

5th Semester

Course No.	Subject	L	T	P/D	Hours	Credit
HU-354	Dynamics of Behavioral Science in Industries	3	0	0	3	3
OE-351	Open elective-I	3	0	0	3	3
CE-351	Concrete Structure Design	4	1	0	5	5
CE-352	Transportation Engg.-I	3	1	0	4	4
CE-353	Theory of Structure Lab	0	0	2	2	1
CE-356	Survey Camp*	0	0	0	0	3
CE-352 (P)	Transportation Engg. Lab	0	0	2	2	1
Total					19	20

****Survey camp of 3 to 4 weeks duration after 4th Semester***

Open Elective

1. CE-1 Environmental Science and Engineering
2. CE-2 Transportation system Planning
3. CE-3 Earthquake Engg.
4. CSE-1 Image Processing
5. CSE-2 UNIX environment Programming
6. CSE-3 Information Security Systems
7. CSE-4 Computer Graphics
8. ME-1 Energy Conservation and Management
9. ME-2 Alternate Sources of Energy
10. ME-3 Computer Graphics and rapid photocopying
11. ME-4 Noise control
12. ME-5 Elements of Mechanical Engineering
13. ME-6 Product Design and Value Engineering
14. ME-7 Production Planning and Control
15. ME-8 Science and Technology
16. EE-1 Neural Networks and Fuzzy Logic
17. EE-2 Switched Mode Power Supplies
18. EE-3 Fundamental of Electrical Machines and Drives
19. EE-4 Image Processing
20. ECE-1 Advanced Telecommunication
21. ECE-2 Biomedical Electronic Instrumentation
22. ECE-3 Introduction to VLSI and HDL
23. ECE-4 Electronics Switching Circuits
24. BS-1 Physics of Semi Conductor Devices
25. BS-2 Material Characterization
26. BS-3 Bio-Polymer
27. BS-4 Aspects of Nano Technology
28. BS-5 Polymer Technology
29. BS-6 Operation Research
30. HU-1 Managing Interpersonal and Group Processes
31. HU-2 Human Resource Management
32. HU-3 Financial Management
33. HU-4 Marketing Management
34. HU-5 Managerial Communication

Objective: To impart knowledge to students about human behaviour, the managerial and Labour social system and work culture with special reference to Indian Scenario.

1. **Behavioural science:** An overview: definitions, Man-the critical factor, behavioural science and its historical development.
2. **Industrial sociology:** Concept and definitions; importance for engineers; growth; criticism of the Hawthorne studies; nature and scope of industrial sociology, industry and community, industry and tradition in India.
3. **Society and technical change:** Concept of social change, meaning and definitions of social change, nature of social change. Factors such as natural, cultural, economic, planning, technological, Indian information technology scenario, effect of technology on social institutions.
4. **Society and environment:** Meaning and definitions, characteristics, classification of environment, physical environment and its influence, social environment and its some basic elements, environment in industry, illumination, noise, atmospheric conditions, music and colour.
5. **Human relations:** Historical overview, definitions, early and later approaches to human relations, strategies for establishing healthy human relations.
6. **Groups:** Meaning and definitions, types of groups, characteristics, functions of formal and informal groups, merits and demerits of informal groups.
7. **Motivation:** Nature of drives, needs and motives, work motives, need-hierarchy theory and two factor theory of motivation, how to motivate the workers at work, factors effecting the morale of workers.
8. **Labour management relations:** Industrial relations; meaning, objectives and definitions, Dunlop's theory of industrial relations, Psychological and Gandhian approach to industrial relations, industrial relations in Japan and India, industrial relation in coming years, challenges of coming years, new dimensions of industrial relations, the ways of industrial peace. Trade unions; meaning and definitions, functions of Indian trade Unions, recent emerging trends in Indian trade unions.

Books:

1. Dynamics of Behavioural Science in Industry : P.C.Rihar
2. Fundamental of Industrial Sociology : P Gisbert
3. A Genesis of Behavioural Science : N Kumar
4. Industrial Relations : A. Monapa
5. Innovation and Change in Organization : N. Kind and Anderson
6. Human Relations and Organization Behaviour,
A global perspective : R.S. Dwivedi

L	T	P
3	0	0

- 1. Mass and energy transfer:** Material balance, steady-state conservative systems, steady-state systems with non conservative pollutants, energy fundamentals.
- 2. Environmental chemistry:** Stoichiometry, chemical equilibria, solubility of gases in water, carbonate system, organic chemistry, nuclear chemistry, nuclear fission.
- 3. Mathematics of growth:** Exponential growth, doubling time, half-life, exponential resource production rates, human population growth, age structure, population momentum.
- 4. Hazardous substances and risk analysis:** Hazardous substance legislation, risk assessment, hazard deification, potential carcinogens, toxicity testing in animals, human exposure assessment.
- 5. Treatment of water and wastes:** Water resources, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, groundwater quality, water treatment systems, wastewater treatment and reuse, solid and biomedical wastes treatment technologies and disposal options.
- 6. Air pollution:** Air quality standards, emission standards, criteria pollutants, air pollution and meteorology, atmospheric dispersion, emission controls.
- 7. Noise pollution:** Effect of noise on people, rating systems, community noise sources and criteria, traffic noise prediction, noise control.

Books:

1. Introduction to Environmental Engineering and Science : Gilbert M Masters
2. Environmental Science and Engineering : J. G. Henry and G. W Heinke
3. Introduction to Environmental Engineering : M.L. Davis and D.A. cornwell

1. **Transportation planning process:** Introduction, Elements of Transportation planning, Definition of goals and objectives, Identification of needs, Generation of alternatives. Evaluation of alternatives, Implementation of alternatives.
2. **Land use and transportation system:** Urban system components, Concept and definitions, criteria for measuring and comparing urban structure, land use and transportation.
3. **Transport demand analysis:** Nature and analysis of Transportation demand, Sequential demand analysis- Trip-generation models, Trip-distribution models, Model split analysis, Traffic assignment models.
4. **Public transportation:** Historical development of urban transportation, Mass Transit Definitions and classifications, Route development, stop location and stopping policy, Schedule development.
5. **Transportation economics:** Scope of transportation economics, Transportation demand, Demand, supply and equilibrium, Sensitivity of travel demand, Factors affecting elasticities, elements of engineering economics.

Books

1. Transportation Engineering : C.Jotin Khisty and B.Kent Lall,
2. Principles of Transportation Engineering : P.Chakraborty and A.Das.
3. Fundamentals of Transportation Engineering: C.S Papacostas
4. Traffic engineering and Transport planning : L.R.Kadyali, Khanna Publishers.

