

**DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY
LUCKNOW**



**Study & Evaluation Scheme with Syllabus
for
B.Tech. Second Year
Civil Engineering
On
Choice Based Credit System
(Effective from the Session: 2017-18)**

2nd Year III-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	ROE030 to 039/ RAS301	Science Based Open Elective/ Mathematics-III	3-1-0	70	20	10	100	4
2.	RVE301/ RAS302	Universal Human Values & Professional Ethics/ Environment & Ecology	3-0-0	70	20	10	100	3
3.	RME303	Mechanics of Solids	3-0-0	70	20	10	100	3
4.	RCE301	Building Materials & Construction	3-1-0	70	20	10	100	4
5.	RCE302	Surveying	3-0-0	70	20	10	100	3
6.	RCE303	Fluid Mechanics	3-0-0	70	20	10	100	3
7.	RCE351	Building Materials Lab	0-0-2	50	30	20	100	1
8.	RCE352	Surveying Lab	0-0-2	50	30	20	100	1
9.	RCE353	Fluid Mechanics Lab	0-0-2	50	30	20	100	1
10.	RCE354	Computer Based Statistical & Numerical Techniques Lab	0-0-2	50	30	20	100	1
11.	RME101*	Elements of Mechanical Engineering*	3-1-0	70	20	10	100*	--
12.	RCE151*	Computer Aided Engineering Graphics*	0-0-3	50	30	20	100*	--
Total							1000	24

CT: Class Test

TA: Teacher Assessment

L/T/P: Lecture/ Tutorial/ Practical

***B.Tech. IInd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects RCE151/RCE251 and RME101/201 of the first year Engineering Programme along with the second year subjects.**

Science Based Open Electives:

- a. ROE030/ROE040 Manufacturing Process
- b. ROE031/ROE041 Introduction to soft computing
- c. ROE032/ROE042 Nano Science
- d. ROE033/ROE043 Laser System and Application
- e. ROE034/ROE044 Space Science
- f. ROE035/ROE045 Polymer Science & Technology
- g. ROE036/ROE046 Nuclear Science
- h. ROE037/ROE047 Material Science
- i. ROE038/ROE048 Discrete Mathematics
- j. ROE039/ROE049 Applied Linear Algebra

2nd Year IV-SEMESTER

S. No.	Subject Code	Subject Name	L-T-P	ESE Marks	Sessional		Total	Credit
					CT	TA		
1.	RAS401/ ROE040 to 049	Mathematics-III/ Science Based Open Elective	3-1-0	70	20	10	100	4
2.	RAS402/ RVE401	Environment & Ecology/ Universal Human Values & Professional Ethics	3-0-0	70	20	10	100	3
3.	RCS405	Data Structures	3-0-0	70	20	10	100	3
4.	RCE401	Hydraulics & Hydraulic Machines	3-0-0	70	20	10	100	3
5.	RCE402	Geoinformatics	3-0-0	70	20	10	100	3
6.	RCE403	Structural Analysis	3-1-0	70	20	10	100	4
7.	RCE452	Geoinformatics Lab	0-0-2	50	30	20	100	1
8.	RCE453	Structural Analysis Lab	0-0-2	50	30	20	100	1
9.	RCE454	Building Planning & Drawing Lab	0-0-2	50	30	20	100	1
10.	RCE455	Hydraulics & Machine Lab	0-0-2	50	30	20	100	1
11.	RME201*	Elements of Mechanical Engineering*	3-1-0	70	20	10	100*	--
12.	RCE251*	Computer Aided Engineering Graphics*	0-0-3	50	30	20	100*	--
Total							1000	24

CT: Class Test

TA: Teacher Assessment

L/T/P: Lecture/ Tutorial/ Practical

***B.Tech. IInd year lateral entry students belonging to B.Sc. Stream, shall clear the subjects RCE151/RCE251 and RME101/201 of the first year Engineering Programme along with the second year subjects.**

Industrial Training:

Students will go for Industrial Training of 8-10 weeks in total in two parts (Industrial Training-1 & Industrial Training-2) which is to be evaluated in VII semester after submission of separate training report for each part.

Industrial Training-1: Students will go to Industrial Training-1 of 4 weeks after IV semester which will be evaluated in VII semester.

Science Based Open Electives:

- ROE030/ROE040 Manufacturing Process
- ROE031/ROE041 Introduction to soft computing
- ROE032/ROE042 Nano Science
- ROE033/ROE043 Laser System and Application
- ROE034/ROE044 Space Science
- ROE035/ROE045 Polymer Science & Technology
- ROE036/ROE046 Nuclear Science
- ROE037/ROE047 Material Science
- ROE038/ROE048 Discrete Mathematics
- ROE039/ROE049 Applied Linear Algebra

RCE301: BUILDING MATERIALS & CONSTRUCTION

UNIT I

Scope of Study of building Materials: building materials and their performance, economics of the building materials. **Stones:** Requirement of good building stone, characteristics of building stone sand their testing. Common building stones. Methods of preservation of stones. **Bricks:** Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles. **Gypsum:** properties of gypsum plaster, building products made of gypsum and their uses. **Lime:** Manufacture of lime, classifications of limes, properties of lime. **Cement:** Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of cement. **Cement Concrete:** Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete. **Pozzolona:** Chemical composition and requirements for uses, Natural and Artificial flyash, Surkhi(burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction. **Timber:** Classification and identification of timber, Fundamental Engineering Properties of timber, Defects in timber, Factor saffecting strength of timber, Methods of seasoning and preservation of timber. Wood based products. **Asphalt:** Bitumen and Tar: Terminology, specifications and uses, Bituminous materials.

UNIT II

Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction. **Paint svernishes and distempers:** Common constituents, types and desirable properties, Cement paints. **Ferrous metals:** Desirable characteristics of reinforcing steel. Principles of cold working. Reinforcings telemechanical and physical Properties chemical composition. Brief discussion on properties and uses of Aluminum and lead. **Glass:** Ingredients, properties types and use in construction. **Insulating Materials:** Thermal and sound insulating material, desirable properties and types.

UNIT III

Buildings: Components of building, area considerations, Construction Principle and Methods for layout, Damp proofing, antitermite treatment in buildings, Vertical circulation means: stair cases and their types, design and construction. Different types of floors, and flooring materials (Ground floor and upper floors). Bricks and stone masonry construction. Cavity wall & hollow block construction.

UNIT IV

Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning.

UNIT V

Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance.

References:

1. SK Duggal, "Building Materials" New Age International
2. Purushothama Raj, "Building Construction Materials & Techniques" Pearson Edu.
3. PC Varghese, "Building Materials" PHI
4. Rangwala, "Building Materials" Charotar Publishing House.
5. Sushil Kumar, "Building Construction" Standard Publisher.
6. Domone, "Construction Materials" 4/e, CRC Press Taylor & Francis Group.
7. Adams, "Adams' Building Construction Adams" CRC Press Taylor & Francis Group.
8. BC Punmia, "Building Construction" Laxmi Publication.
9. Jha & Sinha, "Building Construction" Khanna Publishers
10. Sahu, "Building Materials and Construction" Mc Grew Hill Education
11. Deodhar, "Civil Engineering Materials" Khanna Publishers
12. Mehta, "Building Construction Principles, Materials & Systems" 2/e, Pearson Education Noida.
13. Sandeep Mantri, "Practical building Construction and its Management" Satya Publisher, New Delhi.

RCE302: SURVEYING

UNIT I

Surveying: definition, divisions, classification and principles of surveying. Scales: plain, vernier, diagonal, plan and map. Accuracy and errors: definitions, sources and kinds of errors, application of probability for computation of errors, laws of weights.

UNIT II

Linear measurement: chain and tape surveying, types of chain and tape, ranging, obstacles and tape correction. Compass surveying: Measurement of directions, Reference meridians, bearing and azimuths, local attraction. Theodolite survey: Vernier theodolite, Measurements of horizontal and vertical angles, Horizontal Control, working of Electronic Theodolites.

UNIT III

Leveling: Methods of determining elevations, Direct levelling- basic terms and definitions, principle, booking and reduction of field notes, curvature and refraction correction, use of Automatic level, Digital Level, Vertical Control. Contouring: contours, contour interval, horizontal equivalent, characteristics, methods and interpolation, use to prepare profiles. Tachometry: Principles of stadia systems, subtense bar and tangential methods.

UNIT IV

Traversing and triangulation: Principles of traversing by compass and theodolite, computations of traverse coordinates, omitted measurements, Principles and classification of triangulation systems, strength of figures, satellite stations, and triangulation field work. Introduction to modern surveying Instruments /Techniques like total station.

UNIT V

Elements of simple circular curves, theory and methods of setting out simple circular curves, transition curves- types and their characteristics, ideal transition curve, equations of various transition curves, Introduction to vertical curves. Survey Layout for culverts, canals, bridges, road/railway alignment and buildings.

References:

1. Schofield, "Engineering Surveying" 6/e, CRC Press Taylor & Francis Group.
2. BC Punamia et al: Surveying Vol. I, II, Laxmi Publication
3. Bannister, "Surveying" 7/e, Pearson Education, Noida.
4. AM Chandra: Plane Surveying, Higher Surveying, Narosa Pub.
5. AK Dey Plain Survey, S Chand
6. SK Duggal: Surveying Vol. I, II.
7. R Subramanian : Surveying & Leveling , Oxford University Press
8. C Venkatramaih : Text Book of Surveying , University Press
9. Charles D. Ghilani, Elementary Surveying Pearson Education
10. R. Agor, "Surveying and Levelling" Khanna Publishers.

RCE303: FLUID MECHANICS

UNIT I

Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density-height relationship, manometers, pressure transducers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

UNIT II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential.

UNIT III

Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks.

UNIT IV

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub-layer, separation and its control.

UNIT V

Drag and lift, drag on a sphere, a two dimensional cylinder, and an aerofoil, Magnus effect. Similarity Laws: geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance.

References :

1. Hibbler, "Fluid Mechanics in SI Units" 1/e Pearson Education, Noida.
2. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley & Sons Pvt Ltd,
3. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
4. Katz, "Introductory Fluid Mechanics" Cambridge University Press
5. Pnueli & Gutfinger, "Fluid Mechanics" Cambridge University Press
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. Gupta, "Fluid Mechanics & Hydraulic Machines" Pearson Education, Noida
8. Graebel, "Engineering Fluid Mechanics", CRC Press Taylor & Francis Group.
9. Janna, "Introduction to Fluid Mechanics" 4/e, CRC Press Taylor & Francis Group.
10. AK Jain "Fluid Mechanics" Khanna Publication.
11. White, F.M. "Fluid Mechanics" TMH, New Delhi.
12. Munson et al, "Fundamental of Fluid Mechanics" Wiley Newyork Ltd

13. Garde, R.J., “ Fluid Mechanics”, SciTech Publications Pvt. Ltd
14. I.H. Shames, “Mechanics of Fluids”, McGraw Hill, Int. Student.
15. RK Bansal “Fluid Mechanics and Hydraulic Machines” Laxmi Publication
16. Jagdish Lal “Fluid Mechanics”
17. N Narayan Pillai “ Principles of Fluid Mechanics & Fluid Machines” Universities Press.
18. Esposito, Fluid Power & Applications” 7/e Pearson Education, Noida.
19. DR Malhotra & Malhotra, “Fluid Mechanics Hydraulics & Hydraulic Machines” Satya Prakashan, New Delhi.

RCE351/ RCE451: BUILDING MATERIALS LAB

Testing of various properties of following materials as per BIS specifications

I. Cement

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier’s apparatus.
5. Soundness of cement.
6. Tensile strength

II. Coarse Aggregate

1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity & bulk density
4. Grading of aggregates.

III Fine Aggregate:

1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand

IV Bricks:

1. Water absorption.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence

RCE352: SURVEYING LAB

1. To prepare conventional symbol chart based on the study of different types of topographical maps.
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
3. To find out reduced levels of given points using Auto/dumpy level.
4. To perform fly leveling with Auto/tilting level.
5. To study parts of a Vernier theodolite and measurement of horizontal and vertical angle.
6. To measure horizontal angle between two objects by repetition/reiteration method.
7. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometrical leveling by taking observations in single vertical plane.
8. To study various parts of Electronic Theodolite, Total Station and practice for measurement of distance, horizontal and vertical angles.
9. To set out a simple circular curve by Rankine's method.
10. To plot contour map of given area.

