution & shells of translation - examples - membrane theory - limitation of membrane theory

Flexure theory - Design of cylindrical shell by D.K.J. Method -other theories of analysis - use of ASCE manual for the design of cylindrical shells – pre-stressing of shells

Cylindrical Shells and Folded Plates - Beam method of analysis of cylindrical shell by Lundgren - limitations - Detailed design of cylindrical shells – Hyper shells & conoidal shells. Element of Buckling of shells & shell structures, Analysis and Design of Folded plates.

Doubly Curved Shells - Bending theory of doubly curved shells- Hyperbolic parabolic shells subjected to external loads and gravity loads shells of revolution.

Buckling of RC Roof Shells and Pyramids - Slenderness of beams – Circular shells – Buckling strength of supporting members – Softwares for analysis – Design of pyramid roofs.

Text Books:

1. Ramaswamy G.S, Design and Construction of Concrete Shell Roofs, CBS Publishers, 1986.
2. Timoshenko S & S.W. Krieger, Theory of Plates & Shells, McGraw Hill and Co, 1959.
3. Dr. N.K. Bairagi, Shell Analysis, Khanna Publishers, 1990.
4. Design of Cylindrical Concrete Shells, No.31, ASCE Manual of Engineering Practice.
5. Rudolph S zilard, Theory and analysis of Plates; Classical and Numerical Methods, Prentice – Hall, 1973.
6. G.E.O Widra, Chung.H.,D.Hui, Design and Analysis of Plates and Shells, Amer Society of Mechanical, 1986.

References:

1. Varghese P.C, Design of Reinforced Concrete Shells and Folded Plates, PHI Learning Pvt Ltd, New Delhi, 2010.
2. IS 2210-1988, Criteria for Design of Reinforced Concrete Shell Structures and Folded Plates, BIS New Delhi.
3. ASCE Manual, No. 31, American Society of Civil Engineering, USA, 1952.

Course Outcomes:

1. Able to apply the theory of shells in engineering designs.
2. Able to enrich research capability in shells.

CE437 FAILURE ANALYSIS OF STRUCTURES

Course Objectives:

1. To understand the deterioration process of materials
2. To know about repair materials
3. To assess the condition of the structure

Causes of failure – Types of failure – why, what, how – durability of materials – Landmark case – Performance and shape inadequacy – statistics and reliability – life cycle assessment.

Structural failure –material and load effects – environment effect - Non-structural and structural repairs –Biocidal treatment and use of preservatives –deterioration of wood

Macro micro level failures – component and sub-system failures - failure theories – analytical models – cases and type of problem in components –safety evaluation.

Structural systems–case studies – pin-jointed steel systems – rigid jointed frames – concrete walls arches – reinforced concrete beams and frames – shells –repair of concrete bridge and water retaining structures.

Bridge maintenance techniques – refurbishment of buildings, legal responsibilities – Case studies – Definition of smartness –sensors – automatic and adaptive systems – smart components

References

1. Rasnom, W.H., Building Failures, E&F, N. SPON Ltd., 1980.
2. Moskvin V, Concrete and Reinforced Structures – Deterioration and Protection, Mir Publishers, Moscow, 1980.

Course Outcomes:

1. Able to analyse the distress structure
2. Able to propose repair methodology

CE438 SOIL STRUCTURE INTERACTION

Course Objectives:

1. To gain knowledge on soil- foundation interaction.
2. To Understand soil model and soil response model.
3. To understand analysis of finite plate and to gain knowledge in elastic analysis of plate and laterally loaded pile.

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems, Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis

Soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour ; Beam on Elastic Foundation

Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

Plate on Elastic Medium: Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions

Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile raft system, Solutions through influence charts.

Text Books:

1. N.P. Kurien, Design of Foundation Sytems : Principles& Practices, Narosa, New Delhi 1992,
2. E.S. Melerski, Design Analysis of Beams, Circular Plates and Cylindrical Tanks on Elastic Foundation, Taylor and Francis, 2006.

Reference:

1. L.C. Reese, Single piles and pile groups under lateral loading, Taylor & Francis, 2000
2. G. Jones, Analysis of Beams on Elastic foundation, Thomas Telford, 1997.

Course Outcomes:

1. Able to gain knowledge on soil- foundation interaction.
2. Able to understand soil model and soil response model.
3. Able to understand analysis of finite plate
4. Able to gain knowledge in elastic analysis of plate and laterally loaded pile.