1. **Introduction:** Causes of Earthquakes, plate tectonics, Earthquake mechanism, seismic zoning map of India, Epicenter, focus, magnitude, intensity, characteristics of ground motion and attenuation, Earthquake recording instruments-seismograph, Accelerograph, Seismoscopy/multi SAR.
2. **Theory of vibration:** SDOF system, MDOF, Earthquake Excitation, forced vibration, continuous systems-uniform bending beam, uniform shear beams.
3. **Earthquake response spectra:** Strong motion earthquakes Elastic spectra, inelastic spectra-equivalent linear system.
4. **Site response to earthquakes:** Local geology and soil conditions, soil investigations and tests dynamic design criteria for a given site.
5. **A seismic design of structures:**
 - i. Design data and philosophy, seismic coefficients, permissible stresses and load factors multi-storeyed buildings, base shear, fundamental period of building, distribution of forces along the height, dynamic analysis
 - ii. Earthquake resistant instruction of building and ductility provisions in RCC as per IS-13920-1893, IS-1893-2002, IS-456-2000, IS-800-2000, IS-4326-2002
 - iii. Elevated water tanks-behaviour, Design features and analysis.
 - iv. Stack like structures-fundamental period, Dynamic bending moment and shear diagram.
 - v. Bridges-Seismic force, live load, superstructure and substructure.
 - vi. Dams-Hydrodynamic pressure, Zanger method, vertical component of reservoir load.
6. **Base isolation:** Isolation systems, base Isolation of single and multi-storey buildings, Application of base Isolation.
7. **Seismic strengthening, repair of restoration concepts:** Existing buildings, Aging, weathering, development of cracks, repair of masonry and concrete structure.

Books:

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| 1. Dynamics of structures; | : AK Chopra |
| 2. Structural Dynamics | : Mario Paz |
| 3. Soil dynamics | : Swami saran |
| 4. Elements of Earthquake Engg. | : Jai Krishna |
| 5. Relevant IS Code. | : AR Chander Sekoran |

Introduction: Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels, Imaging geometry.

Image Enhancement: Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.

Image Compression: Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.

Image Segmentation: Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, spatial techniques, and Frequency domain techniques.

Spatial Operations and Transformations: Spatially dependent transform template and convolution, Window operations, 2-Dimensional geometric transformations.

Pattern Recognition: Classification and description, Structure of a pattern recognition system, feature extraction, Classifiers, Decision regions and boundaries, discriminant functions, Supervised and Unsupervised learning, PR-Approaches statistics, syntactic and neural.

Statistical Pattern Recognition: Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayesian parameter estimation approach, Clustering for unsupervised learning and classifiers.

Books

1. Digital Image Processing : R. Gonzalez and R. E. wood
2. Introductory Computer Vision and Image Procession : Andrian Low
3. Pattern Recognition-Statistical, Structural and neural approach : Robert Scholkoff
4. Digital Image Processing : W.K. pratt
1. Fundamentals of Image Processing : K. JAIN.

1. **UNIX Standards:** Brief History of UNIX, AT&T and Berkeley UNIX Systems, POSIX, Library vs. System-Level Functions
2. **Files and Directories:** Basic File Types, File Descriptors, The open() and creat() Functions, Keeping Track of Open Files, File Table Entries, The v-node structure, The fcntl() function, File Attributes, The access() function, Link(), unlink(), remove(), and rename() functions, Functions to Manipulate Directories
3. **Shell Programming:** Bourne Shell, korn shell and C shell. Shell metacharacters, shell variable and scripts, facilities and command, environment, integer arithmetic and string manipulation, decision making, aliasing, arrays and job control.
4. **System I/O:** Standard I/O vs system I/O, System I/O Calls, File and Record Locking,
5. **Processes:** Process Creation and Termination, Process Memory Layout, Dynamic Memory Allocation, Accessing Environment Variables, Real and Effective User IDs
6. **Process Management:** Programs and Processes, The fork() System Function, Parent and Child, The Exec System Functions, Current Image and New Image, The wait() and waitpid() function, Interpreter files and exec
7. **Pipes - Basic IPC:** Interprocess Communication, Pipes, FIFOs
8. **Signals:** What is a Signal?, Types of Signals, Signal Actions, Blocking Signals from Delivery, The sigaction() function, Signal Sets and Operations, Sending a Signal to Another Process, Blocking Signals with sigprocmask (), Scheduling and Waiting for Signals, Restarting System Calls (SVR4) Signals and Reentrancy
9. **Introduction to Threads:** Processes and Threads, Creating Threads, Multitasking, Overview of Thread Architectures, Processes Versus Threads, The Threads API, Thread Termination, Joining and Detaching Threads, Passing Arguments to Threads
10. **Threads Synchronization:** The Sharing Problem, Mutexes, Creating and Initializing Mutexes, Using Mutexes, Additional Synchronization Requirement, Using Condition Variables
11. **Overview of Client/Server Programming:** Designing Distributed Application, Clients and Servers, Ports and Services, Connectionless vs. Connection-Oriented Servers, Stateless vs. Stateful Servers, Concurrency Issues
12. **The Berkeley Sockets API:** Berkeley Sockets, Data Structures of the Sockets API, Socket System Calls, Socket Utility Functions

Books

1. Advanced Programming in the UNIX Environment : W. Richard Stevens
2. The Art of UNIX Programming : Eric Steven Raymond
3. UNIX Network Programming : W. Richard Stevens

1. **Introduction:** Introduction to OSI Network Security Architectures, Services, Mechanisms and Attacks, Classical Encryption Techniques, Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.
2. **Introduction To Finite Fields:** Groups, Rings, and Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields of the Form $GF(p)$, Polynomial Arithmetic, Finite Fields of the Form $GF(2^n)$.
3. **Cryptographic Techniques:** An overview of Cryptology, Primality test, *Perfect* security, Stream Cipher *Stream ciphers*: The one time pad. Pseudo-random key streams - properties and generation. Block Cipher -, Introduction to DES, differential and Linear Cryptanalysis, Block Cipher Cryptography, Triple DES Algorithm, International Data Encryption Algorithm (IDEA), Blowfish Algorithm, RC-x Algorithms, CAST-x Algorithms, Symmetric Block Cipher Schemes, Encryption Function Placement and Confidentiality problems. Cryptographic hash functions, Digital signatures,
4. **Public-Key Cryptography and Message Authentication:** The Key Distribution Problem, Random Number Generation, The Public-Key Cryptosystems, The RSA Algorithm, The Key Management riddle, The Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. The Chinese Remainder Theorem, Discrete Logarithms., Introduction to Message Authentication, requirements and functions, Message Authentication Codes, Hash Functions, their Security and other considerations
5. **Authentication Applications:** The Message Digest (MD5) Algorithm, The Secure Hash Algorithm (SHA-1), RIPEMD-x and HMAC fundamentals, Digital Signature basics, Authentication Protocols, The Digital Signature Standard, Introduction to the Kerberos Authentication scheme, The X.319 Directory Authentication scheme.
6. **Systems and Applications Security** - Authentication, Access control policies, Mail security, PGP, Data (base) security, File system security, Program security, Memory security, Session security, SSH, Web security, Web applications security, Sandboxing, Linux security, Windows
7. **Security Protocols** - Security properties, attacks, Design of a security protocol, Examples of security protocols, Contract signing protocols, Formal models of protocols and detecting leaks, Electronic voting protocols, IPsec,, SSL, TLS worms and viruses, micro payments, smart card security, Security of wired / wireless networks
8. **Intrusion detection** - Key Management in Group Communication Systems, Router security, Denial of service and side-channel attacks, Intrusion Detection Systems, Intrusion detection techniques - centralized and distributed;

