JSPM University Pune

Faculty of Science and Technology

School of Civil and Environmental Sciences

NEP aligned Syllabus

for

SY B. Tech (Civil Engineering)

(Effective from AY: 2026-27)

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: BSC	**Course Title:** Ordinary Differential Equations and Multivariate Calculus	
Course Code: 230GMAB07_03	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):** 2 **Tutorial (T):** 1 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 100 Marks

Course Objectives:

- Develop proficiency in solving first-order and higher-order differential equations using various methods.
- Apply multivariate calculus techniques to solve problems involving functions of multiple variables.
- Develop critical thinking and problem-solving skills by applying differential equations and multivariate calculus concepts to engineering scenarios

Course Outcomes: On completion of the course, the learner will be able to
CO1: Solve ordinary differential equations
CO2: Apply concepts of ordinary differential equations to solve problems.
CO3: Solve second-order ordinary differential equation
CO4: Remember the basic concepts of Laplace transforms
CO5: Apply the concepts of Laplace transform to solve problems.
CO6: Apply multivariate calculus techniques to solve problems involving functions of multiple variables

Course Contents

Unit I	**Ordinary Differential Equations**	**(7 Hours)**
Formation of Differential Equations, Solution of first order first-degree differential Equations, Exact differential equations, reducible to exact, Linear differential equations, reducible to the linear differential equation		
Unit II	**Applications of Differential Equations**	**(7 Hours)**
Orthogonal Trajectories, Newton's Law of cooling, Kirchhoff's law of electric circuits, Law of growth and decay, Heat flow Equation		
Unit III	**Higher order Ordinary Differential Equations**	**(8 Hours)**
Homogeneous Linear Differential equations with constant coefficients, Non-homogeneous Linear Differential equations with constant coefficients, Method of undetermined coefficients, Variation of parameters		

Unit IV	**Laplace Transform**	**(7 Hours)**
Definition and properties, Laplace transforms of common functions, Unit step function, Dirac delta function, convolution theorem		
Unit V	**Applications of Laplace Transform**	**(7 Hours)**
Solving ODEs using Laplace transform, inverse Laplace transform		
Unit VI	**Functions of several variables**	**(9 Hours)**
Functions of several variables, level curves and level surfaces, directional derivatives, differentiability, chain rule, extreme values and saddle point.		

Learning Resources
Text Books: 1. G. B. Thomas, "*Thomas Calculus*", Pearson's Publication, 13th edition. 2. Erwin Kreyszing, *"Advanced Engineering Mathematics"*, Wiley Eastern Ltd,10th edition
Reference Books: 1. B. V. Ramana, *"Higher Engineering Mathematics"*, Tata McGraw-Hill Publishing Company Limited, 13th edition 2. M. D. Raisinghania, *"Ordinary and Partial differential equations"*, S. Chand Publications New Delhi, 16th Edition. 3. Peter V. O" Neil, *Advanced Engineering Mathematics*, Thomson Brooks / Cole, Singapore, 7th edition.

JSPM University Pune

S.Y. B. Tech "Civil"

Semester- III

Course Type: PCC	**Course Title:** Building Planning and Drawing	
Course Code: 250GCEB25	**Teaching Scheme:**(Hrs./Week)	**Examination Scheme:**
Credits: 2.5	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 2	**Theory (TH):** 100 Marks

Prerequisite Courses:

1. Fundamentals of Basic Civil Engineering and Engineering Graphics.

Course Objectives:

- To develop understanding of site planning principles, environmental factors and climate-responsive design.
- To familiarize students with planning regulations, building bye-laws and statutory provisions applicable to building design.
- To enable students to understand the relationship between building planning, site conditions and substructure systems.
- To introduce concepts of superstructure planning, building services integration and modern construction techniques.
- To develop skills in functional planning and interpretation of building drawings.
- To provide knowledge of digital tools, BIM and professional practices in building planning and project coordination.

Course Outcomes: On completion of the course, the learner will be able to

CO1: Analyze site conditions, climate and environmental factors for effective building planning.

CO2: Interpret and apply building regulations, byelaws and statutory requirements in planning and design.

CO3: Identify and compare substructure systems and foundation options based on site conditions.

CO4: Apply principles of superstructure planning, building services integration and modern construction approaches.

CO5: Analyze and compare substructure systems and foundation alternatives based on site conditions and planning requirements.

CO6: Analyze the role of digital tools (CAD, BIM) and project planning tools in planning, coordination and decision-making.

Course Contents

Unit I	**Site Planning and Environmental Considerations**	**(5 Hrs)**

Building classification; site selection criteria; site clearance and setting out; environmental factors; climate and its influence on planning; elements and climatic zones of India; climate-responsive planning; orientation and influencing factors; CBRI recommendations; sun path and wind analysis; landscaping principles; disaster-resilient planning considerations; integration of site and climatic factors in building planning; sustainable and green building concepts.		
Unit II	**Planning and Regulations**	**(5 Hrs)**
Planning principles and space planning concepts; building bye-laws (necessity, plot size, road width, open spaces, FAR, setbacks, height regulations, room sizes, area calculations); provisions for ventilation, lighting, circulation, sanitation and parking; National Building Code and development control regulations; building permission and approval process; introduction to Real Estate (Regulation and Development) Act, 2016; application of statutory regulations in planning and layout design; introduction to town planning concepts (development plan, land use zoning, N.A. permission); basics of land records (7/12 extract, Form 6), concept of TDR; overview of Maharashtra Regional and Town Planning (MRTP) Act.		
Unit III	**Building Components and Substructure**	**(5 Hrs)**
Building components: substructure and superstructure; site conditions and their influence on substructure; basic soil characteristics and bearing capacity; selection of foundation systems (shallow and deep); plinth level, site grading and drainage considerations; foundation layout and levels; coordination of substructure with building services; relationship between building planning, site conditions and foundation systems; economic and sustainability considerations.		
Unit IV	**Superstructure Systems and Planning**	**(5 Hrs)**
Superstructure components: walls, doors, windows, lintels, floors, roofs, truss and staircases; functional and planning requirements; coordination of structural and architectural components; modern construction techniques (MIVAN, prefabrication, precast, AAC, RMC); emerging trends (sustainable materials, smart buildings, lean construction, 3D printing); integration of building services (HVAC, electrical, plumbing, fire safety); considerations of economy, efficiency and sustainability.		
Unit V	**Functional Planning and Building Drawing**	**(5 Hrs)**
Planning of residential buildings (1BHK, 2BHK, duplex); room requirements and grouping; circulation and zoning; furniture layout; planning considerations for public buildings; fundamentals of building drawings (plan, elevation and section); developed plan; Selection of scales for various drawings, dimensioning, abbreviations, and symbols as per IS 962; perspective drawing (one-point and two-point).		
Unit VI	**Digital Planning Tools and Professional Practices**	**(5 Hrs)**
Digital tools in building planning (CAD and BIM), digital workflows in building projects; overview of project planning tools (Primavera, MS Project) and their role in coordination and scheduling; role of drawings in communication and decision-making; sustainable and smart planning approaches (energy efficiency, water management, resource optimization); overview of modular and industrialized construction systems; professional practices in building planning, approvals and regulatory processes; case studies.		

Learning Resources

Text Books:

1. S. K. Duggal, *"Building Materials",* 4th Edition, National Building Code (NBC) of India, 2016.
2. Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, *"Building Construction*, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. *"Engineering Materials",* Charter Publishing House, Anand, India.

Reference Books:

1. Sushil Kumar "*Building Materials and construction*", Standard Publishers, 20th Edition, reprint, 2015.
2. P C Vergese, "*Building Materials*", PHI Learning Pvt. Ltd, 2nd Edition, 2015.
3. Jagadish. K.S, "*Alternative Building Materials Technology*", New Age International, 2007.
4. M. S. Shetty, "*Concrete Technology*", S. Chand & Co. New Delhi, 2005.

MOOC / NPTEL Courses:

1. Building Materials and Composites, by Dr. Sumana Gupta, IIT Kharagpur, (Link for the course: https://archive.nptel.ac.in/courses/124/105/124105013/).

Additional Web Resources:

1. https://www.udemy.com/course/construction-planning/
2. https://www.udemy.com/course/methods-of-building-construction/

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: PCC	**Course Title:** Strength of Materials	
Course Code: 230GCEB05	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any:

1. Fundamentals of Physics
2. Engineering Mechanics.

Course Objectives:

- To provide students with a solid foundation in stresses, strains, and structural behavior under different loads.
- To make the students skilled in analyzing shear force, bending moments, and deflections in beams and columns.

Course Outcomes: On completion of the course, learner will be able to

CO1: Understand the relationship between stress and strain and their impact on material behavior.

CO2: Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.

CO3: Analyse the distribution of shear and bending stresses in beams of different cross-sections.

CO4: Determine the torsional stress in circular shafts and the principal stresses in structural members.

CO5: Analyze axially loaded and eccentrically loaded columns.

CO6: Calculate the deflection of beams using various methods, considering different loading scenarios.

Course Contents

Unit I	**Stresses and Strains**	**(7 Hours)**
Hooke's Law, Stress-Strain Diagram for elastic, plastic materials and brittle materials, Idealized stress-strain diagram, Concept of axial stresses (compression, tension), strains (linear, lateral, shear and volumetric), Elastic constants and their relations.		
Unit II	**Shear Force and Bending Moment Diagram**	**(8 Hours)**
Concept of shear force and bending moment, Relation among shear force, bending moment and intensity of loading. Shear force and bending moment diagrams for determinate beams due to concentrated, uniformly distributed and uniformly varying loads.		
Unit III	**Shear and Bending Stresses**	**(7 Hours)**

Bending stresses in beams: theory of simple or pure bending, assumptions, derivation of flexure formula, Determination of bending stresses – Section modulus rectangular and circular sections (solid and hollow). Shear stresses in beams: concept of shear, shear stress distribution for various cross sections such as circular and rectangular sections.		
Unit IV	**Torsion and Principal Stresses**	**(8 Hours)**
Torsion of circular shafts: theory of torsion, assumptions, Stress strain of hollow and solid shaft. Power transmitted by shafts. Principal stresses and strains: concept of principal planes and principal stresses, normal and shear stresses on an oblique plane.		
Unit V	**Axially and Eccentrically Loaded Columns**	**(7 Hours)**
Axially loaded columns: concept of critical load and buckling, Euler's formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine's formula, Direct and bending stresses for eccentrically loaded short column.		
Unit VI	**Deflection of beams**	**(8 Hours)**
Deflection of determinate beams by Macaulay's method, Moment Area method Different types of structures, loads and forces, static and kinematic indeterminacy, stability and determinacy, equations of equilibrium.		

