



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
B.E. Common	Engineering Mathematics-II	B.E.- 301

Unit I

Second Order linear differential equation with variable coefficients: Methods one integral is known, removal of first derivative, changing of independent variable and variation of parameter, Solution by Series Method

Unit II

Vector Calculus: Differentiation of vectors, scalar and vector point function, geometrical meaning of Gradient, unit normal vector and directional derivative, physical interpretation of divergence and Curl. Line integral, surface integral and volume integral, Green's, Stoke's and Gauss divergence theorem

Unit III

Linear and Non Linear partial differential equation of first order: Formulation of partial differential equations, solution of equation by direct integration, Lagrange's Linear equation, charpit's method. Linear partial differential equation of second and higher order: Linear homogeneous and Non homogeneous partial diff. equation of nth order with constant coefficients. Separation of variable method for the solution of wave and heat equations

Unit IV

Fourier series: Introduction of Fourier series, Fourier series for Discontinuous functions, and Fourier series for even and odd function, Half range series Fourier Transform: Definition and properties of Fourier transform, Sine and Cosine transform.

Unit V

Laplace Transform: Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Change of scale property, second shifting property, Laplace transform of the derivative, Inverse Laplace transform & its properties, Convolution theorem, Applications of L.T. to solve the ordinary differential equations

References

- (i) Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India
- (ii) Higher Engineering Mathematics by BS Grewal, Khanna Publication
- (iii) Advance Engineering Mathematics by D.G.Guffy
- (iv) Mathematics for Engineers by S.Arumungam, SCITECH Publucation
- (v) Engineering Mathematics by S S Sastri. P.H.I.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Transportation - Bridges and Tunnels	CE- 302

Unit I

Introduction, Tractive resistances & Permanent way: Principles of Transportation, transportation by Roads, railways, Airways, Waterways, their importance and limitations, Route surveys and alignment, railway track, development and gauges, Hauling capacity and tractive effort.

- i) Rails: types, welding of rails, wear and tear of rails, rail creep.
- ii) Sleepers: types and comparison, requirement of a good sleeper, sleeper density.
- iii) Rail fastenings: types, Fish plates, fish bolts, spikes, bearing plates, chain keys, check and guard rails.
- iv) Ballast: Requirement of good ballast, various materials used as ballast, quantity of ballast, different methods of plate laying, material trains, calculation of materials required, relaying of track

Unit II

Geometric Design; Station & Yards; Points and Crossings & Signaling and interlocking: Formation, cross sections, Super elevation, Equilibrium, Cant and Cant deficiency, various curves, speed on curves. Types, locations, general equipments, layouts, marshalling yards,

Definition, layout details, design of simple turnouts, Types of signals in stations and yards, principles of signaling and inter-locking.

Unit-III

Bridge Site Investigation and Planning; Loading Standards & Component parts: Selection of site, alignment, collection of bridge design data: essential surveys, hydraulic design, scour, depth of bridge foundation, Economical span, clearance, afflux, type of road & railway bridges. :

Design loads and forces, Impact factor, Indian loading standards for Railways Bridges and Highway Bridges, Bridge super structure and sub-structures, abutments, piers, wing walls, return walls, approaches, floors & flooring system, choice of super structure.

Unit-IV

Bridge Foundations, Construction, Testing and Strengthening of Bridges : Different types of foundation: piles and wells, sinking of wells, coffer-dams. Choice of bridges and choice of materials, details of construction underwater and above water, sheet piles coffer dams, Erection of bridges, girders, equipments and plants. inspection and Data collection, strengthening of bridges, Bridge failure.

Unit-V

Tunnels: 1. Selection of route, Engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts 2, Construction of tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining,

Mucking operation, Drainage and ventilation, Examples of existing important tunnels in India and abroad.

References

1. Chakraborty and Das; Principles of transportation engineering; PHI
2. Rangwala SC; Railway Engineering; Charotar Publication House, Anand
3. Rangwala SC; Bridge Engineering; Charotar Publication House, Anand
4. Ponnuswamy; Bridge Engineering; TMH
5. Railway Engineering by Arora & Saxena - Dhanpat Rai & Sons
6. Railway Track by K.F. Antia
7. Principles and Practice of Bridge Engineering S.P. Bindra - Dhanpat Rai & Sons
8. Bridge Engineering - J.S. Alagia - Charotar Publication House, Anand
9. Railway, Bridges & Tunnels by Dr. S.C. Saxena



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Strength of Materials	CE- 303

Unit I

Simple Stress and Strains: Concept of Elastic body, stress and Strain, Hooke's law, various types of stress and strains, Elastic constants, Stresses in compound bars, composite and tapering bars, Temperature stresses. Complex Stress and Strains: Two dimensional and three dimensional stress system. Normal and tangential stresses, Principal Planes, Principal Stresses and strains, Mohr's circle of stresses, Combined Bending and Torsion, Theories of failure

Unit II

Bending & Deflection: Theory of simple bending: Concept of pure bending and bending stress, Equation of bending. Neutral axis, Section-Modulus, Determination of bending stresses in simply supported, Cantilever and Overhanging beams subjected to point load and uniformly distributed loading. Bending & shear stress distribution across a section in Beams. Deflection of beams: Double Integration Method. Conjugate Beam Method, Macaulay's Method Area Moment Method.

Unit III

Torsion of Shafts: Concept of pure torsion, Torsion equation, Determination of shear stress and angle of twist of shafts of circular section, Hollow shafts, Open and closed coil springs, Leaf Spring, Spiral Spring, Pressure Vessels: Thin and Thick walled cylinders and spheres. Stress due to internal pressure, Change in diameter and volume, Compound cylinders and shrink fittings.

Unit IV

Unsymmetrical Bending: Principal moment of Inertia, Product of Inertia, Bending of a beam in a plane which is not a plane of, symmetry. Shear center; Curved beams: Pure bending of curved beams of rectangular, circular and trapezoidal sections, Stress distribution and position of neutral axis.

Unit V

Columns and Struts: Euler's buckling load for uniform section, various end conditions, slenderness Ratio, Stress in columns, Rankine formulae, Eccentric loading on columns.

Reference

1. Nash; Strength of Materials (Schaum), TMH.
2. Rattan SS; strength of Materials; TMH
3. Negi; Strength of materials; TMH
4. Sadhu Singh; Strength of Materials, ,
5. Ramamrutham; Strength of Materials, ,
6. Subramaniam; Strength of Materials; R; Oxford
7. National Building Code of India, Part-IV

List of Experiments

The experimental work to cover tension, compression, bending and impact test etc. on steel, cast iron, RCC and timber, Fire Resistant Test of Structures and Combustibility of Building Materials Test as per I.S.I. and other experiments based on the syllabus.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Building Design & Drawing	CE- 304

Unit I

Drawing of Building Elements – Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

Unit II

Building Planning – Provisions of National Building Code, Building bye-laws, open area, set backs, FAR terminology, principle of architectural composition (i.e. unity, contrast, etc.), principles of planning, orientation.

Unit III

Building Services – Introduction of Building Services like water supply and drainage, electrification, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings. Design and Drawing of Building – Design and preparation of detailed drawings of various types of buildings like residential building, institutional buildings and commercial buildings, detailing of doors, windows, ventilators and staircases etc.

Unit IV

Home Vastu

Introduction of Vastu Science : Effect of cosmic energy and its centralization. Vastu Purusuh, directions and use of magnetic compass

Home Vastu Analysis : The source of water, storage of water, exit of water, Boundary wall, Doors, Windows and Ventilators, Stairs, Garage, Room of Master Room of House, Bedroom, Study Room, Dining Room, Drawing Room, Guest Room, Worship Room, Kitchen, Toilets, Bath Rooms, Store, Verandah, Basement, the Brahmasthan.

Home Vastu Decoration : The Vastu of colors, Auspicious Articles of Vastu, Vastu of flowers, climbers and pictures etc.

Unit V

Commercial & Industrial Vastu

Commercial Vastu Analysis : Analysis of Direction of Shop or Office, Directions of door, Cabin of Chief, Reception, Direction of Sales Manager, Direction of Customer, The Worship Room, Room of Employees, Workshop, Store, Seminar Room, Guest Room, Cash Room, Kitchen, Toilets etc.