Books

1. Cryptography and Network Security: Principles and Practice : William Stallings
2. Cryptography: Theory and Practice : D Stinson
3. Network Security :C. Kaufman, R. Perlman and M. Spenser
4. Internet Security and Firewalls :S. Bellovin and W. Chesvick
5. Introduction to Cryptography with Coding Theory : Trappe & Washington
6. An Introduction to Cryptography : Richard A Mollin

1. **Introduction To Computer Graphics:** Overview of Graphics Systems, Display Devices, Hard copy Devices. Interactive Input Devices, Display Processors, The Graphical Kernel System, Output Primitives, Line drawing algorithms, Circle Generation algorithms, Character Generation.
2. **Raster Scan Graphics:** Line Drawing Algorithms, Circle Generation, General Function Rasterization, Scan Conversion- Generation of the display, Image Compression, Polygon Filling, Fundamentals of Antialiasing
3. **Two-Dimensional Geometric Transformation & Viewing:** Basic Transformation, Translation, Rotation, Scaling, Other Transformation Reflection, Shear, Transformation functions, Window to viewport co-ordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping.
4. **Three- Dimensional Concepts & Object Representations:** Three Dimensional Display Methods, Parallel Projection, Perspective Projection, Translation, Rotation, Scaling, Composite Transformation, Three dimensional Transformation function, Polygon Surfaces, Curved Lines and surfaces, Bezier Curves and surfaces, B-Spline Curves and surfaces
5. **Graphics hardware:** Display technology, random scan, raster scan display processing, input devices for interaction.
6. **Visible Lines and Visible Surfaces:** Visual Realism, Hidden line and hidden surface removal: depth buffer algorithm, geometric computations, scan line coherence algorithms, area coherence algorithms, priority algorithm, shading and color models, Modeling methods.
7. **Rendering:** A simple illumination model, Transparency, Refraction effects in transparent materials, Simple Transparency Models, Z-Buffer Transparency, Shadows, Texture

Books

1. Procedural Elements for Computer Graphics : D.F. ROGERS,
2. Computer graphics : Hearn and Baker
3. Computer Graphics, A programming approach : S. Harrington
4. Mathematical Elements for Computer Graphics : D.F. Rogers

- 1. Energy management:** Concept of energy management, energy demand and supply, economic analysis; Duties and responsibility of energy managers.
- 2. Energy conservation:** Basic concepts, Energy conservation in household, transportation, agricultural, service and industrial sectors, Lighting, HVAC systems.
- 3. Energy audit:** Definition, need, and types of energy audit; Energy management (audit) approach: Understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements; Fuel & energy substitution; Energy audit instruments; Energy Conservation Act; Duties and responsibilities of energy managers and auditors.
- 4. Material and energy balance:** Facility as an energy system; Methods for preparing process flow; material and energy balance diagrams.
- 5. Energy action planning:** Key elements; Force field analysis; Energy policy purpose, perspective, contents, formulation, ratification; Organizing the management: location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability; Motivation of employees: Information system-designing barriers, strategies; Marketing and communicating: Training and planning.
- 6. Energy conservation in plant service systems:** Centrifugal pumps: Energy consumption & saving potentials; Design consideration minimizing over design; Case studies Fans & Blowers: Specification, safety margin, choice of fans-controls, design considerations. Air compressor & compressed air systems: Selection of compressed air layout, Design consideration. Refrigeration & Air conditioning: Heat load estimation, methods of minimizing heat loads, optimum selections of equipments; Case studies, Energy conservation in cooling towers & spray ponds; Case studies.
- 7. Thermal energy management:** Energy conservation in boilers, steam turbines and industrial heating systems; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pumps; Building Energy Management.

Books

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| 1. Energy Management Principles | : C B Smith |
| 2. Energy Auditing and Conservation; Methods, Measurements Management and Case Study | : Hamies |
| 3. Energy Management and Conservation | : D. Patrick and S W Fardo |
| 4. Heating and Cooling of Buildings: Design for Efficiency | : J. Krieder and A. Rabi |
| 5. Principles of Energy Conservation Archie | : W. Culp |
| 6. P. Energy Management | : O Callaghan |

1. **Introduction:** Trends of energy consumption, sources of energy conventional and renewable, fossil fuel availability and limitations, need to develop new energy sources.
2. **Solar energy:** Solar radiation characteristics and estimation, Solar Collectors, Flat Plate and concentrating types. Their comparative study, design and material selection, efficiency, Selective paints and surfaces. Heating of air and water for building and other uses, Thermal storages, Solar Ponds, Solar pumps, solar Power, Solar Cookers etc. Direct Conversion of Solar energy to electricity and its various uses, materials, limitations and costs.
3. **Bio-conversion:** Generation of bio-gas, digesters and their design, selection of material, feed to digester, paralytic gasification, production of hydrogen, Algae production and their uses.
4. **Wind energy:** Types of rotors, horizontal axis and vertical axis systems, system design and site selection.
5. **Geo-thermal energy:** Sites, potentiality and limitation, study of different conversion systems.
6. **Tidal energy:** Sites, potentiality and possibility of harnessing from site, limitations.
7. **Ocean thermal energy:** Principle of utilization and its limitations, description of various systems.
8. **Other non-conventional energy sources:** Fluidized bed combustions, heat from waste and other sources.