CE439 EARTHQUAKE GEOTECHNICAL ENGINEERING

Course Objectives:

1. To explain the mechanism of earthquake and its related causes to build structures and in-situ soils
2. To explain how ground motion is recorded and how do quantify the earthquake intensity and frequency related parameters
3. To explain how seismic site investigation will be done and seismic soil design parameters are estimated
4. To explain how seismic resistant design of foundation will be done and also explain the concept of liquefaction and related causes including codal recommendations
5. To explain how to do hazard assessment and mitigation and explain how do prepare a risk and microzonation mapping

Mechanism of Earthquakes - Causes of earthquake - Earthquake Fault sources - Elastic Rebound theory - Seismic wave in Earthquake shaking - terminology - Locating an earthquake - Quantification of earthquakes.

Strong Motion Records - characteristics of ground motion - Factors influencing Ground motion - Estimation of frequency content parameters Seismic site investigations – Selected Case Studies.

Evaluation of Dynamic soil properties – Codal Provision Design Ground Motion - Developing Design Ground Motion-Codal recommendations. Earthquake Resistant Design of foundation of buildings - Design considerations.

Earthquake Response of slopes - Evaluation of slope stability - Liquefaction-Susceptibility - Liquefaction Resistance.

Codal recommendations. Risk mapping - Hazard assessment – Mitigation measures - Seismic microzonation and its importance.

Text Books:

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000.
2. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International Series, Pearson Education (Singapore) Pvt. Ltd., 2004.
3. KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler

References:

1. Robert W. Day, Geotechnical Earthquake Engineering Hand book, McGraw Hill, 2002
2. Day R.W, Geotechnical Earthquake Engineering Hand Book, McGraw Hill handbook, New York, 2003.

Course Outcomes:

1. Able to understand the principles of soil reinforcement and they can able to do any reinforced wall design using steel strip or geo-reinforcement
2. Able to understand the application of geosynthetics in geotechnical engineering
3. Able to decide what kind of geosynthetics should be used for the problem specific application including its design principles
4. Able to do proper field test using the recent development in geosynthetics

CE440 ENVIRONMENTAL RISK ASSESSMENT

Course Objectives:

1. To know the bacis concepts of environmental risk assessment and applications
2. To study the transportation, ecological and human health risk assessment

Introduction Basic concepts of environmental risk assessment and definitions, risk assessment as an environment management tool, use of risk assessment and management techniques in policy and regulatory decisions, use of risk assessment and management techniques in industry, typology of risk assessment and management techniques, over view of risk assessment methods - NAS model- hazard identification, dose-response assessment, exposure assessment, risk characterization.

Human health risk assessment Physical risks- ionizing radiation- hazard identification, dose-response assessment, exposure assessment, risk characterization. Chemical risks- hazard identification, dose-response assessment, exposure assessment, risk characterization, deterministic vs. probabilistic risk assessment, neurotoxic risk assessment, immunotoxic risk assessment, developmental toxicity risk assessment, reproductive toxicity risk assessment, risk assessment of endocrine disruptors, carcinogenic risk assessment. Biological Risks- hazard identification, hazard

characterization, exposure assessment, risk characterization, risk assessment of genetically modified organisms.

Ecological risk assessment Risk assessment process for chemicals- hazard identification, effects assessment, exposure assessment, risk characterization. Risk assessment of plant protection products. Risk assessment of genetically modified organisms.

Application of environmental risk assessment in industry Site specific ERA for non-routine releases- hazard identification/ release assessment(methods like Hazop, What-if, knowledge based hazop, Fault tree analysis, Event tree analysis, Cause-consequence analysis, reliability block diagrams, task analysis, etc.), exposure assessment, consequence assessment, risk estimation. Site specific ERA for routine releases.

Transportation risk assessment, product risk assessment, risk minimization measures. Risk assessment techniques for specific industrial applications- off-shore installations, nuclear installations, contaminated land, waste management. Relation between ERA and Life cycle assessment (LCA).

Text Books:

1. European Environmental Agency (EEA), Environmental Risk Assessment – Approaches, Experiences, and Information Sources.
2. Lerche, Ian and Walter Glaesser, Environmental Risk Assessment: Quantitative measures, anthropological influences, human impact, Springer Publishers, 2010.