RCE353: FLUID MECHANICS LAB

Note: Ensure to conduct at least 10 experiments from the list:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. To draw a flow-net using Electrical Analogy Method.
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement
13. To determine the head loss for a sudden Contraction.

RCE354: COMPUTER BASED STATISTICAL & NUMERICAL TECHNIQUES LAB

Write computer program in C/C++ /visual basic for mathematical and engineering solutions.

1. Write a code for finding out the root of the algebraic and transcendental equations using Newton-Raphson's iterative method.
2. Write a computer program for inversion of matrix.
3. Write a computer program for Eigen value solution of matrix.
4. Write a computer program for Runge Kutta fourth order method (RK4) to solve ordinary differential equation.
5. Write a computer program to find the engineering properties of I and channel sections.
6. Write a computer program to solve simultaneous linear equations.
7. Write the program to implement the Gauss forward interpolation formula and backward interpolation formula.
8. Write code for one dimensional heat equation and one dimensional fluid flow problem (boundary value problem).

RCE401: HYDRAULICS & HYDRAULIC MACHINES

UNIT I

Introduction : Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels critical, sub-critical and super-critical type of flows. Critical depth, concepts of specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section, compound sections.

UNIT II

Energy-Depth relationship: Application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods.

UNIT III

Rapidly varied flow: hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds. Open channel surge, celerity of the gravity wave, deep and shallow water waves, Rectangular free overfall.

UNIT IV

Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates. **Pumps:** Positive displacement pumps - reciprocating pumps - operating principles -slip - indicator diagram - separation- air vessels. centrifugal pumps - operation - velocity triangles - performance curves - Cavitation - Multi staging - Selection of pumps.

UNIT V

Rotodynamic Machines, Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves.

References:

1. Chow, V.T. "Open Channel hydraulics" McGraw Hill Publication
2. Subramanya, K., Flow through Open Channels, TMH, New Delhi
3. Ranga Raju, K.G., Flow through open channels, T.M.H. New Delhi
4. Rajesh Srivastava, Flow through Open Channels , Oxford University Press
5. Streeter, V.L.& White E.B., "Fluid Mechanics" McGraw Hill Publication
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
8. AK Jain "Fluid Mechanics" Khanna Publication.
9. Houghtalen, "Fundamentals of Hydraulics Engineering Systems" 4/e Pearson Education, Noida.

RCE402: GEOINFORMATICS

UNIT I

Photogrammetric Survey, basic principles, elevation of a point, determination of focal length of lens, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, scale of a tilted photograph, tilt distortion, relief displacement of a tilted photograph, combined effects of tilt and relief, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope parallax, parallax in aerial stereoscopic views, parallax equations. Photogrammetry – analog, analytical and digital photogrammetry.

UNIT II

Remote Sensing, Introduction, concepts and physical basis of Remote Sensing, Electromagnetic spectrum, radiation laws, atmospheric effects, image characteristics. Remote sensing systems; sources of remote sensing information, spectral quantities spectral signatures and characteristics spectral reflectance curves for rocks, soil, vegetation and water. Introduction to Aerial and space borne platforms. Optical, thermal and microwave sensors and their resolution, salient features of some of operating Remote Sensing satellites.

UNIT III

Digital image processing: introduction, image rectification and restoration, image enhancement, image transformation, manipulation, image classification, fusion. Applications of remote sensing to civil engineering.

UNIT IV

GIS system: Definition terminology and data types, basic components of GIS software, data models, data acquisition, both raster based and vector based data input and data processing and management including topology, overlaying and integration and finally data product and report generation. GIS applications in civil engineering.

UNIT V

Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications.

References:

1. Sateesh Gopi, R Sathkumar & N Madhu “Advanced Surveying GIS & Remote Sensing” Pearson Education.
2. Kang Tshung Chang “Introduction of Geographic Information Systems” TMH.
3. Campbell, “Introduction to Remote Sensing” 3/e, CRC Press Taylor & Francis Group.
4. Chen, “Signal and Image Processing for Remote Sensing” CRC Press Taylor & Francis Group.
5. A M Chandra: Higher Surveying Narosa Pub.
6. B C Punamia: Higher Surveying Laxmi Publication
7. T M Lillesand et al: Remote Sensing & Image Interpretation
8. R. Agor, “Advanced Surveying” Khanna Publishers.
9. B. Bhatta: Remote Sensing & GIS TMH.
10. M Anjireddy: Remote Sensing & GIS, BS Publications
11. Narayan Panigrahi “Geographical Information Science” Universities Press.

12. N K Agarwal: Essentials of GPS, Spatial Networks: Hyderabad.
13. George Joseph "Fundamental of Remote Sensing" Universities press.
14. GS Srivastava "An Introduction to Geoinformatics" TMH.
15. Ahmed EI Rabbany, "Introduction to GPS The Global Positioning System" Artech House, Boston.
16. Chor Pang Lo, "Concepts & Techniques of Geographic Information Systems" 2/e, Pearson Education

RCE403: STRUCTURAL ANALYSIS

UNIT I

Classification of Structures, Types of structural frameworks and Load transfer Mechanisms, stress resultants, degrees of freedom, Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of cables with concentrated and continuous loadings, Effect of Temperature upon length of cable.

UNIT II

Classification of Pin jointed determinate trusses, Analysis of determinate plane trusses (compound and complex). Method of Substitution, Method of tension coefficient for analysis of plane trusses.

UNIT III

Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's theorems, Calculations of deflections: Strain Energy Method, unit load method & for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method.

UNIT IV

Rolling loads and influence line diagrams for determinate beams and trusses, Absolute maximum bending moment and shear force. Muller-Breslau's principle & its applications for determinate structures.

UNIT V

Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch.

References

1. Hibbler, "Structural Analysis", Pearson Education
2. Mau, "Introduction to Structural Analysis" CRC Press Taylor & Francis Group.
3. Ghali, "Structural Analysis: A Unified Classical and Matrix Approach" 5/e, CRC Press Taylor & Francis Group.
4. T S Thandavmorthy, "Analysis of Structures", Oxford University Press 5. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
5. Temoshenko & Young "Theory of Structure" Tata Mc Grew Hill.
6. Reddy, CS, "Basic Structural Analysis", Tata McGraw Hill.
7. Jain, OP and Jain, BK, "Theory & Analysis of Structures ". Vol.I & II Nem Chand.
8. Vazirani & Ratwani et al, "Analysis of Structures", Khanna Publishers
9. Coates, RC, Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980.
10. SP Gupta & Gupta "Theory of Structure Vol.1 & 2" TMH
11. DS Prakash Rao "Structural Analysis: A Unified Approach" Universities Press.
12. S Ramamurtham "Theory of Structure" Dhanpat Rai.
13. Devdas Menon "Advanced Structural Analysis" Narosa
14. Wang, CK, "Intermediate Structural Analysis", Tata Mc-Graw Hill.
15. Hsieh, "Elementary Theory of Structures" 4/e, Pearson Education, Noida.
16. Mckenzie, "Examples in Structural Analysis" 2/e, CRC Press Taylor & Francis

Group.

17. Bibek Kumar Mukherjee, "Theory and Analysis of Structures" Satya Prakashan, New Delhi.
18. Jacques Heyman, "Structural Analysis" Cambridge University Press.

RCE452: GEOINFORMATICS LAB

1. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angles and coordinates.
2. Measurement of area of a land parcel using Total Station.
3. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations.
4. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
5. Visual Interpretation of standard FCC (False colour composite).
6. Digitization of physical features on a map/image using GIS software.
7. Coordinates measurement using GPS.

RCE453: STRUCTURAL ANALYSIS LAB

1. To determine Flexural Rigidity (EI) of a given beam
2. To verify Maxwell's Reciprocal theorem.
3. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
4. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
5. To find deflection of curved members.
6. To find bar forces in a three members structural frames with pin jointed bar
7. To find Critical load in Struts with different end conditions.
8. To find deflections in Beam having unsymmetrical bending.

RCE454: BUILDING PLANNING & DRAWING LAB

Drawing and drafting of following with CAD software

1. Introduction to the tools and commands of drafting software.
2. Working in layers, blocks, x-ref, drawing layout and print setup.
3. 3D drafting and rendering
4. Planning and drafting of elevation and cross section of door and window
5. Planning and drafting of plan and cross section of Dog legged and open well staircase.
6. Planning and Drawings of Residential building of 1 room set (plan and section).
7. Planning and drawing of 3 room residential building with staircase.
8. Preparation of details general arrangement drawing of 4 room duplex house including planning and drafting.

RCE455: HYDRAULICS & MACHINE LAB

Note: Ensure to conduct at least 10 experiments from the list:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study centrifugal pump and their characteristics
8. To study characteristics of Pelton Turbine.
9. To study characteristics Francis Turbine.
10. To study characteristics of Kaplan Turbine.
11. To study the free overfall phenomenon in an open channel and to determine the end depth
12. To determine coefficient of discharge for given rectangular notch.
13. To determine coefficient of disc.

**DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY,
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PROPOSED STUDY & EVALUATION SCHEME

FOR

B. TECH. THIRD YEAR

(CIVIL ENGINEERING)

On

Choice Based Credit System

FIFTH SEMESTER

CIVIL ENGINEERING

SESSION 2018-19

Sl No.	Subject Code	Subject Name	Teaching Deptt.	L-T-P	Th/Lab Marks	Sessional		Total	Credit
					ESE	CT	TA.		
1	RAS501	MANEGIRIAL ECONOMICS	Applied Science	3—0---0	70	20	10	100	3
2	RAS-502/ RUC501	SOCIOLOGY /CYBER SECURITY	Applied Science	3—0---0	70	20	10	100	3
3	RCE501	GEOTECHNICAL ENGINEERING	Core Deptt.	3—0---0	70	20	10	100	3
4	RCE502	DESIGN OF STRUCTURE-I	Core Deptt.	3—1---0	70	20	10	100	4
5	RCE503	QUANTITY ESTIMATION AND MANAGEMENT	Core Deptt.	3—0---0	70	20	10	100	3
6	RCE051 RCE052 RCE053	ELECTIVE -1 MODERN CONSTRUCTION MATERIALS CONCRETE TECHNOLOGY GEOENVIRONMENTAL ENGINEERING	Core Deptt.	3—1--0	70	20	10	100	4
7	RCE551	GEOTECHNICAL ENGINEERING LAB	Core Deptt.	0—0---2	50		50	100	1
8	RCE552	CAD LAB-1	Core Deptt.	0—0---2	50		50	100	1
9	RCE553	CONSTRUCTION MANAGEMENT LAB	Core Deptt.	0—0---2	50		50	100	1
10	RCE554	CONCRETE LAB	Core Deptt.	0—0---2	50		50	100	1
	TOTAL				620	120	260	1000	24

RCE 501 GEOTECHNICAL ENGINEERING

(L-T-P 3-0-0) Credit - 3

Unit 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system. **[8]**

Unit 2

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil. Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping; **[8]**

Unit 3

Soil compaction, water content – dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method. Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation, Contact pressure **[8]**

Unit 4

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients. Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and $c-\phi$ soils, inclined backfill, Graphical methods of earth pressure determination, Stability of slopes, Culman method & Method of slices, Stability number & chart. **[8]**

Unit 5

Sub surface structure: Bearing capacity of shallow foundations, SPT, Plate load test; Effect of water table. Deep foundations: Types of piles, Static and dynamic formulae, Pile group, Settlement of Pile Group, Negative skin friction. **[8]**

Text & References Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, “Soil Mechanics & Foundation Engineering”, John Wiley & Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.

4. Alam Singh – Modern Geotechnical Engineering
5. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
6. I.H. Khan – Text Book of Geotechnical Engineering
7. C. Venkataramaiah – Geotechnical Engineering
8. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
9. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics
10. P. Purushottam Raj- Soil Mechanics and Foundation Engineering, Pearson Education in South Asia, New Delhi.
11. Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
12. Gulati, S.K., “Geotechnical Engineering” McGraw Hill Education (India), Pvt. Ltd., Noida.