Books

1. Solar Energy Utilization : G.D. Rai
2. Solar Heating and Cooling : Duffie and Beckman
3. Power Plant Technology : M.M. EL. Wakil
4. Power Plant Engineering : P.C. Sharma

- 1. Introduction and overview of graphics systems:** Computer-aided design, Presentation Graphics, Computer art, entertainment, education and training, visualization, image processing, graphical user interfaces, Video display devices, Raster scan systems, Random scan systems, Graphics monitors and workstation, Input devices, hard copy devices, graphics software.
- 2. Output primitives:** Point, and lines, line drawing algorithms, loading the frame buffer, line function, circle generating algorithm, ellipse generating algorithms, other curves, pixel addressing, filled area primitives.
- 3. Attributes of output primitives:** Line attributes, curve attributes, area fill attributes.
- 4. Two-dimensional geometric transformations:** Two-dimensional translation, rotation, scaling, matrix representation and homogeneous co-ordinates, composite transformations, other transformations-reflection, shear transformation between co-ordinate systems.
- 5. Two dimensional viewing:** The viewing pipeline, viewing co-ordinate reference frame, window to viewport coordinate transformations, clipping operations, point clipping, line clipping, polygon clipping.
- 6. Three dimensional geometric and modeling transformation:** Translation, rotation, scaling, reflection, shear, composite transformations, three-dimensional modeling and co-ordinate transformations.
- 7. Rapid prototyping:** Details/methods of Rapid prototyping, Basic principles of RP, Different RP Techniques, Advantages of RP, CAD modeling, CAE Analysis

Books

1. Computer graphics : Hearn and Baker
2. Geometric modeling : Vera B. Anand

- 1. Introduction:** Fundamentals of vibration, vibration of membranes and plates, Acoustic wave equation, acoustic energy and sound Intensity, Propagation of sound
- 2. Acoustic waves:** Elastic behavior of fluids, Plane wave equation, Velocity of sound in fluids, Energy density of Plane waves, Acoustic density, Decibel scales, Transmission phenomenon, spherical acoustic wave.
- 3. Resonators and filters:** Helmholtz Resonator, Acoustic impedance, Reflection of waves in pipe, Expansion chamber type of filters.
- 4. Speech, hearing, and noise:** Mechanism of hearing, Thresholds of ear, Loudness.
- 5. Architectural acoustics:** Sound intensity in a Live room, Decay of sound, Measurement of Reverberation time, Sound absorption coefficients, Sound absorbing materials for noise reduction.
- 6. Noise engineering:** Machinery Noise, Reduction of Noise, Reduction of noise and its control, Design for less noise, Enclosures, Silencers, barriers etc. Noise control in industry, Addition of Sound levels, Calculation of SPL.
- 7. Noise measurements:** The range of quantities encountered in Sound, Decibel scale. Frequency / octave bands, Microphones, Sounds Level Meter, Frequency analyzers, fault detection from noise analysis, Diagnostic Maintenance, Measurement environment, Anechoic chamber.

Books

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| 1. Mechanical Vibrations | : G. K. Grover |
| 2. Vibration Theory & Applications | : W. T. Thomson |
| 3. Vibration & Noise for Engineers | : K. K. Pujara and R S Pujara |
| 4. Fundamentals of Acoustics | : Kinsler and Frey |
| 5. Acoustics of Ducts and Mufflers | : Munjal |
| 6. Noise and Vibration Control Engineering | : Beranek |
| 7. Noise Pollution and Control Strategy | : Singal |
| 8. Mechanical Vibrations and Noise Engineering | : Ambekar |

- 1. Introduction:** Plain motion, kinematic concepts of links; basic terminology and definitions; inversion of kinematic chain, Chebyshev spacing of precision points, Absolute and relative motion, instantaneous centers, velocity and acceleration polygons.
- 2. POWER TRANSMISSION and FRICTION DEVICES:** Flat belts, V-belts, length of belts, transmission of power by belts, condition for maximum power transmissions, initial tension, Coulomb friction, pivots and collars, power screws.
- 3. Governors:** Functions, Difference between Governor and Flywheel, Various Terms Used, Types of Governor- Watt, Porter, Proell & Hartnell; Inertia Governor, Sensitiveness and Stability of Governor; Isochronous Governor, Hunting, Effort and Power of a Porter Governor, Controlling Force Diagrams For Porter and Spring Controlled Governor, Coefficient of Insensitiveness.
- 4. Simple stresses and strains:** Types of stresses and strains; Factor of safety; Thermal Stress and Strain, Stresses on oblique plane under biaxial loading, biaxial stresses combined with shear stresses, Principal stresses and planes, Determination of Principal stresses, Mohr's circle-biaxial state of stress accompanied with shear stress.
- 5. Compressor:** Classifications, single and multistage reciprocating compressor, effect of inter cooling, volumetric efficiency.
- 6. STEAM GENERATORS and TURBINE:** Classification and description of generators, Position of steam turbine in power industry; types and application. Impulse turbine; pressure and velocity compounding; velocity diagram; work output, losses and efficiency, Reaction turbines, velocity diagram, Degree of reaction, work output losses and efficiency, Governing of turbine.
- 7. Hydraulic turbines:** Classification, Euler's equation for turbines, velocity triangle for single stage axial and radial machines, Impulse and reaction turbines, Pelton, Francis & Kaplan turbine. Power and efficiency calculations, draft tube, cavitation, water turbine governing.

Books

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| 1. Machines and Mechanisms | : David H. Myszka |
| 2. Theory of Machines | : Sarkar |
| 3. Theory of Machines | : S. S. Rattan |
| 4. Theory of Machines | : Abdulta Sharif |
| 5. Turbo Machine | : Shephard |
| 6. Turbines, Compressors & Fans | : Yahya |
| 7. Hydraulic Machines | : J. Lal |
| 8. Strength of Material | : Timoshenko |
| 9. Strength of Material | : Sadhu Singh |

- 1. Introduction:** Introduction to Product Design, Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle.
- 2. Functional & aesthetics consideration:** Basic design considerations, Role of Aesthetics in product design, Basic concept and elements of Visual design, Functional design practice.
- 3. Manufacturing consideration:** Producibility Requirements in the design of machine components, Forging design, Pressed component design, Design for machining, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts, Redesigning on basis of production consideration.
- 4. Value engineering:** Concept of value, cost and price, customer and value, philosophy and objectives of value analysis, types of value, areas of application of value engineering, limitations of value analysis, difference between value engineering and cost reduction techniques; Tool of technology in value analysis, method & engineering, cause and effect diagram, SWOT analysis, break even analysis, systems approach; Job plan for value analysis approach: Information phase, Function Phase, Creation Phase, Evaluation Phase, Recommendation Phase, Implementation Phase, Audit Phase; Value Engineering Cell, value manual, composition of cell, Cost cutting, various cost cutting techniques; Case studies in value engineering and analysis from manufacturing and service industries.