References:

1. Robson, Mark, William Toscano (Ed.), Risk Assessment for Environmental Health, John Wileyand Sons Inc, 2007.
2. Molak, V., Fundamentals of risk analysis and risk management, CRC Press, 1997.

Course Outcomes:

1. Able to understand the imporatance and applications of risk assessment in various fields

CE441 ECOLOGICAL ENGINEERING

Course Objectives:

1. To know the basic concepts of ecology
2. To study the effects on ecology
3. To understand the energy flow in any ecology system

Scope and applications of Ecological Engineering – Development and evolution of ecosystems– principles and concepts pertaining to species, populations and community

Energy flow and nutrient cycling – Food chain and food webs – biological magnification, diversity and stability, immature and mature systems. Primary productivity – Biochemical cycling of nitrogen, phosphorous, sulphur and carbon dioxide; Habitat ecology - Terrestrial, fresh water, estuarine and marine habitats.

Bio monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems.

Ecological effects of exploration, production, extraction, processing, manufacture & transport.

Case studies of integrated ecological engineering systems

Text Books:

1. Odum, E.P., "Fundamental of Ecology", W.B.Sauders, 1990.
2. Kormondy, E.J., "Concepts of Ecology", Prentice Hall, New Delhi, 1996
3. Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.

References:

1. Colinvaux, P., Ecology, John Wiley and Sons, 1996.
2. Etnier, C &Guterstam, B., "Ecological Engineering for Wastewater Treatment", 2nd Edition, Lewis Publications, London, 1996.

Course Outcomes:

1. Able to understand the importance of maintaining the ecological system

CE442 GROUNDWATER HYDROLOGY

Course Objectives:

1. To know different types of aquifers
2. To understand the surface and subsurface investigation in detail
3. To integrate the fundamental and basic knowledge of ground water movement
4. To understand the process of sea water intrusion and recharge
5. To introduce the different model studies

Groundwater occurrence – distribution – aquifer – types - Surface investigation - Geophysical -electrical resistivity - Seismic refraction - Gravity and magnetic - Geologic - Air photo interpretation - Dowsing.

Subsurface investigation - test drilling - resistivity logging- potential logging - temperature and caliper logging- Steady unidirectional flow - well in a uniform flow - steady flow with uniform recharge - unsteady radial flow to a well - well flow near aquifer boundaries - Multiple well systems - partially penetrating wells - characteristic well losses.

Secular and seasonal variations - Fluctuations due to evapo-transpiration, Meteorological phenomena, tides, external loads and earthquakes - control by drains and wells - Recharge through sewage pits, shafts and wells

Occurrence of sea water intrusion - Ghypon- Heizberg relation between fresh and saline waters - shape length and structure of the fresh salt water interface - prevention and control of seawater intrusion - role of sea water in ground water - coastal zoning.

Sand models - Electrical models - Viscous fluid models - membrane models - numerical analysis methods

References

1. Raghunath H.M., Ground Water Hydrology, New-Age International, 2nd Edition, 1990.

Course Outcomes:

1. Able to identify types of aquifers
2. Able to carry out surface and subsurface investigation to locate groundwater
3. Able to visualise the occurrence and movement of groundwater
4. Able to select suitable type of ground water recharge
5. Able to assess sea water intrusion and its control

CE443 HYDRO POWER ENGINEERING

Course Objectives:

1. To know about hydropower plants and benefits
2. To know the sources of hydropower and storage
3. To know the working of turbines and generators

Sources of energy - Hydropower – Place of hydropower in a power system – Fundamentals of Water Power Engineering- Classification of hydropower plants. Water power estimates – Essentials of stream flow for water power studies. Pondage and storage – effect of pondage on plant capacity-Benefits from storage.

Basic Hydrology : Mass curve and flow duration curve. Effect of reservoirs on flood flow. Load curve and load factor. Utilisation factor - Capacity factor - Diversity factor - Firm Power and Secondary Power-Prediction of load.

Run of the river plants. Pumped storage plants. General arrangement of power house. Types of power house. Mini and micro hydel plants. Tidal Power Plants.

Intakes – Forebay – Gates - Penstocks, Canals and Tunnels - Joints - Anchor Blocks - Bends and Manifolds. Valves - Water Hammer - Surges and Surge Tanks

Turbines and Generators - Flood routing through reservoirs and channels. Dam breach analysis - Cost and value of water power.

