BATCH 2014-OVERVIEW FOR B.TECH COURSE CIVIL ENGINEERING

Semester-II Spring Session 2015

Course Code	Course Title	L – P	Credit (L+P)
CE 201T	Physics-II	4 – 0	4
CE 202T	Chemistry-II	4 – 0	4
CE 203T	Mathematics-II	4 – 0	4
CE 204T	Professional Communication & Engineering Ethics	4 – 0	4
CE 205T	Engineering Mechanics	4 – 0	4
CE 206T	Machine Drawing	3 – 2	4
CE 207P	Computer Programming Lab	0– 3	2
CE 208P	Physics-II Lab	0 – 2	1
CE 209P	Chemistry-II Lab	0 – 2	1
	Total Credits	23-9	28

CE - 201T – Physics – II

L –P
4 – 0 **Credit: 4**

Unit-I

Quantum Mechanics: De-Broglie Hypothesis, Davison Germer experiment, wave function and its properties, expectation value, quantum mechanical operator, Wave Packet, Normalisation factor, Uncertainty principle. Schrödinger Equation for free Particle, Schrödinger wave Equation; Time Dependent and Time Independent, Tunnelling effect and its example (Tunnel diode or alpha decay).

Unit-II

Elementary Solid State Physics: Crystal lattice, Crystal structure, Unit cells, Miller Indices, Bravais lattice, Photographic crystal X-ray diffraction techniques.

Classification of solids, formation of energy bands in metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, Fermi energy.

Unit-III

Diffraction: Optical diffraction techniques- Fresnel and Fraunhoffer diffraction.

X-ray diffraction techniques (Single crystal and Polycrystalline materials)- Laue's method, Powder method, Oscillation and Rotation method.

Unit-IV

Special theory of Relativity*:* Frames of reference, Michelson-Morley experiment, Basic postulates of special theory of relativity, Length contraction, time dilatation, Time-energy relation.
Superconductivity: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), applications of superconductors.

Unit-V

Lasers*:* Introduction, Principle of laser, Stimulated and spontaneous emission, Population inversion, Einstein coefficients, optical pumping, **Resonant Cavity and its modes**, He-Ne Laser, Ruby Laser, Semiconductor Lasers, Applications of Lasers.

Books recommended:

- A. Ghatak, "Optics"
- N. Subrahmanyam and BrijLal, "Optics"
- Jenkins and White, "Fundamentals of Optics"
- Rajnikant, "Applied Solid State Physics"

CE-202T- Chemistry-II

L – P

4 – 0 **Credit: 4**

Unit-I: NANO-TECHNOLGY

Nanoscale and Its Significance, Properties at Nanoscale (Optical, Electrical and Magnetic).Nanostructures (Nano-rods, Nano-rings, Nano-particals), General Methods of Preparation, Carbon Nanotubes, Nanoelectrodes, Nonopolymers.

Unit-II: CORROSION

Introduction, Effects of Corrosion, Factors Effecting the Rate of Corrosion (Nature of the Metal and Nature of the Environment), Electrochemical Theory of Corrosion, Dry Corrosion and Wet Corrosion, Types of Corrosion (Pitting Corrosion, Crevice Corrosion, Galvanic Corrosion and Stress corrosion), Testing and Measurement of Corrosion, Corrosion Protection and Inhibition, Cathodic Protection, Anodic Protection, Protective Coatings

Unit-III: POLYMERS

Advantages of Polymers over other Engineering Materials, Functionality, Degree of Polymerization, Concept of Molecular Weight, Polymerization (Addition, Condensation and Copolymerization), Polymerization Techniques (Bulk, Solution, Suspension and Emulsion polymerizations), Preparation, Properties and Engineering application of some Important Polymers, Polythene (LDPE and HDPE), Polyvinyl Chloride, Polystyrene, Teflon, Phenol Formaldehyde. Introduction to polymeric composites

Unit-IV: LUBRICANTS

Introduction, Theories of Lubrication, Mechanism of Lubrication, Classification of Lubricants (Solid, Semi-Solid, liquid), Properties of Lubricants and Their Significance, Additives for Lubricants, Selection of Lubricants

Unit-V: INSTRUMENTAL TECHNIQUES II

X-ray Spectroscopy: Principle and Applications

Nuclear Magnetic Resonance: Chemical Shift, Splitting and Application

Thermal Analysis: Principle, Working and Application

Basic introduction to SEM and TEM

Books Recommended:

1. S.S Dara A Text Book of Engineering S Chand & Co limited New Delhi
2. Advanced Practical Physical Chemistry by Yadav, Goyal publication
3. Spectroscopic methods : Williams and Fleming
4. Applied Chemistry : Theory And Practice By O. P. Vermani
5. A Text book of Engineering Chemistry by S.S. Dara, S.Chand& Co, New Delhi
6. Laboratory Manual on Engineering Chemistry by S.K. Bhasin and Sudha Rani, DhanpatRai Publishing Company, New Delhi (2004).
7. Applied chemistry,Balsaraf V. M. Et. Al., I. K. International Publishing House Pvt. Ltd (2010
8. Electrochemistry and Corrosion Science by N.Perez
9. Analytical chemistry: An Introduction ByDouglas A. Skoog, Donald M. West, F. James Holler 6^{th} edition
10. Polymer Science (Wiley Easter Limited New Delhi)V.R.Goowriker, N.V Viswanathan and jayadevSreedhar,
11. Nanotechnology Fundamentals And Applications,ManasiKarkare, RajniBahuguna
12. Nanotechnology Importance And Application, Fulekar

CE- 203T – Mathematics-II

L – P

4– 0 **Credit: 4**

Unit-I:

Differential Equation**:** Partial differential equations of first order, langrage linear equation Standard form, Charpit`s Method to solve non- linear partial differential equation.

Unit-II:

Partial differential equations of second and higher, Homogeneous Partial Differential equations with constant coefficients, vibration of stretched flexible string, heat flow equation. Wave equation, solutions by the method of separation of variables. Series solutions of ordinary differential equations

Unit-III:

Fourier Series **:**Fourier Series, Integral Calculus**:** Differential under the sign of integration. Double and triple integrals, change of variables, Beta and Gamma functions

Unit-IV:

Matrices**:** Review of algebra of matrices, partitioning of Matrices,Hermitian and skew-Hermitian Matrices. Orthogonal and unitary matrices, Triangular matrices, Rank of a matrix. Equivalent matrices, elementary transformations, Normal form

Unit-V:

Inverse of matrix (Different Methods) and solution of simultaneous equation by elementary operation.Normal form, Eigen values, and Eigen vectors of a matrix.Caley-Hamilton theorem, Quadratic Form.