Industrial Vastu : Selection of land, Inspection of Plot and Surroundings, The Main Gate, The Security Room, Arrangement of Industrial Complex, Roads, Place of worship, Trees and Plants, Environment, Water Supplies, Arrangement of Utilities and Power Supplies, Pollution Control, Workshop, Store, Godown, Tank Areas, Boilers, Laboratory, Canteen , Employees Rest Rooms, Toilets, Bathrooms.

Specific Vastu Analysis : Vastu analysis of Hotel, Restaurant, Hospital, School, Ashram, Temple, Cities etc..

References

1. Malik & Meo; Building Design and Drawing By
2. Shah, Kale & Patki; Building Design and Drawing; TMH
3. Gurucharan Singh & Jgdish Singh Building Planning, Design and Scheduling

List of Experiments (Expandable)

1. Sketches of various building components.
2. One drawing sheet of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. One drawing sheet each for services and interiors of buildings.
4. One drawing sheet containing detailed planning of one/two bed room residential building (common to all student)
5. One drawing sheet each of residential and institutional building (Each student perform different drawing).



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
CE	VALUE EDUCATION	CE- 305

Chapter 1:

Value Education Concepts of Values-Definition and Types of values –The need for Education in values- Challenges for Value adoption-Character development-Vision of a better world

Chapter 2:

Inculcation of values Classification of values- Personal Values-Family Values-Social Values-Spiritual values- Benefits of value adoption

Chapter3:

Values for Professional excellence Definition-Purpose-implementation-situations to adopt-reflection questions-quotable quotes of Active listening-Decision making-Determination-Perseverance-Discipline-Responsibility

Chapter 4:

Business ethics : Ethics and Entrepreneurship- Professional Ethics –Ethical choices- Resolving Ethical Dilemmas-Leadership and Social Responsibility- Corporate Social Responsibility

Chapter 5:

Quality of Life : Dealing with change-Trends, Organizations and the Individual-Self and the world-Quality from within-Relating to others-The dynamics of personal powers

Chapter 6:

Exploring the self : True Identity-Anatomy of the self-The cyclic processes within the self-States of the awareness-Innate and Acquired qualities-Empowering the self

Chapter 7:

Understanding Self-Esteem: Know self-esteem-Understanding the self-Components of self-esteem-Association with self-esteem-Levels of self-esteem-Reflection exercises

Chapter 8:

Principles of living : Be introspective-Be an observer-Being optimistic-Appreciate differences-Don't compare yourself with others-Live at present

Chapter 9:

Practical Meditation : Why meditate?-Soul consciousness-The supreme-Karma-Timeless dimension-The eight powers

Chapter 10:

Exercises for Practice

Quiet reflection- Practice introversion-Being an observer-Stand back and observe -Self awareness (Soul consciousness)-Experiencing Body free stage-Reflect on original qualities-Visualize the Divine-Think attributes of the Supreme-Developing a living relationship-Surrender to God-Create Good wishes for all-Visualization in Meditation: Orbs of Light- The forest-The Balloon



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – III

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Computer Programming-I	CE- 306

UNIT-I

Basic Java Features - C++ Vs JAVA, JAVA virtual machine, Constant & Variables, Data Types, Class, Methods, Objects, Strings and Arrays, Type Casting, Operators, Precedence relations, Control Statements, Exception Handling, File and Streams, Visibility, Constructors, Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes

UNIT-II

Java Collective Frame Work - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Linked List, Stack, Queues, Trees, Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: Algorithm sorts, Algorithm shuffle, Algorithms reverse, fill, copy, max and min Algorithm binary Search, Algorithms add All, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Un-modifiable Collections.

UNIT-III

Advance Java Features - Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, Multithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC: Relational Database, SQL, MySQL, Oracle

UNIT-IV

Advance Java Technologies - Servlets: Overview and Architecture, Setting Up the Apache Tomcat Server, Handling HTTP get Requests, Deploying a web Application, Multitier Applications, Using JDBC from a Servlet, Java Server Pages (JSP): Overview, First JSP Example, Implicit Objects, Scripting, Standard Actions, Directives, Multimedia: Applets and Application: Loading, Displaying and Scaling Images, Animating a Series of Images, Loading and playing Audio clips

UNIT-V

Advance Web/Internet Programming (Overview): J2ME, J2EE, EJB, XML.

References:

1. Deitel & Deitel, "JAVA, How to Program"; PHI, Pearson.
2. E. Balaguruswamy, "Programming In Java"; TMH Publications
3. The Complete Reference: Herbert Schildt, TMH

List of Program to be perform (Expandable)

1. Installation of J2SDK
2. Write a program to show Concept of CLASS in JAVA
3. Write a program to show Type Casting in JAVA
4. Write a program to show How Exception Handling is in JAVA
5. Write a Program to show Inheritance
6. Write a program to show Polymorphism



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
B.E. Common	Engineering Mathematics-III	BE - 401

Unit I

Difference Operators, Interpolation (Newton Forward & Backward Formulae, Central Interpolation Formulae, Lagrange's and divided difference formulae), Numerical Differentiation and Numerical Integration.

Unit II

Errors & Approximations, Solution of Algebraic & Trancedental Equations (Regula Falsi ,Newton-Raphson, Iterative, Secant Method), Solution of simultaneous linear equatins by Gauss Elimination, Gauss Jordan, Crout's methods , Jacobi's and Gauss-Siedel Iterative methods

Unit III

Functions of complex variables : Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for evaluation of real integrals

Unit IV

Solution of Ordinary Differential Equations(Taylor's Series, Picard's Method, Modified Euler's Method, Runge-Kutta Method, Milne's Predictor & Corrector method), Correlation and Regression, Curve Fitting (Method of Least Square).

Unit V

Concept of Probability: Probability: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Testing of Hypothesis |: Students t-test, Fisher's z-test, Chi-Square Method

Reference:

- (i) Numerical Methods using Matlab by J.H.Mathews and K.D.Fink, P.H.I.
- (ii) Numerical Methods for Scientific and Engg. Computation by MKJain, Iyengar and RK Jain, New Age International Publication
- (iii) Mathematical Methods by KV Suryanarayan Rao, SCITECH Publuication
- (iv) Numerical Methods using Matlab by Yang, Wiley India
- (v) Pobability and Statistics by Ravichandran ,Wiley India
- (vi) Mathematical Statistics by George R., Springer



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Concrete Technology	CE- 402

Unit I

Introduction Classification, properties, grades, advantage & disadvantages of concrete, Ingredients of concrete, types of cement, aggregates, water, admixtures, Inspection & testing of materials as per Indian Standard Specifications.

Unit II

Properties of Fresh and Hardened Concrete : Introduction, Workability, Testing of concrete, Factors affecting, Rheology of concrete, Compressive & Tensile strength, Stress and strain characteristics, Shrinkage and temperature effects. Creep of concrete, Permeability, durability, thermal properties & micro-cracking of concrete.

Unit III

Design of Concrete Mix : Various classical methods of concrete mix design, I.S. code method, basic considerations and factors influencing the choice of mix design, acceptance criteria for concrete, concrete mixes with Surkhi and other Pozzolanic materials, design of plastic concrete mix, computer aided design of concrete mix.

Unit IV

Production and Quality Control of Concrete: Production of crushed stone aggregate, batching equipments for production and concreting, curing at different temperatures, Concreting underwater, hot & cold weather condition, statistical quality control, field control, non-instructive testing, repair technology for concrete structures, Inspection & Testing of Concrete.

Unit V

Special Concretes : Light weight concrete, Ready mix concrete, Vacuum concrete, Ferrocement, Fiber reinforced concrete, Polymer concrete composites, Shotcrete, Guniting, Rubble concrete, Resin concrete, Prestressed concrete, Heat resistant concrete, Mass concrete, Temperature control of mass concrete.

References:

1. Varshney RS; Concrete Technology; Oxford & IBH publishing co.
2. Gambhir ML; Concrete Technology – TMH
3. Sinha SN; Reinforced Concrete Technology; TMH
4. New Building Materials Published by B.M.T.P.C., New Delhi
5. Hand books on Materials & Technology - Published by BMTPC & HUDCO
6. Mohan Rai & M.P. Jai Singh; Advances in Building Materials & Construction
7. Jackson N; Civil Engineering materials.
8. Properties of Concrete - A.M. Neville - Pearson Education



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Surveying	CE- 403

Unit-I

Traversing by theodolite, Field work checks, traverse computations, latitude and departures, adjustments, computations of co-ordinates, plotting & adjusting or traverse, Omitted measurements, Measurement EDM, Trigonometrical leveling.