Text Books:

1. Creager and Justin, Hydroelectric Engineering Handbook, John Wiley and Sons, 1963.
2. Barrows, H. K., Water Power Engineering, McGraw Hill Inc, 1955.
3. Mosonyi, Water Power Development, Hungarian Academyof Sciences, 1965.
4. Guthrie Brown, Hydroelectric Engineering Practice, Blackie and Sons Ltd; London, 1984.
5. Dandekar and Sharma, Water Power Engineering, VikasPublishing House (P) Ltd., 2002.

6. Nigam, P. S., Handbook of Hydro Engineering. Nem Chand and Sons, Roorkee, 1985.

References:

1. ZhengNaibo et al, Mini Hydropower, John Wiley and Sons, 1997.
2. UNIDO, Small Hydropower Series, UN, 1985.
3. SmailKhennas and Andrew Barnett, Best Practices for Sustainable Development of Mini Hydropower in Developing Countries, World Bank/ESMAP.
4. CBIP Journals and Publications.
5. Journal of Water Power and Dam Construction.
6. Indian Journal of Power and River Valley Development.

Course Outcomes:

1. Able to know the sources, storage and production of electricity in hydropower plants

CE444 TRANSPORTATION PLANNING

Course Objectives:

1. To know about the processes and concepts of transportation planning
2. To study about trip generation
3. To study about trip distribution
4. To study about modal split analysis
5. To study about trip assignment

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 processes

Trip Generation Analysis: Definition 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 analysis - Household models - Trip attractions of work centres.

Trip Distribution Analysis: Trip distribution models - Growth factor models – Gravity models - Opportunity models.

Mode Split Analysis: Mode split analysis - Mode choice behaviour, Competing modes, Mode split curves, Probabilistic models. Route Split Analysis - Route split analysis: Elements of transportation networks, coding -minimum path trees, allor-nothing assignment.

Text Books:

1. Khisty, C. J., Transportation Engineering – An Introduction, Prentice Hall, 3rd Edition, 2002.
2. Papacostas, Fundamentals of Transportation Planning, Tata McGraw Hill, 3rd Edition, 2002.
3. Dicky, J. W., Metropolitan Transportation Planning,Tata McGraw Hill, 1983
4. Bruton, M. J., Introduction to Transportation Planning, Hutchinson of London, 1970.

5. Hutchinson, B. G., Principles of Urban Transportation System Planning, McGraw Hill
6. ITE (1982), 'Transportation and Traffic EngineeringHand Book', Chapters 10,12 , and 17, Prentice Hall, New Jersey
7. Kanafani, A., Transportation Demand Analysis, McGraw-Hill, 1983.

References:

1. Konstadinos G. Goulias, Transportation Systems Planning: Methods and Applications, CRC Press, 2002
2. Meyer, M. D. and Miller, E. J., Urban Transportation Planning, McGraw-Hill International, 2001
3. Oppenheim, N., Applied Models in Urban and RegionalAnalysis, Prentice-Hall, NJ, 1995.
4. Ortuzar, J. D., and Willumsen, L. G., Modelling Transport, John Wiley and Sons Ltd, 2001.
5. Wilson, A. G, Urban and Regional Models in Geography and Planning, John Wiley and Sons, 1974.

Course Outcomes:

1. Able to apply the principles of the transportation planning process and demand estimation.
2. Able to analyse the trip production and trip attraction models.
3. Able to analyse the growth factor, gravity and opportunity models.
4. Able to apply the mode choice behaviour and mode split models.
5. Able to apply the shortest path models for route assignment.

CE445 TRANSPORTATION INFRASTRUCTURE DESIGN

Course Objectives:

1. To study about design of highways and intersections
2. To know the importance of traffic signs
3. To study the pavement, pedestrian and terminal facilities

Design of Highways: Hierarchy of Highway System, Functions, Geometric Design Standards, Design Controls and Criteria – Vehicle, Driver and Traffic; Cross-Section Elements, Typical Sections, Design of the Alignment - Sight distance , Horizontal Alignment, Vertical Alignment, Integration, Optical Design, Landscaping and Safety Considerations, Evaluation and Design of existing geometrics.

Design of Intersections: Types of Intersections and Controls, Principles of Intersection Design; Design of At-Grade Intersections – Design Elements, Channelization, Design using Templates; Rotary and Roundabout – Design, Capacity; Signalised Intersections – Benefits and Drawbacks, Warrants, Design; Signal Coordination – Methods, Design; Grade separated intersections – Warrants, Types, Geometric Standards, Spacing and Space controls, Ramps and Gore area design, Parking Facilities.