Learning Resources

Text Books:

1. S. B. Junnarkar and Dr. H. J. Shah "*Mechanics of Structures Vol. I &II*", Charotar Publishing House Pvt Ltd, Twenty second edition.
2. R. Subramanian "*Strength of Materials*" Oxford University Press.

Reference Books:

1. Timoshenko and Young "*Elements of Strength of Materials*" East-West Press Ltd.
2. F.L. Singer and Andrew Pytel "*Strength of Materials*" Harper and Row Publication.
3. Beer and Johnston "*Mechanics of Materials*", McGraw Hill Publication.
4. E.P. Popov "*Introduction to Mechanics of Solids*", Prentice Hall Publication.
5. Gere & Timoshenko "*Mechanics of Materials*", CBC publisher.
6. Norris, Wilbur and Utku "*Elementary Structural Analysis*", Tata McGraw Hill Publisher.

MOOC / NPTEL Courses:

1. NPTEL Course "Strength of Materials", Prof. Sriman Kumar Bhattacharyya, IIT Kharagpur.
   Link of the Course: https://archive.nptel.ac.in/courses/105/106/105106050/

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: PCC	**Course Title:** Surveying	
Course Code: 230GCEB06	**Teaching Scheme:** (Hrs. / Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 marks

Prerequisite Courses, if any:

1. Basic Introduction to Civil Engineering field, Engineering Mathematics

Course Objectives:

- To develop a comprehensive understanding of surveying's role in civil engineering, emphasizing its significance in construction projects.
- To empower students to identify and differentiate between sources of measurement errors, emphasizing accuracy and precision in various surveying techniques.
- To enable students to effectively recognize, rectify, and prevent errors in measurements, spanning differential level circuits, horizontal distances, and traverse angles.
- To equip students with essential communication skills, safety protocols, and instrument handling techniques for efficient fieldwork.
- To train students in hazard recognition and safety measures, ensuring personal and team well-being in challenging environments.
- To provide practical knowledge in traverse calculations, total station operation, and curve design, facilitating accurate data collection, analysis, and project completion.

Course Outcomes: On completion of the course, learner will be able to

CO1: Define and Explain basics of plane surveying and differentiate the instruments used for it.
CO2: Express proficiency in handling surveying equipment and analyze the surveying data from the equipment.
CO3: Describe different methods of surveying and find relative positions of points on the surface of earth.
CO4: Execute curve setting for civil engineering projects.
CO5: Articulate advancements in surveying.
CO6: Differentiate map and aerial photographs, also interpret aerial photographs.

Course Contents

Unit I	**Chain and Compass Surveying**	**(5 Hrs)**

a) Definition and Importance of Surveying; Principles of Surveying,
b) Definition, objective and fundamental classification of surveying (Plane and Geodetic), concept of Scale, Ranging, Chaining, Offsetting and Traversing (Concepts only).

Construction and use of prismatic compass, Concept of bearing &, types of bearings such as Whole Circle Bearing, Quadrental Bearing, meridian and their types, local attraction and correction for local attraction, dip, declination and calculation of true bearings (including numerical of all types)		
Unit II	**Levelling**	**(5 Hrs)**
a) Introduction to leveling, Types of leveling, Types of benchmarks, Study and use of dumpy level, auto level, digital level and laser level in construction industry, principal axes of dumpy level, testing and permanent adjustments reciprocal leveling, curvature and refraction corrections, distance to the visible horizon. Collimation Plane Method, Rise & Fall Method b) Study of vernier transit 20" theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles, measurement of deflection angles using transit theodolite and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite. c) Theodolite traversing – computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table. Checks, omitted measurements, area calculation by independent co-ordinates.		
Unit III	**Tacheometry and Contouring.**	**(5 Hrs)**
a) Tacheometry – applications and limitations, principle of stadia tacheometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points, finding Tacheometric constants. Tacheometric contouring. Numericals b) Contouring – Definition of Contours, Characteristics of Contours, Contour Patterns for various natural features, direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications		
Unit IV	**Curves**	**(5 Hrs)**
Introduction to horizontal and vertical curves (including numerical but derivation not expected), different types of curves and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves and compound curves to be asked), Transition curves: necessity.		
Unit V	**Construction Survey & Space Based Positioning System (SBPS)**	**(5 Hrs)**
a. Introduction to construction survey, establishing of horizontal and vertical controls, setting out of buildings, maintaining verticality of tall buildings, survey for open traverse (roadway, railways, drainage lines, water lines, canals)., Setting out of a bridge, Determination of the length of the central line and the location of piers. Setting out of a tunnel – Surface setting out and transferring the alignment underground. b. Introduction to SBPS, SBPS systems - GPS, GLONASS, Galileo, GAGAN, BeiDou and their features, Segments of SBPS (Space, Control and User), applications of SBPS in surveying.		
Unit VI	**Introduction to Geodetic Survey & Aerial Photogrammetry**	**(5 Hrs)**
Introduction to Geodetic Survey, Objects, Methods of Geodetic Surveying, Introduction to triangulation and trilateration, Objective of triangulations surveys, Classification of triangulation systems, Triangulation figures, Strength of figure, Study and use of one second theodolite and Electronic Total Station, Aerial Photogrammetry Objects, Classification- qualitative & quantitative photogrammetry,		

Applications, comparison of Map and aerial photographs, Flight Planning, Calculation of no of Photographs.

Learning Resources

Text Books:

1. T. P. Kanetkar and S. V. Kulkarni, Pune Vidyarthi, *"Surveying and Levelling Vol. I and Vol. II",* Griha Prakashan, sixth edition
2. Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain, *"Surveying, Vol. I & II",* Laxmi Publications, fourth edition.
3. Dr A. M. Chandra, *"Plane Surveying & Higher Surveying",* New age international publishers, sixth edition.

Reference Books:

1. Alfred Leick "*GPS Satellite Surveying*" Wiley, third edition.
2. Burrough "*Principles of Geographical Information System*", Oxford University Press.
3. M. D. Saikia "*Surveying*" PHI Learning Pvt.Ltd., fifth edition
4. Satheesh Gopi, R. Sathikumar "*Advanced Surveying -Total Station, GIS and Remote Sensing*" by and N. Madhu, Pearson publication, third edition
5. R. Subramanian "*Surveying & leveling*" by, Oxford Publication, seventh edition.

MOOC / NPTEL Courses:

1. Essentials of Surveying: Application and Techniques, by Mr. Pankaj Kumar Swarnkar, Chhattisgarh Swami Vivekanand Technical University, Bhilai, (Link for the course): https://onlinecourses.swayam2.ac.in/nou24_ce11/preview

Additional Web Resources:

1. https://www.youtube.com/watch?v=9Bm1pYjNDVI&list=PL20A0651466E8A776&index=5

JSPM University Pune S.Y. B. Tech (Regular) Semester- III		
Course Type: IOC	**Course Title: Bioengineering**	
Course Code: 250GBTB01	**Teaching Scheme: (Hrs./Week)**	**Examination Scheme:**
Credits: 2	**Lecture (L): 2 Tutorial (T): 0 Practical(P): 0 Experiential Learning (EL): 0**	**Theory (Th): 100 Marks**

Prerequisite Courses, if any:
Biology

Course Objectives:

- To apprehend with a solid foundation in the fundamental concepts of bioengineering, including cell structure, biomolecules, and human anatomy.
- To introduce insight of the principles and applications of biomedical engineering, covering various medical imaging devices and biomedical recorders.
- To acquaint students with the integration of artificial intelligence in healthcare, exploring its applications, limitations, and ethical considerations.
- To equip students with knowledge of computational models and methods used in biological research and data analysis.
- To develop proficiency in bioinformatics tools and databases for analyzing genomic and proteomic data and understanding drug design.
- To explore bio-inspired systems and their applications in environmental remediation, energy harvesting, and storage.

Course Outcome: Upon completion of the course, learners will be able to:
CO1: Identify biological concepts essential for engineering applications.
CO2: Apply knowledge of medical imaging devices and biomedical recorders to real-world biomedical engineering problems.
CO3: Assess AI technologies in healthcare settings, to address their potential and associated ethical issues.
CO4: Illustrate computational methods to simulate biological processes and analyze complex biological data.
CO5: Illustrate on bioinformatics tools and techniques to analyze genomic and proteomic data, and participate in drug design and development projects.
CO6: Describe bio-inspired approaches for environmental remediation, energy solutions, and other technological applications.

Course Contents

Unit I	**Foundations of Bioengineering**	**(5Hrs)**
Cell structure and function, Biomolecules: Nucleic acids, proteins, amino acids, lipids and carbohydrates, Human anatomy and physiology, Respiratory system, Central Nervous System: resting and action potential generation, Cardiovascular System: Structure and function of a heart		
Unit II	**Biomedical Engineering**	**(5Hrs)**

Definition, types of medical imaging Devices, working principle, applications, limitations: MRI, CT scans, and X-rays, Design and application of materials in medical devices and implants: Pacemaker and Continuous Glucose Monitoring Unit, Biomedical recorders: Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG).		
Unit III	**Healthcare Engineering**	**(5Hrs)**
Introduction to Artificial Intelligence in healthcare, Application of AI in Healthcare and Research: Drug Discovery, Clinical trials, AI powered stethoscope, Limits, Ethical and Social issue, Introduction to Robotics and Automation in healthcare, Robot assisted recovery and rehabilitation		
Unit IV	**Computational Biosciences**	**(5Hrs)**
Introduction to computational models in biology, Applications of computational methods in biological research, Simulation techniques for studying biological processes, Modeling complex biological systems; Use of tools in understanding diseases, Machine Learning in Biological Data Analysis.		
UNIT V	**Bioinformatics Perspective**	**(5Hrs)**
Major bioinformatics databases (e.g., NCBI, EMBL), Tools for sequence alignment (e.g., BLAST), Techniques for analyzing genomic and proteomic data, Next-generation sequencing data analysis, Structural Bioinformatics and Molecular Modeling: Protein structure prediction methods, Molecular docking and drug design.		
Unit VI	**Bio-Inspired Systems**	**(5Hrs)**
Introduction to biomimetics and biomimicry; Bio-inspired Environmental Remediation and its applications. Biomimetic approaches to energy harvesting and storage (e.g., photosynthesis-inspired solar cells, energy-efficient designs); Biofuels and biologically inspired energy conversion technologies.		

Learning Resources

Textbooks:

1. Lehninger principles of biochemistry fourth edition.
2. Joseph D. Bronzino “The Biomedical Engineering Handbook Third Edition”

Reference Books:

1. Chinmaya Panda, R. Shreya, and Lalit M. Pandey “Importance of Biology for Engineers: A Case Study”
2. R. S. Khandpur “Handbook of Biomedical Instrumentation.”
3. Ian Peate and Murlitharan Nair “Fundamentals of Anatomy and Physiology” Allison M. Okamura, Maja J. Mataric, Henrik I. Christensen “Medical and Health care Robotics.