Unit-II

Tachometry: Tachometric systems and principles, stadia system, uses of anallatic lens, tangential system, sublense system, instrument constant, field work reduction, direct-reading tacheometers, use of tacheometry for traversing and contouring.

Unit-III

Curves: Classification and use; elements of circular curves, calculations, setting out curves by offsets and by theodolites, compound curves, reverse curves, transition curves, cubic spiral and lemniscate, vertical curves, setting out.

Unit-IV

Control Surveys: Providing frame work of control points, triangulation principle, co naissance, selection and marking of stations, angle measurements and corrections, baseline measurement and corrections, computation of sides, precise traversing.

Unit-V

Hydrographic Surveying: Soundings, methods of observations, computations and plotting. Principles of photographic surveying: aerial photography, tilt and height distortions, Remote sensing, simple equipments, elements of image interpretation, image-processing systems.

Reference

1. T.P. Kanetkar, Surveying & Levelling, Vol. I & II.
2. Duggal; Surveying vol I and II; TMH
3. Basak; Surveying and Leveling; TMH
4. R.E.Devis, Surveying theory & Practice, Mc.Graw Hill, New York
5. David Clark & J Clendinning, Plane & Geodetic surveying Vol. I & II, constable & Co. London.
6. S.K. Roy, Fundamentals of surveying, prentice - Hall of India New Delhi
7. B.C. Punmia, Surveying Vol. I, II, III, Laxmi Publications New Delhi
8. K.R. Arora, Surveying Vol. I & II, standard book House, New Delhi

List of Experiments/ Field work (Expandable):

1. Theodolite traversing
2. Profile leveling, contouring & cross sectioning
3. Determination of tachometric constants & uses of tachometer in various field works
4. Curve setting by different methods.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Engineering Materials & Construction Techniques	CE- 404

A) Construction Materials:

UNIT-I

Stones : Occurrence, varieties, Characteristics and their testing, uses, quarrying and dressing of stones. Timber : Important timbers, their engineering properties and uses, defects in timber, seasoning and treatment, need for wood substitutes, Alternate materials for shuttering doors/windows, Partitions and structural members etc. Brick and Tiles: Manufacturing, characteristics, Classification and uses, Improved brick from inferior soils, Hand molding brick table, Clay-fly ash brick table, Flooring tiles and other tiles and their characteristics.

UNIT-II

Advance Construction Materials : Use of fly ash in mortars, concrete, Fly ash bricks, stabilized mud blocks, non-erodible mud plinth, D.P.C. materials, Building materials made by Industrial & agricultural waste, clay products P.V.C. materials, advance materials for flooring, doors & windows, facia material, interiors materials for plumbing, sanitation & electrification.

(B) Construction Techniques:

UNIT-III

Foundation: Type of soils, bearing capacity, soil slablisation and improvement of bearing capacity, settlement and safe limits. Spread foundations, wall footings, grillage, foundations well foundation, causes of failure and remedial measures; under reamed piles, foundation on shrinkable soils, black cotton soil, timbering for trenches, dewatering offoundations. Hyperbolic parabolied footing, Brick arch foundation. Simple methods of foundation design, Damp proof courses, Repairs Techniques for foundations

UNIT-IV

Masonry and Walls : Brick masonry, Bonds, Jointing, Stone masonry, casting and laying, masonry construction, Brick cavity walls, code provisions regarding load bearing and non load bearing walls. Common defects in construction and their effect on strength and performance of walls, designed Brick masonry, precast stone masonry block, Hollow concrete block, plastering and pointing, white and color washing, distempering, dampness and its protection, Design of hollow block masonry walls. Doors, Windows and Ventilators: Types based on material etc., size location, fittings, construction sunshades, sills and jambs, RCC doors/windows frames. Stairs types, rule of proportionality etc., Repairs techniques for masonry, walls, doors & windows.

UNIT-V

Floors and Roofs : Types, minimum thickness, construction, floor finishes, Flat roofs, RCC jack arch, reinforced brick concrete, solid slab and timber roofs, pitched roofs, false ceiling, roof coverings, Channel unit, cored unit, Waffle unit, Plank and Joist, Brick panel, L-Panel, Ferrocement roofing units, water proofing .Services : Water supply & Drainage, Electrification, Fire protection, thermal insulation, Air Conditioning, Acoustics & Sound insulation, Repairs to damaged & cracked buildings, techniques and materials for low cost housing., Repairs techniques for floors & roofs.

References:

1. Mohan Rai & M.P. Jai Singh; Advance in Building Materials & Construction,.
2. S.C. Rangwala; Engineering Materials
3. Sushil Kumar; Building Construction,
4. B.C. Punmia; Building Construction ,.
5. Building Construction, Metchell
6. Construction Technology, Chudley R.
7. Civil Engineering Materials, N. Jackson.
8. Engineering Materials, Surendra Singh.

List of Experiments:

1. Tests on Bricks
2. Tests on Aggregates
3. Tests on Cement
4. Determination of compressive strength of concrete with different cement grades.
5. Determination of workability of concrete by slump test
6. Determination of workability by compacting factor apparatus.
7. Determination of workability by Vee Bee consistometer.
8. Nondestructive testing of concrete by Rebound hammer test
9. Nondestructive testing of concrete by ultrasonic Method.
10. Test for the effect of admixtures on the concrete compressive strength
11. Testing of microconcrete
12. Design of concrete mix.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester –IV

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Fluid Mechanics	CE- 405

Unit-I

Turbulent flow : Laminar and turbulent boundary layers and laminar sublayer, hydrodynamically smooth and rough boundaries, velocity distribution in turbulent flow, resistance of smooth and artificially roughened pipes, commercial pipes, aging of pipes.

Pipe flow problems : Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes.

Pipe Network : *Water Hammer (only quick closure case). transmission of power. *Hardy Cross Method

Unit-II

Uniform flow in open channels : Channel geometry and elements of channel section, velocity distribution, energy in open channel flow, specific energy, types of flow, critical flow and its computations, uniform flow and its computations, Chezy's and Manning's formulae, determination of normal depth and velocity, Normal and critical slopes, Economical sections, Saint Venet equation.

Unit-III

Non uniform flow in open channels : Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow hydraulic jump in rectangular channels and its basic characteristics, surges in open channels & channel flow routing, venturi flume.

Unit-IV

Forces on immersed bodies: Types of drag, drag on a sphere, a flat plate, a cylinder and an aerofoil development of lift, lifting vanes, magnus effect.

Unit-V

Fluid Machines:

Turbines : Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton turbine-their construction and settings, speed regulation, dimensions of various elements, Action of jet, torque, power and efficiency for ideal case, characteristic curves. Reaction turbines: construction & settings, draft tube theory, runaway speed, simple theory of design and characteristic curves, cavitation.

Pumps:

Centrifugal pumps : Various types and their important components, manometric head, total head, net positive suction head, specific speed, shut off head, energy losses, cavitation, principle of working and characteristic curves.

Reciprocating pumps: Principle of working, Coefficient of discharge, slip, single acting and double acting pump, Manometric head, Acceleration head.

List of Experiment

1. Study the performances characteristics of Pelton Wheel
2. Study the performances characteristics of Francis Turbine
3. Study the performances characteristics of Kaplan Turbine
4. Calibration of multistage (Two) Pump & Study of characteristic of variable speed pump
5. To study the performance & details of operation of Hyd. Ram
6. Determination of coefficient of discharge for a broad crested weir & to plot water surface profile over weir
7. Study of the characteristic of the Reciprocating pump

Suggested Books & Study Material:

1. Fluid Mechanics - Modi & Seth - Standard Book house, Delhi
2. Open Channel Flow by Rangaraju - Tata Mc Graw - Hill Publishing Comp. Ltd., New Delhi
3. Fluid Mechanics - A.K. Jain - Khanna Publishers, Delhi
4. Fluid Mechanics, Hydraulics & Hydraulic Machanics - K.R. Arora - Standard Publishers Distributors 1705- B, Nai Sarak, Delhi-5. Hyd. of open channels By Bakhmetiff B.A. (McGraw Hill, New York)
6. Open Channel Hyd. By Chow V.T. (McGraw Hill, New York)
7. Engineering Hydraulics By H. Rouse
8. Centrifugal & Axial Flow Pump By Stemanoff A.J. New York
9. Relevant IS codes.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

SECOND YEAR

Semester –IV

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Computer programming-II	CE- 406

UNIT I

Introduction .NET framework, features of .Net framework, architecture and component of .Net, elements of .Net.