Books

1. Product Design and Development : Kail T. Ulrich and Steven D. Eppinger
2. Product Design and Engineering : A.K. Chitale and Gupta
3. Product Design and Process Engineering : Niebel & Draper
4. Design of Systems and Devices : Middendorf Marcel Dekker
5. Value Engineering SAVE : Mudge
6. Techniques of Value Analysis and Value Engineering: Miles Lawrence
7. Value Engineering in Manufacturing : ASME
8. Value Engg. Theory : D. E. Parker

- 1. Introduction:** Types and Characteristics of Production Systems – (i) Continuous or Process Production (ii) Mass Flow Line Production. PPC Phases – Planning Phase, Action Phase, Control Phase, Implications for Production planning & Inventory Control.
- 2. Forecasting:** Definition and Concept, Purpose of Sales Forecasting, Basic elements of sales forecasting, Techniques of Forecasting – Time Series Analysis ; Delphi Method, Forecasting by moving average, Weighted Moving Average, Exponential Smoothing, Correlation Analysis and Linear Regression Analysis.
- 3. Inventory control & management:** Inventory Control, Types Of Inventory, objectives of Inventory Control, Economic Order Quantity (EOQ) Inventory Models, ABC Analysis – Need and Procedural Steps: Material Requirement Planning (MRP) – Function – Inputs to MRP, Bill of Material (BOM).
- 4. Process planning:** Introduction and Concept, Information Required to Process Planning, Process Planning Procedure, Make or Buy decisions, Process Analysis, Process chart – Outline and Symbols, Automated Process Planning – Computer Assisted Process Planning (CAPP), Group Technology (GT).
- 5. Production scheduling:** The Production Environment, Controlling Continuous Production, Sequencing and Line Balancing Methodologies, Master Production Schedule (MPS) – Managing the Master Production Schedule, Maintenance of MPS - Scheduling in Manufacturing Systems - Conventional & Flexible Systems.
- 6. Supporting ppc activities:** Enterprise Resource planning (ERP) - Objective and Advantages of ERP, Supply Chain Management (SCM) - Definitions, Need, SCM Models, Concept of Lean Manufacturing (LM) and Just in time (JIT) in Production Systems.

Books

1. Production Planning b& Inventory Control : L Seetharama L
2. Production & Operation Management : N. Gaither Dryden
3. Material Management System : R.J.Brown
4. Decision Support for Inventory Management & Production Planning: Peterson and Surer

1. **ANN Models & Architecture:** Biological foundations, ANN models, Types of activation function, introduction to network architecture, multilayer feed forward network (MLFFN), Kohonen self organizing map, radial basis function network (RBFN), recurring neural network.
2. **Learning Processes:** Supervised and unsupervised learning, error-correction learning, Hebbian learning, Boltzman learning, single layer and multilayer perception model, least mean square algorithm, back propagation algorithm, Application in forecasting and pattern recognition and other power engineering problems.
3. **Fuzzy Sets and Theory:** Fuzzy sets, fuzzy set operations, properties, membership functions, fuzzy to crisp conversion, measures of fuzziness, fuzzification and defuzzification methods, application in engineering problems.
4. **Fuzzy Control System:** Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems.

Books:

1. Neural Network Design : M. T. Hagon, Howard B. Demuth and Mark Beale
2. Introduction to Artificial Neural Systems : Jacek M Zurada
3. Neural Computing: Theory and Practice : Wasserman
4. Neural Networks-Algorithms, application and programming techniques. J.A. Freeman
- 5., Essentials of Fuzzy Modeling and Control: Ronald R. Yager and Dimiyar P. Filev
6. Neural Networks, Fuzzy logic and genetic Algorithm: S. Rajasekran and G. A.V Pai

L	T	P
3	1	0

Linear power supplies and their limitations. Switched mode power supply. Analysis of various converter topologies – buck, boost and buck-boost. Calculation of inductor and capacitor size. Isolated converter topologies – fly back, forward, push pull, half bridge and full bridge. Comparison of these converters.

Design of inductor and transformer for dc- dc converters. Control of switched mode dc power supplies, transfer function and compensation. Current mode control, power supply protection and EMI considerations.

Book:

Power Electronics converters, applications and design : Ned Mohan, T.M. Undeland and W.P. Robbins

1. **Introduction to Transformer:** Working Principle, Construction and Operation and Equivalent circuit.
2. **Basic Concept of Rotating Machines:** Parts of rotating electrical machines, Torque production and Energy conversion.
3. **D. C. Motors:** EMF equation, Types of DC Motors, Torque speed characteristics, types of starters and speed control, losses and efficiency.
4. **Three-Phase Induction Motors:** Construction, Principle of working, Rotating magnetic field production, Slip, Equivalent circuit, Torque-slip characteristics, Speed control and method of starting.
5. **Special Motors:** Single phase motors, Stepper motor, Servomotors, Synchronous motor.
6. **Industrial Applications:** Case study of motor drive system for steel mills, paper mills and machine tool application.

Books:

1. Electric Machines : Ashfaq Hussain
2. Electrical Machinery : P. S. Bhimbra
3. Electrical Machinery : Chapman

- 1. Introduction:** Digital image representation, Fundamental steps in image processing, Elements of Digital Image processing systems, Elements of visual perception, Image model, Sampling and quantization, Relationship between pixels, imaging geometry.
- 2. Image Enhancement:** Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering, Smoothing filters, Sharpening filters, Frequency domain: Low-Pass, High-Pass, Homomorphic filtering.
- 3. Image Compression:** Coding redundancy, Inter-pixel redundancy, fidelity criteria, Image compression models, Error-free compression, Variable length coding, Bit-plane coding, Loss-less predicative coding, Lossy compression, Image compression standards, Fractal Compression, Real-Time image transmission, JPEG and MPEG.
- 4. Image Segmentation:** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion in segmentation, Spatial techniques, Frequency domain techniques.
- 5. Spatial Operations and Transformations:** Spatially dependent transform template and convolution, Window operations, 2-Dimensional geometric transformations.
- 6. Pattern Recognition:** Classification and description, Structure of a pattern recognition system, feature extraction, Classifiers, Decision regions and boundaries, discriminant functions, Supervised and Unsupervised learning, PR-Approaches statistics, syntactic and neural.
- 7. Statistical Pattern Recognition:** Statistical PR, Classifier Gaussian Model, Classifier performance, Risk and error, Maximum likelihood estimation, Bayesian parameter estimation approach, Clustering for unsupervised learning and classifiers.