MOOC / NPTEL Courses:

- NPTEL Course on “Next Generation Sequencing Technologies: Data Analysis and Applications”, By Prof. Riddhiman Dhar | IIT Kharagpur
  https://onlinecourses.nptel.ac.in/noc24_bt64/preview
- NPTEL Course on “Introduction to Dynamical Models in Biology”, By Prof. Biplab Bose, IIT Guwahati.
  https://onlinecourses.nptel.ac.in/noc24_bt41/preview

Additional Web Resource’s:

https://onlinecourses.nptel.ac.in/noc24_bt70/preview

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: VEC	**Course Title: Professional Laws, Ethics, Values and Harmony**	
Course Code: 230USYB02_03	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2	**Lecture (L): 2** **Tutorial (T): 0** **Practical (P): 0** **Experiential Learning (EL): 0**	**Theory (TH): 50 Marks**

Prerequisite Courses, if any: Nil

Course Objectives:

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill moral, social values and loyalty and to appreciate the rights of others.
- The students will learn the rights and responsibilities as employee, team member and a global citizen.
- Self-explore by using different techniques to live in harmony at various level.
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life.

Course Outcomes:

CO1: Understanding basic purpose of profession, professional ethics and various moral and social issues.
CO2: Acquiring knowledge of various roles of Engineer in applying ethical principles at various professional levels.
CO3: Excelling in competitive and challenging environment to contribute to industrial growth.
CO4: Handling ethical dilemmas while discharging duties in professional life.
CO5: Inculcating awareness of professional rights and responsibilities of Engineer, safety and risk benefit analysis of Engineer.

Course Contents

Unit I	**Introduction To Professional Ethics, Human Values**	**(5 Hrs)**
Self-awareness, values and Ethics at work, Professional Habits, Multi-tasking abilities, Stress and Burnout in Professional Practice-Techniques for coping with stress and preventing burnout- Emotional Intelligence		
Unit II	**Introdution to Law in Professions**	**(4 Hrs)**
Legal ethics and values- professional rights of employer and employee, occupational crime, penalities and laws- Code of Conduct		
Unit III	**Engineering Ethics**	**(6 Hrs)**
Moral and Virtue, Abraham Maslow theory- Maslow's hierarchy of needs, Kohlberg's theory – Gilligan's theory		
Unit IV	**Engineering As Social Experimentation**	**(5 Hrs)**
–Engineers as responsible Experimenters, Codes of Ethics – A Balanced Outlook on Law.		
Unit V	**Safety, Responsibilities and Rights**	**(5 Hrs)**

Safety and Risk – Assessment of Safety and Risk – principle of Confidentiality – Conflicts of Interest –Discrimination.

Unit VI	Global Issues	(5 Hrs)

Environmental Ethics – Computer Ethics – Weapons ethical concern, – Moral Leadership – Code of Conduct – Corporate Social Responsibility and advocacy

Learning Resources

Textbook:

1. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi
2. Jayshree Suresh, Raghavan B.S. (2016). Human Values & Professional Ethics: S Chand & Company. Pvt. Ltd: New Delhi.
3. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi,2003.
4. Professional Ethics: R. Subramanian, Oxford University Press, 2015. 2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015

Reference Books:

1. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
2. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). Introduction to Psychology. 6th Edition.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Reamer & Fredric (2005) Social Work Values and Ethics, New Delhi: Rawat Publication
6. Philip, Seed and Lloyd, Greg (1997) Quality of Life, London: Nessica Kingsley Publishers
7. McCormick, J. Mary, (1975) Enduring Values in a Changing Society, New York: Family Service Association of America

JSPM University Pune

S.Y. B. Tech "Civil"

Semester- III

Course Type: LC	**Lab Course Title:** Building Planning and Drawing Lab	
Course Code: 250GCEB26	**Teaching Scheme:**	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (TH):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50

Prerequisite Courses: Engineering Graphics

List of Laboratory Experiments

1.	Draw a plan, section and elevation of fully paneled door and window.
2.	Draw a plan, sectional elevation of open well and dog legged staircase.
3.	Draw an elevation of king post truss.
4.	Perspective drawing of a small building element (based on one and two-point)
5.	Draw a developed plan of the G+1 residential building, including construction notes, schedule of opening, site plan, floor plan, elevation, and section.
6.	Report on Introduction to Computer-Aided Drafting (CAD) and Coordinate Systems.
7.	Draw and modify commands in CAD software, including layers, dimensioning, text, blocks, and related drafting tools.
8.	Prepare a 2D plan of a G+1 or G+2 building (residential or public), including proper layers, dimensions, and annotations.
9.	Prepare the section of a G+1 or G+2 building, showing foundation details, floor levels, staircase, and roof.
10.	Prepare the elevation of a G+1 or G+2 building, including heights, openings, and architectural features.

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: LC	**Lab Course Title:** Strength of Materials Lab	
Course Code: 230GCEB08	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 Marks

Prerequisite Courses, if any:-

Course Objectives (COs):

- To understand the fundamental mechanical properties of engineering materials through standard laboratory testing methods.
- To perform and analyze various strength tests on metals, timber, bricks, and tiles as per relevant IS standards.
- To develop practical skills in handling testing equipment and interpreting experimental results.
- To correlate laboratory results with real-life engineering applications and material selection.

Course Outcomes (COs): After completion of the course, students will be able to:

CO 1: Perform mechanical tests such as tension, torsion, impact, compression, and bending on different materials.

CO 2: Evaluate material properties like strength, ductility, toughness, hardness, and durability using standard procedures.

CO 3: Interpret test results and compare them with IS code specifications for quality assessment.

CO 4: Conduct field and laboratory tests on bricks and tiles to assess suitability for construction.

CO 5: Apply experimental findings for material selection and quality control in civil engineering practice.

List of Laboratory Experiments	
1.	Tension test of mild steel
2.	Izod impact test on a metal specimen
3.	Charpy impact test on a metal specimen
4.	Torsion Test on Mild Steel
5.	Compression test of timber (Parallel & Perpendicular)
6.	Bending test of timber
7.	Compressive strength test of bricks
8.	Field tests of bricks (Water absorption test, Efflorescence, Soundness Test, and Drop Test)
9.	Flexural strength of floor tiles

10.	Abrasion test of floor tiles

IS Codes:

IS 1608: *Method for Tensile Testing of Metallic Materials*
IS 1757: *Method for Charpy Impact Test (V-Notch) for Metallic Materials*
IS 1598: *Method for Izod Impact Test of Metallic Materials*
IS 1717: *Method for Torsion Testing of Metallic Materials*
IS 1708: *Methods of Testing Small Clear Specimens of Timber*
IS 3495: *Methods of Tests of Burnt Clay Building Bricks*

- Part 1: Determination of Compressive Strength
- Part 2: Determination of Water Absorption
- Part 3: Determination of Efflorescence

IS 13630: *Methods of Test for Ceramic Tiles*

Reference Books:

1. Strength of Materials, Bansal, R. K. (2010). *Strength of Materials*. Laxmi Publications, New Delhi, India.
2. Strength of Materials, Timoshenko, S. P., and Gere, J. M. (2009). *Mechanics of Materials*. CBS Publishers & Distributors, New Delhi, India.

Virtual LAB Links:

1. Lab Name: Strength of Materials Lab, Link of the Virtual Lab:https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- III

Course Type: LC	**Lab Course Title:** Surveying lab	
Course Code: 230GCEB09	**Teaching Scheme:** (Hrs. / Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 Marks

Prerequisite Courses, if any: -

Course Outcomes: On completion of the course, the learner will be able to

CO1: Measure magnetic bearings of triangle or quadrilateral sides using a prismatic compass

CO2: Conduct plane table surveys using radiation and intersection methods for detailed mapping of small structures or areas.

CO3: Perform simple and differential levelling with multiple change points using instruments like dumpy levels, auto levels, or digital levels.

CO4: Gain expertise in measuring horizontal and vertical angles using theodolite and tacheometer methods.

CO5: Develop hands-on experience in setting out circular curves by Rankine's method, setting out building foundations using total station.

CO6: Design the road alignment using the various surveying techniques and instruments and able to prepare topographical maps using tacheometric contouring methods.

List of Laboratory Experiments

Group A (Any 8)

1.	Measurement of magnetic bearings of sides of a triangle or quadrilateral, correction for local attraction and calculations of true bearings using prismatic compass.
2.	Plane table survey consisting of both Radiation and Intersection method. Actual mapping of small structure like an area map from central commanding area / small building using combination of both methods.
3.	Simple and differential levelling with at least three change points using dumpy level/auto level/digital level.
4.	Measurement of horizontal angle by repetition and reiteration methods using theodolite.
5.	Finding horizontal distance and vertical elevation using a Tacheometer.
6.	Setting out a circular curve by Rankine's method of deflection angles.
7.	Setting out a building from a given foundation plan (minimum six co-ordinates)
8.	Study and use of nautical sextant and measurement of horizontal angles

9.	Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout.
Group B (Any 01)	
1.	Road project using Auto level for a minimum length of 200 m including fixing of alignment, profile levelling, cross-sectioning, plotting of L section and Cross Section. (One full imperial sheet including plan, L-section and any three typical Cross-section).
2.	Tachometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using both methods, manual as well as using any suitable software such as Autodesk land desktop, Auto-civil, Foresight etc. (minimum contour interval 1 meter).
Virtual LAB Links: 1. Lab Name: Surveying Lab, Link of the Virtual Lab: https://sl-iitr.vlabs.ac.in/Objective.html	

SEMESTER-IV

JSPM University Pune

S.Y. B.Tech. "Civil Engineering"

Semester- IV

Course Type: BSC	**Course Title: Vector Calculus and Partial Differential Equations**	
Course Code: 230GMAB08_04	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 2** **Tutorial (T): 2**	**Theory (TH): 100 Marks**

Prerequisite Courses, if any: Basic knowledge of vectors

Course Objectives:

- To make students familiarize with concepts and techniques in vector calculus.
- To equip them with the techniques that will help in solving problems in engineering by making use of partial differential equations

Course Outcomes: On completion of the course, the learner will be able to
CO1: recall basic concepts of Vector calculus
CO2: utilize differential operators
CO3: evaluate integrals
CO4: utilize the technique to solve partial differential equations
CO5: solve partial differential equations
CO6: apply concepts of partial differential equations

Course Contents

Unit I	**Vector algebra**	**(5 Hrs)**
Vectors in 2-Space and 3-Space, vector addition, scalar multiplication, Vector Dot Product, orthogonality of vectors, Vector cross product, work done by a force function, scalar triple product and applications, Image Manipulation and Filtering Using Vectors		
Unit II	**Vector Differential Calculus**	**(5 Hrs)**
Vector function, vector differentiation, gradient of scalar field, directional derivative, divergence of a vector field, curl of a vector field and its applications, image processing.		
Unit III	**Vector Integral Calculus**	**(5 Hrs)**
Line integrals, path independence, surface integrals, Greens Theorem in the plane (without proof), Stokes Theorem (without proof), Gauss divergence theorem (without proof).		
Unit IV	**Partial differential equations**	**(5 Hrs)**
Basic concepts of PDE, formation of PDEs, linear partial differential equations of first order, Solution techniques for first order partial differential equations, non-linear partial differential equations of first order.		
Unit V	**Higher order partial differential equations**	**(5 Hrs)**
Homogeneous linear partial differential equations with constant coefficient, solution to Homogeneous linear partial differential equations with constant coefficient, Classification of second order partial differential equations.		