UNIT II

Basic Features Of C# Fundamentals, Classes and Objects, Inheritance and Polymorphism, Operator Overloading, Structures. Advanced Features Of C# Interfaces, Arrays, Indexers and Collections; Strings and Regular Expressions, Handling Exceptions, Delegates and Events.

UNIT III

Installing ASP.NET framework, overview of the ASP .net framework, overview of CLR, class library, overview of ASP.net control, understanding HTML controls, study of standard controls, validations controls, rich controls. Windows Forms: All about windows form, MDI form, creating windows applications, adding controls to forms, handling Events, and using various Tolls

UNIT IV

Understanding and handling controls events, ADO.NET- Component object model, ODBC, OLEDB, and SQL connected mode, disconnected mode, dataset, data-reader Data base controls: Overview of data access data control, using grid view controls, using details view and frame view controls, ado .net data readers, SQL data source control, object data source control, site map data source.

UNIT V

XML: Introducing XML, Structure, and syntax of XML, document type definition (DTD), XML Schema, Document object model, Presenting and Handling XML. xml data source, using navigation controls, introduction of web parts, using java script, Web Services

References:

1. C# for Programmers by [Harvey Deitel](#), [Paul Deitel](#), Pearson Education
2. Balagurusamy; Programming in C#; TMH
3. Web Commerce Technology Handbook by Daniel Minoli, Emma Minoli , TMH
4. Web Programming by Chris Bates, Wiley
5. XML Bible by Elliotte Rusty Harold ,
6. ASP .Net Complete Reference by McDonald, TMH.
7. ADO .Net Complete Reference by Odey, TMH

List of Experiments/ program (Expandable):

1. Working with call backs and delegates in C#
2. Code access security with C#.
3. Creating a COM+ component with C#.
4. Creating a Windows Service with C#
5. Interacting with a Windows Service with C#
6. Using Reflection in C#
7. Sending Mail and SMTP Mail and C#
8. Perform String Manipulation with the String Builder and String Classes and C#:



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –V

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Transportation Road Engineering	CE- 501

Unit – I

High way planning, Alignment & Geometric Design: Principles of highway planning, road planning in India and financing of roads, classification patterns. Requirements, Engg. Surveys for highway location.

Cross sectional elements- width, camber, super-elevation, sight distances, extra widening at curves, horizontal and vertical curves, numerical problems.

Unit – II

Bituminous & Cement Concrete Payments: Design of flexible pavements, design of mixes and stability, WBM, WMM, BM, IBM, surface dressing, interfacial treatment- seal coat, tack coat, prime coat, wearing coats, grouted macadam, bituminous concrete specification, construction and maintenance. Advantages and disadvantages of rigid pavements, general principles of design, types, construction, maintenance and joints, dowel bars, tie bars. Brief study of recent developments in cement concrete pavement design, fatigue and reliability.

Unit – III

Low Cost Roads, Drainage of Roads, Traffic Engg. & Transportation Planning: Principles of stabilization, mechanical stabilization, requirements, advantages, disadvantages and uses, quality control, macadam road-types, specifications, construction, maintenance and causes of failures.

Surface and sub-surface drainage, highway materials: properties and testing etc. Channelised and unchannelised intersections, at grade & grade separated intersections, description, rotary-design elements, advantages and disadvantages, marking, signs and signals, street lighting. Principles of planning, inventories, trip generation, trip distribution, model split, traffic assignment, plan preparation.

Unit – IV

Airport Planning, Runway & Taxiway: Airport site selection. air craft characteristic and their effects on runway alignments, windrose diagrams, basic runway length and corrections, classification of airports.

Geometrical elements: taxi ways and runways, pattern of runway capacity.

Unit – V

Airport, Obstructions, Lightning & Traffic control: Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental landing system, precision approach radar, VOR enroute traffic control.

List of Experiments:

1. Aggregate Crushing Value Test
2. Determination of aggregate impact value
3. Determination of Los Angeles Abrasion value
4. Determination of California Bearing Ratio values
5. Determination of penetration value of Bitumen
6. Determination of Viscosity of Bituminous Material
7. Determination of softening point of bituminous material
8. Determination of ductility of the bitumen
9. Determination of flash point and fire point of bituminous material
10. Determination of Bitumen content by centrifuge extractor
11. Determination of stripping value of road aggregate
12. Determination of Marshall stability value for Bituminous mix
13. Determination of shape tests on aggregate

Reference Books & Study Materials:

1. Highway Engineering by Gurucharan Singh
2. Principles of Pavement Design by E.J. Yoder & M.W. Witzech
3. Highway Engineering by O'Fleherly
4. Highway Engineering by S.K. Khanna & C.E.G. Justo
5. Airport Planning & Design by S.K. Khanna & M. G. arora
6. Foresch, Charles "Airport Planning"
7. Horonjeff Robert "The Planning & Design of Airports"
8. Sharma & Sharma, Principles and Practice of Highway Engg.
9. Haung, Analysis and Design of Pavements



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –V

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Structural Design & Drawing (R.C.C.-I)	CE- 502

Unit - I

Basic Principles of Structural Design : Assumptions, Mechanism of load transfer, Various properties of concrete and reinforcing steel, Introduction to working stress method and limit state methods of design, partial safety factor for load and material. Calculation of various loads for structural design of singly reinforced beam, Partial load factors.

Unit - II

Design of Beams: Doubly reinforced rectangular & Flanged Beams, Lintel, Cantilever, simply supported and continuous beams, Beams with compression reinforcement: Redistribution of moments in continuous beams, Circular girders: Deep beams. Design of beam for shear and bond.

Unit-III

Design of Slabs: Slabs spanning in one direction. Cantilever, Simply supported and Continuous slabs, Slabs spanning in two directions, Circular slabs, Waffle slabs, Flat slabs, Yield line theory.

Unit -IV

Columns & Footings: Effective length of columns, Short and long columns- Square, Rectangular and Circular columns, Isolated and combined footings, Strap footing, Columns subjected to axial loads and bending moments (sections with no tension), Raft foundation.

Unit -V

Staircases: Staircases with waist slab having equal and unequal flights with different support conditions, Slabless tread-riser staircase.

NOTE :- All the designs for strength and serviceability should strictly be as per the latest version of IS:456. Use of SP-16 (Design aids)

Suggested Books: -

1. Plain & Reinforced Concrete Vol. I & II – O.P. Jain & Jay Krishna
2. Limit State Design by P.C.Varghese ; Prentice Hall of India, New Delhi
3. Design of Reinforced Concrete Elements by Purushothman; Tata McGraw Hill, New Delhi
4. Reinforced Cement Concrete by Gupta & Mallick, Oxford and IBH
5. Reinforced Cement Concrete by P. Dayaratnam, Oxford and IBH
6. Plain & reinforced concrete - Rammuttham
7. Plain & reinforced concrete – B.C. Punnia
8. Structural Design & Drawing by N.K.Raju.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –VI

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Water Resources and Irrigation Engineering	CE- 601

Unit-I

Hydrology : Hydrological cycle, precipitation and its measurement, recording and non recording rain gauges, estimating missing rainfall data, rain gauge net works, mean depth of precipitation over a drainage area, mass rainfall curves, intensity-duration curves, depth-area duration curves, Infiltration and infiltration indices, evaporation stream gauging, run off and its estimation, hydrograph analysis, unit hydrograph and its derivation from isolated and complex storms, Scurve hydrograph, synthetic unit hydrograph.