RCE 502 DESIGN OF STRUCTURE 1

(L-T-P 3-1-0) Credit- 4

Unit – 1

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint by Slope-Deflection method, Moment Distribution method and Strain Energy method. **[8]**

Unit – 2

Muller-Breslau’s Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged and fixed arches, Influence line diagrams for maximum bending moment, Shear force and thrust in two hinge arches. Analysis of two and three hinged stiffening girders. **[8]**

Unit – 3

Introduction to Suspension Bridges, Analysis of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. **[8]**

Unit – 4

Basic Force and Displacement Matrix method for analysis of beams, frames and trusses. **[8]**

Unit – 5

Basics of Plastic Analysis. Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Single Storied Frames. **[8]**

References:

1. Jain, A. K., “Advanced Structural Analysis “, Nem Chand & Bros., Roorkee.
2. Hibbeler, R.C., “Structural Analysis”, Pearson Prentice Hall, Sector - 62, Noida-201309
3. C. S. Reddy “Structural Analysis”, Tata Mc Graw Hill Publishing Company Limited, New Delhi.

4. Timoshenko, S. P. and D. Young, "Theory of Structures", Tata Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
5. Dayaratnam, P. "Analysis of Statically Indeterminate Structures", Affiliated East-West Press.
6. Wang, C. K. "Intermediate Structural Analysis", Mc Graw-Hill Book Publishing Company Ltd.
7. Thandavamoorthy, T.S., "Structural Analysis" Oxford University Press, New Delhi.
8. Martin, H. C." Introduction to Matrix Methods of Structural Analysis", Mc-Graw Hill Book Publishing Company Ltd, New Delhi.
9. Mau, "Introduction to Structural Analysis" CRC Press Taylor & Francis Group.
10. Ghali, "Structural Analysis: A Unified Classical and Matrix Approach" 5/e, CRC Press Taylor & Francis Group.
11. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
12. Vazirani & Ratwani et al , "Analysis of Structures", Khanna Publishers
13. Coates, RC, Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980.
14. SP Gupta & Gupta "Theory of Structure Vol.1 & 2" TMH
15. DS Prakash Rao "Structural Analysis: A Unified Approach" Universities Press.
16. S Ramamurtham "Theory of Structure" Dhanpat Rai.
17. Devdas Menon "Advanced Structural Analysis" Narosa
18. Hsieh, "Elementary Theory of Structures" 4/e, Pearson Education, Noida.
19. Mckenzie, "Examples in Structural Analysis" 2/e, CRC Press Taylor & Francis Group.
20. R Agor, Structural Analysis, " Khanna Book Publishing.
21. Jacques Heyman, "Structural Analysis" Cambridge University Press.

RCE 503 QUANTITY ESTIMATION & MANAGEMENT (L-T-P 3-0-0) Credit - 3

UNIT I: Quantity Estimation for Buildings

Measurement units for various building materials, Centreline method, Long and short wall method of estimates, PWD schedule of rate, Delhi schedule of rate. [8]

UNIT II: Rate Analysis, Specification and Tenders

Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items. [8]

UNIT III: Elements of Management & Network Techniques

Project cycle, Organization, planning, scheduling, monitoring, updating and management system

in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques. [8]

UNIT IV: Equipment Management

Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunnelling Equipment [8]

UNIT V: Project Cost Management

Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison, present worth method Equivalent annual cost method, discounted cash flow method, Depreciation and break even cost analysis. [8]

References:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., "PERT and CPM Principles and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
4. Construction Management by Ojha
5. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
6. Construction Technology by Sarkar, Oxford
7. Delhi Schedule of Rates (latest version)
8. S V Deodhar and SC Sharma, "Construction Engineering and Management, Khanna Publishing house.

RCE 051 MODERN CONSTRUCTION MATERIALS (L-T-P 3-0-0) Credit - 3

Unit – 1

Introduction, properties and uses of modern building materials: fly ash bricks, soil - cement blocks, calcium silicate bricks, red mud jute fibre polymer composite (RFPC) , glass reinforced gypsum. [8]

Unit – 2

Introduction , properties and use of: geosynthetics, bituminous material, fire resistant materials (chemicals ,paints ,tiles ,bricks, glass),metals, light - weight concrete, mass concrete, waste material based concrete. [8]

Unit – 3

Introduction , properties and use of: Ferro cement & fibre reinforced concrete, different types of fibres, high density concrete, Nuclear concrete, heat resisting & refractory concretes, pre fabricated systems. [8]

Unit – 4

Introduction , properties and use of: Polymers, fibre reinforced polymers, polymer concrete composites (PCCs), sulphur concrete and sulphur - infiltrated concrete. [8]

Unit – 5

Introduction , properties and use of: Conventional and modern water proofing materials, Conventional and modern insulating materials(thermal, sound and electrical insulating materials).Concept of polymer floor finishes. [8]

Reference Book:

- 1) Ghambhir M.L."Concrete Technology" Tata McGraw Hill education private Limited.
- 2) A.R. Santhakumar, Concrete Technology, Oxford University Press.
- 3) Building Materials, P.C. Varghese, Prentice-Hall India.
- 4) Shetty, M. S., "Concrete Technology" S. Chand Publication.
- 5) Krishnaraju .N., Advanced Concrete Technology, CBS Published.
- 6) Materials Science and Engineering: An introduction, W.D. Callister, John Wiley.
- 7) Neville. A.M., Concrete Technology, Prentice Hall, Newyork.
- 8) Dr. U. K. Shrivastava, Building Materials Technology, Galgotia Publication pvt.ltd.
- 9) Materials Science and Engineering, V. Raghavan, Prentice Hall.
- 10) Properties of Engineering Materials, R.A. Higgins, Industrial Press.
- 11) Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press.
- 12) The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess, R.J. Gray & A. Bentur, Prentice Hall.
- 13) Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann.
- 14) The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin.
- 15) Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill.
- 16) S K Sharma, "Civil Engineering and construction material," Khanna Publuishing House.
- 17) Properties of concrete, A.M. Neville, Pearson.

Unit I

Cement: production, composition properties, types and cement chemistry. Introduction to supplementary cementitious materials. Aggregates: mineralogy, properties, test and standards. Quality of water for use in concrete. **[8]**

Unit II

Introduction & study of accelerators, retarders, water reducers, air entrainers, water proofers, super plasticizers. Study of supplementary cementing materials like fly ash, silica fume, ground granulated blast furnace slag, metakaoline and pozzolana; their production, properties and effect on concrete properties. **[8]**

Unit III

Principle of mix proportioning, properties related to mix design, Mix design method (IS method and ACI method). Mix design of concrete: packing density, Rheology, mix design examples. **[8]**

Unit IV

Concrete production, batching, mixing and transportation of concrete. Workability: test for workability of concrete (slump test, compacting factor test and Vee Bee test). Segregation and bleeding in concrete, curing of concrete and its methods. Determination of compressive and flexural strength as per BIS. Mechanical properties of concrete: elastic modulus, poisson's ratio, creep, shrinkage and durability of concrete. **[8]**

Unit V

Study and uses of high strength concrete, self compacting concrete, fiber reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. **[8]**

References

1. Neville, A.M. and Brooks, J.J., "CONCRETE TECHNOLOGY", ELBS.
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.
3. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.
4. Santha kumar, A.R; "Concrete Technology", Oxford University Press, New Delhi, 2007.
5. Gupta B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
6. Newman, K., "CONCRETE SYSTEMS in COMPOSITE MATERIALS".EDT BY L.Holliday. Elsevier Publishing Company. 1966.
7. Popovics. S., "FUNDAMENTALS OF PORTLAND CEMENT CONCRETE: A Quantitative Approach VOL 1 FRESH CONCRETE" JOHN WILEY & SONS.1982.

8. P.K. Mehta and Paulo J.M. Monteiro, "Concrete: microstructure, properties and materials", The Mc Graw Hill Companies.
9. Jayant D. Bapat (2013), Mineral admixtures in cement and concrete, Taylor and Francis group.
10. Concrete mix proportioning as per IS 10262:2009 – Comparison with IS 10262:1982 and ACI 211.1-91 M.C. Nataraja and Lelin Das
11. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
12. IS456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.

RCE 053 GEOENVIRONMENTAL ENGINEERING (L-T-P 3-0-0) Credit - 3

UNIT-1 Fundamentals of Geoenvironmental Engineering

Scope of geoenvironmental engineering - multiphase behaviour of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geoenvironment - case histories on geoenvironmental problems. [8]

UNIT-2 Soil-Water-Contaminant Interaction

Soil mineralogy characterization and its significance in determining soil behaviour – soil-water interaction and concepts of double layer, forces of interaction between soil particles, concepts of unsaturated soil, water flow in saturated and unsaturated zone, soil-water-contaminant interactions and its implications, factors effecting retention and transport of contaminants. [8]

UNIT-3 Waste Containment System

Evolution of waste containment facilities and disposal practices, Site selection based on environmental impact assessment ,different role of soil in waste containment, different components of waste containment system and its stability issues , property evaluation for checking soil suitability for waste containment . [8]

UNIT-4 Contaminant Site Remediation

Site characterization, risk assessment of contaminated site, remediation methods for soil and groundwater, selection and planning of remediation methods. [8]

UNIT-5 Advanced Soil Characterization

Contaminant analysis, water content and permeability measurements, electrical and thermal property evaluation, use of GPR for site evaluation, introduction to geotechnical centrifuge modeling. [8]

Text

1. Yong, R. N., "Geoenvironmental Engineering, Contaminated Soils, Pollutant Fate, and Mitigation" CRC Press, New York, 2001.
2. Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004.
3. Fredlund D.G. and Rahardjo, H., "Soil Mechanics for Unsaturated Soils" Wiley-Interscience, USA, 1993.
4. Mitchell, J. K., "Fundamentals of Soil Behaviour" Wiley, 2005.
5. Hillel D., "Introduction to Environmental Soil Physics" Academic Press, New York, 2003.
6. Rowe R.K., "Geotechnical and Geoenvironmental Engineering Handbook" Kluwer Academic Publications, London, 2000.
7. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000.

References

1. Hillel D., "Introduction to Soil Physics" Academic Press, New York, 1982.
2. Sparks, D.L., "Environmental Soil Chemistry" Academic Press, New York, 2002.
3. Bagchi, A., "Design of landfills and integrated solid waste management" John Wiley & Sons, Inc., USA, 2004.
4. Alvarez-Benedi J. and Munoz-Carpena, R., "Soil-Water-Solute Process Characterization: An Integrated Approach" CRC Press, New York, 2005.
5. Berkowitz, B. Dror, I. and Yaron, B., "Contaminant Geochemistry" Springer, Germany, 2008.
6. Mohamed, A. M. O., "Principles and Applications of Time Domain Electrometry in Geoenvironmental Engineering" Taylor and Francis, New York, 2006.
7. O P Gupta, Elements of land and soil pollution, Khanna Publishing House

RCE-551 GEOTECHNICAL ENGINEERING LAB

(L-T-P 0-0-2) Credit- 1

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.

9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Tri-axial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

References:

1. Bowles, Joseph E., “Engineering Properties of Soil and Their Measurement” Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032.

RCE 552 CAD LAB 1

(L-T-P0-0-2) Credit- 1

1. Working on Latest Version of ANALYSIS SOFTWARE LIKE ANSYS , ADINA , NISA, MATLAB
2. Working on Latest Version of DESIGN SOFTWARE LIKE STAAD PRO / STRUDS / SAP / ETAB / STRAP
3. Working on Latest Version of GEOTECHNICAL SOFTWARES like GEO-5 / PLAXIS

RCE 553 CONSTRUCTION MANAGEMENT LAB

(L-T-P 0-0-2) Credit-1

1. Estimation of quantities for any one of the following: Building/ Septic tank/Water supply pipe line/road/bridge.
2. Preparation of Bill of Quantities (BOQ) for above project.
3. Practice of MS Project/Primavera software for same problem.
4. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).

These exercises will be done through use of software and spread in 8-10 classes.