Books Recommended:

1. Advanced Engineering Mathematics by E.Kreyszig
2. Differential equations and its applications, H.T.Piaggio, Prentice-Hall
3. Applied Mathematics for Engineers byP.N.Wartikar
4. Advanced Engineering Mathematics,2/e by Greenberg, Pearson education, 2004
5. Ordinary and partial Differential equation, M.D.Raisingania, S.Chand and Co
6. Linear Algebra,Hoffmann&Kunze, Prentice-Hall
7. Mathematical Analysis by S.C.Malik&SavitaArora New Age international Limited
8. Integral Calculus by Shanty Narayan.

CE -204T- Professional Communication& Engineering Ethics

L – P

4– 0 **Credit: 4**

Unit I:

Communication: definition and description; types of communication; body language; barriers to Communication. Speech sounds: description and articulation of Phonemes, words, word stress, sentence stress and intonation in basic patterns; basics of connected speech and conversational patterns.

Unit II:

Written communication: nature, styles and types, Report writing; structure, drafting and types; business correspondence: purpose, types of business letters; resume; proposals and invitations; emails. Presentation: skills and deliverance; making and answering phone calls; debating and group discussions; facing interviews.

Unit III:

Engineering ethics, Nature and scope, Types of ethics: Common ethics, Personal ethics, Professional ethics, Origin of ethical theories, Rights and responsibilities of engineers, Case studies.

Unit IV:

Islamic perspective on ethics and education, concept of rights and duties in Islam, sociological perspective on education, social and value implications of technology, Environmental Obligations on Engineers

Unit V:

Moral development, Different stages of moral development; pre-conventional, conventional and post-conventional, Moral and non-moral actions, Impediments to responsible action, Computer ethics, Computer Crimes, need of computer ethics, hacking, Bio-Ethics,

RECOMMENDED BOOKS:

1. Battacharaya, Inderjit. An Approach to communication Skills.
2. P.D. Chaturvedi and M. Chaturvedi, Business Communication, Delhi: Pearson Education, 2006.
3. Charles B. Fleddermann, Enginerring Ethics 2nd ed. Pearson education Inc.
4. FrankanaWalliam .K :Ethics
5. Sinha. J.N :Manual of Ethics

CE - 205T- Engineering Mechanics

L - P
4 - 0 **Credit: 4**

UNIT I

Analysis of Stresses & Strains: Forces & stresses, normal stress & normal strain, axial loading, stress strain diagram (mild steel), mechanical property, Hooke's Law, modulus of Elasticity, ultimate & allowable stress, factor of safety, composite sections, bars of varying cross-section, super-position principle, temperature stresses, Poisson's ratio, bulk modulus, shear strain, relation among E, V & G.

UNIT II

Moments of Area of Plane Area: Center of Gravity (symmetrical & un-symmetrical sections), moment of inertia, of symmetrical & unsymmetrical sections, parallel axis theorem, perpendicular axis theorem, radius of gyration.

UNIT III

Bending moment & Shearing Force: Notation & sign convention for flexural loads, shear force & bending moment diagrams of determinate structures, (Cantilever, simply supported beams & varying load beams) supported to point loads, UDL and VDL; computing of reactions using equation of equilibrium.

UNIT IV

Trusses: Planner Truss structures, idealization of planar structures, sign convention & member force representation, analysis of trusses by methods of Joints, graphical and sections.

UNIT V

Torsion of shafts: Preliminary discussion of stresses in a shaft, deformation in a circular shaft, polar moment of inertia, angle of twist, design of transmission shaft.

Books Recommended:

- Shames I.H., Engineering Mechanics, Prentice Hall, New Delhi.
- Beer, F.P. and Johnston, Vector Mechanics for Engineers, McGraw Hill – Eighth Edition.
- Beer, F.P. and Johnston, Mechanics of Materials, Tata McGraw Hill, New Delhi.
- D.S. Kumar, Engineering Mechanics, S.K. Kataria& Sons, New Delhi.
- Khurmi, Strength of Materials.
- Ramamurtha, Strength of Materials

CE – 206 T - Machine Drawing

L – P
3 – 2 **Credit: 4**

UNIT I: Principles of Sectioning, types of Sections, standard practices.

UNIT II: Nut and Bolt, types and their assembly, threads and various types of screw threads, threaded fasteners, locking devices, foundation bolts.

Permanent fasteners: Rivet and riveted Joints, welding symbols and welding joints.

UNIT III: Pin and cotter joints (temporary fasteners), Spigot and socket type cotter joint, sleeve type cotter joint, knuckle joint, Gib and cotter joint.

UNIT IV: Keys and Shaft Couplings (temporary fasteners), Flanged (Protected and unprotected), Muff coupling (Pin type), friction coupling, clutches, Oldham coupling and universal coupling.

UNIT V: Shaft bearing: Type of Bearings, journal bearings, pivot bearings, thrust bearings, ball bearings, bearing bracket, hangers and ball bearings.

Books Recommended:

1. P.S Gill Machine Drawing
2. N.D Bhatt Machine Drawing

CE-207P Computer Programming Lab

L – P

0 -3 **Credit:2**

Introduction to Pointers: A first look at pointers, declaring pointers, using pointers, naming pointers, pointer operators, pointer expression and pointer arithmetic.

Arrays and Pointers: Arrays and pointers in practice, multidimensional arrays, and pointers, accessing array elements, dynamic memory allocation – The Malloc function.

Characters and Strings: Fundamentals of strings and characters, character handling library, string conversion function, standard I/O library function, comparison, search and memory function of string.

Structures: Definition, initializing, assigning values, passing of structures as arguments, Arrays of structures, pointers to structures, self-referential structures. Unions, type-def, bit fields, C program examples.

Console & File I/O: Standard I/O, Formatted I/O, opening & closing of files, I/O operations on files.