Pedestrian and Bicycle Facilities: Characteristics of Pedestrians and Bicycles, Issues Shared by Pedestrians and Bicycles, Pedestrian Facility Design - Walkways, Sidewalks, and Public Spaces, Pedestrian Facility Capacity and LOS

Signs and Pavement Markings, Intersections, Midblock Crossings, Flyovers and Subways; Bicycle Facility Design - Shared Roadways, Bike Lanes, Parking and Storage

Terminal Planning and Design: Terminal Functions, Analysis of Terminals, Process Flow Charts of Passenger and Goods Terminals, Terminal Processing Time, Waiting Time, Capacity and Level Of Service Concept, Study of Typical Facilities of Highway, Transit, Airport and Waterway Terminals, Concept of Inland Port.

Text Books:

1. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna publishers, 1987.
2. IRC-SP41: Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas
3. Salter, R. J., Highway Traffic Analysis and Design,ELBS, 1996.
4. Edward K. Morlock, Introduction to Transportation Engineering and Planning, International Student Edition, McGraw-Hill Book Company, New York, 1992.
5. Joseph, De Chiara, Urban Planning and Design Criteria, Van Nostrand Reinhold, 1982.

References:

1. Joseph De Chiara, Michael J. Crosbie, Mike Crosbie, Time-Saver Standards for Building Types, McGraw-Hill Professional, 2001.
2. Guide for the Planning, Design, and Operation of Pedestrian Facilities, AASHTO, 2004
3. Guide for the Development of Bicycle Facilities, AASHTO, 1999
4. Manual on Uniform Traffic Control Devices (MUTCD), 2009
5. Urban Intersection Design Guide, Texas Department of Transportation, 2005

Course Outcomes:

1. Able to understand the importance of traffic signs
2. Able to design highways and intersections
3. Able to know the planning of terminals and design

CE446 OCEAN WAVE MECHANICS AND MARINE STRUCTURES

Course Objectives:

1. To know about wave loads to marine structure
2. To analyse the waves by modelling
3. To understand the basics of wave maechanics

Introduction to marine Structures – Coastal, Port and Offshore – Parameters – Wind, Wave, Tides, Currents – Storm surge, Tidal bore, Tsunami, Seiche - Zones based on waves

Basic of fluid mechanics - Euler's equation of motion – Path and Stream lines – Bernoulli's equation – Basic of wave motion – Small Amplitude wave theory – Celerity – Water particle displacement and pressure distribution under progressive waves – Wave energy and power

Shoaling – wave refraction, diffraction and reflection – breaking of waves – types – criteria – wave height – Finite amplitude wave theories – Stoke's, Solitary and Stream function theory

Collection and detailed analysis of wave data – wave prediction models

Wave load on slender structures – linear diffraction theory – wave slamming – wave forces on walls and rubble mound structures

Wave energy potential – wave energy conversion – wave energy devices

Text Book:

1. Sundar V, Ocean wave Mechanics – Application in marine structures, Ane Books Pvt. Ltd, 2016

Course Outcomes:

1. Able to understand the bascics of wwave motion
2. Able to understand the wave loads to marine structures
3. Able to analyse and predict waves by modelling

CE447 CONTRACT LAWS AND REGULATIONS

Course Objectives:

1. To know laws of contract and processing of tenders
2. To understand the importance of legal requirements and labour regulations

Construction Contracts- Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

Tenders - Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Transparency in Tenders Act.

Arbitration - Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of
Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

Legal Requirements - Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for

Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

Labour Regulations - Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration– Insurance and Safety Regulations – Workmen's Compensation Act – Indian Factory Act – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws

Text Books:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.TripathiPrivate Ltd., Bombay, 1982
2. CPWD Hand book.

References:

1. Jimmie Hinze, Construction Contracts, Second Edition, McGraw Hill, 2001
2. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects,Sixth Edition, McGraw Hill, 2000.

Course Outcomes:

1. Able to understand the imporatance of legal tenders, contracts, other legal requirements and labour regulations

CE448 FUNDAMENTALS OF NANOSCIENCE

Course Objectives:

1. To study the fundamentals of nanoparticles and its properties
2. To know the applications of nanoscience
3. To study about the analysis techniques

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology andEngineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular BeamEpitaxy, Atomic Layer Epitaxy, MOMBE.