References:

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., “PERT and CPM Principals and applications” Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., “Civil Engineering Contracts and Estimates” University Press India, Pvt. Ltd. Hyderabad –500 004

4. Construction Management by Ojha
5. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
6. Construction Technology by Sarkar, Oxford
7. S V Deodhar and SC Sharma, " Construction engineering and Management", Khanna Publishing House.
7. Delhi Schedule of Rates (latest version)

RCE 554 CONCRETE LAB

(L-T-P 0-0-2) Credit- 1

1. Study of IS codes for (i) Aggregates (ii) Cements (iii) Admixtures (iv) Fly ash
2. Concrete Mix design computation by ACI 211.1-91 method, IS code method as per 10262-2007 & 456-2000, DOE method for given sample.
3. Preparation and testing of samples as per any one of the above mentioned computations (Minimum grade of concrete is M30)
4. Tests on Concrete- (a) Workability tests - Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test. (b) Strength tests- compressive strength, flexural strength, split tensile strength.
5. Effects of Admixture - Accelerator, Retarder, Super Plasticizer.
6. Non destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test.

References:

1. Concrete Technology – A.M. Neville & J. J. Brooks , Pearson
2. Concrete Technology Theory & Practice-M.S. Shetty, S. Chand Publishers
3. Concrete Technology Theory & Practice-M.L. Gambhir, TMH Publishers
4. IS:10262-2009-Concrete Mix Proportioning Guidelines

SIXTH SEMESTER**CIVIL ENGINEERING****SESSION 2018-19**

Sl No	Subject Code	Subject Name	Teaching Deptt.	L-T-P	Th/Lab Marks	Sessional		Total	Credit
						ESE	CT TA.		
1	RAS601	INDUSTRIAL MANAGEMENT	Applied Science	3—0---0	70	20	10	100	3
2	RUC601/ RAS602	CYBER SECURITY/SOCIOLOGY	Applied Science	3—0---0	70	20	10	100	3
3	RCE601	DESIGN OF STRUCTURE-II	Core Deptt.	3—0---0	70	20	10	100	3
4	RCE602	ENVIRONMENTAL ENGINEERING	Core Deptt.	3—1---0	70	20	10	100	4
5	RCE603	TRANSPORTATION ENGINEERING	Core Deptt.	3—0---0	70	20	10	100	3
6	RCE061 REC062 RCE063	ELECTIVE -2 FOUNDATION DESIGN INTEGRATED WASTE MANAGEMENT FOR A SMART CITY GEOSYNTHESIS AND REINFORCED SOIL STRUCTURES	Core Deptt.	3—1---0	70	20	10	100	4
7	RCE651	CAD LAB-2	Core Deptt.	0—0---2	50		50	100	1
8	RCE652	ENVIRONMENTAL ENGINEERING LAB	Core Deptt.	0—0---2	50		50	100	1
9	RCE653	TRANSPORTATION ENGINEERING LAB	Core Deptt.	0—0---2	50		50	100	1
10	RCE 654	STRUCTURAL DETAILING LAB	Core Deptt.	0—0---2	50		50	100	1
	TOTAL				620	120	260	1000	24

Unit – 1

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method. [8]

Unit – 2

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear.

Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. [8]

Unit – 3

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of RCC staircases.

Design of lintels and chajjas. Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, cracking and vibrations. [8]

Unit – 4

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. [8]

Unit – 5

Structural behaviour of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings.

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method. [8]

References

1. IS: 456 – 2000.
2. Reinforced Concrete Design by S. U. Pillai & D. Menon, Tata Mc.- Graw, New Delhi
3. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.
4. Reinforced Concrete Vol. - II by H.J. Shah, Charotar Publisher, Gujarat.
5. RCC Designs (Reinforced Concrete Structures) by B.C. Punmia, Ashoka Kumar Jain and Arun Kumar Jain, Laxmi Publishers, New Delhi.
6. Reinforced Concrete Structures by R. Park and Pauley.
7. Reinforced Concrete Design by P. Dayaratnam.

8. Reinforced Concrete Design by M.L. Gambhir
9. Reinforced Concrete Design by S.N. Sinha , TMH
10. Plain and Reinforced Concrete Vol. I & II by O.P. Jain & Jai Krishna, Nem Chand & Bros.
11. SP-16: Design Aid to IS- 456.

RCE 602 ENVIRONMENTAL ENGINEERING

(L-T-P 3-1-0) Credit - 4

Unit-I

Fresh water, water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period.

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control. **[8]**

Unit-2

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs.

Capacity of distribution reservoirs: general design guidelines for distribution system. **[8]**

Unit-3

Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water, disposal of wastewater on land and water bodies. **[8]**

Unit-4

Objectives of water treatment: unit operations, processes, and flow sheets.

Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber.

Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters.

Disinfection: requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination, water softening and ion-exchange process **[8]**

Unit-5

Objectives of waste water treatment: unit operations, processes, and flow sheets.

Secondary and tertiary treatment: secondary sedimentation and theory of organic matter removal.

Working of activated sludge process, trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, rotating biological contactors (RBC).

Anaerobic digestion of sludge: design of low and high rate anaerobic digesters and septic tank.

Working of up flow anaerobic sludge blanket (UASB) reactor and other emerging technologies for wastewater treatment **[8]**

Text Books:

1. Peavy, Howard S., Rowe, Donald R and Tchobanoglous, George, “Environmental Engineering” McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Metcalf & Eddy “Wastewater Engineering: Treatment & Reuse”, Tata Mc-Graw Hill.
3. M. P. Poonia and SC Sharma: Environmental Engineering, kahna publishing house
4. Garg, S.K.: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol.–II).
5. OP Gupta, Elements of Environmental Polluton Control, Khanna Publication
6. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-Graw Hill.

References:

1. Manual on Water Supply and Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O., Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Hammer and Hammer Jr.: Water and Wastewater Technology
6. Raju: Water Supply and Wastewater Engineering
7. Rao: Textbook of Environmental Engineering
8. Davis and Cornwell: Introduction to Environmental Engineering
9. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
10. Punmia: Water Supply and Wastewater Engineering Vol. I and II
11. Birdie: Water Supply and Sanitary Engineering
12. Ramalho: Introduction to Wastewater Treatment Processes
13. Davis Mackenzie L., Cornwell, David A., “Introduction to Environmental Engineering” McGraw Hill Education (India) Pvt. Ltd., New Delhi.
14. Birdie: Water Supply and Sanitary Engineering
15. Ramalho: Introduction to Wastewater Treatment Processes
16. Parker: Wastewater Systems Engineering
17. OP Gupta, Elements of Environmental Polluton Control, Khanna Publication

RCE 603 TRANSPORTATION ENGINEERING**(L-T-P 3-0-0) Credit- 3****UNIT-1**

Introduction: Role of Transportation, Modes of Transportation History of road development, Road types and pattern, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan,

Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location, [8]

UNIT-2

Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. [8]

UNIT-3

Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC: 65-2017. Highway capacity and level of service of rural highways and urban roads as per latest IRC recommendation [8]

UNIT-4

Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors, Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015) [8]

UNIT-5

Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB),Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) and Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, Roller Compacted Concrete Roads. [8]

Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

Text Book:

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. "Highway Engineering", Nem Chand and Bros., Roorkee- 247 667.
2. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee- 247 667.
3. LR Kadiyali, Transportation Engineering, Khanna Publication.

References:

1. Kadiyali L. R., & Lal, N.B. "Highway Engineering , Khanna Publications,
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, New Delhi

3. Kumar, R Srinivasa, "A Text book of Highway Engineering", Universities Press, Hyderabad.
4. Kumar, R Srinivasa, "Pavement Design", Universities Press, Hyderabad.
5. Chakraborty Partha & Das Animesh., "Principles of Transportation Engineering", Prentice Hall (India), New Delhi,
6. IRC : 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, New Delhi
7. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)
8. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (First Revision)
9. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
10. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
11. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
12. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (First Revision)
13. IRC: SP: 68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements", Indian Roads Congress, New Delhi.
14. IRC: 15-2002, "Standard Specifications and Code of Practice for construction of Concrete Roads" Indian Roads Congress, New Delhi.
15. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

RCE 061 FOUNDATION DESIGN (L-T-P 3-0-0) Credit – 3

UNIT-1

Introduction to soil exploration, methods of boring and drilling, soil sampling and sampler, in-situ tests, SPT, CPT, DCPT, geophysical methods; soil resistivity methods seismic refraction methods. **[8]**

UNIT-2

Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method

Settlement of shallow foundations: components of settlement & its estimation, immediate, consolidation, & differential settlements. **[8]**

UNIT-3

Design of shallow foundation; principles of design of footing, design of isolated footings and strip footing.

Deep foundation; introduction, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under reamed piles. [8]

UNIT-4

Introduction, shapes and characteristics of wells, components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts.

Retaining walls: introduction, types of retaining structures, support systems for flexible retaining walls (struts, anchoring), construction methods, introduction and uses of sheet piles. [8]

UNIT-5

Geotechnical properties of reinforced soil, use of soil reinforcement, shallow foundation on soil with reinforcement, design considerations, idealized soil, foundation and interface behaviour, elastic models of soil behaviour. [8]

Reference Books:

- 1) Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
- 2) Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai
- 3) Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
- 4) Joseph E. Bowles: Foundation analysis and design. McGraw-Hill Higher Education
- 5) Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.
- 6) Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
- 7) B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
- 8) V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Bangalore
- 9) P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
- 10) I.H. Khan – Text Book of Geotechnical Engineering
- 11) C. Venkataramaiah – Geotechnical Engineering
- 12) Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
- 13) Gulati, S.K., “Geotechnical Engineering” McGraw Hill Education (India), Pvt. Ltd., Noida.

RCE 062 INTEGRATED WASTE MANAGEMENT FOR A SMART CITY

(L-T-P 3-0-0) Credit - 3

Unit-1

Introduction: Solid Waste Management- Definition, Concept of 4Rs (reduce, reuse, recycle and recover) of waste management, Elements of a waste management system, Current Issues in Solid Waste Management, Integrated Waste Management Hierarchy: Source reduction, Recycling, Waste-to-Energy and Land filling. Review of waste management under Swachh Bharat Mission and Smart Cities Program. [8]

Unit-2

Municipal Solid Waste: Waste Composition and Quantities, Collection, Transportation, Segregation, and Processing. [8]

Unit-3

Disposal of Municipal Solid Waste: Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016. [8]

Unit-4

Construction and Demolition (C&D) Waste Management: Overview, Components; C&D Waste Management Rules 2016, Beneficial Reuse of C & D Waste Materials. [8]

Unit-5

Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges.

Hazardous Wastes: Definition, Classification, Risk assessment, Transportation of hazardous waste, Current Management Practices: Environmental audit, Containment, Remedial alternatives. [8]

Books:

1. George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill
2. Ramachandra T.V., *Management of Municipal Solid Waste*, 2009; by The Energy and Resource Institute, TERI
3. Sasikumar, K, Gopi Krishna, Sanoop, *Solid Waste Management*; 2009, PHI.