Unit VI	Applications of Partial Differential Equations	(5 Hrs)
Method of separation of variables, vibration of stretched string- wave equation, one dimensional heat equation, Laplace's equation in two dimension.		

Learning Resources
Text Books: (Maximum 2) 1. Erwin Kreyszing, 'Advanced Engineering Mathematics, Wiley Eastern Ltd,10th edition. 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishing Company Limited, 42nd edition
Reference Books: 1. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 13th edition 2. Peter V. O" Neil, Advanced Engineering Mathematics, Thomson Brooks / Cole, Singapore, 7th edition. 3. G. B. Thomas, "Thomas Calculus", Pearson's Publication, 13th edition.

JSPM University Pune

S.Y. B. Tech "Civil Engineering"

Semester- IV

Course Type: PCC	**Course Title: Concrete Technology**	
Course Code: 230GCEB10_04	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2.5	**Lecture (L): 2** **Tutorial (T): 0** **Experiential Learning (EL): 2**	**Theory: 100 Marks**

Prerequisite Courses, if any: Nil

Course Objectives:

- To familiarize students with concrete materials, their properties, and roles in performance.
- To provide knowledge on the production, properties, and behavior of fresh and hardened concrete.
- To introduce types and effects of admixtures and advanced concretes.
- To enable students to design concrete mixes and apply special concreting techniques.

Course Outcomes: On completion of the course, learner will be able to

CO1: Investigate the properties of concrete ingredients.

CO2: Analyze the impact of admixtures and classify various types of concrete

CO3: Demonstrate the knowledge of concrete production process and determine the properties of fresh concrete.

CO4: Determine the properties of hardened concrete

CO5: Design the concrete mixes using IS code method and exercise quality control.

CO6: Evaluate factors affecting concrete durability and suitability of special concreting techniques under varied conditions

Course Contents

Unit I	**Introduction to Concrete and its Ingredients**	**(5 Hours)**

Materials for Concrete: Cement, Manufacturing Process, Physical Properties, Hydration of Cement, hydration products, Chemical Compounds in Cement, Types of Cement, Aggregates: Classification of aggregates, Physical Properties, Bulking of Sand, Mechanical Properties, Water: Specifications of Water to be used For Concrete

Unit II	**Admixtures**	**(4 Hours)**

Admixtures In Concrete: Types – mineral and chemical, Plasticizers and Super-plasticizers and their Effects on Workability, Air Entraining Agents, Accelerators, Retarders, Pozzolanic Admixtures, Green concrete, Bonding Admixtures, Damp-Proofing Admixtures, Construction Chemicals.

Unit III	**Production and Properties of Fresh Concrete**	**(5 Hours)**

Properties of Fresh Concrete -Types of Batching, Mixing, Transportation, Placing Including Pumping and Compaction Techniques for Good Quality Concrete, Workability, Factors affecting workability, Methods of Measuring Workability, Segregation and Bleeding, setting time, Curing of Concrete, Types of curing, Temperature Effects on Fresh Concrete		
Unit IV	**Properties of Hardened Concrete**	**(6 Hours)**
Desired Properties of Concrete, Strength, Durability & Impermeability, Characteristic Strength, Compressive, Tensile and Flexure of Concrete, Bond Strength, Tests on Concrete, Modulus of Elasticity, Effect of W/C Ratio and admixtures on Strength, Creep and Shrinkage of Concrete, Significance, Types of Shrinkage and Their Control. Factors Affecting Creep. Nondestructive tests: rebound hammer, ultrasonic pulse velocity, pullout test and impact echo test.		
Unit V	**Concrete Mix Design**	**(5 Hours)**
Mix Design - Mix design by I.S. code method, Nominal Mix Concrete, Factors Governing Mix Design, Methods of Expressing Proportions, Trial Mixes, Acceptance Criteria.		
Unit VI	**Durability of Concrete and Concreting Techniques**	**(5 Hours)**
Durability of Concrete: Minimum & Maximum Cement Content, Strength & Durability Relationship, Exposure to Different Conditions, Factors Contributing to Cracks in Concrete, Sulphate Attack, Alkali Aggregate Reaction (AAR), factors affecting on AAR, deteriorating effects of AAR, Chloride Attack, Corrosion of Steel (Chloride Induced). Special concreting techniques- ready mix concrete, under water concreting, roller compacted concrete, cold and hot weather concreting.		

Learning Resources

Text Books:

3. Shetty, M.S., "*Concrete Technology"*, Theory & Practice, S.Chand and Co, 2004.
4. Gambhir, M.L., "*Concrete Technology"*, Tata McGraw Hill, 2004.
5. Nevile, "*Properties of Concrete"*, Longman Publishers, 2004.
6. Santakumar A.R., "*Concrete Technology"*, Oxford University Press, New Delhi, 2007.

Reference Books:

4. Krishnaswamy, *"Concrete Technology",* Dhanapat Rai and Sons
5. Orchard, *"Concrete Technology"*, Applied Science Publishers
6. Neville A. M., *"Concrete Technology",* Pearson Education
7. IS:10262, IS:456, IS 4926 (2003). Bureau of Indian Standards, New Delhi

Website Links:

NPTEL Course: https://nptel.ac.in/courses/105102012

JSPM University Pune
S.Y. B.Tech. "Civil Engineering"
Semester- IV

Course Type: PCC	**Course Title:** Analysis of Structures	
Course Code: 230GCEB11_04	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3.5	**Lecture (L):** 2 **Tutorial (T):** 1 **Practical (P):** 0 **Experiential Learning (EL):** 2	**Theory (TH):** 100 Marks

Prerequisite Courses, if any:

1. Strength of Materials.
2. Engineering Mechanics.

Course Objectives:

- To provide students with a comprehensive understanding of structural analysis concepts, including structural classification, indeterminacy, and energy methods, for solving deflections and forces in determinate and indeterminate structures.
- To equip students with advanced analytical techniques such as compatibility methods, slope deflection, moment distribution, and influence line analysis for evaluating the behavior of beams, trusses, and frames under various loading and support conditions.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the principles of equilibrium, stability, and determinacy, and analyze plane trusses using the method of joints and method of sections.
CO2: Apply various analytical methods such as moment area, conjugate beam, and virtual work to determine the deflections of beams and frames.
CO3: Construct influence line diagrams and evaluate the effects of moving loads on statically determinate structures.
CO4: Understand and apply the basic concepts of the force and stiffness methods for analysing statically indeterminate structures.
CO5: Analyze statically indeterminate beams and frames using the moment distribution method to evaluate moments and displacements.
CO6: Analyze statically indeterminate structures using the slope deflection method and comprehend the fundamentals of the direct stiffness method.

Course Contents

Unit I	**Fundamentals of Structural Analysis**	**(5 Hours)**
Equilibrium, structural stability, and determinacy principles. Overview of shear force and bending moment diagrams for beams and frames. Analysis of statically determinate structures using the method of joints and method of sections for plane trusses.		
Unit II	**Deflection Analysis in Determinate Structures**	**(5 Hours)**
Determination of deflections in beams and frames using the moment area method, conjugate beam method, and virtual work method.		
Unit III	**Influence Lines and Moving Load Analysis**	**(5 Hours)**

Construction and application of influence line diagrams. Analysis of structures subjected to moving loads.		
Unit IV	**Introduction to Indeterminate Structure Analysis**	**(5 Hours)**
Overview of statically indeterminate structures. Introduction to the force method and stiffness method for analysis.		
Unit V	**Moment Distribution Method for Indeterminate Structures**	**(5 Hours)**
Analysis of statically indeterminate beams and frames using the moment distribution method.		
Unit VI	**Advanced Methods for Indeterminate Structures**	**(5 Hours)**
Analysis of statically indeterminate beams and frames using the slope deflection method. Introduction to the direct stiffness method.		

Learning Resources

Text Books:

1. Junnarkar, S. B. and Shah, H. J., “Mechanics of Structures Vol. II”, Charotar Publishing house
2. Reddy, C. S., “Basic Structural Analysis”, Tata McGraw Hill Publishing Company Limited.
3. C. K. Wang, “Intermediate structural analysis”, McGraw Hill Book Comp.
4. Devdas Menon, Structural Analysis, Narosa Publishing House, 2008. (ISBN: 9781842653371)

Reference Books:

1. Gupta, S. P. and Pandit, G. S., “Theory of Structures, Vol. I”, Tata McGraw Hill Publishing Company Limited.
2. Timoshenko, S. P. and Young, D. H., “Theory of Structures”, McGraw Hill Publication, 2/e
3. R.C. Hibbeler, “Structural Analysis”, Pearson Education Asia Publication, 6/e
4. Utku, S., Norris, C. H. and Wilbur, J. B., “Elementary Structural Analysis”, McGraw Hill Publication, 4/e
5. T.G.H. Megson, “Structural and Stress Analysis”, Butterworth Heinemann Publication

MOOC / NPTEL Courses:

1.NPTEL Course “Structural Analysis - I”, By Prof. Amit Shaw | IIT Kharagpur. Link of the Course: https://onlinecourses.nptel.ac.in/noc22_ce29/preview

JSPM University Pune
S.Y. B.Tech. "Civil Engineering"
Semester- IV

Course Type: MMC	**Course Title: IoT and Applications**	
Course Code: 230GETB34_03	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2	**Lecture (L): 01** **Tutorial (T): 00** **Practical (P): 02** **Experiential Learning (EL): 00**	**Evaluation:** **Practical (PR): 50 Marks** **Oral (OR): 50 Marks**

Prerequisite Courses, if any:

1. Sensors and Actuators

Course Objectives:

- Introduction to IoT, Overview of IoT Building Blocks
- Build small applications in IoT for Engineering Applications using Sensors, Actuators, Microcontrollers and Cloud
- Learn commonly used IoT Simulation Hardware platforms
- Understand different Communication Technologies used in IoT
- Development of application-level protocol and Security of IoT Ecosystem
- Understand IoT applications in different domains

Course Outcomes: On completion of the course, learner will be able to…

CO1. Apply the knowledge of Applications/Devices, Protocols, and Communication Models of IoT in practical scenarios.