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wetetching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

Clean rooms: specifications and design, air and water purity, requirements for particularprocesses, Vibration free environments: Services and facilities required. Working practices,sample cleaning, Chemical purification, chemical and biological contamination, Safety issues,flammable and toxic hazards, biohazards.

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques.AFM, SPM, STM, SNOM, ESCA, SIMS - Nano indentation

Text Books:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

References:

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
2. AkhleshLakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Course Outcomes:

1. Able to understand the fundamentals of nanoscience
2. Able to know the applications of nanoscience

CE449 REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

Course Objectives:

1. To know about repair materials
2. To assess the condition of structure
3. To know the rehabilitation methods and strategies

Introduction to Rehabilitation: An overview of present repair practices - distress identification and repair management - Causes of distress in concrete structures-Holistic Models for deterioration of concrete - Condition Survey- Definition, objectives, different stages-Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy

Non Destructive and Destructive Testing Methods: Non-Destructive evaluation tests - Concrete strength assessment - Rebound hammer test - Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing

Chemical tests - Carbonation tests and chloride content, Corrosion potential assessment - cover meter survey, half cell potentiometer test, resistivity measurement, Discussion of case studies of RCC buildings subjected to distress - Identification and estimation of damage. Evaluation of Structural properties.

Repair/ Rehabilitation methods and strategies: Rehabilitation and retrofitting methods-repair options, performance requirements of repair systems, important factors to be considered for selection of repair methods, Repair stages.

Repair/Rehabilitation strategies- Stress reduction technique, repair and strengthening of columns and beams, Compressive strength of concrete, cracks/joints, masonry, foundation, base isolation. Guidelines for repair and rehabilitation works.

Reference:

1. Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" RandD Centre (SDCPL), RaikarBhavan, Bombay, 1987.
2. Santhakumar A.R., "Concrete Technology" Oxford University Press, 2007, New Delhi
3. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt of India Press, New Delhi

Course Outcomes:

1. Able to assess the condition of structure
2. Able to know about repair and rehabilitation methods

CE450 ENGINEERING ECONOMICS

Course Objectives:

1. To introduce basics of economics
2. To study about value engineering
3. To know about replacement and maintanence analysis
4. To study the concept of depriciation

Introduction to Economics - Flow in an Economy, Law of Supply and Demand, Concept of Engineering Economics - Engineering Efficiency, Economic Efficiency, Scope of Engineering Economics, Elements of Costs, Marginal Cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-Even Analysis, P/V ratio, Elementary Economics Analysis- Material selection for product, Design selection for a product, Building material selection, Process Planning

Make or Buy Decision, Value Engineering-Function, Aims, Value Engineering procedure, Interest Formulas and their Applications - Time Value of Money, 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, Uniform Gradient Series Annual Equivalent Factor, Effective Interest Rate, Examples in all the methods.

Methods of Comparison of Alternatives- Present Worth Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Future Worth Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Annual Equivalent Method (Revenue Dominated Cash Flow Diagram, Cost Dominated Cash Flow Diagram), Rate of Return Method, Examples in all the methods

Replacement and Maintenance Analysis- Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, Replacement of an Asset with a New Asset - Capital Recovery with Return and Concept of Challenger and Defender, Simple Probabilistic Model for items which fail completely.

Depreciation - Introduction, Straight Line Method of Depreciation, Declining Balance, Method of Depreciation, Sum-of-the-Years-Digits Method of Depreciation, Sinking Fund Method of Depreciation/Annuity Method of Depreciation, Service Output Method of Depreciation, Evaluation of Public Alternatives-Introduction, Examples, Inflation Adjusted Decisions- Procedure to Adjust Inflation, Examples on comparison of alternatives and Determination of Economics Life of asset.