References:

1. Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India
2. MSW Management Rules 2016, Govt. of India, available online at CPCB website
3. Construction and Demolition Waste Management Rules, 2016, MoEF&CC
4. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
5. O P Gupta, " Element of Solid waste hazardous management, Khanna Publishing house.
6. Freeman, M. H.1988. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Book Company, New York
7. <http://swachhbharatmission.gov.in/sbmcms/index.htm>
8. <http://swachhbharaturban.gov.in/>

RCE 063 GEOSYNTHETICS AND REINFORCED SOIL STRUCTURES

(L-T-P 3-0-0) Credit - 3

UNIT 1

Introduction to Geosynthetics, types of geosynthetics, artificial and natural geosynthetics and their applications, manufacture of geosynthetics, strength of reinforced soils, testing of Geosynthetics. [8]

UNIT-2

Drainage application of geosynthetics , filtration applications of geosynthetics, erosion control using geosynthetics geosyntheitics in flexible payment, introduction to geosyenthitcs in landfills, geosynthetics for construction of landfills **[8]**

UNIT-3

Sustainable infrastructure development, different types of soil retaining structures, design codes for reinforced soil retaining walls, construction aspects of geosynthetics reinforced soil retaining wall, testing requirements for reinforced soil retaining walls, geosynthetic reinforced soil embankments. **[8]**

UNIT-4

Design of reinforced soil retaining walls – simple geometry, design of reinforced soil retaining walls – sloped backfill soil, soil embankments supported on geocell mattresses, geosynthetic reinforced pile systems for high embankments **[8]**

UNIT-5

Reinforced soil for supporting shallow foundations, response of footings resting on reinforced foundation soils, bearing capacity analysis of footings resting on reinforced foundation soils, carbon footprint analysis **[8]**

REFERENCES

1. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4th edition, 1999.
2. Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 123, CIRIA, Thomas Telford. London, UK, 1996.
3. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana, Asian Books Private Ltd., New Delhi, 2004.
4. Hoe I. Ling, Guido Gottardi , Daniele Cazzuffi , Jie Han , Fumio Tatsuoka “Design and Practice of Geosynthetic-Reinforced Soil Structures”
5. Sanjay Kumar Shukla, Erol Guler “Advances in Reinforced Soil Structures”

RCE 651 CAD LAB- 2

(L-T-P 0-0-2) Credit - 1

1. Working on Latest Version of Environmental Engineering software for Analysis and Design of water & wastewater treatment and distribution systems (WATER CAD / SEWER CAD / WATER GEM / SEWER GEM / LOOP)

2. Working on Latest Version of Transportation Engineering software like MAX ROAD/ Surveying Software.
3. Working on Latest Version of GIS software (ARC GIS / ENVI / GEPSY)

RCE 652 ENVIRONMENTAL ENGINEERING LAB (L-T-P 0-0-2) Credit -1

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total , suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.
13. Determination of optimum dose of coagulants by Jar Test Apparatus.
14. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

Note: 1. Experiment at S.NO. 14 is mandatory.

2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

References:

1. A.P.H.A. "Standard Methods for the Examination of Water and Wastewater", American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. "Chemistry for Environmental Engineering", McGraw Hill.
3. Mathur, R.P. "Water & Wastewater Testing", Lab Manual, Roorkee.
4. O P Gupta, Environmental Chemistry, " Khanna Publishing house.

RCE 653 TRANSPORTATION ENGINEERING LAB (L-T-P 0-0-2) Credit - 1

1. To Determine the Crushing Value of Coarse Aggregates.
2. To Determine the Impact Value of Coarse Aggregates.
3. To determine the Flakiness Index and Elongation Index of Coarse Aggregates.
4. To determine the Los Angeles Abrasion Value of Coarse Aggregates.
5. To determine the Stripping Value of Coarse Aggregates.
6. To determine the penetration Value of Bitumen.
7. To determine the Softening Point of Bituminous material.

8. To determine the Ductility Value of Bituminous material.
9. To determine the Flash and Fire Point of Bituminous material.
10. To determine the Stripping Value of Bituminous material.
11. Classified both directional Traffic Volume Study.
12. Traffic Speed Study. (Using Radar Speedometer or Enoscope).
13. Determination of CBR Value of soil sample in the Lab or in Field.

Note: A minimum of 8 experiments are to be performed from the list of Experiments.

References:

1. Khanna S. K., Justo C.E.G, & Veeraragavan A., “Highway Materials and Pavement Testing”, Nem Chand and Bros., Roorkee- 247 667.
2. Gambhir, M.L., Jamwal, Neha,” Lab Manual: Building and Construction Materials, Testing and Quality Control” McGraw Hill Education (India), Pvt.Ltd., Noida.
3. Duggal, Ajay K., Puri, Vijay P.,” Laboratory Manual in Highway Engineering” New Age International (P) Limited, Publishers, New Delhi.
4. Sood Hemant, Mittal, L.N., Kulkarni,P.D., “ Laboratory Manual on Concrete Technology” CBS Publishers & Distribiters Pvt. Ltd. New Delhi.

RCE 654 STRUCTURAL DETAILING LAB

(L-T-P 0-0-2) Credit - 1

1. Study of SP34/IS13920/IS456:2000 for detailing of structural elements.
2. Preparation of working hand sketches and Auto CAD drawings for the following-
 - RC Beams- Simply supported, Continuous, Cantilever
 - T – beam / L-beam floor
 - Slabs – Simply supported, Continuous, One way and two way slabs.
 - Columns – Tied Columns and Spirally reinforced columns.
 - Isolated footings for RC Columns.
 - Combined rectangular and trapezoidal footings.
3. Preparation of bar bending schedule
4. Detailing of Buildings with respect to Earthquake Resistant Design
5. Study of full set of structural drawing of a building as made available by Institute.

References: Krishna Raju N., “Structural Design and Drawing” University Press (India), Pvt.Ltd., Hyderabad.

**Dr. A.P. J. ABDUL KALAM TECHNICAL UNIVERSITY,
LUCKNOW**



Syllabus

4th Year

[Effective from session 2016-17]

B. Tech. Civil Engineering

Dr. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Study & Evaluation Scheme

B Tech Civil Engineering

Effective from session 2016-17

Final Year , VII Semester

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme			Subject Total	Credit	
			L	T	P	Sessional Exam		ESE			
						CT	TA				Total
THEORY SUBJECT											
1	NOE071- NOE074	Open Elective – I	3	1	0	30	20	50	100	150	4
2	NCE031- NCE034	Department Elective-III	3	1	0	30	20	50	100	150	4
3	NCE041- NCE044	Department Elective-IV	3	1	0	30	20	50	100	150	4
4	NCE701	Design of Steel Structures	3	1	0	30	20	50	100	150	4
5	NCE702	Water Resources Engg	3	1	0	30	20	50	100	150	4
PRACTICAL / DESIGN / DRAWING											
6	NCE751	Seminar	0	0	4		-	50	-	50	1
7	NCE752	Industrial Training**					-	50	-	50	1
8	NCE753	Project#	0	0	4		-	100	-	100	3
9	NGP 701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	15	5	8					1000	26

** 4 weeks Industrial Training after VI semester to be evaluated in VII semester.

Project should be initiated in VII semester beginning and should be completed by the end of VIII semester.

Departmental Elective-3 (Full Unit Course with Credit: 4)

S. No.	Code and Course
2 (A)	NCE 031 - Bridge Engineering
2 (B)	NCE 032 - Finite Element Methods
2(C)	NCE 033 - Environmental Geo-technology
2(D)	NCE 034 - Industrial Pollution Control & Env. Audit
2 (E)	NCE 035 – Engineering Hydrology

Departmental Elective-4 (Full Unit Course with Credit: 4)

S. No.	Code and Course
3 (A)	NCE 041 - Precast and Modular Construction Practices
3 (B)	NCE 042 - Plastic Analysis of Structures
3 (C)	NCE 043 - Open Channel Flow
3 (D)	NCE 044 – Tunnel Engineering

Dr. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Study & Evaluation Scheme

B Tech Civil Engineering

Effective from session 2016-17

Final Year , VIII Semester

S No	Course Code	SUBJECT	PERIODS			Evaluation Scheme			Subject Total	Credit	
			L	T	P	Sessional Exam		ESE			
						CT	TA				Total
THEORY SUBJECT											
1	NOE081- NOE084	Open Elective – II	3	1	0	30	20	50	100	150	4
2	NCE051- NCE054	Departmental Elective-V	3	1	0	30	20	50	100	150	4
3	NCE061- NCE064	Departmental Elective-VI	3	1	0	30	20	50	100	150	4
4	NCE801	Construction Technology & Management	3	1	0	30	20	50	100	150	3
PRACTICAL / DESIGN / DRAWING											
5	NCE851	Project	0	0	12		100	100	250	350	8
6	NGP 801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	12	4	12					1000	24

Departmental Elective-5 (Full Unit Course with Credit: 4)

S. No.	Code and Course
2 (A)	NCE 051 - Computer Aided Design
2 (B)	NCE 052 - Analysis and Design of Hydraulic Structures
2 (C)	NCE 053 - Water Resources Systems
2 (D)	NCE 054 - Machine Foundation Design

Departmental Elective-6 (Full Unit Course with Credit: 4)

S. No.	Code and Course
3 (A)	NCE061 - Ground Improvement Techniques
3 (B)	NCE 062 - River Engineering
3 (C)	NCE 063 – Groundwater Management
3 (D)	NCE 064 - Earthquake Resistant Design of Structures

List of Open Electives for B. Tech. Courses

OPEN ELECTIVE-I

NOE -071	Entrepreneurship Development
NOE-072	Quality Management
NOE-073	Operations Research
NOE-074	Introduction to Biotechnology

OPEN ELECTIVE-II

NOE-081	Non Conventional Energy Resources
NOE-082	Nonlinear Dynamic Systems
NOE-083	Product Development
NOE-084	Automation & Robotics

NCE-701 Design of Steel Structures

L – 3, T – 1 CT – 30, TA – 20, ESE – 100

Unit - 1

General Considerations

Introduction, Advantages of Steel as a Structural Material, Disadvantages of Steel as a Structural Material, Structural Steel, Stress-Strain Curve for Mild Steel, Rolled Steel Sections, Convention for Member Axes, Loads, Dead Load, Live Loads, Environmental Loads, Seismic Forces, Snow and Rain Loads, Erection Loads, Basis for Design, Design Philosophies, Local Buckling of Plate Elements.

Introduction to Limit State Design

Introduction, Limit States for Steel Design, Limit States of Strength, Limit States of Serviceability, Actions (Loads), Probabilistic Basis for Design, Design Criteria 8

Unit -2

Simple Connections--Riveted, Bolted and Pinned Connections

Introduction, Riveted Connections, Patterns of Riveted Joints, Bolted Connections, Types of Bolts, Types of Bolted Joints, Load Transfer Mechanism, Failure of Bolted Joints, Specification for Bolted Joints, Bearing-Type Connections, Prying Action, Tensile Strength of Plate, Efficiency of the Joint, Combined Shear and Tension, Slip-Critical Connections, Combined Shear and Tension for Slip-Critical Connections, Working Load Design, Design of eccentric bolted connections .

Simple Welded Connections

Introduction, Types, Symbols, Welding Process, Weld Defects, Inspection of Welds, Assumptions in the Analysis of Welded Joints, Design of Groove Welds, Design of Fillet Welds, Fillet Weld Applied to the Edge of A Plate Or Section, Fillet Weld for Truss Members, Design of Intermittent Fillet Welds, Plug and Slot Welds, Stresses Due To Individual Forces, Combination of Stresses, Failure of Welds, Distortion of Welded Parts, Fillet Weld Vs Butt Weld, Welded Jointed Vs Bolted and Riveted Joints, Design of eccentric welded connections, Working Load Design. 8

Unit – 3

Tension Members

Introduction, Types of Tension Members, Net Sectional Area, Effective Net Area, Types of Failure, Design Strength of Tension Members, Slenderness Ratio (λ), Displacement, Design of Tension Member, Lug Angles, Splices, Gusset Plate, Working Load Design. 8

Unit – 4

Compression Members

Introduction, Effective Length, Slenderness Ratio (λ), Types of Sections, Types of Buckling, Classification of Cross Sections, Column Formula, Design Strength, Design of Axially Loaded Compression Members, Built-Up Columns (Latticed Columns), Lacing, Batten, Compression Member Composed of Two Components Back-to-Back, Splices, Design of Column Bases. 8

Unit – 5

Beams

Introduction, Types of Sections, Behaviour of Beam in Flexure, Section Classification, Lateral Stability of Beams, Lateral-Torsional Buckling, Bending Strength of Beams, Laterally Supported Beams, Laterally Unsupported Beams, Shear Strength of Beams, Web Buckling, Bearing Strength, Web Crippling, Deflection, Design Procedure of Rolled Beams, Built-Up Beams (Plated Beams), Purlins, Beam Bearing Plates, Effect of Holes in Beam, Introduction to Plate Girder , Introduction to Gantry Girder. 8

Text Books

1. Design of Steel Structures by N. Subramanian, Oxford University Press
2. Limit State Design of Steel Structures by S. K. Duggal, Tata Mcgraw Hill.
3. Design of Steel Structures by K S Sairam, Pearson Education

4. Design of Steel Structures by S Ramamurtham, DhanpatRai Publishing Company.

Reference Books

1. Steel Structures by Robert Englekirk. Hohn Wiley & sons inc.
2. Structural Steel Design by Lambert tall (Ronald Press Comp. Newyork.
3. Design of steel structures by Willam T Segui , CENGAGE Learning
4. Structural Steel Design By D MacLaughlin , CENGAGE Learning

NCE – 702 WATER RESOURCES ENGINEERING

L – 3, T – 1 CT – 30, TA – 20, ESE – 100

UNIT – I

Hydrology : Hydrologic Cycle. Water Budget Equation, Hydrologic system, Precipitation : Types, measurements and analysis, error in estimation, missing data, consistency of rainfall records, Intensity during frequency (IDF) and probabilistic maximum Precipitation (PMP) curves.