CO2. Demonstrate the use of Sensors, Actuators, Microcontrollers, and Cloud platforms in developing small Mechanical Engineering IoT-oriented applications.

CO3. Select and utilize commonly used IoT Simulation Hardware platforms for designing and testing IoT solutions.

CO4. Apply interfacing and communication technologies to develop functional IoT systems.

CO5. Illustrate the process of IoT application development and the integration of security measures within the IoT ecosystem.

CO6. Evaluate the applicability of present and future domain-specific IoT applications in real-world scenarios.

Course Contents

Unit I	**Introduction to the Internet of Things (IoT)**	**3Hrs**
	Overview, History, Definition and Characteristics, Connectivity Terminologies, building blocks, Types of technologies used in IoT Systems, Baseline Technologies (Machine-to-Machine (M2M) Communications, IoT Vs M2M, IoT enabled Technologies, IoT Levels and Templates.	
Unit II	**Sensors, Actuators, and Microcontrollers**	**3 Hrs**

	Measuring physical and virtual quantities in the digital world, Overview of Sensors working, Analog vs. digital Sensors, Wired vs. wireless Sensors, Types of Sensors, Types of Converter Types of Transducers and Actuator, Type of microcontrollers in embedded Systems	
Unit III	**IoT Simulation Environment and Interfacing**	**3 Hrs**
	IoT supported Hardware platforms: Introduction to IoT Simulation Environment and Devices, Architecture, Setup, IDE, Installation, Interfaces (serial, SPI, I2C), Programming with a focus on interfacing for reading input from pins, connecting external gadgets/sensors/actuators,	
Unit IV	**Interfacing and Communication for IoT Applications**	**3 Hrs**
	IoT Architecture: Building architecture and Open-source architecture (OIC), Main design principles and needed capabilities, An IoT architecture outline, and Standards Considerations. Communication: Overview and Working of Controlled Systems, Connectivity models - TCP/IP Vs OSI model, IoT Communication Models, IoT Communication APIs, Serial Vs Parallel Communication, Wires Vs Wireless Communication, their Technologies and Hardware IoT	
Unit V	**IoT Application Development and Security**	**3 Hrs.**
	Application Protocols: MQTT, REST/HTTP, SQL Back-end Application Designing, Back-end Application Designing, JSON lib for data processing Security: Need of security in IoT, Security & Privacy during development, IoT security for consumer devices, Security levels, protecting IoT devices, Security, Privacy and Trust in IoT-Data-Platforms	
Unit VI	**Applications of IoT Ecosystem**	**3 Hrs.**
	IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, Business, Manufacturing, Smart Homes/Home automation, Surveillance applications, Connected Vehicles, Agriculture, Healthcare, Activity Monitoring, Retail, Logistics, Security, Health and Lifestyle, Legal challenges.	

Learning Resources
Text Books: (Maximum 2)
1. Bahga, A. and Madisetti, V., (2015), “Internet of Things - A Hands-on Approach,” Universities Press, ISBN: 9788173719547 2. Hajjaj, S S H. and Gsangaya, K. R., (2022), “The Internet of Mechanical Things: The IoT Framework for Mechanical Engineers,” CRC Press, ISBN: 9781032110950

Reference Books:

1. Raj, P. and Raman, A. C., (2017), "The Internet of Things: Enabling Technologies, Platforms, and Use Cases," Auerbach Publications/CRC Press, ISBN: 9781498761284
2. Adrian McEwen, A. and Cassimally, H., (2013), "Designing the Internet of Things," John Wiley and Sons, ISBN:
3. Veneri, G., Capasso, A., (2018), "Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry 4.0," Packt Publishing, ISBN: 9781789537222
4. Hersent, O, Boswarthick, D., Elloumi, O., (2012), "The Internet of Things: Key Applications and Protocols", Wiley, ISBN: 9781119994350 7. Uckelmann, D., Harrison, M., Michahelles, F., (2011), "Architecting the Internet of Things," Springer, ISBN: 9781119994350

MOOC / NPTEL Courses:

1. NPTEL Course "Introduction To Internet Of Things", Prof. Prof. Sudip Misra, IIT Kharagpur,
   Link of the Course: https://onlinecourses.nptel.ac.in/noc22_cs53/preview 2
2. NPTEL Course "A brief introduction of Micro - Sensors", Prof. Santanu Talukder, IISER Bhopal,
   Link of the Course:https://nptel.ac.in/courses/108106165
3. NPTEL Course "Optical Fiber Sensors", Prof. Balaji Srinivasan, IIT Madras,
   Link of the Course:https://nptel.ac.in/courses/108106173/
4. Coursera Course "Embedded Hardware and Operating Systems" Farhoud Hosseinpour, Nguyen Gia Tuan, EIT Digital
   Link of the Course: https://www.coursera.org/learn/embedded-operating-system

JSPM University Pune
S.Y. B.Tech. "Civil Engineering"
Semester- IV

Course Type: MMC	**Course Title: Food Safety and Hygiene**	
Course Code: 240GSFB51	**Teaching Scheme:** (1/Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 1 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Theory (TH):**

- **Course Objectives (COs)**

1. To understand the principles and importance of food safety and hygiene
2. To study foodborne hazards and their control measures
3. To develop knowledge of food safety regulations and standards
4. To understand sanitation, personal hygiene, and plant hygiene practices
5. To introduce food safety management systems such as GMP, GHP, and HACCP.
6. To build competency in identifying and preventing food contamination

- **Course Outcomes (CO)**

CO1- Explain the importance of food safety and hygiene in food production and handling
CO2- Identify biological, chemical, and physical hazards in food
CO3- Apply principles of sanitation and hygiene in food processing environments
CO4- Interpret national and international food safety regulations.
CO5- Develop basic HACCP plans for food products
CO6- Evaluate food safety risks and recommend preventive measures

Course Contents

Unit I	**Introduction to Food Safety and Hygiene**	**(4 Hours)**

Concept and importance of food safety, Food safety vs food quality, Food contamination and spoilage, Types of food hazards: Biological, Chemical, and Physical hazards, Foodborne diseases and outbreaks

Unit II	**Food Microbiology and Foodborne Pathogens**	**(5 Hours)**

Sources of microbial contamination, Growth factors affecting microorganisms (intrinsic and extrinsic factors), Important foodborne pathogens: Salmonella, Escherichia coli, Listeria monocytogenes, Staphylococcus aureus, Norovirus, Food poisoning and food infections

Unit III	**Personal Hygiene and Sanitation**	**(5 Hours)**

Importance of personal hygiene in food handling, Hygienic practices for food handlers, Cleaning and sanitation: Types of detergents and sanitizers, Cleaning-In-Place (CIP) systems, Pest control management, Waste disposal management

Unit IV	**Food Safety Management Systems**	**(5 Hours)**

Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Sanitation Standard Operating Procedures (SSOP)

Unit V	Food Safety Regulations and Standards	(5 Hours)
Hazard Analysis and Critical Control Points (HACCP) principles and implementation, ISO 22000 Food Safety Management System Role of FSSAI, WHO, FAO, and Codex Alimentarius Commission,		
Unit VI	**Audit and inspections**	**(5 Hours)**
Food safety audits and inspections, Food labeling regulations, Food safety audits and inspections, National and international food safety standards		

Learning Resources

Text Books:

1. **Food Safety and Standards Act (FSSAI) Manual,** Author: Food Safety and Standards Authority of India
2. **Food Safety Management: A Practical Guide for the Food Industry,** Authors: Sara Mortimore & Carol Wallac
3. **Food Hygiene and Sanitation,** Author: Sunetra Roday

Reference Books:

1. Principles of Food Sanitation, Authors: Norman G. Marriott & Robert B. Gravai
2. Fundamentals of Food Hygiene, Safety and Quality, Author: Alok Kuma
3. Food Safety Handbook, Author: Richard A. Sprenger

MOOC / NPTEL Courses:

2. NPTEL Course "Food Science and Technology - I", By Prof. H.N. Mishra | IIT Kharagpur. Link of the Course: https://onlinecourses.nptel.ac.in/noc22_ce29/preview
3. **Food Microbiology for Safe and Sustainable Food Systems, Prof. Prem Prakash Srivastav, IIT Kharagpur https://nptel.ac.in/courses/126105550**

JSPM University Pune

S. Y. B. Tech "Civil Engineering"

Semester- IV

Course Type: PEC-II	**Course Title: Introduction to Remote Sensing and GIS**	
Course Code: 250GCEB26	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 2 Hrs./ week**	**Theory: 100 Marks**

Prerequisite Courses, if any:

1. Fundamentals of Physics, and Mathematics

Course Objectives:

- To introduce the fundamental principles of remote sensing, electromagnetic radiation, and various platforms and sensors used for data acquisition.
- To develop understanding of remote sensing data acquisition systems, image processing techniques, and their applications in different fields.
- To impart knowledge of GIS concepts, data models, database management, and spatial data handling techniques.
- To familiarize students with spatial analysis methods, GIS software tools, and project planning for solving real-world engineering problems.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the fundamental principles of remote sensing, electromagnetic radiation, and characteristics of various platforms and sensors.

CO2: Analyze different data acquisition systems and evaluate the role of resolutions and LiDAR in remote sensing applications.

CO3: Apply image preprocessing and classification techniques for interpretation of remote sensing data.

CO4: Understand GIS concepts, data models, coordinate systems, and methods of spatial and non-spatial data handling.

CO5: Analyze GIS databases and topology, and utilize GIS software tools for error correction and spatial data management.

CO6: Apply spatial analysis techniques and develop GIS-based solutions for real-world problems through effective implementation.