Books Recommended:

- *C How to Program*, Deitel&Deitel, Prentice hall
- Let us C, Yashavantkanetkar, BPB Publications

Lab Programs

1. Write a program in C to copy one array to another array ?
2. Write a program in C to merge two arrays ?
3. Write a program in C to read and display biodata using structures ?
4. Write a program in C to read and display integer array using functions ?
5. Write a program in C to read and display biodata using functions ?
6. Write a program in C to read and display a 3 x 3 Matrix ?
7. Write a program in C to transpose the 3 x 3 Matrix ?
8. Write a program in C to print the sum of two 3 x 3 Matrix. ?
9. Write a program in C to print the product of two 3 x 3 Matrix ?
10. Write a program in C to read and display a N x N Matrix ?
11. Write a program in C to transpose the N x N Matrix ?
12. Write a program in C to print the sum of two N x N Matrix ?
13. Write a program in C to print the product of two N x N Matrix ?
14. Write a program in C to read and display a M x N Matrix ?
15. Write a program in C to transpose of M x N Matrix ?
16. Write a program in C to print the sum of two M x N Matrix ?
17. Write a program in C to print the sum of two M x N Matrix ?
18. Write a program in C to find sum of two matrices using array
19. Write a program to sort a 4X4 matrix
20. Write a function to swap two numbers using call by reference.
21. Write a function to find minimum of an array using pointers.
22. Write a function to reverse a string using pointers.

CE - 208P – Physics - II Lab

L – P

0 – 2 **Credit:1**

Lab 1 Determination of refractive index of prism by spectrometer.

Lab 2 Determination the wavelength of sodium light by diffraction grating.

Lab 3 Determination of Wavelength of sodium light by Newton's ring.

Lab 4 Study of Zener diode voltage regulating characteristics.

Lab 5 To study double slit interference by He-Ne laser.

Lab 6 To plot the graph for the transistor characteristics.

Lab 7 To plot the graph for the semi-conductor diode.

Lab 8 To find the dead time of a G. M. Counter.

CE-209P Chemistry-II Lab

L- P

0 – 2 **Credits:1**

List of Experiments

1) Synthesis of the phenol formaldehyde resin
2) Synthesis of the urea formaldehyde resin
3) To determine the temporary and permanent hardness of the a sample of water by complexometeric titration
4) To determine the Alkalinity of the given sample of water
5) Determination of the ion exchange capacity of cation exchange resin
6) Determination of the ion exchange capacity of anion exchange resin
7) Titration of Fe (II) Vs K_2CrO_7 and Determination of Redox potential of Fe^{2+} /Fe^{3+}
8) Estimation of Copper in Brass with sodium thiosulphate
9) To determine the concentration of the $KMnO_4$ solution using spectrophotometer.

Demonstration of Experiments

Determination of specific rotation of the sucrose by Polorimetry

Spectrophotometer (concentration determination, wavelength maximum)

BATCH-2013-OVERVIEW FOR B.TECH COURSE CIVIL ENGINEERING

Semester –IV- Spring Session 2015

Course Code	Course Title	L – P	Credit (L+P)
CE-401T	Structural Analysis-II	4 – 0	4
CE-402T	Surveying-II	4 – 0	4
CE-403T	Fluid Mechanics-II	4 – 0	4
CE-404T	Concrete and Construction Technology	4 – 0	4
CE-405T	Building Drawing	2 – 2	4
CE-406T	Numerical Methods in Civil Engineering	3 – 0	3
CE-407P	Fluid Mechanics Lab-II	0– 2	2
CE-408P	Structure Lab-II	0 – 2	2
CE-409P	Surveying Lab-II	0 – 3	2
CE-409PC	Surveying Camp	-	2
CE-410P	Concrete Technology Lab	0 – 2	2
	Total Credits	21-11	33

CE-401T-Structural Analysis-II

L – P

4 – 0 **Credit:4**

UNIT I: Introduction to indeterminate structures:

Introduction to Indeterminate structures, Types of structural supports (hinged, roller and Fixed), Degrees of Freedom, Kinematic and Static indeterminacy of structures (Statically indeterminate structures, Redundant Frames, Order of redundancy).

UNIT II: Energy Methods of Analysis of structures:

Strain Energy Method of analysis of Indeterminate Structures; Strain Energy stored due to axial loading and bending; Castigliano's 2nd theorem of minimum energy and its application to analysis of internally and Externally Indeterminate Beams, Frames, and Trusses.

UNIT III: Force methods of Analysis of structures:

Method of consistent deformation for analysis of indeterminate beams, Fixed Beam, propped cantilever; Deflection of truss joints, First theorem of Castigliano's and its application; Analysis of two hinged arches.

UNIT IV: Displacement methods of Analysis of structures:

Analysis of Indeterminate Beams & Frames (with & without Sway) by Classical Displacement Methods viz; Slope Deflection Method & Moment Distribution Method.

UNIT V: Analysis of Influence lines and Cables:

Influence lines for beams for point loading, udl loading, for wheel loads; Analyze the beam for shear and moments and for their maximum value; analysis of a cable for moments and shear.

BOOKS RECOMMENDED:

1) Indeterminate Structural Analysis by C.K.Wang.

2) Indeterminate Structural Analysis by R.L.Jindal.

3) Structural mechanics by Norris and Wilbur.

4) Theory of Structures by S.RamamruthamR.Narayan

5) Analysis of Structures: Thandavamoorthy

CE-402T-Surveying-II

L – P

4 – 0 **Credit: 4**

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UNIT I: TACHEOMETRY: Stadia and its principle, analytic lens, Heights and distances from stadia intercepts; sub tense method, tangential method; Accuracy, Tacheometric alidade.

UNIT II:GEODETIC SURVEYING: Triangulation-principles: choice of stations, Base line measurements- electronic methods of distance measurements, Triangulation adjustments-Heights, figure adjustments; spherical excess, computations of sides of spherical triangles.

UNIT III:CURVES AND SETTING OUT WORKS: Elements of simple curve; design and setting out of a simple curve, compound curve, transition curve, Vertical curves. Setting out Buildings, Culverts and Bridges, Tunnels, Transfer of alignment. Fixing of horizontal and vertical controls

UNIT IV:HYDROGRAPHIC SURVEYING & REMOTE SENSING: Shoreline and River Survey, the sextant, vertical and Horizontal control, soundings, current meter measurement, stream gauging.Photogrammetry, satellite imaging, microwaves.

UNIT V:PHOTOGRAMMETRY & GPS SURVEYING: Introduction to ground photographic survey-Photo theodolites, Stereo-photogrammetry, Arial surveying, Arial Photography, instruments used, scale of Photograph, number of photographs, mapping.Introduction to various types of instruments for mappingIntroduction to Principles of Satellite Positioning; Introduction to GPS Positioning; GPS Signals & GPS instrumentation; GPS satellite surveying; Modeling GPS Observations; Future of GPS.

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BOOKS RECOMMENDED:

1) Surveying Vol.II by Dr. K. R. Arora

2) Surveying Vol.II by S.K Duggal, Tata McGraw Hill, N.Delhi.