Unit-II

Floods and Ground water: Types of floods and their estimation by different methods, probability and frequency analysis, flood routing through reservoirs and channels, flood control measures, economics of flood control, confined and unconfined aquifers, aquifer properties, hydraulics of wells under steady flow conditions, infiltration galleries. Ground water recharge necessity and methods of improving ground water storage. Water logging-causes, effects and its Prevention. Salt efflorescence-causes and effects. reclamation of water logged and salt affected lands.

Unit-III

Water resources planning and management: Planning of water resources projects, data requirements, economic analysis of water resources projects appraisal of multipurpose projects, optimal operation of projects introduction to linear programming and its application to water Resources projects. Role of water in the environment, rain water harvesting, impact assessment of water resources development and managerial measures.

Unit – IV

Irrigation water requirement and soil-water-crop relationship:

Irrigation, definition, necessity, advantages and disadvantages, types and methods. Irrigation development. Soils - types and their occurrence, suitability for irrigation purposes, wilting coefficient and field capacity, optimum water supply, consumptive use and its determination. Irrigation methods surface And subsurface, sprinkler and drip irrigation. Duty of water, factors affecting duty and methods to improve duty, suitability of water for irrigation, crops and crop seasons, principal crops and their water requirement, crop ratio and crop rotation, intensity of irrigation.

Unit – V

Canal irrigation:

Types of canals, alignment, design of unlined and lined canals, Kennedy's and Lacey's silt theories, typical canal sections, canal losses, linings-objectives, materials used, economics. Canal falls & cross drainage works, - description and design, head and cross regulators. escapes and outlets, canal transitions.

Well irrigation:

Types of wells, well construction, yield tests, specific capacity level and specific yield, hydraulic design of open wells and tube wells, methods of raising well water, characteristics of pumps and their selection, interference of wells, well losses, advantages and disadvantages of well irrigation.

Suggested Books :-

1. Engg. Hydrology - J.NEMEC - Prentice Hall
2. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill.
3. Engg. Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.
4. Hydrology & Flood Control by Santosh Kumar - Khanna Publishers



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –VI

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Environmental Engineering	CE- 602

Unit – I

Estimation of ground and surface water resources. quality of water from different sources, demand & quantity of water, fire demand, water requirement for various uses, fluctuations in demand, forecast of population.

Unit – II

Impurities of water and their significance, water-borne diseases, physical, chemical and bacteriological analysis of water, water standards for different uses. Intake structure, conveyance of water, pipe materials, pumps - operation & pumping stations.

Unit – III

Water Treatment methods-theory and design of sedimentation, coagulation, filtration, disinfection, aeration & water softening, modern trends in sedimentation & filtration, miscellaneous methods of treatment.

Unit – IV

Layout and hydraulics of different distribution systems, pipe fittings, valves and appurtenances, analysis of distribution system. Hardy cross method, leak detection, maintenance of distributionsystems, service reservoir capacity and height of reservoir.

Unit – V

Rural water supply schemes, financing and management of water supply project, water pollution control act, conservancy & water carriage system, sanitary appliance and their operation, building drainage system of plumbing.

Suggested Books and Reading Materials:-

1. Water Supply Engineering by B.C. Punmia - Laxmi Publications (P) Ltd. New Delhi
2. Water Supply & Sanitary Engg. by G.S. Birdi - Laxmi Publications (P) Ltd. New Delhi
3. Water & Waste Water Technology by Mark J.Hammer - Prentice - Hall of India, New Delhi
4. Environmental Engineering - H.S. Peavy & D.R.Rowe - Mc Graw Hill Book Company, New Delhi
5. Water Supply & Sanitary Engg. by S.K. Husain
6. Water & Waste Water Technology - G.M. Fair & J.C. Geyer
7. Relevant IS Codes

List of Experiments:

1. To study the various standards for water
2. To study of sampling techniques for water
3. Measurement of turbidity
4. To determine the coagulant dose required to treat the given turbid water sample
5. To determine the conc. of chlorides in a given water samples
6. Determination of hardness of the given sample
7. Determination of residual chlorine by “Chloroscope”
8. Determination of Alkalinity in a water samples
9. Determination of Acidity in a water samples
10. Determination of Dissolved Oxygen (DO) in the water sample.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –VI

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Structural Design & Drawing – I (Steel)	CE- 603

Unit – I

Various loads and mechanism of the load transfer, partial load factors, structural properties of steel, Design of structural connections - Bolted, Rivetted and Welded connections.

Unit – II

Design of compression members, Tension members, Roof Trusses - Angular & Tubular, Lattice Girders.

Unit-III

Design of simple beams, Built-up beams, Plate girders and gantry girders.

Unit – IV

Effective length of columns, Design of columns-simple and compound, Lacings & battens. Design of footings for steel structures, Grillage foundation.

Unit – V

Design of Industrial building frames, multistory frames, Bracings for high rise structures, Design of transmission towers.

NOTE: - All the designs for strength and serviceability should strictly be as per the latest version of IS:800.

Reference Books :-

- i) Design of steel structures by Arya & Azmani Nemchand & Bros, Roorkee
- ii) Design of steel structures by P.Dayaratnam
- iii) Design of steel structures Vol. I & II by Ramchandra
- iv) Design of steel structures by L.S. Negi
- v) Design of steel structures by Ramammutham
- v) Design of steel structures by Punmia



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –VI

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Qty. Surveying & Costing	CE- 604

Unit – I

Introduction: Purpose and importance of estimates, principles of estimating. Methods of taking out quantities of items of work. Mode of measurement, measurement sheet and abstract sheet; bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit – II

Rate Analysis: Task for average artisan, various factors involved in the rate of an item, material and labour requirement for various trades; preparation for rates of important items of work. Current schedule of rates. (C.S.R.)

Unit – III

Detailed Estimates: Preparing detailed estimates of various types of buildings, R.C.C. works, earth work calculations for roads and estimating of culverts Services for building such as water supply, drainage and electrification.

Unit – IV

Cost of Works: Factors affecting cost of work, overhead charges, Contingencies and work charge establishment, various percentages for different services in building. Preparation of DPR.

Unit – V

Valuation: Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate interest, methods of valuation, rent fixation of buildings.

Suggested Books:

1. Quantity Surveying & Costing – B.N. Datta
2. Estimating & Costing for Civil Engg. – G.S. Birdi
3. Quantity surveying & costing – Chakraborty
4. Estimating & Costing – S.C. Rangawala

Practical & Sessional Works:

1. Preparation of detailed estimate.
2. Detailed estimate for services of plumbing and water supply or Electrification work.
3. Detailed estimate for earth work for the road construction or arched culvert.
4. Rate analysis for at least 8 items of construction.
5. Preparation of DPR of Civil Engineering Project.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

THIRD YEAR

Semester –VI

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Geo Tech Engg	CE- 605

UNIT – I

Basic Definitions & Index Properties: Definition and scope of soil mechanics, Historical development. Formation of soils. Soil composition. Minerals, Influence of clay minerals on engineering behaviour. Soil structure. Three phase system. Index properties and their determination. Consistency limits. Classification systems based on particle size and consistency limits.

UNIT – II

Soil Water and Consolidation: Soil water, Permeability Determination of permeability in laboratory and in field. Seepage and seepage pressure. Flownets, uses of a flownet, Effective, neutral and total stresses. Compressibility and consolidation, Relationship between pressure and void ratio, Theory of one dimensional consolidation. Consolidation test, Fitting Time curves. Normally and over consolidated clays. Determination of preconsolidation pressure, settlement analysis. Calculation of total settlement.

UNIT – III

Stress Distribution in Soils and Shear Strength of Soils: Stress distribution beneath loaded areas by Boussinesq and water gaurd's analysis. Newmark's influence chart. Contact pressure distribution. Mohr - Coulomb's theory of shear failure of soils, Mohr's stress circle, Measurement of shear strength, Shear box test, Triaxial compression test, unconfined compression test, Value shear test, Measurement of pore pressure, pore pressure parameters, critical void ratio, Liquefaction.

UNIT – IV

Stability of Slopes: Infinite and finite slopes. Types of slope failures, Rotational slips. Stability number. Effect of ground water. Selection of shear strength parameters in slope stability analysis. Analytical and graphical methods of stability analysis. Stability of Earth dams.