Course Outcomes:

1. Able to understand the concepts of depreciation and value engineering
2. Able to know about replacement and maintenance analysis
3. Able to know about basic terms in economics

Text Books:

1. Pannerselvam, R., Engineering Economics, Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.

Reference Books:

1. Degarmo, E.P., Sullivan, W.G. and Canada, J.R.. Engineering Economy, Macmillan, New York, 1984.
2. Grant, E.L., Ireson,.W.G. and Leavenworth, R.S., Principles of Engineering Economy, Ronald Press, New York, 1976.
3. Smith G.W. En :'Engineering Economics, Iowa State Press, Iowa, 1973

GLOBAL ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

CE351 ARCHITECTURAL HERITAGE OF INDIA

Course Objectives:

1. To know the architectural history of India
2. To know about the materials and construction style of various civilisations

Indus valley civilisation-Chronological introduction-Construction style - Materials used-The cities Harappa, lothal and Mohenjodaro, The great bath-The granary at Harappa-The assembly hall- Ajanta-Ellora Cave temples-Mahabodhi temple complex

Chera-Chola-Pandya architecture-Chronological introduction- construction style - materials used-Brihadeeswarar Temple-Meenakshi Temple- Kalinga-Chalukya –Pallava-architecture-Mahabalipuram stone temples-Khajuraho- MuskinBhanvi- Konark Sun Temple-Hoysala-Vijayanagara architecture-twin temples Mosale-Virupaksha temple Raya Gopura at Hampi

Mughal architecture-Chronological introduction- Construction style-Materials used-QutubMinar-TajMahal- Humayun's Tomb-Redfort-FatehpurSikri-Agra fort-Jama Masjid-Rajput civil architecture-Chronological introduction- Construction style-Materials used-All hill forts of Rajasthan

British colonial architecture-Chronological introduction-Construction style - Materials used-Buildings in Chennai, Mumbai, Shimla-Churches-Mountain railways of India-bridges.

Other colonial architecture-Portuguese-Dutch-French-Danish-Chronological introduction-Construction style - Materials used-Churches-Churches and Convents of Goa and Cochi-French town of Puducherry-Tranquebar fort – Bungalow on the beach

References:

1. Introduction to Indian architecture, BindiaThapar, SuparnaBhalla, Surat Kumar Manto, Periplus Asian Architecture Series, 2004.

Course Outcomes:

1. Able to understand the history and importance of architecture in various civilisations
2. Able to study about various materials used and construction style

CE352 GLOBAL WARMING AND CLIMATE CHANGE

Course Objectives:

1. To know the causes and effects of global warming
2. To know the agreements took place among the countries regarding climate change

Global warming-Causes of global warming-Greenhouse gases-Deforestation and global climate phenomena

Carbon dioxide and climate change-Methane and climate change-Nitrous oxide and climate change-Chlorofluorocarbons and climate change

Ozone layer, depletion and consequences-Methyl bromide and ozone depletion- El Nino and global climate change pattern

Zero waste, recycling the waste products and effects in climate change- Consequences of global warming

Convention on climate change-Kyoto protocol- Montreal protocol-Paris agreement

References:

1. Global Warming and Climate Change: Past, Present & Future,S.K. Agarwal, P H Publishing Corporation, 2013.

Course Outcomes:

1. Able to know the causes and effects of global warming
2. Able to know about international agreements

CE353 DESIGN OF SUSTAINABLE BUILDING

Course Objectives:

1. To study about sustainable building concepts
2. To know about energy conservation inside building
3. To introduce Energy efficient and green building concepts

Introduction - Life Cycle impacts of materials and products – sustainable design concepts – strategies of Design for the Environment -The sun-earth relationship and the energy balance on the earth's surface, climate, wind – Solar radiation and solar temperature – Sun shading and solar radiation on surfaces – Energy impact on the shape and orientation of buildings – Thermal properties of building materials.

Energy Efficient Buildings - Passive cooling and day lighting – Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency – Energy audit and energy targeting- Technological options for energy management.

Indoor Environmental Quality Management - Psychrometry- Comfort conditions- Thermal comfort- Ventilation and air quality-Air conditioning requirement- Visual perception- Illumination requirement- Auditory requirement- Energy management options- -Air conditioning systems- Energy conservation in pumps- Fans and blowers- Refrigerating machines- Heat rejection equipment- Energy efficient motors- Insulation.

Green building concept - Green building rating tools- Leeds and IGBC codes. – Material selection - Embodied energy- Operating energy- Façade systems- Ventilation systems- Transportation- Water treatment systems- Water efficiency- Building economics

Case study: Students to work through a controlled process of analysis and design to produce drawings and models of their own personal green building project. Topics include building form, orientation and site considerations; conservation measures; energy modeling; heating system and fuel choices; renewable energy systems; material choices; and construction budget-Students will research green construction and design in a particular –construction context and report their results to the class.