Course Contents

Unit I	**Fundamentals of Remote Sensing**	**(8 Hrs)**

Physics of remote sensing, sources of energy, active and passive radiation, electromagnetic radiation, reflectance, transmission, absorption, thermal emissions, interaction with atmosphere, atmospheric windows, spectral reflectance of Earth's surface features, concept of remote sensing, platforms and sensors, types of platforms, aircrafts, manned and unmanned spacecrafts, airborne and spaceborne platforms, satellite sensors including IRS, LANDSAT, SPOT, IKONOS, Quickbird, GeoEye, Kompsat, WorldView II and III, microwave sensors, ALOS, Planet data, Sentinel, SMAP, MODIS.		
Unit II	**Data Acquisition Systems and Applications**	**(7 Hrs)**
Optical remote sensing, thermal remote sensing, microwave remote sensing, spatial resolution, spectral resolution, radiometric resolution, temporal resolution, signal to noise ratio, LiDAR data acquisition, LiDAR data processing, applications in agriculture, forestry, soil, geology, land use and land cover, water resources, urban planning, disaster management.		
Unit III	**Data Products and Image Processing**	**(8 Hrs)**
Data products and characteristics, digital image formation, image display mechanisms, image histograms, lookup tables, atmospheric correction, radiometric correction, geometric correction, orthorectification, visual image interpretation, ground truth, supervised classification, unsupervised classification.		
Unit IV	**Introduction to GIS and Data Models**	**(7 Hrs)**
Mapping concepts, paper-based map analysis, limitations of conventional maps, computer automated cartography, history and development of GIS, GIS definition, components of GIS, advantages of digital maps, projections, coordinate systems, information systems, modelling real-world features, spatial data, non-spatial data, vector data model, raster data model, TIN data model, data collection, data input, data conversion, metadata.		
Unit V	**GIS Database, Topology and Software**	**(8 Hrs)**
Database structures, file systems, standard data formats, data compression techniques, GIS hardware, GIS software, introduction to ArcGIS, introduction to QGIS, topology concepts, types of errors, editing, error rectification, types of topology, modelling topological relationships, tolerances.		
Unit VI	**Spatial Analysis**	**(7 Hrs)**
Proximity analysis, overlay analysis, buffer analysis, network analysis, route alignment, canal alignment, digital elevation models, interpolation methods, 3D analysis, map composition, qualitative maps, quantitative maps, map elements, map scales.		

Learning Resources

Text Books:

1. James B. Campbell & Randolph H. Wynne., Introduction to Remote Sensing, The Guilford Press, 2022, Sixth Edition
2. Kang Tsung Chang., Introduction to Geographic Information Systems, 9th Edition Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2018.

JSPM University Pune

S.Y. B. Tech "Civil Engineering"

Semester- IV

Course Type: VEC	**Course Title**: Environmental Policy and Legislations	
Course Code: 230GCEB03_04	**Teaching Scheme:** (2 Hrs/Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any:
Basic knowledge of environmental issues and pollution

Course Objectives:

- Understand the evolution of environmental policy and law globally and in the Indian context.
- Analyze the environmental laws and regulations and their implications for environmental governance.
- Critically evaluate the effectiveness and challenges of environmental policy implementation and enforcement.
- Explore emerging environmental issues and policy responses considering sustainable development principles.
- Develop a holistic understanding of the interconnectedness between environmental, social, and economic dimensions in policy - making.

Course Outcomes: On completion of the course, learner will be able to

CO1: To understand the meaning, Concept, basic knowledge of environment, constitutional provisions for the Protection of environment, environmental policies, and legislations.
CO2: To Understand the various principles of environmental law and its applicability.
CO3: To be familiar with the laws and policies in the field of environment.
CO4: To explore the role of international organizations, agreements and cooperation in addressing environmental challenges.
CO5: To know about the regulatory framework, implementation and enforcement of environmental regulations.
CO6: To develop understanding of emerging issues and policy responses.

Course Contents

Unit I	**Introduction to Environmental Policy and Law**	**(5 Hrs)**
Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Bhopal gas tragedy; Rio conference.		
Unit II	**General principles in Environmental law**	**(5 Hrs)**
Precautionary principle: Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts.		
Unit III	**Environment Laws and Regulations**	**(5 Hrs)**

The Environment (Protection) Act, 1986, The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981, Wildlife Protection Act, 1972, Forest Conservation Act, 1980.		
Unit IV	**International Legislation**	**(5 Hrs)**
Wetland Convention (Ramsar Convention), Montreal Protocol, Climate Conventions, Biological Diversity Convention		
Unit V	**Implementation, Enforcement, and Policy Analysis**	**(5 Hrs)**
Regulatory Compliance and Monitoring Mechanisms, Challenges in Enforcement and Role of Stakeholders, Environmental Policy Instruments, Impact Assessment and Evaluation Techniques, Comparative Analysis of Environmental Policies		
Unit VI	**Emerging Issues and Policy Responses**	**(5 Hrs)**
Climate change mitigation and adaptation strategies, Biodiversity conservation and ecosystem restoration, Circular economy and waste management policies.		

Learning Resources

Textbooks:

3. Divan S. and Rosencranz A. "Environmental Law and Policy in India", Oxford, New Delhi, Second Edition.
4. Richard Revesz and Michael Livermore. "*Environmental Law and Policy",* West Academic Press, Fourth Edition.

Reference Books:

8. P. Leelakrishnan, "*Environmental Law in India*", LexisNexis Butterworth, Sixth Edition.
9. Roberts, J, "*Environmental Policy*", Routledge: Abingdon, Oxon, Second Edition.

MOOC / NPTEL Courses:

4. NPTEL Course "*Environment Policy and Administration*", Dr Tejpal Dhewa, Central University of Haryana, Mahendergarh (Link of the Course: https://onlinecourses.swayam2.ac.in/cec23_hs60/preview)

JSPM University Pune

S.Y. B. Tech "Civil Engineering"

Semester- IV

Course Type: AEC	Course Title: Communicative Proficiency Skills	
Course Code: 230UENB02_02	Teaching Scheme: (Hrs./Week)	Examination Scheme:
Credits: 2	Lecture (L): 1 Tutorial (T): 0 Practical(P): 2 Experiential Learning (EL): 0	Theory (TH): 50 Marks

Prerequisite Courses, if any: Nil

Course Objectives: Course Objectives:

- **Recall** theory of communication for effective body language.
- **Understand** the importance of developing Public Speaking Skills and formulate.
- thoughts effectively in the form of an effective Presentation.
- **Carry** reflexive or non-reflexive movements of the part or whole body.
- **Analyze** how sentences are built, learn to expand sentences, and learn tocombine short, choppy sentences into longer, grammatically correct sentences.
- **Evaluate** the most appropriate form in which to present information through socialmedia
- **Create** awareness about importance of professional behavior and suggest standards for
- appearance, actions, and attitudes in business Environment.

Course Outcomes: On completion of the course, learner will be able to

CO1: Recalling theory of communication for effective body language.

CO2: Understand the importance of developing Public Speaking Skills and formulate the thoughts effectively in the form of an effective Presentation.

CO3: Carrying reflexive or non-reflexive movements of the part or whole body.

CO4: Analyzing how sentences are built, learning to expand sentences, and learning to combine short, choppy sentences into longer, grammatically correct sentences.

CO5: Evaluate the most appropriate form in which to present information through social media,

CO6: Create awareness about importance of professional behavior and suggest standard for appearance, actions, and attitudes in business environment.

Course Contents

Unit I	Public Speaking Skills	(3 Hrs)

Importance of Public Speaking Skills, Presentation Skills: Stage Presence, Body Language, Voice Modulation, Interview Skills: Self-evaluation, Formal Dressing, Clarity of thoughts, Group Discussion: Dos and Don'ts of Group Discussion, Difference between discussion and debate, Attitude

Unit II	Effective Body Language	(2 Hrs)

Kinesics: Body language, Facial Expressions, Non-verbal behavior, Proxemics: Definition, Public Space, Social Space, Personal Space, Intimate Space, Gesture: Active Gestures, Passive Gestures, Posture: Attentive posture

Unit III	**Syntax Skills**	**(2 Hrs)**
Definition of syntax, Syntax, and grammar; Basic concepts and terminologies, Basic elements of sentences and clauses, Syntactic categorization of sentence elements.		
Unit IV	**Technical Writing**	**(3 Hrs)**
Paragraph Writing, Report writing: Formal and Informal Report, Resume writing: Difference in CV and Resume, Advertisement writing.		
UNIT V	**Corporate/ Business Etiquette**	**(2 Hrs)**
Corporate Grooming and Dressing, Email and Telephone Etiquette, Etiquette in social and office- setting, Professional Behaviour		
Unit VI	**Basic Social Media Communication Skills**	**(3 Hrs)**
Professional Blog Writing, Building and optimizing professional profiles on social media, Creating professional and engaging content, Networking through social media		

Learning Resources

Textbook:

1. Krishna Mohan & Meera Banerji" *"Developing Communication Skills"* Macmillan

Reference Books:

1. R. C. Sharma & Krishna Mohan "*Business Correspondence and Report Writing"* (Tata McGraw Hill)
2. Raymond Murphy (CUP*) "Essential English Grammar" (Elementary &Intermediate)*
3. Saran Freeman, "*Written Communication in English*" (Orient Longman)

MOOC / NPTEL Courses:

1. NPTEL Course "*Speaking Effectively*" Prof Anjali Gera Roy ,IIT Kharagpur

Link of the Course https://onlinecourses.nptel.ac.in/noc23_hs13/preview

Additional Web Resources: https://www.bbc.co.uk/learningenglish/

JSPM University Pune S.Y. B. Tech "Civil Engineering" Semester- IV		
Course Type: AEC	**Lab Course Title: Communicative Proficiency Skills**	
Course Code: 230UENB02_02	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2	**Lecture (L): 1** **Tutorial (T): 0** **Practical(P): 2** **Experiential Learning (EL):0**	**Theory (TH): 50 Marks**
Prerequisite Courses, if any: - Nil		

List of Laboratory Experiments	
Group A	
1.	Presentation Skills
2.	Interview Skills
3.	Group Discussion
4.	Grammar
5.	Report Writing
Group B	
6.	Paragraph Writing
7.	CV/Resume Writing
8.	Blog Writing
9.	Advertisement Writing
10.	Email Writing

JSPM University Pune S.Y. B. Tech "Civil Engineering" Semester- IV		
Course Type: LC	**Lab Course Title:** Concrete Technology Lab	
Course Code: 230GCEB13_04	**Teaching Scheme:**	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (TH):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 **Oral (OR):**
Prerequisite Courses: Concrete Technology		

List of Laboratory Experiments (Any 10)	
1.	Determination of the fineness of cement by dry sieving method.
2.	Determination of the standard consistency of cement paste.
3.	Determination of the initial and final setting times of cement.
4.	Determination of the soundness of the cement.
5.	Determination of specific gravity of cement.
6.	Determination of the compressive strength of the cement.
7.	Determination of specific gravity and water absorption of fine aggregate.
8.	Determination of specific gravity and water absorption of coarse aggregate.
9.	Determination of fineness modulus value by conducting sieve analysis for fine aggregate.
10.	Determination of the aggregate crushing value of the given aggregate.
11.	Determination of the impact value of the given aggregate.
12.	Determination of the flakiness index and elongation index of coarse aggregate.
13.	Determination of the compressive strength of the cement mortar paste.
14.	Measurement of workability of concrete by slump cone test

15.	Tests for determination of compressive strength of concrete
16.	Mix Design by IS 10262-2009.
17.	Determination of compressive strength of concrete by Maturity meter.