3) Surveyingand Leveling by Basak, Tata Mcg raw Hill, N.Delhi

4) Surveying Vol.II by B.C Punima, Vol 2, Laxmi Publications Pvt. Ltd. N.Delhi

5) Surveying &Levelling by P.B. Shahni

CE-403T-Fluid Mechanics - II

L – P

4 – 0 **Credit: 4**

UNIT I: FLOW THROUGH PIPES: Nature of turbulent flow in pipes, Hydraulic and energy grade lines. Equation for velocity distribution over smooth and rough pipes, Resistance coefficient and its variation, Nikuradse experiments, Moody diagram, Flow in sudden expansion, Contraction, diffusers, Bends, Valves and Siphons; Concept of equivalent length, branched pipes in series and parallels, Simple networks, Transmission of power.

UNIT II: FLUID FLOW PAST SUBMERGED BODIES: Drag and lift, Drag on a sphere, cylinder and disc: Lift, Magnus effect and Circulation.

UNIT III: FLOW IN OPEN CHANNELS: Uniform flow, critical depth, Normal depth, Specific energy, Resistance formulae, gradually varied flow equations, Classification of water surface profiles, Computation of water surface profiles, step by step method and graphical integration method. Hydraulic jump, Momentum Principle for open channels, Evaluation of the jump elements.Venturi-flumes

UNIT IV: WATER HAMMER AND SURGE TANKS: Sequence of events after sudden valve closure, pressure diagrams, Gradual closure or opening of the valve, Instantaneous closure of valve in a rigid pipe, Instantaneous closure of valve in an Elastic pipe and compressible fluid, Methods of Analysis; Surge tanks, Location of surge tanks,types,Design of surge tanks.

UNIT V: HYDRAULIC MACHINES: Types of Turbines, Description and principles of impulse and reaction Turbines, Unit quantities and specific speed, Runaway speed, Turbine characteristics, Selection of Turbines, Cavitation; Draft tube, Draft tube dimensions, Types of Draft tubes; requirements, Reciprocating pumps.

BOOKS RECOMMENDED:

1) Engineering Fluid Mechanics by R.J.Garde.

2) Open Channel Flow by Subramanaya.

3) Fluid Mechanics and Hydropower Engg. byDr D.S Kumar

4) Handbook of Hydroelectric Engg. by Nigam

5) Flow through Open Channels by RangaRaju, Tata McGraw Hill Publishing Company Ltd. N.Delhi.

CE-404T-Concreteand Construction Technology

L – P

4 –0 **Credit: 4**

UNIT I: CEMENT, AGGREGATES AND WATER:

Chemical composition of cement, Hydration of cement, Types of cement, Testing of cement; Fineness test, Standard consistency test, Setting time tests, Strength test, properties of aggregates, Qualities of water required as per Codal guidance.

UNIT II: FRESH CONCRETE AND PROPERTIES OF HARDENED CONCRETE:

Strength of concrete: W/C ratio –Gel/Space ratio, Relation between compressive and tensile strength, Workability, Factors affecting workability, Measurements of workability, Bleeding of concrete, Segregation of concrete, curing of concrete, Elasticity, creep and shrinkage; Bond strength; Durability of cement, Testing of hardened concrete.

UNIT III: ADMIXTURES, CONCRETE MIX DESIGN, SPECIAL CONCRETE:

Various types of admixtures used, concrete mix design, light weight concrete, Cold weather concreting, Hot weather concreting, Self-compacting concrete, Aerated concrete.

UNIT IV: PROJECT PLANNING TECHNIQUES: Network planning and scheduling, resource leveling and allocation with examples using Critical Path method. Computerized network techniques.

Form work, Scaffolding, Shoring and Underpinning –their types and application to Building process.

UNITV:CONSTRUCTIONEQUIPMENTS:
Succranes,Hoists,Mixers,Conveyors,Vibrators,Scaffolding,Shuttering etc., their characteristics, performance and applications to building process.

BOOKS RECOMMENDED:

1) Concrete Technology by M.S.Shetty; S.Chand& Company, N,Delhi.

2) Gambhir, M.L. "Concrete Technology", Tata McGraw Hill New Delhi.

3) Neville, A.M."Properties of Concrete "Pearson Publishers.

4) Construction Methods Plant and Equipment by R.L.Purifoy

CE-405T-Building Drawing

L – P

4 –0 **Credit:4**

UNIT I: Introduction

Standard Conventions in Drawing; Basic principles of planning and design in buildings. Drawing of plans, elevations and sections giving construction details of important building components including foundation, plinth. DPC, lintels, slabs and roofs; full specifications for each component.

UNIT II:

Drawing exercises on layouts of building services; Drawing of doors, windows and ventilators.

UNIT III:

Drawing of RCC slabs (One and two way),; beams (including cantilever); columns. Footings (Isolated, Square, rectangular, circular; combines rectangular and trapezoidal).

UNIT IV:

Drawing of RCC staircase; Drawing of various components of a Dog-legged stair case (section and Plan). Drawing of round stair (section and plan).

UNIT V:

Drawing of various timber and steel trusses with joint details; Drawing of Pratt, Howe showing details of top chord, bottom chord, rafter and purlins.

BOOKS RECOMMENDED:

1. Building Drawing by M.G.Shah
2. Civil Engineering Drawing by Chakorbarty
3. Civil Engineering Drawing by J.B.Mckay
4. Building Drawing by V.B.Sikka

CE-406T-Numerical Methods in Civil Engineering

L – P

3 –0 **Credits: 3**

UNIT I:Finite Difference and Interpolation: Difference table and its usage, the difference operator Δ, and the operator E. Interpolation with equal intervals, Newton's forward difference formula, Newton's backward difference formula, interpolation with unequal intervals, Newton's divided difference formula, and Lagrange's interpolation formula.

UNIT II:Central Differences and Inverse interpolation: The central difference operator δ and the averaging operator μ. Relations between the operators, Gauss's backward and forward interpolation formula, Sterling's, Bessel's, Laplace and Everett's formulae.The central difference operator δ and the averaging operator μ.Relations between the operators, Gauss's, Sterling's, and Evett's formulae and their applications.

UNIT III:Numerical Solutions of Algebraic and Transcendental Equations andNumerical Differentiation and Integration:

Regula-Falsi method, Bolzano's process of bisection of intervals, Newton-Raphson method. Numerical differentiation of a function, differential coefficients of a function in terms of its difference, numerical integration of a function, trapezoidal rule , Sympson's rule, Weddle's rule, The Euler-Maclaurin expansion formula.