Books:

1. Digital Image Processing : R. Gonzalez and R. E. Wood
2. Introductory Computer Vision and Image Procession : Andrian Low
3. Pattern Recognition-Statistical Structural and neural approach : Robert Scholkoff
4. Digital Image Processing : W.K. Pratt
5. Fundamentals of Image Processing. : R. K. Jain

- 1. Evolution of Tele-Communication:** Basic Switching System, Simple Tele-phone Communication, Telephone Transmitter, Telephone receiver, Telephone's bell & dialer pulsing mechanism, subscribers telephone sets, Dialing types, signaling tones, Brief Introduction to Electromagnetic Exchanges.
- 2. Electronic Switching** – Space Division Switching Stored Programme Control – Centralized SPC, Distributed SPC, Software Architecture, Application Software – Enhanced Services, Multi Stage Switching Networks.
- 3. Time Division Switching** - Time Division space switching, Time Division Time Switching, Time multiplexed space switching, Time multiplexed Time Switching, Combination Switching
- 4. Traffic Engineering,** Grade of Service and Blocking Probability - Telephone Networks, Subscriber Loops, Switching Hierarchy and Routing, Signaling Techniques, In Channel, Common Channel. Transmission media.
- 5. Fax system:** Basic facsimile system, facsimile applications working of FAX machines, recording media, FAX reproduction technique.
- 6. Mobile radio communication:** Introduction, cellular structures & planning, Frequency allocation, propagation Problems, Base station antennas, Mobile unit antenna Type of mobile systems, Handoffs, Analog cellular Radio Digital Cellular radio, Digital Narrow band TDMA, CDMA technology.

Books

- | | |
|---|--------------------|
| 1. Digital Telemetry | : John C Bellamy. |
| 2. Telecommunication Switching System and Network | : Tyagrajan |
| 3. Telecommunication system Engg. | : Roger L.Freeman. |
| 4. Wireless Mobile Communication | : Rappaport |

- 1. Bioelectronics signal:** Origins of Bioelectric signals, Electrocardiogram (ECG), Electromyogram (EMG). Recording Electrodes: Silver-silver Electrodes, Electrodes for ECG, EEG and EMG. Physiological Transducers: Pressure Transducers, Temperature sensors, Pulse sensors.
- 2. RECORDING AND MONITORING INSTRUMENTS:** Biomedical Recorders: Block diagrams of electrocardiogram phonocardiograph, Electroencephalograph, Electromyography. Monitoring

system, block diagram of patient monitor, measurement of heart rate, blood pressure measurement, and temperature measurement respiration rate. Basic Arrhythmia Monitoring system: Block diagram, Foetal Monitoring System: Methods of monitoring Foetal Heart Rate, Abdomen Foetal Electrocardiogram and Foetal Phonocardiogram. Biomedical Telemetry: Introduction, block diagram and description of single channel/multi channel telemetry systems.

3. **AUDIO METERS:** Mechanism of hearing, measurement of sound, basic audiometer, pure tone audiometer, sped audiometer.
4. **IMAGE SYSTEMS:** Introduction, Basic principle and block diagram of x-ray machine, x-ray computed topography (C.T. Scanner) and Nuclear Magnetic resonance (NMR) Topography, Ultrasonic Imaging System: Introduction, medical ultrasound, block diagram of pulse echo-system, A-Scan, M-mode, B-scanner and real time ultrasound imaging systems.
5. **THERAPEUTIC EQUIPMENTS:** Type of cardiac Pacemakers. Cardiac Defibrillator. Kidney Machine.
6. **PHYSIOTHERAPHY EQUIPMENTS:** Short-wave Diathermy, Microwave Diathermy, Ultrasound Therapy unit.
7. **PATIENT SAFETY:** Electric shock hazard, leakage currents, Test Instruments for checking safety parameters of Biomedical Equipments.

Books:

1. Handbook of Biomedical Instrumentation : R.S.Khandpur.
2. Biomedical Instruments: Theory and Design : Walter Welko- Witz and Sid Doutsch

Introduction, Trends & Projections in VLSI Circuits, Flow diagram of VLSI Circuit Design and VLSI Design issues.

MOSFET fundamentals, Enhancement Mode MOSFETs, Depletion Mode MOSFETs, Weak & strong Inversion Conditions, Threshold Voltage Concept in MOSFETs, IV Characteristics of a MOSFET, Limitations in IV Model and MOSFET Parasitic.

Basic VLSI Design Styles-NMOS, CMOS Process flow; Noise Margin; Inverter Threshold Voltage; NMOS Inverter design and characteristics; CMOS Inverter Design and Properties; Delay, Power Dissipation and scaling in CMOS circuits. Introduction to SPICE

Introduction to HDL: Design Flow, Design Methodologies, HDL History, Capabilities, Hardware Abstraction, Basic Terminology, Model Analysis, Comparison between VHDL and Verilog.

Basic VHDL Elements: Identifiers, Data Objects, Data Types, Operators.

Behavioral Modeling: Entity declaration, architecture body, Various Sequential Statements and Constructs, multiple processes, postponed processes.

Dataflow Modeling: Concurrent Signal Assignment Statements, delta delay model, multiple drivers, block statement, concurrent assertion statement.

Structural Modeling: Component Declaration, component Instantiation, resolving signal values.

Supporting Constructs: Generics and Configuration, Subprograms and Overloading, Operator overloading, Package declaration, package body, design Libraries, visibility.

Books

1. CMOS Digital Integrated Circuits-Analysis & Design : S.M. Kang and Y. Leblibici
2. Solid State Electronic Devices : B.G. Streetman & S. Banerjee
3. Introduction to VLSI : K. Eshraghian and Pucknell
4. VHDL primer : J. Bhasker
5. VHDL: Analysis and Modelling of Digital Systems : Z. Navabi; McGraw Hill Pub.

1. **Introduction to sequential circuits:** Flip –Flops, flip-flop conversions, flip-flop excitation table. Classification of sequential circuits. Registers and A to D and D to A converter circuits.
2. **Design & analysis of synchronous sequential circuits:** - Sequential circuits introductory examples, Counters, Sequence Detector and Sequence Generator circuits. Definite state model. Basic definition, capabilities & Limitation of finite state machines, state equivalence & machine minimization, simplification of incompletely specified machines, Extraction of maximum compatibles, synthesis & analysis of synchronous sequential circuits.
3. **Design of asynchronous sequential circuits:** - Introduction to asynchronous circuits, timing diagram, state diagram & flow tables, fundamental mode circuits, synthesis, state assignment in asynchronous sequential circuits, pulse mode circuits.
4. **Hazards:** - Introduction, gate delays, generation of spikes, production of static hazards in combinational networks, elimination of static hazards, design of hazard free combinational networks, hazard free asynchronous circuit design, dynamic hazards, essential.
5. **Contact networks & symmetric networks:** - Relay contents, analysis & Synthesis of contact Networks, Properties of symmetric functions, Synthesis & identification of symmetric functions