JSPM UNIVERSITY PUNE

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State Government of Maharashtra - JSPM University Act, 2022 (Mah.IV of 2023)

JSPM University Pune

S.Y. B. Tech "Civil Engineering"

Semester- IV

Course Type: SEC

Course Title: Building Information Modelling Lab

Course Code: 250GCEB27	**Teaching Scheme: (Hrs. / Week)**	**Examination Scheme:**
Credits: 1	**Lecture (L): 0**	**Practical (PR): 50 marks**
	Tutorial (T): 0	**Oral (OR):**
	Practical (P): 2	
	Experiential Learning (EL): 0	

Prerequisite Courses, if any: -

List of Laboratory Experiments

Group A

1. Creation of basic building model in Autodesk Revit including walls, doors, and windows
2. Creation of curtain walls and wall openings in Revit
3. Modelling of floors and roofs in Revit
4. Creation of stairs and dormer windows in Revit
5. Application of rooms, areas, and preparation of schedules in Revit
6. Development of conceptual mass and family creation in Revit
7. Worksharing and collaboration features in Revit (central file and teamwork)
8. Sheet composition, annotation, rendering, and walkthrough in Revit

Group B

9. Creation of surface from survey data in Autodesk Civil 3D
10. Generation of contours and surface analysis in Civil 3D
11. Creation of horizontal alignment for road design in Civil 3D
12. Development of vertical profile and profile views in Civil 3D
13. Corridor modelling for road projects in Civil 3D
14. Cross-section generation and earthwork quantity calculation in Civil 3D
15. Plotting, report generation, and BIM integration using Civil 3D

JSPM University Pune
S.Y. B.Tech. "Civil Engineering"
Semester- IV

Course Type: MLC	**Course Title:** Road Safety and Management	
Course Code: 230GCEB49	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 1 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any: NA

Course Objectives:

- To provide basic overview of functioning of different Civil Engineering related industries / firms.
- To create awareness about application of different drawings, contract documents in Civil Engineering.
- To provide insight of code of ethics, duties and responsibilities, health and safety as a Civil Engineer.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the significance of road safety and analyse human factors leading to road crashes.
CO2: Evaluate the effectiveness of the forgiving system approach and global road safety initiatives.
CO3: Design pedestrian-friendly urban infrastructure considering road safety guidelines.
CO4: Analyze traffic management strategies, including speed control and NMT safety provisions.
CO5: Interpret the principles of road safety auditing and assess different RSA stages.
CO6: Apply road safety audit checklists and best practices to improve road safety compliance.

Course Contents

Unit I	**Fundamentals of Road Safety**	**(3 Hours)**
Need for road safety and its global & national scenario. Road crash investigation and identification of crash characteristics. Human factors related to crashes and accident investigations.		
Unit II	**Forgiving System Approach & Road Safety Initiatives**	**(3 Hours)**
Introduction to forgiving system approach. Role of iRAP, World Bank & other NGOs in road safety initiatives. Implementation of safety measures for crash prevention.		
Unit III	**Urban Road Safety and Pedestrian Protection**	**(2 Hours)**
IRC standards for urban road safety. Pedestrian and cyclist safety-oriented design. Importance of trauma care and the golden hour in road crashes.		
Unit IV	**Traffic Management & Speed Control**	**(2 Hours)**

Traffic signal timing optimization and pedestrian signal design. Non-Motorized Transport (NMT) infrastructure provisions. Nighttime illumination and global Safe System Approach. Speed management strategies for enhanced safety.		
Unit V	**Road Safety Auditing – Concepts & Applications**	**(2 Hours)**
Need and significance of road safety audits. Procedures, design standards, and different stages of RSA. Legal aspects, audit team requirements, and types of audits.		
Unit VI	**Checklists and Best Practices in Road Safety Auditing**	**(2 Hours)**
Understanding and application of road safety checklists. Using checklists in RSA for effective implementation. Best practices and case studies in road safety auditing.		

Textbooks:

1. Martin Belcher, Steve Proctor, Phil Cook *"Practical Road Safety AUditing"* ICE Publishing - 2015
2. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.

Reference Books:

1. Highway Safety Manual by Transportation Research Board
2. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications
3. Babkov, V.F. `Road conditions and Traffic Safety', MIR publications, - 1975.
4. Khanna and Justo , 'Highway Engineering', Nem Chand & Brothers, Roorkee.
5. Pignataro, Louis, `Traffic Engineering - Theory and Practice', John Wiley.
6. RRL, DSIR, `Research on Road Safety', HMSO, London
7. IRC SP 88- 2019 Road Safety Audit Manual (Second Revision)
8. IRC SP 55 2015 Work Zone Traffic Management

MOOC / NPTEL Courses for basic knowledge:

NPTEL Course "*Traffic Engineering*", Prof. Bhargab Maitra, IIT Kharagpur

Link of the Course: https://nptel.ac.in/courses/105105215

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: BSC	**Course Title**: Numerical Methods	
Course Code: **230GMAB09_05**	**Teaching Scheme**: (Hrs./Week)	**Examination Scheme**:
Credits: 3	**Lecture (L):** 2 **Tutorial (T):** 1 **Practical (P):** 0 **Experiential Learning (EL)**: 0	**Theory (TH)**: 100 Marks

Prerequisite Courses, if any

Course Objectives:

- Introduce students to classical numerical methods available for engineering problem-solving.
- Expose students to concepts such as precision, errors and tolerances and their effect on the quality of the solutions produced by scientific computing.
- Develop and practice systematic, logical thought processes towards problem solving
- Enhance fundamental understanding of concepts acquired in algebra, calculus and differential equations.
- The course provides students with the necessary background to enable them to use basic computational tools and gain a fundamental understanding of numerical methods.

Course Outcomes: On completion of the course students will be **able to:**

CO1: Calculate errors induced in the values by truncation of a series expansion.

CO2: Understand the basic concepts of root finding methods, system of equations and their solutions.

CO3: Apply numerical methods to understand the concept of Calculus (Differentiation and Integration).

CO4: Understand the concepts of interpolation and construction of polynomials.

CO5: Identify various numerical methods to solve linear and non-linear ordinary differential equations and its applications in non-linear analysis.

CO6: Apply numerical concepts to solve Ordinary Differential Equations and Partial Differential Equations.

Course Contents

Unit I	**Approximation and Round off errors**	**(4 Hours)**
Accuracy of numbers, Significant figures, Accuracy and Precision, Introduction to errors, Round off error, Truncation error.		
Unit II	**Algebraic and Transcendental Equation**	**(5 Hours)**
System of Equations, Graphical Method, False Position Method, Simple fixed point iteration, Newton-Raphson Method.		
Unit III	**Calculus of Finite Differences**	**(6 Hours)**

Differences, Forward Differences, Backward Differences, Central Differences, Other Differences, Properties of Operators, Relation between operators, Estimation of Error by Difference Table.		
Unit IV	**Interpolation**	**(5 Hours)**
Newton's Gregory Formula for Forward Interpolation, Newton's Gregory Formula for Backward Interpolation, Central Difference Formula, Lagrange's interpolation formula, Newton's divided difference formula.		
Unit V	**Numerical Integration**	**(4 Hours)**
General Quadrature formula, Trapezoidal rule, Simpson's One-Third Rule, Simpson's Three-Eight Rule.		
Unit VI	**Numerical Solutions of Ordinary Differential Equation**	**(6 Hours)**
Introduction to Ordinary Differential Equation, Euler's Method, Euler's Modified Method, Runge-Kutta Method.		

Learning Resources

Text Books:

1. S. S. Sastry, "Introductory Methods of Numerical Analysis", Fifth edition, Eastern Economy edition.
2. Steven C. Chapra, Raymond P. Canale, "Numerical Methods for Engineers", Seventh edition, Msc Graw Hill education.

Reference Books:

1. H. K. Dass, "Advanced Engineering Mathematics", S Chand & Company Limited,

MOOC / NPTEL Courses:

1. Introduction to Numerical Methods, Numerical Methods in Civil Engineering, IIT Kharagpur by Dr. A. Deb: https://nptel.ac.in/courses/105105043
2. Numerical methods, By Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorke: https://onlinecourses.nptel.ac.in/noc24_ma54/preview
3. Numerical Methods In Civil Engineering, Indian Institute of Technology Bombay and AICTE Via Swayam Help: https://www.classcentral.com/course/swayam-numerical-methods-in-civil-engineering-23058
4. https://nptel.ac.in/courses

Additional Web Resources:

1. http://digimat.in/nptel/courses/video/105105043/L23.html
2. https://www.scribd.com/document/355240948/Sem-1-Numerical-Methods-for-Civil-Engineering
3. https://www.numberanalytics.com/blog/ultimate-guide-numerical-methods-civil-engineering

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: PCC	**Course Title:** Concrete Structures	
Course Code: 240GCEB40_05	**Teaching Scheme:** (Hrs. / Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):** 2 **Tutorial (T):** 1 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 100 Marks

Prerequisite Courses, if any: -

1. Analysis of Structures
2. Engineering Mechanics
3. Building Materials

Course Objectives:

1. To introduce students to the fundamental materials and concepts of reinforced cement concrete design.
2. To develop an understanding of the design philosophy and practical skills required to design structural elements using limit state method.
3. To enable students to perform safe and serviceable design of various RCC elements like beams, slabs, columns, and footings.

Course Outcomes: On completion of the course, learner will be able to:

CO1: Explain the fundamental properties of concrete and reinforcing steel and differentiate between various RCC design philosophies in accordance with IS specifications.
CO2: Analyze and design RCC beam sections for flexure using the limit state method, including singly, doubly reinforced, and T-sections.
CO3: Design RCC beams for shear and torsion, and compute bond strength and development length as per IS 456 guidelines.
CO4: Design one-way and two-way RCC slabs using limit state design principles.
CO5: Design RCC columns subjected to axial and eccentric loading using interaction curves.
CO6: Design isolated RCC footings considering bending moment and shear forces according to IS code provisions.