Evaporation and consumptive use: Process affecting factors, estimation and measurement techniques.

Infiltration : Process affecting factors, measurement and estimation, Infiltration Indices. 8

UNIT – II

Surface Runoff: Components and factors affecting runoff, methods of estimation of runoff volume and peak runoff, rating curve, Rainfall – runoff relationships Hydrograph analysis: components, factors affecting hydrographs, base flow separation, Direct Runoff Hydrograph, Unit Hydrograph: Theory and assumptions. Derivation of Unit Hydrograph, Synthetic Unit Hydrograph Introduction to computer models for rainfall runoff analysis.

Irrigation: Developments in India, Necessity and types Advantages & disadvantages of irrigation.

Functions of water in plant growth, Methods of Irrigation, Water requirement of crops. Irrigation frequency, Irrigation efficiencies, Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Commanded area, curves in channels, channel losses. 8

UNIT – III

Sediment Transportation: Suspended and Bed load and its estimation

Irrigation channels: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, Longitudinal cross section, Schedule of area

statistics and channel dimensions, use of Garret's Diagrams in channel design, cross sections of an Irrigation channel, Computer programs for design of channels

Lining of Irrigation Canals: Advantages and types, factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging: Definition, effects, causes and anti-water logging measures, Drainage of water logged land, Types of drains open and closed, spacing of closed drains. 8

UNIT – IV

Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects

Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion

River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge. 8

UNIT – V

Ground Water Hydrology: Zones of underground water, Aquifers and their types, important terms, Determination of discharge through unconfined and confined aquifers with steady flow conditions, Interference among wells, determination of aquifer constants, Well loss and specific capacity, efficiency of a well, types of water wells, bored and open wells, specific yield of a well, Relative merits of well and canal irrigation, type of tube wells, well surrounding and well development, Suitable site selection for a tube well, Types of open wells, Methods of lifting water. Infiltration galleries. 8

Text Book

1. Irrigation Engg. and Hydraulic Structures by S.K. Garg, Khanna Publishers.
2. Irrigation and water Power engineering by B.C. Punmia, Laxmi Publications.
3. Engineering Hydrology by K. Subramanya, TMH.

4. Irrigation Water Power and Water Resource Engg. by K.R. Arrora.
5. Water resource engineering by Ralph A. Wurbs & Wesley P. James, Pearson Publication.

References

1. Water Resources Engg. By Larry W. Mays, John Wiley India
2. Water resources Engg. By Wurbs and James, John wiley India
3. Water Resources Engg. By R. K. Linsley, McGraw Hill
4. Irrigation and water Resources Engg. By G L Asawa, New age International Publishers
5. Irrigation Theory and practices by A.M. Michel.
6. Fundamental of Hydraulic Engineering System by Houghalen, Pearson Publication.

NCE - 801 TRANSPORTATION ENGINEERING - II

L – 3, T – 1 CT – 30, TA – 20, ESE – 100

UNIT –I

Introduction, Permanent Way and Components:

History and administrative setup of Indian Railways; Rails, Type of rails, rail gauges, permanent way formation,– functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, defect in rails, rail fastenings, Fish plates, spikes, chairs, keys, bearing plates. sleepers, Timber, steel, cast iron, concrete and prestressed concrete sleepers, sleeper density, ballast: material, specifications. 8

UNIT-II

Track Geometrics, Turnouts and Crossings, Stations and Yards:

Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings. Different types of stations and Yards: classification and functioning. 8

UNIT –III

Signalling and Interlocking, Urban Railways: Classification of Signals, method of train working, absolute block system, Centralized train control system, ATS, interlocking of track, principle of interlocking, types of interlocking, high speed track – track requirement, speed limitations, high speed technologies, Urban railway- railway system in urban areas. 8

UNIT – 4

Introduction to Airport Engineering

Air craft characteristics affecting airport planning & design, selection of site for an airport. Airports - layout and orientation, Runway and taxiway design consideration and geometric design. Airport drainage management, Zoning laws, Visual aids and air traffic control, Runway lighting, Runway operation Helipads, hangers, service equipment. 8

UNIT – 5

Water Transport

Harbours and ports, Types of Harbours; Harbours - layouts, shipping lanes, anchoring, location identification; Littoral transport with erosion and deposition; sounding methods; Dry and Wet docks, components and operational Tidal data and analyses.

Inland waterways: advantages and disadvantages; Development in India. Inland water operation. 8

Text Books

1. A Text Book of Railway Engineering by S. P. Arora & S. C. Saxena
2. Railway Engineering by M. M. Aggrawal.

References

1. Railway Engineering by Rangwala (Charotar Publishing House).
2. Airport Engineering by Rangwala (Charotar Publishing House).
3. Airport Planning & Design by Khanna , Arora & Jain Nem Chand & Brothers).
4. Docs & Harbour Engineering by Bindra (Dhanpat Rai Publishing Company).

5. Docs & Harbour Engineering by Rangwala (Charotar Publishing House).
6. Docs & Harbour Engineering by Oza (Charotar Publishing House).

NCE 031 Bridge Engineering

L T P
3 1 0

Unit – 1

Site selection, various types of bridges and their suitability, loads, forces and IRC bridge loading and permissible stresses, Design of RC bridges under concentrated loads using effective width and Pigeauds Method, 8

Unit – 2

Courbon's method of load distribution. Detail design of Reinforced Concrete slab culvert 8

Unit – 3

T-beam bridge, box culverts, 8

Unit – 4

Design elements of plate girder, economical section and design. 8

Unit – 5

Design of piers, pier caps and Abutments, different types of bearings & its design 8

Text Books :

1. Essentials of Bridge Engineering by D J Victor
2. Limit State Design of Steel Structures by S K Duggal
3. Design of steel Structures by Ramchandra
4. Bridge Engineering by S.Ponnusway
5. Principles & Practices of Bridge Engineering by S.P. Bindra
6. Bridge Engineering (An integrated Treatise) by V.V. Sastry

NCE 032 Finite Element Methods

L T P
3 1 0

Unit - 1

Calculus of variation, Introduction to calculus of variations, Introduction to equilibrium equations in elasticity, Euler's Lagrange's equations, Principal of virtual work, virtual displacements, Principles of minimum potential energy, boundary value, initial value problems, Flexibility approach, Displacement approach, Different problems in structural analysis. 8

Unit - 2

FEM Procedure, Derivation of FEM equations by variation principle polynomials, Concept of shape functions, Derivation for linear simplex element, Need for integral forms, Interpolation polynomials in global and local coordinates. Weighted residual Methods: Concept of weighted residual method, Derivation of FEM equations by Galerkin's method, Solving cantilever beam problem by Galerkin's approach, Derivation of shape functions for CST triangular elements, Shape functions for rectangular elements, Shape functions for quadrilateral elements. 10

Unit - 3

Higher order Elements: Concept of iso-parametric elements, Concept of sub-parametric and super-parametric elements, Concept of Jacobin matrix.

Numerical Integration: Numerical Integration, one point formula and two point formula for 2D formula, Different problems of numerical integration evaluation of element stiffness matrix, Automatic mesh generation schemes, 8

Unit - 4

Pascal's triangle law for 2D shape functions polynomial, Pascal's triangle law for 3D shape function polynomials, Shape function for beam elements, Hermitian shape functions.

Convergence: Convergence criteria, Compatibility requirements, Geometric isotropy invariance, Shape

functions for iso-parametric elements, Special characteristics of stiffness matrix, Direct method for deriving shape functions using Lagrange's formula, Plane stress problems. 8

Unit - 5

Analysis of structures: Truss elements, Analysis of truss problems by direct stiffness method. Analysis of frames and different problems, Different axi-symmetric truss problems. 6

Text Book:

1. The Finite Element method -ZIENKIEWICZ.O.C.Tata McGraw Hill Pub. New Delhi, 2000
2. Finite Element Methods by C R Alaval , PHI
3. Finite Elements in Engineering:- Chandrupatta, et. Al. Prentice Hall of India Pvt. Ltd.,
4. Finite element method with application in engineering by Chandrupatla & Belegundu, Pearson Publication.
5. Finite Element Method Basics concept & Applications by Alawala
6. Fundamental of Finite element Analysis by Devid V. hutton
7. Finite element Methods is fundamentals an application in engineering by Chen Z

Reference Books:

1. Concepts and Applications of Finite Element Analysis: COOK. D. Robert. Malus.S.David, Plesha E. Michel, John wiley & sons 3rd Edn. New York, 2000
2. Finite Element Analysis -C.S. Krishnanmoorthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi,
3. Introduction to the Finite Element method -Desai / ABEL-C.B.S. Publishers & Distributors, New

NCE 033 Environmental Geotechnology

L T P
3 1 0

Unit -1

Introduction, Development of Environmental Geotechnology, Aims, Environmental Cycle and their interaction with geotechnology, Natural environment, cycles of nature, environmental geotechnical problems. 8

Unit -2

Identification and characteristics of contaminated soil, classification, Characteristics of dust, dust in environment, ion-exchange reaction and ion exchange capacity, ion exchange reaction in contaminated soil-water system, Site Investigation for detection of sub-surface contamination 8

Unit -3

Load-environment factor design criteria, soil-structure vs structure soil interaction, load and environmental loads, Bearing capacity based on load footing interaction, lateral earth pressure, pile foundations, environmental factors affecting pile capacity, under-water foundation problems. 8

Unit – 4

Ash Pond and Mine Tailing Impoundments, Geotechnical re-use of waste materials and fills, Grouting and injection process, Grout used for controlling hazardous wastes, Sinkhole: interaction with environment , remedial action 8

Unit -5

Sanitary landfills: Selection of waste disposal sites, Landfills for Municipal and Hazardous wastes, Design of liners: clay and synthetic clay liners, Bearing capacity of foundation on sanitary landfills. 8

Recommended Books:

1. Fang, H. – Introduction to Environmental Geotechnology.
2. Sharma, H. D. and Sangeeta, P.L. - waste containment systems, waste stabilization and landfills: design and evaluation.
3. Koerner, R. M. - Designing with geosynthetics
4. Environmental & Geotechniques by Robert W. Sarsby
5. Geostatics for Environmental & geotechnical Publication Shahrukh Rouhanvy

NCE – 034 Industrial Pollution Control and Environmental Audit

L T P
3 1 0

Unit-1

Industrial wastes & their sources: various industrial processes, sources and types of wastes-solid, liquid, gaseous, noise & radiation emissions. Sources for industrial water usages and various industrial processes requiring water use and water quality. 8

Unit-2

Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial wastewaters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radioactivity etc. Wastewater re-uses & recycling, concept of zero discharge effluent. 8

Unit-3

Control of gaseous emissions: hood and ducts, tall stacks, particulate and gaseous pollutant control; Solid waste generation and disposal management; Hazardous wastes: definitions, concepts and management aspects; Noise & radiation: generation, control and management. 8

Unit-4

Recent trends in industrial waste management, cradle to grave concept, life cycle analysis, clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc. 8

Unit-5

Environmental audit: definitions and concepts, environmental audit versus accounts audit, compliance audit, relevant methodologies, various pollution regulations, Introduction to ISO and ISO 14000. 8

Recommended References:

1. *Industrial Wastewater Management Handbook*, Azad, Hardom Singh, Editor-in-Chief, McGraw Hill, New York.
2. *Wastewater Reuse and Recycling Technology-Pollution Technology Review-72*, Culp, Gordan, George Wasner, Robert Williams and Mark , V.Hughes Jr., Noyes Data Corporation, New Jersey.
3. *The Treatment of Industrial wastes*. Edmund, B. Besselieve P.E., McGraw Hill, New York.
4. *Industrial Pollution Control –Issues and Techniques*. Nancy, J. Sell, Van Nostrand Reinhold Co, NY.
5. *Wastewater Engineering: Treatment & Re-use*. Metcalf & Eddy, Tata Mc Graw-Hill.
6. *Industrial Pollution Prevention Handbook*. Shen, T.T., Springer-Verlag, Berlin.
7. *Environmental Engineering*. Pandey, G.N. and Corney, G.C., Tata McGraw Hill, New Delhi
8. *Environment (protection) Act- 1986*. Any authorized & recent publication on Government Acts.
9. *Industrial Pollution Control and Environmental Audit* by Sanjay Gupta

NCE-035 : Engineering Hydrology

L T P
3 1 0

Unit-1

Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement, depth-area-duration & intensity- duration- frequency relationships, probable maximum precipitation. 8

Unit-2

Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapo-transpiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement & estimation 8

Unit-3

Runoff and Hydrographs : Hydrograph, runoff characteristics of stream, Yield, Rainfall-runoff correlations, flow duration curve, mass curve, droughts and floods. Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. 8

Unit-4

Flood: Rational method, empirical formulae, unit hydrograph method, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and

safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. 8

Unit-5

Groundwater: introduction, forms of subsurface water, aquifers & its properties, Compressibility of aquifers, flow equations for confined and unconfined aquifers, well hydraulics- steady and unsteady flow to a well in confined aquifer, well losses, specific capacity, ground water irrigation, rain water harvesting. 8

Recommended Books:

- *'Hydrology for Engineers'* by Linsley R. K., Kohler M. A. and Paulhus J. L. H.
- *'Engineering Hydrology'* by K. Subramanya, Mc Graw Hill Education
- *'Hydrology: Principles. Analysis. Design'* by Raghunath H. M.
- *'Handbook of Applied Hydrology'* by Chow V. T. , Mc Graw Hill Education
- *'Irrigation: Theory & Practice'* by Michael A. M.
- *'Engineering Hydrology'* by Ojha, Oxford University Press.
- *'Introduction to Hydrology'* by Viessman & Lewis by Pearson Publication.
- *'Applied Hydrology'* by Fetter, by Pearson Publication.

NCE- 041 Precast and Modular Construction Practices

L T P
3 1 0

Unit – 1

Overview of reinforced and prestressed concrete construction Design and detailing of recast / prefabricated building components, 8

Unit – 2

Structural design and detailing of joints in prefabricated structures, Production of ready mixed concrete, quality assurance, 8

Unit – 3

Use of equipments in precast prefabricated structure, Productivity analysis, Economics of form work, Design of Formwork and their reusability, 8

Unit – 4

Modular construction Practices, Fibonacci series, its handling and other reliable proportioning concepts.8

Unit – 5

Modular coordination, Standardisation, system building, Lamination and Advantages of modular construction. 8

Books :

1. Handbook of low cost housing by A K Lal
2. Precast Concrete Structures by Kim Elliot

NCE – 042 Plastic Analysis of Structures

L T P
3 1 0

Unit - 1

Introduction, Historical review, plastic failure, plastic moment, capacity of a cross-section, shape factor, concept of load factor. 8

Unit – 2

Plastic hinge and collapse Mechanisms. Analysis of beams and frames. 8

Unit – 3

Semi Graphical method and Mechanism method. 8

Unit – 4

Plastic moment distribution for multi-storey and multi-bay frames. 8

Unit – 5

Analysis for deflections at collapse. Effect of axial force and shear. 8

Books :

1. Plastic Analysis of Structures by P G Hodge, McGraw Hill
2. Plastic Analysis and Design of steel structures by M Bill Wong
3. Inelastic Analysis of Structures by M Jirasek & Z P Bazant , John Wiley

NCE- 043 : Open Channel Flow

L T P
3 1 0

Unit – I

Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections,

Energy-depth relations: Concept of specific energy, specific force, critical flow, critical depth, hydraulic exponents, and channel transitions. 8

Unit – II

Gradually Varied Flow (GVF): Equation of gradually varied flow and its limitations, flow classification and surface profiles, Control sections,

Computation methods and analysis: Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels.

8

Unit – III

Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater,

8

Flow measurement: by sharp crested and broad crested weirs, critical depth flumes, sluice gate, Free overfall.

Rapidly varied unsteady flow: Equation of motion for unsteady flow, “Celerity” of the gravity wave, deep and shallow water waves, open channel positive and negative surge,

8

Unit-IV

Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, Flow over side-weir and Bottom-rack.

8

Unit – V

Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert.

8

References:

1. Chow, V.T., Open channel Hydraulics, McGraw Hill International
2. Henderson, F.M., Open Channel Flow, McGraw Hill International
3. Subramanya, K., Flow in Open Channels, Tata McGraw Hill
4. Ranga Raju, K.G., Flow through open channels, T.M.H.
5. M. Hanif Chaudhry, Open Channel Flow, PHI
6. French, R.H., Open channel Hydraulics, McGraw Hill International
7. Srivastava, Flow through Open Channels, Oxford University Press.
8. Open Channel Flow by Madan Mohan Das

NCE 044 - Tunnel Engineering

L T P
3 1 0

Unit – 1

Site investigations , Geotechnical Considerations of tunneling

8

Unit – 2

Design of Tunnels

8

Unit – 3

Construction & Excavation methods , soft ground tunnels , Rock tunnels

8

Unit-4

Micro tunneling techniques , Tunnel support design

8

Unit – 5

Ventilation of tunnels , tunnel utilities , safety aspects

8

Books :

1. Tunnel Engineering Handbook by J O Bickel & T R Kuesel
2. Rock Mechanics Design in Mining & Tunneling by Z T Bieniawski
3. Harbour & Dock & Tunnel by R. Srinivasan
4. Tunnel Engineering by S.C. Saxena

NCE – 051 COMPUTER AIDED DESIGN

L T P
3 1 0

UNIT – 1

Elements of Computer Aided Design and its advantages over conventional design. Hardware required for CAD works. 8

UNIT – 2

Principles of software design, concept of modular programming, debugging and testing. 8

UNIT – 3

Computer applications in analysis and design of Civil Engineering systems. 8

UNIT - 4

Use of software packages in the area of Structural, Geotechnical, and Environmental fields. 8

UNIT – 5

Expert system, their development and applications, Introduction to Neural Networks. 8

Reference:

1. Computer Aided Design – S. Rajiv, Narosa Publication
2. A.I. and Expert System – Robert L. Lertner & / Lane E. Drang, McGraw Hill
3. "Neural Computing: Wasserman, vonnostrand.
4. Auto Cadd 2013 Dummies Bill Fane
5. Cad Frame & Architecture by Pieter Van Der Wolf

NCE – 052 ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURES

L T P
3 1 0

UNIT – I

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification, Introduction to design principle of falls, Design of Sarda type and straight glacis fall.

Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars. 8

UNIT – II

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types. Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. 8

UNIT – III

Flood routing: Types, methods of reservoir routing, channel routing by Muskingham Method.

Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure Phreatic line, and its determination Introduction to stability analysis. 8

UNIT – IV:

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks. 8

UNIT – V

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential specially in reference to India, classification of

power plants, important terms, types of turbines and their suitability. Power House layout and important structures of a powerhouse. 8

Text Books

1. Water Resources Engg. By Larry W Mays, John Wiley India
2. Water resources Engg. By Wurbs and James, John wiley India
3. Water Resources Engg. By R.K. Linsley, McGraw Hill
4. Irrigation and Water Resources Engg. By G L Asawa, New age International Publishers

References

5. Irrigation Engg. And Hydraulic Structures by S. K. Garg, Khanna Publishers
6. Irrigation and Water Power Engineering by B. C. Punimia & Pande B.B. Lal

NCE 053 WATER RESOURCES SYSTEMS

L T P
3 1 0

Unit –I

Concept of System & System Analysis: Definition and types of a system, System Approach and analysis, Basic Problems in System Analysis. 8

Unit-II

System Techniques in Water Resources: Optimization using calculus, Linear programming, Dynamic programming and Simulation, Combination of Simulation and Optimization. 8

Unit-III

Economic Considerations in Water Resources Systems: Basics of Engineering Economics, Economic Analysis, Conditions of project optimality, Benefit-cost Analysis 8

Unit- IV

Multi-objective Planning: Non-inferior solutions, Plan Formulation & Plan Selection. 8

Unit V

Applications of Linear Programming: Irrigation water allocation for single and multiple crops, Multi-reservoir system for irrigation Planning, Reservoir operation for Irrigation and Hydro-power Optimization

Application of Dynamic Programming: Optimal crop water allocation, Steady State, Reservoir Operation policy for Irrigation. 8

Books Recommended:

1. Ossenbruggen, P. J. – System Analysis for Civil Engineering, John Wiley, New York
2. Taha, H. –Operational Research-An Introduction, Vth Edn, Prentice Hall.
3. Loucks, D. P., Stedenger, and Haith, D. A. – Water Resources Systems Planning & Analysis, Prentice Hall.
4. Jain, S. K. and Singh, V. P. – Water Resources Systems Planning & Management, Elsevier, Amsterdam
5. Water Resource System by Subhash Chander & Rajesh k Prasad
6. Water Resource System by PR Bhawe

NCE 054 Machine Foundation Design

L T P
3 1 0

Unit -1

Vibration of elementary Systems: Vibration motion, vector representation of harmonic motion, Single degree of freedom system: Free Vibrations- damped and undamped, Forced Vibrations – damped and undamped. 8

Unit -2

Dynamics of soil-foundation System: types of machine foundation, design criteria, dynamic loads, physical modeling and response analysis, Barken's approach, Ford & Haddow's analysis, Hammer foundation, I. S. Codes. 8

Unit -3

Dynamic soil testing techniques: cyclic plate load test, block vibration test, shear modulus test, geophysical methods, Resonance-column test, Two & three borehole techniques, Model tests using centrifuge and shake table, recent developments 8

Unit – 4

Vibration isolation and control: vibration transmitted through soil media, active and passive isolation, vibration isolation – rigid foundation and flexible foundation, method of isolation, properties of material and media used for isolation, vibration control of existing machine, foundation isolation by barriers. 8

Unit -5

Guidelines for design and construction of machine foundation: data required for design of reciprocating, impact and rotary type machines, guidelines for the design of different type machines, construction guidelines, guidelines for providing vibration absorbers. 8

Books:

1. S. Prakash – Machine Foundation .
2. B. B. Prasad – Fundamentals of Ground Vibration
3. Richard, Hall and Wood – Vibrations of Soil and Foundations
4. Foundation for Industrial Machine by R.G. Bhatia

NCE 061 Ground Improvement Techniques

L T P
3 1 0

Unit -1

Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes. 8

Unit -2

In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement. 8

Unit -3

In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method. 8

Unit – 4

Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout

Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test. 8

Unit -5

Underpinning of foundations: importance and situations for underpinning, methodology, typical examples.