UNIT – V

Lateral Earth Pressure: Active, passive and earth pressure at rest. Rankine, Coulomb, Terzaghi and Culmann's theories. Analytical and graphical methods of determination of earth pressures on cohesion-less and cohesive soils. Effect of surcharge, water table and wall friction. Arching in soils. Reinforced earth retaining walls.

LABORATORY WORK : Laboratory work will be based on the above course as required for soil investigators of engineering projects.

List of Experiments:

1. Determination of Hygroscopic water content
2. Particle - size analysis
3. Determination of Specific gravity of soil particles
4. Determination of plastic limit
5. Determination of liquid limit
6. Determination of shrinkage limit
7. Permeability tests
8. Direct shear test
9. Consolidation test

Suggested Books: -

1. Soil Mech. & Found. Engg. by Dr. K.R. Arora - Std. Publishers Delhi.
2. Soil Mech. & Found. by Dr. B.C.Punmia- Laxmi Publications, Delhi.
3. Modern Geotech Engg. by Dr. I Aram Singh - IBT Publishers, Delhi.
4. Geotech Engg. by C. Venkatramaiah - New Age International Publishers, Delhi
5. Soil Mech. & Found. Engg. by S.K. Garg- Khanna Publishers, Delhi.
6. Soil Testing for Engg. by T.W. Lambe - John Wiley & Sons. Inc.
7. Relevant I.S. Codes



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Construction Planning & Management	CE- 701

Unit –I

Preliminary and detailed investigation methods: Methods of construction, form work and centering. Schedule of construction, job layout, principles of construction management, modern management techniques like CPM/PERT with network analysis.

Unit –II

Construction equipments: Factors affecting selection, investment and operating cost, output of various equipments, brief study of equipments required for various jobs such as earth work, dredging, conveyance, concreting, hoisting, pile driving, compaction and grouting.

Unit –III

Contracts: Different types of controls, notice inviting tenders, contract document, departmental method of construction, rate list, security deposit and earnest money, conditions of contract, arbitration, administrative approval, technical sanction.

Unit –IV

Specifications & Public Works Accounts: Importance, types of specifications, specifications for various trades of engineering works. Various forms used in construction works, measurement book, cash book, materials at site account, imprest account, tools and plants, various types of running bills, secured advance, final bill.

Unit-V

Site Organization & Systems Approach to Planning: Accommodation of site staff, contractor's staff, various organization charts and manuals, personnel in construction, welfare facilities, labour laws and human relations, safety engineering. Problem of equipment management, assignment model, transportation model and waiting line modals with their applications, shovel truck performance with waiting line method.

Reference Books :-

1. Construction Equipment by Peurify
2. CPM by L.S. Srinath
3. Construction Management by S. Seetharaman
4. CPM & PERT by Weist & Levy
5. Construction, Management & Accounts by Harpal Singh
6. Tendering & Contracts by T.A. Talpasai



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Advanced Structural Design – II (RCC)	CE- 702

Unit – I

Design of Multistory Buildings – Sway and nonsway buildings, Shear walls and other bracing elements.

Unit II

Earth Retaining Structures: Cantilever and counter fort type's retaining walls.

Unit – III

Water Tanks: Tanks on ground and underground tanks: Square, rectangular, circular tanks, Overhead tanks: square, rectangular, circular & intze tanks.

Unit – IV

Silos and Bunkers

Unit – V

T-beam & Slab bridges- for highway loading (IRC Loads). Prestressing concepts materials, systems of prestressing & losses Introduction to working & limit State Design.

Suggested Books: -

1. R.C.C. by O.P. Jain Vol. II
2. R.C.C. by B.C. Punmia
3. Essentials of Bridge engineering – D.J. Victor
4. Bridge Engineering – Ponnuswamy
5. Advanced R.C.C. Design by N.K. RAJU
6. N.Krishna Raju, Prestressed Concrete, Tata Mc Graw Hill, New Delhi.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Design of Hydraulic Structure	CE- 703

Unit – I

Gravity dams: Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, evaluation of profile by method of zoning, practical profile, foundation treatment, construction joints, galleries in gravity dams.

Unit – II

Earth Dams: Types, causes of failure and design criteria, soils suitable for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method of analysis, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.

Rock fill dams: Types, merits and demerits, conditions favourable for their adoption.

Unit – III

Spillways : Ogee spillway and its design, details of siphon, shaft, chute and side channel spillways, emergency spillways.

Unit – IV

Energy dissipations and gates: Principles of energy dissipation Energy dissipaters based on tail water rating curve and jump height curves Spillway crest gates - vertical lift and radial gates, their design principles and details. Design of canal regulating structures, Detailed design of Sarda Falls, design of cross drainage works, sphypon aquaduct.

Unit – V

Hydropower Plants: Introduction of Hydropower development, assessment of powerpotential, types of hydropower plants, general features of hydro-electric schemes, selection of turbines, draft tubes, surge tanks, penstocks, power house dimensions, development of micro hydel stations, tidal plants, pumped storage plants and their details

Reference Books: -

1. Engineering for Dams (Volumes I, II & III) by Creager, Justin & Hinds
2. Hydroelectric Hand Book by Creager
3. Hydraulic Structures by Varshney
4. Irrigation & Water Power Engg. by Punmia & Pandey
5. Water Power Engineering by Dandekar



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Elective - I

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Computational Methods In Structural Engineering	CE- 7101

Unit - I

Matrix formulation for the principle of virtual work and energy principles, principle of contragradience, stiffness and flexibility matrices, Degree of Freedom. Axial, bending, shear and torsional deformations. Local and Global Element stiffness matrices for bar, beam, shaft, grid, shear wall, beamcolumn, beam with rigid ends, beam on elastic foundation and elements with special boundary conditions. nonprismatic and curved elements, forces and displacements in general coordinate axes, structure stiffness matrix.

Unit - II

Basics of the Direct Stiffness method - Analysis of pinjointed frames, rigid jointed structures, plane grids and composite structures for different loads including temperature, shrinkage, prestressing forces. Elastic stability analysis of 2-D rigid jointed frames, (Sway & Nonsway)

Unit - III

Concepts of Bandwidth, various storage schemes & equation solvers; Reduction in order of stiffness matrix - use of substructures, static condensation method, Exploiting symmetry, skew symmetry and cyclic symmetry in structures, Imposition of Constraints – Lagrange Multiplier and Penalty Method

Unit - IV

Analysis of continuum structures - Fundamental equations of theory of elasticity (2D), basic concepts of Finite Element Analysis, derivation of generalised element stiffness matrix and load vectors, convergence requirements, stiffness matrices for various elements using shape functions, Triangular and Rectangular elements. (PSPS)

Unit - V

Two Dimensional Iso parametric elements, shape functions for Simplex. Lagrangian and Serendipity family elements in natural coordinates, computation of stiffness matrix for isoparametric elements, degrading of elements, plate bending elements.

Reference Books :-

1. Ghali A & Neville M., Structural Analysis - A Unified Classical and Matrix Approach, Chapman and Hall, New York.
2. Weaver William & Gere James M., Matrix Analysis of Framed structures, CBS Publishers and Distributors, New Delhi.
3. Cook R.D., Concepts and Applications of Finite Element Analysis, Wiley, New York.
4. Gallagher R., Finite Element Analysis Fundamentals, Prentice-Hall, Englewood Cliffs, NJ.
5. Rubenstein M.F., Matrix Computer Analysis of structures, Prentice Hall, Englewood Cliffs, N.J.
6. Zeinkiewicz O.C & Taylor R.L., The Finite Element Method, McGraw Hill, London



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Traffic Engineering	CE- 7102

Unit -I

Traffic Characteristics :

- (i) Road user's characteristics - general human characteristics, physical, mental and emotional factors, factors affecting reaction time, PIEV theory.
- (ii) Vehicular characteristics: Characteristics affecting road design-width, height, length and other dimensions. weight, power, speed and braking capacity of a vehicle.

Unit -II

Traffic Studies :

- (i) Spot Speed Studies and Volume Studies.
- (ii) Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies.
- (iii) Origin and Destination Studies (O & D) : Various methods, collection and interpretation of data, planning and sampling.
- (iv) Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service.
- (v) Parking Studies: Methods of parking studies cordon counts, space inventories, parking practices.