Books:

1. Switching and finite automata theory : ZVI Kohavi
2. Logical design of switching circuits : Douglas Lewin.
3. Logic Design : N.N Biswas

1. **Introduction:** Properties of concrete and reinforcing steel, design philosophies, limit state, ultimate load method, working stress method.
2. **Limit state method:** Design of Beams: Singly reinforced, doubly reinforced, rectangular, T and L beams and lintels.
Design of Slabs: One way, two way, baffle slabs.
Design of Columns: Subjected to eccentric and axial loading, Using S.P. 16.
Design of Stair Cases: Types terms used, design of stairs spanning, horizontally, doglegged stairs with quarter space landing, stairs with central stringer beam.
3. **Design of footings:** Individual and combined footing and raft foundation.
4. **Design of retaining walls:** Various types of retaining walls, design of cantilever and counterfort retaining walls.
5. **Design of water tanks:** Analysis of beams curved in plan, design of R.C.C. rectangular and circular water tanks resting on ground, design of underground tanks, design of overhead water tanks.

Books

1. Reinforced Concrete Structures Vol-1 : B.C.Punmia
2. Reinforced Concrete (Limit state design) : A.K.Jain
3. R.C.C.Design : P.Dayaratnam
4. Reinforced Concrete : Ashok K.Jain
5. Design Codes and Design Aids

3. **Road development and planning:** Brief history of road development, road cross section, necessity of transportation planning, classification of roads, road patterns, planning surveys, saturation system, highway planning in India, road development plans
4. **Highway location and alignment:** Basic requirements of an ideal alignment and factors controlling, engineering survey for highway location, drawing and reports, highway projects.
5. **Highway geometric design:** Highway cross-section elements, sight distances, Design of horizontal alignment, Transition curves and vertical alignment.
6. **Traffic engineering:** Traffic characteristics, traffic studies and their uses, traffic flow characteristics, traffic control devices, intersections, traffic planning, Trip-generation models, trip-distribution models, modal split analysis.
7. **Pavements design:** Design factors, Design of flexible pavements, CBR, GI and Burmister methods, Design of rigid pavements.
8. **Pavement materials:** Soils, Aggregates and their characteristics, Bituminous materials and mixtures, portland cement concrete.
9. **Construction of roads:** Construction of water bound macadam roads, bituminous pavements, cement concrete pavements, design and construction of joints in cement concrete pavements.
10. **Hill roads:** General considerations, alignment, geometric design and construction, drainage and maintenance problems in hill roads
11. **Highway maintenance:-** Pavement failures, maintenance of highway pavement , evaluation and strengthening of existing pavements.

Books:

- | | |
|---|-------------------------------------|
| 1. Highway Engineering | : S.K. Khanna and C.E.G. Justo |
| 2. Principles of Transportation Engineering | : Patha Chakraborty and Animesh Das |
| 3. Traffic Engineering and Transport Planning | : L.R.Kadiyali |
| 4. Highway Vol. I and II | : C.A.O_Flaherty |
| 5. Highway Engineering | : S.K. Sharma |

List of experiments:

1. To verify the Betti's law.
2. Study of a three hinged arch experimentally for a given set of loading and to compare the results with those obtained analytically.
3. To obtain experimentally the influence line diagram for horizontal thrust in a three hinged arch and to compare the same with the theoretical value.
4. To determine the flexural rigidity of a given beam.
5. To study the behavior of different type of struts.
6. To verify moment area theorem for slopes and deflection of a beams.
7. To find the deflection of a pin-connected truss and to verify the results by calculation and graphically.
8. To determine the carry over factors for beam with rigid connections.
9. To determine the rotational stiffness of a beam when far end is (a) fixed (b) pinned.
10. Determine experimentally the horizontal displacement of the roller end of a two hinged arch for a given set of a loading and to compare the results with those obtained analytically.
11. To obtain experimentally the influence line diagram for horizontal thrust in a two hinged arch and to compare the same with the theoretical value.

List of experiments:

1. To determine the impact value of aggregates
2. To determine the crushing value of aggregates
3. To determine the flakiness and elongation index of aggregates.
4. To perform Los- angeles and test on aggregates.
5. To determine the c b r value of a given soil sample.
6. To determine the c b r value of given soil aggregates mix.
7. To conduct the grain size analysis of course aggregate & fine aggregates.
8. To perform penetration test on bitumen
9. To determine the softening point of bitumen material.
10. To determine the specific gravity and water absorption of aggregates.
11. To determine the ductility value of a bitumen Material.
12. To perform float test on bitumen.

6th Semester

Course No.	Subject	L	T	P/D	Hours	Credit
CE-361	Steel Structure Design	3	1	0	4	4
CE-362	Environment Engg.-I	3	1	0	4	4
CE-363	Transportation Engg. -II	3	1	0	4	4
CE-364	Irrigation Engg. and Hydrology	3	1	0	4	4
CE-365	Structural Drawing	0	0	3	3	2
CE-366	Minor Project	0	0	3	3	2
CE-362 (P)	Environment. Engg. Lab	0	0	2	2	1
Total					24	21

** Industrial Training of 6 to 8 weeks duration after 6th Semester

L	T	P
3	1	0

1. **Design of connections in steel structures:** Riveted, and bolted and welded connections, assumptions, Different types of joints, design of various types of riveted and welded connections subjected to direct loads and moments.
2. **Design of tension members:** Selection of section, I.S. specifications, design of axially loaded tension members, design of members for axial tension and bending, end connections, design of lug angles and tension splices.
3. **Design of compression members:** Theory of buckling, design of column, cross section (single and built up sections), design of angle struts, eccentrically loaded columns, column splices, lacings and battens.
4. **Design of beams:** Laterally stability, design of single and built up beams, plated beams and curtailment of flange plates.
5. **Design of column bases and column footings:** Slab base, gusseted base, and column bases subjected to moment. Independent column footing, combined column Footing.
6. **Design of roof trusses:** Types of trusses, roofs and side coverage, types of loadings and load combinations, design of members and connections.
7. **Water tanks:** Design of rectangular pressed steel tanks, cylindrical tanks with hemispherical bottom, design of staging.
8. **Plastic design of steel structures:** Review of plastic analysis as covered in earlier courses, Effect of normal and shear forces on plastic moments, lateral buckling and local buckling of beam. Design of beams and frames, design of connections-straight corner, beam column and plate connections.