Geotextiles: types, functions, specifications, precautions in transportation and storage. 8

Recommended Books:

1. S. K. Garg – Soil Mechanics & Foundation Engineering.
2. Purshotham Raju – Ground Improvement.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. N. Mandal – Geosynthetics World
5. Bergado et. al. – Soft Ground Improvement
6. Koerner, R. M. - Designing with geosynthetics
7. Ground Improvement Techniques by Dr. P Purushothama Raj

NCE 062 RIVER ENGINEERING

L T P
3 1 0

Unit – I

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes. 8

Unit –II

Behaviour of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control. 8

Unit-III

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration. 8

Unit-IV

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. 8

Unit-V

River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works. 8

Textbook:

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson

4. Principles of River Engineering by (the non tidel alluvial) PH Jameen

NCE-063: Groundwater Management

L T P
3 1 0

Unit-1

Introduction, hydrological cycle & definitions, Occurrence of ground water, hydro-geology & aquifers, Ground water movement, Darcy's law, flow-nets in isotropic medium. 8

Unit-2

Steady and unsteady flow through confined and unconfined aquifers, Dupuits theory, Observation wells, Well Hydraulics: Single & Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity, Inverse problem i.e. pumping tests for aquifer parameters, 8

Unit-3

Water Wells: Design of water wells, Well construction, Well completion, Development of wells Pumping equipment for water wells, maintenance of wells, ground water irrigation. 8

Unit-4

Ground Water quality, Contamination of groundwater and its Control, Ground Water Modeling Techniques, Ground water exploration, Surface and Subsurface Investigations of Ground water, Artificial discharge and Recharge of Ground Water, Groundwater drainage, 8

Unit-5

Ground Water Management Techniques: Groundwater budgeting, groundwater modeling & stimulation, application of GIS and remote sensing in groundwater management. roof-top rainwater harvesting and recharge. 8

Recommended References:

- 'Groundwater Hydrology' by Todd D. K.
- 'Groundwater Resource Evaluation' by Walton W. C.
- 'Groundwater' by Raghunath H. M.
- 'Handbook of Applied Hydrology' by Chow V. T.
- 'Irrigation: Theory & Practice' by Michael A. M.
- 'Groundwater' by S.Ramakrishnan

NCE – 064 EARTHQUAKE RESISTANT DESIGN

L T P
3 1 0

Unit – 1

Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes, 8

Unit - 2

Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system, 8

Unit -3

Dynamics of multi degree of freedom system, Idealization of structures, seismic response, 8

Unit – 4

Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Introduction to earthquake resistant brick and masonry buildings. 8

Unit – 5

Reinforced Concrete framed buildings, Code provisions. Introduction to machine foundation & its design. Degrees of freedom of a block foundation. 8

References:

1. Introduction to Structural Dynamics - J.M. Biggs

2. Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran
3. IS: 1983 - 1984 Criterion for Earthquake Resistant Design.
4. Structural Dynamics - Theory & computation - Mario Paz.
5. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.
6. Earthquake Resistant of Design of structures, Agarwal and Srikhande.
7. Earthquake Resistant of Design of structures, S.K.Duggal

OPEN ELECTIVES- I
NOE-071: ENTREPRENEURSHIP DEVELOPMENT

L T P
3 1 0

UNIT -I

Entrepreneurship- definition. growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries

and sub-control types. **5**

Government policy for small scale industry; stages in starting a small scale industry. **2**

UNIT -II

Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. **8**

UNIT -III

Accountancy- Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, quality control, marketing, industrial relations, sales and purchases, advertisement, wages and incentive, inventory control, preparation

of financial reports, accounts and stores studies. **9**

UNIT -IV

Project Planning and control:

The financial functions, cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. profit planning and programming, planning cash flow, capital expenditure and operations. control of financial flows, control and communication. **9**

UNIT -V

Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes

and workman compensation act. **5**

Role of various national and state agencies which render assistance to small scale industries. **2**

Text / Reference Books:

1. Forbat, John, "Entrepreneurship" New Age International.
2. Havinal, Veerbhadrapa, "Management and Entrepreneurship" New Age International
3. Joseph, L. Massod, "Essential of Management", Prentice Hall of India.

NOE-072: QUALITY MANAGEMENT

L T P
3 1 0

UNIT-I

Quality Concepts:

Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. **3**

Control on Purchased Product

Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. 2

Manufacturing Quality

Methods and techniques for manufacture, inspection and control of product, quality in sales and services, guarantee, analysis of claims. 5

UNIT-II**Quality Management**

Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. 3

Human Factor in quality

Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods. 2

UNIT-III Control**Charts**

Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. 5

Attributes of Control Chart

Defects, construction and analysis of charts, improvement by control chart, variable sample size, construction and analysis of C charts. 5

UNIT -IV

Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results, reliability control, maintainability, zero defects, quality circle. 8

UNIT –V

ISO-9000 and its concept of Quality Management
ISO 9000 series, Taguchi method, JIT in some details. 7

Text / Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.
3. Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992.

NOE-073: OPERATIONS RESEARACH**L T P****3 1 0****UNIT-I****Introduction:**

Difinition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study.

Linear Programming:

Two variable Linear Programaming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, senstivity analysis.

UNIT-II**Transportation Problems:**

Types of transportation problems, mathematical models, transportation algorithms,

Assignment:

Allocation and assignment problems and models, processing of job through machines.

UNIT-III

Network Techniques:

Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem.

Project Management:

Phases of project management, guidelines for network construction, CPM and PERT.

UNIT-IV

Theory of Games :

Rectangular games, Minimax theorem, graphical solution of $2 \times n$ or $m \times 2$ games, game with mixed strategies, reduction to linear programming model.

Quality Systems:

Elements of Queuing model, generalized poisson queuing model, single server models.

UNIT-V Inventory

Control:

Models of inventory, operation of inventory system, quantity discount.

Replacement:

Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Text / Reference Books:

1. Wayne L. Winston, "Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

NOE-074: INTRODUCTION TO BIOTECHNOLOGY

L T P
3 1 0

UNIT-I

Introduction: Concept nature and scope of biotechnology.

Cell Structure and Function: Eukaryotic and prokaryotic cells, cell wall, membrane organization, cell organelles, Nucleus, Mitochondria, endoplasmic reticulum, chloroplast, viruses and toxins into cells.

Cell Division: Mitosis and Meiosis.

8

UNIT-II

Biomolecules: A brief account of structure of carbohydrates, Lipids and Proteins.

Genes: Brief idea about Mendel's laws and chromosomes, nature of genetic materials, DNA and RNA, DNA replication.

7

UNIT-III

Gene Expression: Central dogma, genetic code, molecular mechanism on mutations, regulations of gene expression, house keeping genes, differentiation and development mutations and their molecular basis.

Genetic Engineering: Introduction, cloning (vectors and enzymes), DNA and genomic libraries, Transgenics, DNA fingerprinting, genomics.

9

UNIT-IV

Applications of Biotechnology: Bioprocess and fermentation technology, cell culture, Enzyme

technology, biological fuel generation, sewage treatment, environmental biotechnology, biotechnology and medicine, biotechnology in agriculture, food and beverage technology, production of biological invention. **9**

UNIT-V

Safety and Ethics: Safety, social, moral and ethic considerations, environmental ethics, bioethics and stem cell research, safety of new biotechnology foods, agro biodiversity and donor policies. **7**

Text Books/ Reference Books:

1. Smith, "Biotechnology" Cambridge Press.
2. P.K. Gupta, "Elements of Biotechnology" Rastogi
3. H. D. Kumar, "Modern concepts of Biotechnology" Vikas publishing House.

OPEN ELECTIVES- II

NOE-081: NON-CONVENTIONAL ENERGY RESOURCES

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UNIT-I

Introduction

Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. **3**

Solar Cells:

Theory of solar cells. solar cell materials, solar cell array, solar cell power plant, limitations. **4**

UNIT-II

Solar Thermal Energy:

Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. **9**

UNIT-III Geothermal

Energy:

Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. **4**

Magneto-hydrodynamics (MHD):

Principle of working of MHD Power plant, performance and limitations. **2**

Fuel Cells:

Principle of working of various types of fuel cells and their working, performance and limitations. **3**

UNIT-IV

Thermo-electrical and thermionic Conversions:

Principle of working, performance and limitations. **2**

Wind Energy:

Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. performance and limitations of energy conversion systems. **6**

UNIT-V

Bio-mass:

Availability of bio-mass and its conversion theory. **2**

Ocean Thermal Energy Conversion (OTEC):

Availability, theory and working principle, performance and limitations.

Wave and Tidal Wave:

Principle of working, performance and limitations.

Waste Recycling Plants. **3**

Text/References Books:

1. Raja et al, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, " Energy Resources: Conventional & Non-Conventional " BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.

6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.

NOE-82: NON-LINEAR DYNAMIC SYSTEMS

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3 1 0

UNIT-I

Dynamic systems:

Concept of dynamic systems, importance of non-linearity, nonlinear dynamics of flows (in 1, 2, and 3 dimensions) and Maps (1 and 2 dimensions) in phase space, Equilibrium, Periodicity.

Picard's theorem, Peano's theorem, boundedness of solutions, omega limit points of bounded trajectories.

8

UNIT-II

STABILITY-I:

Stability via Lyapunov's indirect method, converse Lyapunov functions, sublevel sets of Lyapunov functions, Lasalle's invariance principle.

7

UNIT-III

Stability-II

Lyapunov's direct method, converse Lyapunov's theorems, Brockett's theorem, applications to control system, stable manifold theorem, centre manifold theorem, normal form theory and applications to nonlinear systems.

8

UNIT-IV

Bifurcation:

Elementary Bifurcation theory, catastrophe, strange attractor, fractals, fractal geometry and fractal dimension.

8

UNIT-V

Chaos:

Deterministic Chaos, routes to chaos (period doubling, quasiperiodicity, intermittency, universality, renormalization); Measurement of Chaos (Poincare section, Lyapunov index, entropy); control of chaos.

9

Reference Books:

1. D.K. Arrowsmith and C.M. Place, "An Introduction to Dynamical Systems" Cambridge University press, London, 1990.
2. K.T. Alligood, T.D. Sauer, and J.A Yorke, "CHAOS: An Introduction to Dynamical System" Springer Verlag, 1997.
3. H.K. Khalis, "Nonlinear Systems" Prentice Hall, 1996.
4. R. R. Mohler, "Non linear systems, Vol-I: Dynamics and Control" Prentice Hall, 1991.
5. J.M. T. Thomson and H.B. Stewart, "Nonlinear Dynamics and Chaos" John Wiley & Sons, 1986.
6. Stanislaw H. Zak, "Systems and control" Oxford University Press, 2003.

NOE- 083: PRODUCT DEVELOPMENT

L T P
3 1 0

UNIT-1

Concept of Product, definition and scope.

Design definitions, old and new design methods, design by evolution, examples such as evolution of sewing M/C, bicycle, safety razor etc., need based developments, technology based developments physical reliability & economic feasibility of design concepts.

UNIT –II

Morphology of design, divergent, transformation and convergent phases of product design, identification of need, Analysis of need. Design criteria; functional, aesthetics, ergonomics, form, shape, size, colour.

Mental blocks, Removal blocks, Ideation techniques, Creativity, Check list.

UNIT –III

Transformations, Brainstorming & Synetics, Morphological techniques.

Utility Concept, Utility Value, Utility Index, Decision making under Multiple Criteria.

Economic aspects, Fixed and variable costs, Break-even analysis.

UNIT-IV

Reliability considerations, Bath tub curve, Reliability of systems in series and parallel, Failure rate, MTTF and MTBF, Optimum spares from Reliability considerations.

Design of display and controls, Man- machine interface, Compatibility of displays and controls. Ergonomic aspects, Anthropometric data and its importance in design.

Application of Computers in Product development & design.

UNIT-V

Existing techniques, such as work-study, SQC etc. for improving method & quality of product.

Innovation versus Invention. Technological Forecasting.

Use of Standards for Design.

Text/Reference Books:

3. A.K. Chitambar & R.C. Gupta "Product design & Manufacturing" – Prentice Hall (EE)
4. R.P. Crawford, "The Technology of creation Thinking" Prentice Hall.
5. C.D. Cain, "Product Design & Decision" Business Books.
7. C.D. Cain, "Engg. Product Design" Business Books.

NOE-084: AUTOMATION AND ROBOTICS

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3 1 0

1. **Introduction:** Definition, Classification of Robots, geometric classification and control classification.
2. **Robot Elements:** Drive system, control system, sensors, end effectors, gripper actuators and gripper design.
3. **Robot Coordinate Systems and Manipulator Kinematics:** Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world.
Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators.

4. **Robot Control:** Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Seroo system for robot control,

and introduction to robot vision.

5. **Robot Programming:** Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handling, assembly operations, collision free motion planning.

6. **Applications:** Application of robot in welding, machine tools, material handling, assembly operations parts sorting and parts inspection.

Text/Reference Books:

1. Coifet Chirroza, "An Introduction to Robot Technology" Kogan Page.
2. Y. Koren "Robotics for Engineers" Mcgraw Hill.
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill.
4. J.J. Craig, "Robotics" Addison-Wesley.
5. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
6. Asfahl, "Robots & Manufacturing Automation" Wily Eastern.