Unit -III

Traffic Operations and Control :

1. Traffic regulations and various means of control.
2. One way streets- advantages and limitations.
3. Traffic signals- isolated signals, coordinated signals, simultaneous, alternate, flexible and progressive signal systems. Types of traffic signals, fixed time signals, traffic actuated signals, speed control signals, pedestrian signals, flashing signals, clearance interval and problems on single isolated traffic signal.

Unit -IV

Street Lighting :

1. Methods of light distribution.
2. Design of street lighting system.
3. Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors.
4. Different types of light sources used for street lighting. (v) Fundamental factors of night vision.

Unit -V

Accident Studies & Mass Transportation:

1. Accident Studies: Causes of accidents, accident studies and records, condition and collision diagram, preventive measures.
2. Expressways and freeways, problems on mass transportation and remedial measures, brief study of mass transportation available in the country.

Reference Books :-

1. Traffic Engineering and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi
2. Traffic Engineering by Matson, W.S.Smith & F.W. Hurd
3. G.J. Pingnataro, Principles of Traffic Engineering
4. D.R.Drew, Traffic Flow Theory



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Industrial Waste Treatment	CE- 7103

Unit - I

Problem of Water Pollution: Effects of wastes on streams and sewage treatment plant. Natural purification of streams. oxygen sag curve. allowable organic load on streams classification of stream, stream standards and effluent standards. requirement of water for different purposes.

Unit - II

Measurement of Waste Water Volume: Sampling of waste waters, grab and composite samples. analysis of waste water. biochemical oxygen demand. chemical oxygen demand and pH value of waste, toxicity of waste by bioassay method. Pretreatment of Wastes: Volume and strength reduction, salvage of materials, recovery of by products, reuse of waste water.

Unit - III

Conventional Methods of Treatment of Waste Water: Removal of suspended solids, removal of inorganic and organic dissolved solids, sludge disposal, advance methods of treatment, such as reverse osmosis, ion exchange, electrodialysis, algal harvesting etc. low cost treatment plants. common effluent treatment plant, design and operation.

Unit - IV

Combined Treatment of Waste Water Sewage: Energy requirement optimization and budget, municipal regulation, sewer rental charge, instrumentation in waste water treatment plants, collection of data, operation and maintenance of plants, water pollution control board.

Unit – V

Brief study of industrial processes and treatment methods of waste water from common industries, such as textile, dairy, paper and pulp, tannery, distillery. Hazardous wastes- Impact handling and disposal.

Reference Books:-

1. "Liquid Waste of Industries - Theories, Practice and Treatment" - N.L. Nemerow, Wesley Publishing Co.
2. Treatment of Industrial Waste - E.B. Besselièvre & Max Schwartz - Mc Graw Hill Book Company
3. "Waste Water Engg. - Treatment Disposal & Reuse" - Metcalf & Eddy - Tata Mc Graw Will, New Delhi
4. Waste Water Treatment - Archival - Tata Mc Graw Will, New Delhi
5. Industrial Pollution Control, hand book - Lund H.F. Tata Mc Graw Will, New Delhi



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Earth Quake Engineering	CE- 7104

Unit – I

Single DOF systems - Undamped and Damped, Response to Harmonic and periodic excitations, Response to Arbitrary, Step, Ramp and Pulse Excitations.

Unit – II

Numerical Evaluation of Dynamic Response - Time stepping methods, methods based on Interpolation of Excitation, Newmark's and Wilson - α method, Analysis of Nonlinear Response, Introduction to frequency

Unit – III

Elements of seismology - Definitions of the basic terms related to earthquake (magnitude, intensity, epicenter, focus etc.), seismographs Earthquake Response of structures - Nature of dynamic loading resulting from earthquake, construction of Response spectrum for Elastic and Inelastic systems.

Unit – IV

Multiple DOF systems: Stiffness and Flexibility matrices for shear buildings, free and forced vibrations-undamped and damped, Modal and Response History Analysis, Systems with distributed mass & elasticity.

Unit – V

Earthquake Resistant Design of Structures, Design of structures for strength & serviceability, Ductility and energy absorption, Provisions of IS : 1893 and IS : 4326 for seismic design of structures, Code for ductile detailing IS : 13920.

Reference Books :-

- (a) Chopra A.K., Dynamics of structures - Theory and Applications to Earthquake Engineering, Prentice Hall of India, New Delhi.
- (b) Berg G.V. Elements of Structural Dynamics, Prentice Hall of India, Englewood Cliffs, NJ
- (c) Paz Mario, Structural Dynamics, CBS Publishers, Delhi
- (d) Clough R.W. & Penzien J., Dynamics of structures McGraw Hill, New York.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Engineering Geology	CE- 7105

UNIT-I

Introduction and Physical Geology: Objects and scope of geology. The crust and the interior of the earth, origin and age of the earth, Sub-aerial and sub-terrain weathering, denudation and deposition, wind, river, glacial and marine erosion, volcanoes, soil formation, soil profile, geological classification of soil and concept of earthquake Plate- tectonics.

UNIT-II

Mineralogy and Crystallography: Fundamentals of mineralogy, study of common rock forming minerals, ores & minerals of economic importance to civil engineering., elements of crystallography and introduction to crystal systems.

UNIT-III

Petrology: Composition of earth's crust, study of igneous, sedimentary and metamorphic rocks and their formation, characteristics classification, Rocks of civil engineering importance.

Geology of India: Physical features of India, Brief geological history of India, occurrence of important ores and minerals in India.

UNIT-IV

Structural Geology: Structures related to rocks, Dip, Strike and outcrops, Classification and detailed studies of geological structures i.e. folds, Faults, Joints, Un-conformity and their importance in Civil Engineering.

UNIT-V

Applied Geology: Introduction to applied geology and its use in civil engg., properties of rocks, selection of sites for roads, bridges, dams, reservoirs and tunnels. Prevention of engineering structures from seismic shocks, stability of hill sides, water bearing strata, artesian wells, Use of remote-sensing techniques in selection of above sites.

REFERENCE READINGS:-

1. Prabin Singh – “Engineering and General Geology”
2. Gulati ; Geotechnical Engineering; TMH
3. P.K. Mukerjee – “ A text Book of Geology”
4. S.K. Garg – “ A text Book of Physical and Engineering Geology”

LIST OF EXPERIMENTS:-

1. Identification of simple rock forming minerals and important ores.
2. Identification of rock
3. Simple map Exercises.
4. Field Visit / Geological Excursion



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Steel-II	CE- 801

Unit – I

Plate girder bridges (Riveted and welded)

Unit – II

Trussed girder bridges for railways and highways (IRC & IRS holding). Bearings for bridges.

Unit – III

Water Tanks:

Pressed steel tanks, tanks with ordinary plates, square, rectangular, circular with hemispherical bottom and conical bottom.

Unit – IV

Chimneys:

Guyed and self supporting steel stacks.

Unit – V

Bunkers, Silos & Towers

Reference Books :-

1. Design of Steel Structures – Ramammutham
2. Design of Steel Structures – Punia
3. Steel Str. by Ramchandra Vol II
4. Steel Str. by Arya & Ajmani
5. Design of steel structures – L.S. Negi



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Branch	Subject Title	Subject Code
CE	Theory of Structure	CE- 802

Unit I

Virtual work and Energy Principles:

Principles of Virtual work applied to deformable bodies, strain energy and complementary energy, Energy theorems, Maxwell's Reciprocal theorem, Analysis of Pin-Jointed frames for static loads.

Indeterminate Structures-I :

Static and Kinematics indeterminacy, Analysis of Fixed and continuous beams by theorem of three moments, Effect of sinking and rotation of supports, Moment distribution method (without sway)

Unit II

Indeterminate Structures - II:

Analysis of beams and frames by slope Deflection method, Column Analogy method.

Arches and Suspension Cables:

Three hinged arches of different shapes, Eddy's Theorem, Suspension cable, stiffening girders, Two Hinged and Fixed Arches - Rib shortening and Temperature effects.

Unit III

Rolling loads and Influence Lines:

Maximum SF and BM curves for various types of rolling loads, focal length, EUDL, Influence Lines for Determinate Structures- Beams, Three Hinged Arches. Moment distribution method in analysis of frames with sway, analysis of box frames, analysis of portals with inclined members, analysis of beams and frames by Kani's method

Unit IV

Plastic analysis of beams and frames. Analysis of tall frames, wind and earthquake loads, codal provisions for lateral loads. Approximate analysis of multistory frames for vertical and lateral loads.