Textbooks:

1. Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005
2. Edward G Pita, "An Energy Approach- Air-conditioning Principles and Systems", Pearson Education, 2003.

References:

1. Colin Porteous, "The New Eco-Architecture", Spon Press, 2002.
2. Energy Conservation Building Codes: www.bee-india.nic.in
3. Lever More G J, "Building Energy Management Systems", E and FN Spon, London, 2000.
4. Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.
5. John Littler and Randall Thomas, "Design with Energy: The Conservation and Use of Energy in Buildings", Cambridge University Press, 1984.

Course Outcomes:

1. Able to understand green building concepts with case studies
2. Able to know the importance of energy efficient buildings

CE451 ENVIRONMENTAL MANAGAMENT

Course Objectives:

1. To learn the importance of environmental impact assessment in various development projects
2. To understand the legal provisions on EIA and EIA notifications
3. To brief the various methodologies involved in environmental impact assessment
4. To identify the prediction tools for the assessment of different environmental impacts
5. To describe the concepts of environmental management system

Environmental Management: Principles of Environmental Management – Ecosystem Concepts- Environmental concerns in India Policy and Legal Aspects of EM - Introduction to Environmental Policies - Environmental Laws and Legislations - Environmental Legislation in India.

Environmental Impact Assessment (EIA) - Impact Prediction, Evaluation and Mitigation- Forecasting Environmental Changes. Strategic Environmental Assessment (SEA)- Environmental Clearance Procedure in India- EIA Documentation and Processes. Environmental Clearance Procedure in India. EIA Documentation and Processes. EIA Monitoring and Auditing

Environmental Audit - Environmental management system audits as per ISO 19011- 2011 – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit

Life Cycle Assessment (LCA) - Stages in LCA of a Product. Procedures for LCA - Different Applications of LCA .

Environmental Management System - EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence-communication – documentation and document control – operational control – monitoring and measurement – management review.

Environmental Design - ED for Manufactured Products - ED for Buildings - ED for Developmental Planning - Environmental Economics - Economics and the Environment - Environmental Valuation - Economics of Natural Resources - Environmental and Regional Economics - Ecological Economics

Text Books:

1. Walter Klopffer and Birgit Grahl, Life Cycle Assessment(LCA): A guide to Best practice, Wiley-VCH, 2014
2. Vijay Kulkarni and Ramachandra T.V., Environmental Management, Commonwealth of Learning, Canada and Indian Institute of Science, Banglore, 2006

References:

1. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
2. Murali Krishna I.V., Valli Manickam, Environmental Management – Science and Engineering for Industry, Butterworth-Heinemann, 2017

Course Outcomes:

1. Able to analyse the environmental impacts of proposed projects
2. Able to categorize the type of EIA required for proposed projects
3. Able to predict and assess the impact of proposed projects on the environment
4. Able to use mathematical tools to predict the environmental impacts
5. Able to propose proper mitigation measures to avoid environmental impacts
6. Able to summarise the EIA report with suitable environmental management plan

CE452 DISASTER MANAGEMENT

Course Objectives:

1. To study about the disaster and their assessment
2. To know about management and mitigation

Cyclones: Formation, Cyclonic precipitation, anti-cyclones.

Flood: Flood and its estimation, Flood warning, Flood protection measures.

Earthquake: Causes of earthquake, plate tectonics, seismic zoning map, Characteristics of strong ground motions & attenuation, progressive collapse of structures, damage assessment, rehabilitation and retrofitting of structures.

Environmental disaster: Impact assessment studies, computation and preparedness.

Disaster management: Developing appropriate technology for disaster mitigation, Role of management teams, importance of awareness, alertness and preparedness camp.

Hazard resistant design of structures.

Text Books:

1. K. C. Patra, Hydrology and Water Resources Engineering, CRC Press, Florida, USA, 2nd Edition
2. N. Sharma, Earthquake resistant building construction, S. K. Kataria & Sons, New Delhi.

References:

1. K. Subramanian, Engineering Hydrology, Tata McGraw Hill, New Delhi.
2. V. P. Singh, Elementary Hydrology, Prentice Hall of India.
3. P. C. Sinha, Disaster Mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd.
4. D. P. Coppola, Introduction to International Disaster Management, Butterworth-Heinemann.
5. F. B. Friedman, Practical Guide to Environmental Management, McGraw Hill.

Course Outcomes:

1. Able to design hazard resistant structures
2. Able to manage during disasters