UNIT IV:Difference Equations and Numerical solutionsof Ordinary Differential Equations: Linear homogeneous and non-homogeneous difference equations of order n with constant coefficients and their solutions, method of undetermined coefficients.Picard's method, Taylor series method, Euler's method and Runga-Kutta method.

UNIT V:Numerical Solution of Simultaneous Equations and Eigen value Problems: Gauss elimination method, Gauss-Jordan method, Gauss-Jacobi and Gauss-Seidel iteration methods, power methods for solving Eigen value problems.

BOOKS RECOMMENDED:

1. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar&R.K.Jain.

2. Numerical methods by E. Balagurusamy

3. Mathematical numerical analysis by S.C. Scarborough.

CE-407P-Fluid Mechanics Laboratory-II

L – P

0 –2 **Credits: 2**

List of experiments:

1. To determine the loss coefficient for various pipe fittings.

2. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.

3. To determine Manning's coefficient of roughness 'n' for the bed of a given flume.

4. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.

5. To calibrate a broad crested weir.

6. To study the formation of hydraulic jump.

CE-408P-Structural Laboratory-II

L – P

0 –2 **Credits 2**

LIST OF EXPERIMENTS:

1. Deflection of curved beams
2. Behavior of Portal Frame under different load combinations
3. Deflection of Truss
4. Behavior of a cantilever beam under symmetrical and un-symmetrical loading
5. Analysis of an elastically coupled beam
6. Analysis of a redundant joint
7. Analysis of two hinged arch
8. Study of Loading frame and Degrees of loading.

CE-409P- Surveying Laboratory-II

CE-409PC- Survey Camp

L – P

0 –3 **Credits: 2+2**

A) **THEODOLITE SURVEYING**:

1. Study of equipment: i) Ordinary theodolites.

ii) E D M Theodolites.

iii) G T S Theodolites.

2. Temporary adjustments of a theodolite.

3. Field work using a theodolite

i) Measurement of horizontal and vertical angles by ordinary and electronic theodolites.

ii) Measurement of linear and angular measurements using EDM/GTS Instruments. (Basic Introduction)

B) TACHEOMETRIC SURVEYING:

1. Study of equipment and graduated staff,Temporary adjustments.

2. Field work:

I) Determination of constants "K & C ".

ii) Stadia traversing & recording stadia field book.

Iii) Location of details by tachometric Methods

C) SURVEY CAMP-Triangulation:

(i) Ordinary Methods (ii) On the basis of Global Positioning System (GPS)

2. Shifting of Horizontal and Vertical Controls.

3. Setting out of works.

4. Setting out of Curves.

5. Contouring:(i) Contouring of a Dam Reservoir/Railway line

(ii) Preparing a contour plan byvarious methods.

(iii) Setting out of Contour lines of an appropriate sit

CE-410P-Concrete Laboratory

L – P

0 –2 **Credits: 2**

List of Experiments:

A) CEMENT:-

1. Determination of standard consistency of cement.

2. Determination of initial setting time and final setting time of cement.

3. Determination of fineness of cement.

4. Determination of compressive strength of cement.

B) CONCRETE:-

1. Determination of consistency of fresh concrete by Slump test

2. Determination of workability of freshly mixed concrete by Compaction factor Test.

2. Determination of cube strength of concrete for different mixes and different W/C ratios.

3. Determination of flexural strength of concrete (Nominal mix).

4. Determination of direct tensile strength of concrete by cylinder splitting test.

5. Determination of bond strength between mild steel plain bars and concrete &between Tor Steel and Concrete.

OVERVIEW FOR B.TECH COURSE CIVIL ENGINEERINGBATCH 2012

Semester-VI- Spring Session 2015

Course Code	Course Title	L – P	Credit
CE 601T	Design Of Steel Structures	4 – 0	4
CE 602T	Geotechnical Engineering-II	4 – 0	4
CE 603T	Transportation Engineering-I (Highway & Pavement Management System)	4 – 0	4
CE 604T	Water Resources Engineering	4 – 0	4
CE 605T	Advanced Structural Analysis	4 – 0	4
CE 606T	Quantity Survey & Cost Estimation	4 – 0	4
CE 607P	Geotechnical Lab-II	0– 2	2
CE 608P	Transportation Lab	0 – 2	2
	Total Credits	24 - 4	28

CE-601T-Design of Steel Structures

L – P

4 –0 **Credits 4**

UNIT I: CONCEPTS OF DESIGN OF STEEL STRUCTURES

Structural steels and their properties.Working stress and Plastic design concepts.Riveted, bolted and welded connections and their design.

UNIT II: DESIGN OF TENSION MEMBERS

Limit State design of tension members; Design of cables and of other tension members; Codal Provisions.

UNIT III: DESIGN OF FLEXURAL MEMBERS

Design of axial and flexural forces, Design of flexural member: Steel beams, built-up sections. Design of Plate Girders.

UNIT IV: DESIGN OF COMPRESSION MEMBERS

Buckling phenomenon of compression members, Design of column bases & grillage foundation. Steel roof Truss: Evaluation of gravity and wind loads on roof trusses. Design of truss members and Purlins.

UNIT V: TIMBER STRUCTURES

Structural timbers and their properties, Introduction to IS Codes on timber design. Design of members in tension, compression and flexure.Bolted, nailed joints and splices.

BOOKS RECOMMENDED:

1. Design of Steel structures (Vol I & II) by Ramachandra
2. Design of Steel Structures by Arya &Ajmani
3. Design of Steel Structures by Duggal
4. Design of Steel Structures by Vizrani&Ratwani
5. Design of steel structures by Negi
6. Design of steel structures by Gaylord
7. Design of wooden structures by Donald Breyer, Kinneth Fridley, Kelly Cobeen, Jr. pollock
8. Design of Steel Structures by Subramanyam
9. IS code 800-2007.

CE-602T-GEOTECHNICAL ENGINEERING-II

L – P

4 –0 **Credits 4**

UNIT I: SHEAR STRENGTH

Shear Strength concept, Mohr's Columb equation, laboratory determination. Tri-axial compression test under different Drainage conditions, viz; undrained, drained and consolidated, direct shear test. Unconfined compression test. Strength envelope.

UNIT II: BEARING CAPACITY & FOUNDATION

Basic definitions and methods of determination.Prandtl's solution.Terzaghi's solution for ultimate bearing capacity.Size effects.Effects of rigidity of footings.Plate load test.