Unit V

Matrix method of structural analysis: force method and displacement method..

Influence lines for intermediate structures, Muller Breslau principle, Analysis of Beam-Columns.

Reference Books:

1. Ghali A & Neville M., Structural Analysis - A Unified classical and matrix Approach, Chapman and Hall, New York.
2. Wang C.K. Intermediate structural analysis, McGraw Hill, New York.
3. Kinney Streling J. Indeterminate structural Analysis, Addison Wesley.
4. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Company, New Delhi.
5. Norris C.H., Wilbur J.B. and Utkys. Elementry Structural Analysis, McGraw Hill International, Tokyo
6. Wang C.K. Intermediate structural analysis, McGraw Hill, New York.
7. Kinney Streling J. Indeterminate structural Analysis, Addison Wesley.
8. Reddy C.S., Basic Stgtructural Analysis, Tata McGraw Hill Publishing Company, New Delhi.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Elective - II

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Pavement Design	CE- 8101

Unit -I

Equivalent Single Wheel Load (ESWL) : Definition, calculation of ESWL, repetition of loads and their effects on the pavement structures.

Unit -II

Flexible Pavements : Component parts of the pavement structures and their functions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory , Burmister's two layered theory, methods of design, group index method, CBR method, Burmister's method and North Dakota cone method.

Unit -III

Rigid Pavements : Evaluation of subgrade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stresses, critical loading positions.

Unit -IV

Rigid pavement design : IRC method, Fatigue analysis, PCA chart method, joints, design and construction & types, AASHTO Method, Reliability analysis.

Unit -V

Evaluation and Strengthening of Existing Pavements : Benkleman beam method, Serviceability Index Method. Rigid and flexible overlays and their design procedures.

Reference Books :-

1. Principles of pavement design by E.J.Yoder & M.W. Witzak
2. AASHO, "AASHO Interim Guide for Design of Pavement Structures", Washington, D.C.
3. Portland Cement Association, Guidelines for Design of Rigid Pavements, Washington
4. DSIR, Conc. Roads Design & Construction
5. Srinivasan M. "Modern Permanent Way"



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Air Quality Monitoring & Control	CE- 8102

Unit – I

Air pollution problem:

Economics and social aspects, historical episodes of air pollution. Sources of Air pollution, effects of air pollution on health, animal, plants and materials

Unit – II

Role of meteorological condition, properties of typical air pollutants, air diffusion and concentration pollutants. general diseases caused by air pollutants. toxicity of various pollutants. Plums patterns and height of chimneys.

Unit – III

Atmospheric chemistry, formation of secondary pollutants – PNN, PBN, Photolytic cycles, general diseases and toxicity of pollutants

Unit – IV

Sampling and Analyzing of Air Pollutants:

Instruments pollution survey, standards of air pollution.Principle of air pollution control, site selection and zoning, various control methods, process and equipment changes, design and operation of various air pollution control equipments.

Unit – V

Air pollution control legislation, public education pollution standards, status of air pollution control in various countries.

Industrial Hygiene: Concept and importance, factory Involved in environmental hazards, industrial ventilation occupational diseases, control methods

.Reference Books :--

1. "Air Pollution" - Faith W.L, John Wiley & Sons
2. "Air Pollution" - Mc Cabe L.C., Mc. Graw Hill, International
3. Air Pollution - Stern A.C., Academic Press N. York
4. Fundamentals of Air Pollutions - Raju BSN Oxford & IBH Publishing Co. Pvt. Ltd.



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Advance Water Resources Engineering	CE- 8103

Unit-I

Hydrology : Hydrological cycle, precipitation and its measurement, recording and non recording rain gauges, estimating missing rainfall data, rain gauge net works, mean depth of precipitation over a drainage area, mass rainfall curves, intensity-duration curves, depth-area duration curves,

Unit-II

Hydrology :Infiltration and infiltration indices, evaporation stream gauging, run off and its estimation, hydrograph analysis, unit hydrograph and its derivation from isolated and complex storms, S-curve hydrograph, synthetic unit hydrograph.

Unit-III

Floods : Types of floods and their estimation by different methods, probability and frequency analysis, flood routing through reservoirs and channels, flood control measures, economics of flood control.

Unit-IV

Ground water : Occurrence, confined and unconfined aquifers, aquifer properties, hydraulics of wells under steady flow conditions, infiltration galleries. Ground water recharge-necessity and methods of improving ground water storage.

Water logging and salt efflorescence : Water logging-causes, effects and its prevention. Salt efflorescencecauses and effects. reclamation of water logged and salt affected lands.

Unit-V

Water resources planning and management :

Planning of water resources projects, data requirements, economic analysis of water resources projects appraisal of multipurpose projects, optimal operation of projectsintroduction to linear programming and its application to water resources projects. Role of water in the environment, rain water harvesting, impact assessment of water resources development and managerial measures.

Suggested Books :-

1. Engg. Hydrology - J.NEMEC - Prentice Hall
2. Hydrology for Engineers Linsley, Kohler, Paulnus - Tata Mc.Graw Hill.
3. Engg. Hydrology by K. Subhramanya - Tata Mc Graw Hills Publ. Co.
4. Hydrology & Flood Control by Santosh Kumar - Khanna Publishers



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Environmental Engineering. – II	CE- 8104

Unit –I

Sewerage schemes and their importance, collection & conveyance of sewage, storm water quantity, fluctuation in sewage flow, flow through sewer, design of sewer, construction & maintenance of sewer, sewer appurtenances, pumps & pumping stations.

Unit –II

Characteristics and analysis of waste water, cycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, Th OD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water disposal i.e. by land treatment & by dilution, self purification capacity of stream, Oxygen sag analysis.

Unit –III

Unit operations for waste water treatment, preliminary treatment such as screens, grit chamber, floatation tank, sedimentation and chemical clarification, role of micro-organism in biological treatment, Sewage filtration-theory & design.

Unit – IV

Methods of Biological Treatment (Theory & Design) - Activated Sludge process, Oxidation ditch, stabilization ponds, aerated lagoon, anaerobic lagoons, septic tank & imhoff tank, sources & treatment of sludge, sludge thickening and digestion sludge drying beds, sludge disposal.

Unit – V

Advanced Waste Water treatment - Diatomaceous earth filters, ultra filtration, Adsorption by activated carbon, Phosphorus removal, Nitrogen removal, Physico chemical waste water treatment, and Solid waste disposal - classification, composition, collection, & disposal methods. Rural sanitation - collection & disposal of refuse, sullage & night soil

Laboratory work shall be based on the topics of environmental engineering I & II and consist of experiments of water and waste water quality as per facility available in the institution.

List of Experiment

1. To study the various standards for waste water
2. To study the sampling techniques for waste water
3. To determine the alkalinity in water sample
4. To determine the acidity in water sample
5. Determination of Dissolved Oxygen in the water and waste water sample
6. Determination of Biological Oxygen demand of a waste water sample
7. Determination of Chemical Oxygen demand of a waste water sample
8. Determination of various types of solids in the waste water sample
9. Determination of bacterial number by membrane filter Technique
10. Determination of bacterial colonies by standard plat count method



R.K.D.F. UNIVERSITY, BHOPAL

B.E. (CIVIL ENGINEERING)

FINAL YEAR

Semester –VIII

Course Content & Grade

Branch	Subject Title	Subject Code
CE	Steel-II	CE- 8105

Unit – I

Plate girder bridges (Riveted and welded)

Unit – II

Trussed girder bridges for railways and highways (IRC & IRS holding). Bearings for bridges.

Unit – III

Water Tanks: Pressed steel tanks, tanks with ordinary plates, square, rectangular, circular with hemispherical bottom and conical bottom.

Unit – IV

Chimneys: Guyed and self supporting steel stacks.

Unit – V

Bunkers, Silos & Towers

Reference Books :-

1. Design of Steel Structures – Ramammutham
2. Design of Steel Structures – Punia
3. Steel Str. by Ramchandra Vol II
4. Steel Str. by Arya & Ajmani
5. Design of steel structures – L.S. Negi