Books:

1. Design of Steel Structures : A.S.Arya and J.L. Ajmani
2. Design of Steel Structures : Ram Chandra
3. Design of Steel Structures : P. Dayaratnam

- Water environment:** Environment, water resources of hydrosphere, different water pollutants and their impacts on human being, sources of supply, yield, design of intakes, estimation of demand, design period.
- Water and waste water characteristics:** Water quality criteria and standards for potable and industrial uses, control of water borne diseases, Physical, chemical and biological characteristics of domestic and industrial waste waters, significance of pollutant parameters and effluent discharge standards.
- Treatment objective and methods** Unit operations and processes and selection of treatment mode and sequence
Primary treatment: screening, neutralization, equalization, flocculation, sedimentation, floatation, stripping.
Secondary treatment: suspended and attached biological growth systems for aerobic, anaerobic, and anoxic processes, lagoons and stabilization ponds.
Tertiary treatment: Oxidation/reduction, precipitation, adsorption, ion exchange and membrane (R) O/UF) Processes, disinfection.
- Conveyance and distribution systems:**
Conductors: different pipe systems, design considerations, laying, testing and effects of pipe corrosion and its preventive measures.
Sewers: hydraulic design, construction and appurtenances, operation and maintenance.
Pumps and pumping: necessity, types of pumps, characteristics curves, selection criteria, economical diameter of pumping/transmission main, problems in sewage pumping.
Distribution network: methods, layout, storage, and distribution reservoir, analysis of distribution systems.
- Plumbing systems:** General principles, materials for service pipe, service connection, water meters, and valves, Principles of house drainage, pipes, traps, sanitary fittings, systems of plumbing, house drainage plans.
- Rural and semi urban sanitation:** Collection and disposal of dry refuse, sullage, excretal waste, night soil disposal without water carriage, latrines, chemical toilets, pre-cast units for low cost sanitation.

Books:

- Theory and Practice of Water and Waste water treatment : Ronald L. Droste
- Wastewater Engineering-Treatment and reuse : Metcalf and Eddy
- Water and Waste water Technology : M.J Hammer
- CPHEEO (Ministry of Urban Development, New Delhi). Manual on
 - Water Supply and Treatment.
 - Sewerage and Sewage Treatment.

1. **Urban transportation planning:** Introduction, Transportation system management, Transportation plan, Travel forecasting, Trip generation models – Multiple linear regression analysis, Category analysis, Trip Distribution – Fratar method, Gravity model, Mode usage – Trip interchange mode choice models, Trip assignment- Minimum path techniques.
2. **Airports:** Introduction, ICAO, Aircraft characteristics, Airport Planning, Regional planning, development of new airports, airport site selection, Airport obstructions, Zoning, classification of obstructions, imaginary surfaces, approach zone and turning zones, Runway design, airport capacity, loading apron, service hanger, taxiway design, introduction to airport pavement design.
3. **Railways:** Component parts of railway track, gauges, resistances to traction and stresses in track, various resistances and their evaluation, hauling capacity and tractive effort, stresses in rail, sleepers, Coning of wheels, creep, wear, joints in rails, sleeper types, rail fittings and fixtures, ballast, Geometric Design, Track alignment, horizontal curves, super elevation, equilibrium cant and cant deficiency, transition curves, vertical curves-gradients and grade compensation, points and crossings, Design of simple turn out, various types of track junctions, Principles and classification of signals, functions and methods of interlocking.

Books:

1. Transportation Engineering : C.J. Khisty and B.K. Lall
2. Airport Planning and Design : Khanna, Arora and Jain
3. A Textbook of Railway Engineering : Saxena and Arora
4. Planning and Designing of Airport : Robers Horenjeff
5. Indian Railway Tracks : M. M. Agarwal
6. Fundamentals of Transportation Engineering : C.S Papacostas

1. Hydrology:

Hydrological cycle

Precipitation: Measurement, Computation of average rainfall over a basin

Losses: Evaporation, transpiration, depression storage, infiltration, overland flow

Runoff: Factors affecting computation, estimation of maximum rate of runoff

Hydrograph Analysis: Unit and S-hydrograph, Unit Hydrograph from complex storms, rational method.

2. **Ground water flow:** Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquitards, radial flow into a well under confined and unconfined condition, tube wells, pumping and recuperation tests, ground water potential.

3. Irrigation engineering:

Water requirements of crops: Function of irrigation water, limiting soil water conditions, Depth and frequency of irrigation, duty and delta, irrigation efficiencies, principal crops, assessment of irrigation water.

Irrigation methods and their efficiencies

Canals: Canal classification, distribution system for canal irrigation, canal capacity, canal losses, alignment of canals, most efficient section, lined canals, their design, regime theory, Critical shear stress, bed load, local and suspended load transport, cost analysis of lined and unlined canals, drainage behind lining.

Water logging: causes and control, drainage system design, salinity.

Books:

1. Design of Irrigation Structures : S.K.Sharma.
2. Irrigation and Water Power Engineering : B.C.Punmia, Pande and B.B.Lal
3. Irrigation Engineering and Hydraulic Structures : S.R.Sahasrabudhe
4. Irrigation Engineering Vol.I,II and III : K.R.Sharma
5. Irrigation Practice and Design Vol.1 to VII : K.B.Khushalni
6. The Fundamentals Principles of Irrigation and Water Power: B.B.Priyani
7. Fundamentals of Irrigation Engineering : Bharat Singh
8. ISI Codes.

1. Introduction: Building Byelaws, Orientation and Principles of planning, introduction of structural drawing.
2. Different types of bonds in walls and junctions in brick masonry, details of masonry columns, Drawings of partition walls, cavity walls.
3. Structural Drawing of RCC Structures, foundations, stair cases, retaining walls, water tanks.
4. Structural Drawing of steel structures, connections, beams, columns, trusses.

List of experiments:

1. To find the turbidity and colour of a given sample of water.
2. To determine the pH value of a given sample of water.
3. To determine the carbonate, bicarbonate, and hydroxide alkalinity of a sample.
4. To find out the concentration of chlorides in the given sample of water.
5. To estimate the hardness of the given sample of water by standard EDTA method.
6. To determine residual chlorine in a given sample of water.
7. To find out total dissolved solid, settleable solids and suspended solids of the given sample.
8. To find the quantity of dissolved oxygen (DO) present in the given sample.
9. To determine biochemical oxygen demand (BOD) exerted by the given waste water sample.
10. To find the optimum amount of coagulant required to treat the turbid water by Jar Test.
11. To find out total bacterial count present in a given sample (SPCT).
12. To determine MPN of coliforms of the given sample.

Books

1. Standard Methods for the Examination of Water and Wastewater: APHA, AWWA, WPCF
2. Chemistry for Environmental Engg and Science: C.N. Sawyer, P.L. McCarty & G.F. Parkin