UNIT III: FOUNDATION DESIGN (GEOTECHNICAL ASPECTS)

Basic terminology, bearing capacity of shallow foundations.Importance and types of foundations. Design principles for footings and rafts. Foundations on clays and sands.Foundations-types and applications. Pile foundation types. Classification and determination of load carrying capacity, dynamic and static methods. Pile load test, pile groups, efficiency of pile groups.

UNIT IV: EARTH PRESSURE AND EARTH STABILIZATION

Lateral earth pressure. Rankine's Theory of Active and Passive states. Lateral earth pressure under various conditions-like surcharge, sloping backfill and high water table behind the wall. Earth pressure diagrams, total thrust. Tension cracks and bracing of excavations.

Methods of Stabilization.Brief introduction to each of the methods of the methods of stabilization such as Shot-creting, geo-reinforcement.

UNIT V: STABILITY OF SLOPES AND SOIL DYNAMICS

Infinite slopes, conjugate stresses, stability number. Swedish and French circle methods. Submergence case, complete Draw-down case. Steady seepage case.

Dynamic behavior of soils and its impact on Foundation design.

BOOKS RECOMMENDED:

1. Soil mechanics by Alam Singh
2. Soil mechanics & Foundation Engineering by K.R.Arora
3. Soil Mechanics by S.B.Saighal
4. Soil Mechanics and Foundation Engineering by P Purushotham
5. Soil Mechanics and Foundation Engineering Engineering by S.K.Garg

CE603T-Transportation Engineering-I

L – P

4 – 0 **Credits:4**

UNIT-I: Scope, history,classification of roads. Comparison with other modes of transportation

UNIT-II: Alighnment design: route survey and highway location.Geometricdesign : cross section elements; sight distances, horizontal and vertical alighnment

UNIT-III:Pavement design: factors effecting pavement design, tyoes of pavements, Emperical methods of flexible pavement design (e.g C.B.R, GROUP INDEX AND Burmister's layer theory) stress due to load and temperature in rigid pavements,introduction to design methods of rigid pavements

UNIT-IV: Highway materials and construction: Properties and tests for road aggregates and bituminous materials, design of bituminous concrete mix, methods of preparing subgrade, base course and construction of various types of surface covers, joints in cement concrete roads.

UNIT–VI: Pavement management system: basic concept, data requirements & collection methods, maintenance and rehab treatments, priority programming, implementation of PMS

BOOKS RECOMMENDED:

1. Khanna, S.K. and Justo, C.E.G. 2002. "Highway Engineering".Nem Chand Brothers, Roorkee.

2.Bhanot, K.L.1990. " Highway Engineering", S. Chand and Company (P) Ltd., New Delhi.

3.Rao, G.V. 1996. "Principles of Transportation and Highway Engineering", Tata McGraw Hill, New Delhi

4.Pavement Design and Management Guide by Transportation Association of Canada, Ottawa, Ontario, Edn. Dr. Ralph Haas,

CE-604T-Water Resources Engineering

L – P

4 –0 **Credits 4**

UNIT I: HYDROLOGY

Scope and applications of Hydrological cycle; precipitation measurement by rain Guages, guage networks. Hyetographs and methods of determining mean rainfall.

Hydrological Abstractions: Evaporation, Transportation, Interception, Depression storage, Infiltration.

UNIT II: STREAM FLOW

Factors affecting Runoff.Rainfall-Runoff relationships. Unit Hydrograph, Peak Flow, low flows, requirements for Hydrological design, velocity & Discharge measurements.

UNIT III: FLOOD ESTIMATION AND GROUND WATER

Occurrence and distribution of floods; various methods of flood estimation; viz rational method and Unit hydrograph method, etc.

Occurrence and distribution of ground Water, specific yield of acquifers, movement of ground water.Darcy's Law, safe yield of a basin, steady flow in a well for confined and unconfined acquifers.

UNIT IV: FLUVIAL HYDRAULICS

Principles of sediment transport, critical tractive force, Shield's plot, Bed and suspended load. Bed movement, Einstein's Analysis, White's Theory, Rigid and loose Boundaries.

UNIT V: RESERVOIR DESIGN STUDIES

Area-Volume curves, types of reservoirs and zones of storage, storage capacity of reservoirs. Mass-curve technique, reservoir flood routing, sedimentation of reservoirs.

BOOKS RECOMMENDED:

1. Irrigation, Water Power & Water Resources Engineering by K.R.Arora
2. Engineering hydrology by K Subramanya
3. Engineering Hydrology by EM Wilson
4. Mechanics of sediment transportation and alluvial stream problems by RJ Garde& KG Rangaraju
5. Hydrology Principles Analysis & design by HM Ragunath
6. Applied Hydrology by K Linsley, A Kohler, LH Paulhus
7. Hydrology & Water Resources Engineering by SK Garg

CE-605T-Advanced Structural Analysis

L – P

4 –0 **Credits 4**

UNIT I: MATRIX METHODS OF STRUCTURAL ANALYSIS

Introduction to matrix stiffening &Flexibilty Methods.Formulation of Stiffness matrix for simple Planar Elements- Trusses & Beams.

UNIT II: APPLICATION OF MATRIX METHOD OF STRUCTURAL ANALYSIS

Analysis of Planar Trusses & Beams using Direct Stiffness method. Application of matrix displacement method to rigid Jointed frames.

UNIT III: FINITE ELEMENT METHOD

Introduction to Finite Element Method of Structural Analysis. Review of principle of Virtual work.

UNIT IV: APPLICATION OF FINITE ELEMENT METHOD OF STRUCTURAL ANALYSIS

Formulation of Element Stiffness Matrix for 1D Bar & Beam Element.Application of Finite Element Method of structural Analysis to beams and frames.

UNIT V: FINITE ELEMENT METHOD APPLIED TO HIGHER ORDER

Application to Bar Elements with varying area of cross-section and Beams with varying Moment of inertia.

Plane Stress & plane Strain Problems. Use of Higher order Elements.

BOOKS RECOMMENDED:

1. Finite Element Method by Deb Debasis
2. Theory of Structures by Ramamurathan
3. Matrix Analysis of Framed Structures by Harry h.West
4. Concepts & Applications of Finite Element Analysis by Robert D Cook
5. Basic Structural Analysis by CS Reddy

CE-606T-Quantity Survey& Cost Estimation

L – P

4 –0 **Credits 4**

UNIT I: ESTIMATE

Importance, items of a work and their units. Types of Estimate, viz; preliminary; approximate; Abstract estimate; plinth area estimate; detailed estimate; revised estimate; supplementary estimate, bill of quantities and abstract of cost.

UNIT II:ANALYSIS OF RATES

Preparing of rates, Labour schedule, material schedule and rate schedule. Analysis of rates-of lime concrete in Foundation; Brickwork in foundation in superstructure; stone masonry; RCC masonry; RCC work; RB work; Plastering; Pointing; white washing; colour; washing; painting; woodwork; earthwork in foundation; earthwork in road; DPC; steel work for reinforcement; steel work in trusses; woodwork in frames, shutters, etc.

UNIT III:SPECIFICATIONS & WORKS ESTIMATE

General specifications & detailed specifications, Book of specifications, specifications, specifications for earthwork in foundation; LC in foundation; RCC work; Brick work; RB work; woodwork in doors, windows, etc. DPC centering & shuttering; earthwork in canal & road.

Estimates of building; Estimates of walls; methods of building estimate; Longwall, shortwall& centerline methods; Estimate of masonry platform; estimate of a masonry tank, estimate of roof trusses; Estimate of a single roomed building; estimate of a 2 roomed building with CGI roof over wooden trusses and over steel truss; estimate of a shop; estimate of a RCC Beam; RCC slab.

UNIT IV: ESTIMATE OF ROAD

Methods of estimate; materials for different items of works and labour; methods of estimating earthwork; estimate of a metalled road.

UNIT V: VALUATION & RENT FIXATION

Valuation of building various methods; rent fixation, plinth area requirements.

BOOKS RECOMMENDED-

1. Estimating & Costing by Datta
2. Estimating & Costing by Mahajan
3. Estimating, Costing & Valuation by SC Rangawala

CE-607P-Geo-Technical Laboratory II

L – P

0 –2 **Credits 2**

LIST OF EXPERIMENTS:

1. Shear strength tests:
   a. Unconfined Compression Test
   b. Direct Shear Test
   c. Tri-axial Compression test (UU)
   d. Vane Shear Test.

Conduct and determination of Shear Parameters.

2. Conduct of Plate Load Test
3. Conduct of SPT
4. Sub-soil exploration by electric resistivity method

CE-608P-Highway Laboratory

L – P

0 –2 **Credits 2**

LIST OF EXPERIMENTS:

1. **TESTS ON AGGREGATE-**

a. Aggregate grading
b. Specific Gravity
c. Crushing
d. Abrasion
e. Impact
f. Soundness
g. Flakiness
h. Shape
i. Fineness Modulus
j. Silica content
k. Silt content,
l. Alkalinity.

2. **TESTS ON BITUMEN-**

a. Viscosity
b. Penetration,
c. Softening point
d. Flash & Fire Point.
e. Ductility,
f. specific gravity,
g. elastic recovery,
h. marshall stability

3. **TESTS ON SUB-GRADE-**

a. Sub-grade Modulus
b. CBR.

Books recommended:

1. Khanna, S.K. and Justo, C.E.G. 2002. "Highway Engineering".Nem Chand Brothers, Roorkee

2.Highway Materials and Pavement Testing by Khanna, Justo &Veeraragavan, Nem Chand Brothers, Roorkee

3.Material Testing Laboratory Manual by Kukreja, Kishore &Chawla, Standard Publishers, NaiSarak, Delhi

OVERVIEW FOR B.TECH COURSE CIVIL ENGINEERINGBATCH 2011

Semester-VIII- Session Spring 2015

Course Code	Course Title	L - P	Credit
CE 801 T	Design of Bridge Structures	4 - 0	4
CE 802 T	Hydropower Engineering	4 - 0	4
CE 803 P	Project	0 - 10	10
CE 804 P	Tour &Training	-	2
CE 805 P	Professional viva-voce	-	2
	Elective courses		
CE 806 T : E1	Earthquake Resistant Design	4 - 0	4
	Transportation Planning & Economics	4 - 0	
CE 807 T : E2	Operation Research	4 - 0	4
	Rock Mechanics & Tunneling Technology	4 - 0	
	TOTAL CREDITS	16 - 10	30

CE 801 T- Design of Bridge Structures

L – P

4 –0 **Credits: 4**

UNIT I:INTRODUCTION TO BRIDGES

Introduction to bridge components, design codes, bridge types, Standard loads on bridges

UNIT II:

Introduction to Hydraulic Design of Bridges, scour depth, afflux, stream flow (discharges).

UNIT III:DESIGN OF STEEL BRIDGES

Various forms of steel bridges (Plate girder & trussed bridges) Super structure as per IRC standards; Design of stringer and cross girder for single & multi-lane bridges for standard IRC loading.

UNIT IV:DESIGN OF BRIDGE DECK SLABS

Design of various forms of concrete bridge decks as per- Design for standard IRC loading

UNIT V:DESIGN OF TRUSS MEMBERS

Design of various forms of truss members for steel bridges based on standard IRC loading

BOOKS RECOMMENDED:

1. Design of Bridges by John victor
2. Design of Bridges by Krishna Raju
3. Design of Masonry& timber structures by A.S. Arya
4. Relevant IRC/IS codes & specifications.

CE-802 T-Hydropower Engineering

L – P

4 –0 **Credits: 4**

UNIT I: GENERAL INTRODUCTION

Development of water power, Estimation of Hydropower potential, Comparison of hydro, thermal & nuclear power.

Classification of hydro-power plants.

UNIT II: ANALYSIS OF STREAM FLOW & DEMAND

Flow duration curve, firm power, secondary power, load & Load duration curves, load factor etc.

UNIT III: WATER CONVEYANCE SYSTEM

Power canals, Alignment, Design of power canals, flumes, covered conduits & tunnels.

Penstocks- Alignment, types of penstocks, Economic diameter of penstocks, Anchor blocks.

UNIT IV: DAMS

Selection of site, preliminary investigations, Final investigations.

Rigid Dams: Basic principles of design & details of construction.

Embankment Dams: Earthen dams, rock-fill dams, design Considerations.

Spillways: Types of spillways, Spillway gates, Design of stilling basins.

UNIT V: POWER HOUSE DETAILS

Forebay, intakes, General layout of power house & arrangement of hydropower units; Underground power stations.

BOOKS RECOMMENDED:

1. Dandekar, M.M. "Water Power Engineering".
2. Deshmukh, M.M. "Water Power engineering", DanpatRai& Sons, New Delhi.
3. Arora, K.R. "Irrigation, Water Power & Water Resources Engineering", Standard Publishers Distributors, Delhi.

CE 803 P- Project

L – P

0 –10 **Credits: 10**

The project assigned to the group of students at the 7th semester level will have to be completed at the 8th semester. It may require complete field survey, a design & calculations of various structures associated with the project, comparative economic studies, preparations of estimates, laboratory/experimental work etc.

On completion of the project work, a detailed technical report is to be submitted by every student in accordance with the standards adopted for technical report. There will be a viva-voce examination after the submission of the technical report. The H.O.D. would constitute a project evaluation board which will assess the individual project work. The weightage will be as follows:

i) Supervisor or Internal guide (From the department) = 40 %
   Supervisor or internal guide will assess 20% for work performed and 20% for Project report.

ii) Project Report = 20 % (To be assessed by the evaluation board).

Evaluation board assessment will be done by internal expert/supervisor & the external expert in the ratio of 1:1.

iii) Presentation & viva-voce = 40 %.

The evaluation board will comprise of supervisor, internal expert & one subject expert preferably from outside the University.

CE 804 P-Tour & Training

L – P

0 –0 **Credits: 2**

The students shall go for tour & training to study an ongoing project work in the state or outside so as to acquaint themselves with the latest technologies in engineering. The students are required to submit a detailed tour & training report and shall submit the same to the evaluation board to be constituted by the HOD.

The weightage shall be as follows:

i) Expert/supervisor (From the department) = 40 %
ii) Project Report = 20 %
iii) HOD/Board/Viva = 40 %

CE 805 P-Professional Viva -Voce

L – P

0 –0 **Credits: 2**

A viva-Voce shall be conducted at the 8th semester to assess the students' knowledge of the various subjects that have been taught all through the Engineering degree. The HOD shall constitute an evaluation board to conduct the Viva-Voce.

CE 806 T : E1- Earthquake Resistant Design

L – P

4 –0 **Credits: 4**

UNIT I:

Introduction to earthquakes, Acceleration time history, Response spectrum, Design spectra

UNIT II:

Response of buildings subjected to ground motion based on modal analysis.

UNIT III:

Seismic design of R.C.C. structures (up to 2-storey Buildings) based on Codal provisions IS: 1893.

UNIT IV:

Seismic design of brick masonry structures based on Codal provisions.

UNIT V:

Detailing of RCC Elements as per IS: 13920, Repair & seismic strengthening of buildings as per IS: 13935.

BOOKS RECOMMENDED:

1. Dynamics of structures by Anil K Chopra.
2. Seismic design of structures by PankajAggarwal, ShrikhandeSeismic design of RCC & Masonry structures by pauley, T & Priestley.

CE 806 T: E1-Transportation Planning & Economics

L – P

4 –0 **Credits: 4**

UNIT I:

Introduction and scope of transportation planning and transportation economics, transportation planning issues.

UNIT II:

Public Transportation: public transport modes, desirable characteristics of public transport systems, transit system operations, route development, stopping policy, stop location, scheduling, capacity of transit systems, socially optimal pricing

UNIT III:

Transport analysis and forecasting: transport planning process, transportation and land use, transport planning strategies, transport planning models, travel demand analysis, operational transportation and land use models.

UNIT IV:

Transport economics and finance: pavement economics- construction cost; maintenance cost and vehicle operation cost, economic evaluation of highway projects- basic principles

UNIT V:

Time value of money; costs and benefits; net present value (NPV) method; benefit-cost (B/C) ratio method; internal rate of return (IRR) method; comparison of evaluation techniques, freight transport-trends and economic growth.

BOOKS RECOMMENDED:

1.Transport Planning and Traffic Engineering by CA O'Flaherty, John Wiley & Sons, Inc., New York; Toronto.

2.Transportation Engineering and Planning by Papacostas&Prevedouros, Prentice-Hall of India Private Ltd, New Delhi-110001

3. Principles of Transportation Engineering by Chakarborty& Das, Prentice-Hall of India Private Ltd, New Delhi-110001

4. Urban Transportation Planning by Meyer & Miller, McGraw Hill, New Delhi

CE 807 T: E2-Operation Research

L – P

4 –0 **Credits: 4**

UNIT I: INTRODUCTION

Introduction to operation Research, Basic definitions, scope , objectives, phases, models and limitations of operations research. Linear Programming problem â €.Formulation of LPP, raphical solution of LPP, simplex method, artificial variables, big-M method, two phase method, degeneracy and unbound methods.

UNIT II:Transportation Problems

Formulation, solution, unbalanced transportation problem. Finding basic feasible solutions â €. North-west corner rule, least cost method and Vogelaâ €™s approximation method.Optimality test; the stepping stone method and MODI method.

UNIT III: Assignment Model and Hungarian method

Assignment Model Formulation, Hungarian method for optimal solution; solving unbalanced problems; travelling salesman problem and assignment.

UNIT IV:Sequencing Models

Solution of sequencing problem â €; processing n jobs through two machines, â € processing n jobs through three machines â €; Processing two jobs through m machines â €; processing n jobs through n machines.

UNIT V:Dynamic Programming

Characteristics of Dynamic Programming, Dynamic Programming approach for priority management, employment smoothening, capital budgeting, stage coach/shortest path, cargo loading and reliability problems.

BOOKS RECOMMENDED:

1. P. SankaraIyer, â € Operations Research, Tata McGraw Hill 2008
2. A.M. Natarajan, P.Balasubramani, A. Tamilarasi, â € Operations, Pearson Education, 2005.

CE 807 T: E2-Rock Mechanics & Tunneling Technology

L – P

4 –0 **Credits: 4**

UNIT I: INTRODUCTION TO ROCK MECHANICS

Introduction, terminology, Rock classification systems, physical & mechanical properties of rocks, laboratory testing, stability of rock slopes, Rock bolting.

UNIT II: INTRODUCTION TO TUNNELS

Introduction, Classification of tunnels. Survey for a tunnel project

UNIT III: METHODS OF TUNNELING

Methods of Tunneling in soft & hard rock.Methods of rock blasting in tunnels.

UNIT IV: TUNNEL SERVICES

Tunnel services in rock tunnels; ventilation, drainage and lighting.

UNIT V: TUNNEL LINING & SUPPORTS

Lining of tunnels in soft grounds methods and types, tunnel supports for weak rocks including rock bolting.

BOOKS RECOMMENDED:

1. Brown, E.T. “Analytical & computational Methods in Engineering Rock Mechanic, CBS Publishers & Distributors, New Delhi.
2. Godman, P.E. “Introduction to Rock Mechanics”, John Wiley, 1989.