Course Contents

Unit I	**Introduction RCC Design**	**5 Hrs**
Properties of concrete and reinforcing steel, Characteristic strengths, Stress strain curves, Shrinkage and creep phenomenon, I.S. specification, Design Philosophies- working stress method, serviceability method and limit state method of design.,		
Unit II	**Limit State design of beams and for flexure**	**5 Hrs**

Analysis and design of beam sections in flexure by limit state method: Single and doubly reinforced sections and T-sections		
Unit III	**Limit State design of beams for shear and Torsion**	**5 Hrs**
Design of beams for shear, shear reinforcement, bond strength, development length		
Unit IV	**Limit State Design of Slabs**	**5 Hrs**
Limit state design of Slabs: one-way and two-way slabs		
Unit V	**Limit State Design of Columns**	**5 Hrs**
Imit state design of RC columns, interaction curves, short and long columns, Eccentrically loaded columns		
Unit VI	**Limit State Design of Footing**	**5 Hrs**
Design of RC footing under bending moment and shear		

Learning Resources

Text Books:

1. R.C.C Designs, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, **Laxmi Publications**
2. Reinforced Concrete Design, 2nd Edition, by S. Unnikrishna Pillai and Devdas Menon,
3. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
4. 2. IS 456: 2000, Indian Standard Plain and Reinforced Concrete – Code of Practice (4^{th} Revision), BIS, New Delhi.
5. 3. SP-16, Design Aids for Reinforced Concrete to IS: 456 – 1978, BIS, New Delhi.

Reference Books:

1. Reinforced Concrete, 6th Edition, by S. K. Mallick and A.P. Gupta, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 1996.
2. 6. Reinforced Concrete Design, 1st Revised Edition, by S.N. Sinha, Tata McGraw-Hill Publishing Company. New Delhi, 1990.

MOOC / NPTEL Courses:

1. NPTEL Course: Design of Reinforced Concrete Structures by Prof. Nirjhar Dhang IIT Kharagpur.
   Link: https://archive.nptel.ac.in/courses/105/105/105105105/

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: PCC	**Course Title: Flow through Pipes and Open Channel**	
Course Code: 240GCEB03_05	**Teaching Scheme: (Hrs./Week)**	**Examination Scheme: Theory: 100 Marks**
Credits: Theory: 3.5	**Lecture (L): 3 Hrs./ week** **Experiential Learning (EL): 2 Hrs./ week**	**CIE: 100 Marks** **ESE: 100 Marks**

Prerequisite Courses, if any:

1. Fundamentals of Physics, Mathematics and Engineering Mechanics

Course Objectives:

- Understand fluid properties and their applications in fluid flow and static systems.
- Apply dimensional analysis and similitude concepts to solve fluid mechanics problems.
- Analyze fluid statics and dynamics for practical applications in engineering.
- Explore advanced flow topics and hydraulic machinery for energy and flow systems.

Course Outcomes: On completion of the course, learner will be able to

CO1: Measure the fluid properties, classify them, and perform dimensional analysis for fluid flow applications.

CO2: Analyze fluid statics, pressure measurement, and stability of submerged and floating bodies.

CO3: Apply kinematics, dynamics, and flow equations to solve fluid flow problems.

CO4: Demonstrate laminar flow, boundary layers, and flow transitions with practical control methods.

CO5: Evaluate pipe flow, energy losses, and turbulent flow using established theories and diagrams.

CO6: Differentiate open channel and pipe flow and understand the principles of hydraulic machinery.

Course Contents

Unit I	**Properties and Fundamental Concepts of Fluids**	**(7 Hrs)**

Properties of Fluid Mass density, specific weight, specific gravity, specific volume, vapour pressure, compressibility, elasticity, surface tension, capillarity; Newton's law of viscosity, Rheological diagram, classification of fluids, Newtonian and Non-Newtonian fluids, ideal and real fluids, dynamic viscosity and kinematics viscosity, variation of viscosity with temperature; Basic concept applicable to fluid mechanics.

Unit II	**Fluid Statics, Buoyancy and Floatation**	**(8 Hrs)**

Fluid Statics: The basic equation of hydrostatics, concept of pressure head, Measurement of pressure datum (absolute, gauge), Pascal's Law, Application of the basic equation of hydrostatics. Piezometers, Simple and differential manometers, inclined manometers, Introduction to pressure transducers. Total pressure, Center of pressure for plane and curved surfaces, Pressure Diagrams, Practical applications (gate, dams, lock gates).

Buoyancy and Floatation: Principle of floatation and Buoyancy, Equilibrium of floating bodies, Stability of Floating bodies, meta-centre, metacentric height and its determination (experimental and analytical), Stability of submerged bodies. Relative Equilibrium of liquids: Fluid masses subjected to uniform linear acceleration and rotational

Unit III	**Fluid Kinematics, Fluid Dynamics, Notches and Weirs**	**(8 Hrs)**

Fluid Kinematics: Methods for describing the motion of fluid; Velocity and acceleration of fluids, Type of flow: Steady and unsteady, uniform and nonuniform, Laminar and Turbulent, one, two and three dimensional flows in Cartesian co-ordinate, Equation for one dimensional flow along a streamline, Rotational and irrotational motions, Circulation and vorticity, Derivation of Cauchy's Riemann equation, Velocity potential, stream function and flow net, Method of drawing flow net, use and limitation of flow net

Fluid Dynamics: Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, Assumptions of Bernoulli's equation, Kinetic energy correction factor, Hydraulic Grade line and total energy line, Linear momentum equation and momentum correction factor, angular momentum, Application of continuity, Bernoulli and momentum equations. Flow through orifices and mouthpieces under free and submerged condition, venturi meter, orifice meter, Nozzle meter, rotameter and pitot tube.

Flow over Notches and Weirs: Classification of notches and weirs, Discharges over a sharp crested rectangular notch, velocity approach, end contractions, discharges over a triangular notch, trapezoidal notch, Cipolletti notch, Ventilation of weir, time required to empty a tank.

Unit IV	**Laminar Flow, Boundary Layer Theory, Dimensional Analysis and Modelling**	**(7 Hrs)**

Laminar Flow: Reynolds Experiment, Laminar flow through a circular pipe, Flow between tow fixed parallel plates, Stoke's law, Methods of measurement of viscosity, Flow through porous media, Darcy's law, Transition from laminar to turbulent flow.

Boundary Layer Theory: Development of boundary layer on a flat plate, Nominal, displacement, momentum and Energy thicknesses. Laminar, turbulent and transitional boundary layer, Application of momentum equation for boundary layer development, Local and mean drag coefficient, Hydro dynamically smooth and rough boundaries, Boundary layer separation and its control.

Unit V	**Flow in Pipes and Turbulent Flow**	**(7 Hrs)**

Flow through pipes: Energy losses in pipe flow (major and minor losses), Flow through pipes such as simple, compound, parallel, branched pipes and siphons, Dupit's equation, Hydraulic transmission of power through pipes, introduction to three reservoir problem and pipe network.

Turbulent Flow: Characteristics of turbulent flow, instantaneous velocity, temporal velocity, scale of turbulence and intensity of turbulence, semi-empirical theories to estimates shear stress in turbulent flows using Boussinesq's theory, Prandtl's mixing length theory,

velocity distribution in turbulent flow, Prandtl's velocity distribution equation, Karman Prandtl velocity distribution equations for smooth and rough boundaries, Equation for mean velocity for pipes, Darcy flow; Friction factor for commercial pipes.

Unit VI	**Open Channel Flow and Introduction to Hydraulic Machinery**	**(8 Hrs)**

Open Channel Flow: Difference between pipe flow and open channel flow. Types of open channel flow. Uniform and Nonuniform flow. Concept of specific energy and specific force. Sub-critical, critical and super-critical flow, type of channel transition, Continuity Equation and Momentum Equation for open channel flow.

Hydraulic Machinery: Concept of impact of jet. Jet impinging on a stationary plate, jet impinging on a moving plate (straight and inclined). Jet striking the plates mounted on a circular wheel. Types of Turbines (Pelton Wheel and Reaction Turbine). Types of Pumps.

Learning Resources

Text Books:

1. Modi, P. N. and S. N. Seth "*Hydraulics and Fluid Mechanics*", Standard book house, New Delhi, ISBN: 978-81-89401-26-9.
2. K L Kumar, "*Engineering Fluid Mechanics*" S. Chand &Company Ltd, 8th Edition, ISBN – 9788121901000
3. Douglas J. F. Gaisorek J. M., Swaffield J. A., "*Fluid Mechanics*" Addison-Weisley Harlow 1999.
4. R. K. Bansal, "*A Textbook of Fluid Mechanics and Hydraulic Machines*", Laxmi Publications, 9th Edition. 2004. ISBN: 9788131808153

Reference Books:

1. K Subramanya, "*Theory and Applications of Fluid Mechanics*", Tata McGraw Hill Publishing co. Ltd. ISBN – 0074603698
2. R. J. Garde and Mirajgaonkar, "*Fluid Mechanics Through Problems*", New Age International.
3. Streeter V.L. Wylie E. Benjamin, "*Fluid Mechanics*", Mc Graw Hil, London, 1998.

Website Links:

Fluid Mechanics NPTEL Course: https://archive.nptel.ac.in/courses/105/103/105103192/

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: PEC	**Course Title:** Infrastructure Planning and Management	
Course Code: 240GCEB07_05	**Teaching Scheme:** **(Hrs./Week)**	**Examination Scheme:**
Credits: 3	**Lecture (L):** 3 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 100 Marks

Prerequisite Courses, if any: 1. Basic Civil Engineering
2. Mathematics and Statistics

Course Objectives:

- To introduce the role and types of infrastructure in economic development.
- To evaluate ways to measure capacity and forecast infrastructure demand.
- To apply finance and PPP models in infrastructure projects.
- To apply socio-economic and land-use models in infrastructure analysis.
- To explore management systems for urban and rural infrastructure.
- To design smart and sustainable infrastructure solutions.

Course Outcomes: On completion of the course, learner will be able to
CO1: Differentiate between types of infrastructure and evaluate their role in development.
CO2: Evaluate capacity and demand forecasting methods for infrastructure.
CO3: Apply financial and PPP models in infrastructure planning.
CO4: Integrate strategic planning principles at urban, regional, and national scales.
CO5: Design management approaches for infrastructure systems like roads, bridges, and utilities.
CO6: Design smart and sustainable infrastructure solutions.

Course Contents

Unit I	**Introduction to Infrastructure**	**(7 Hours)**

Definition of basic terminologies, Role of infrastructure in economic development, Types of infrastructure, Measurement of infrastructure capacity, Bases for quantification of demand and supply of various types of infrastructure, Indian scenario in respect of adequacy and quality.

Unit II	**Infrastructure Planning and Demand Forecasting**	**(8 Hours)**

Goals and objectives of infrastructure planning, Identification and quantification of the causal factors influencing the demand for infrastructure, Review and application of techniques to estimate supply and demand for infrastructure. Use of econometric, social and land use indicators and models to forecast the demand and level of service of infrastructure and its impact on land use, Critical review of the relevant forecasting techniques

Unit III	Infrastructure Finance and Public-Private Participation	(8 Hours)
Infrastructure finance and economics, ways and sources of infrastructure finance and funding. Overview of Public-Private Sector Participation in infrastructure projects, Understanding stakeholders' concerns, Regulatory framework, Risk management in infrastructure projects, Public policy for infrastructure.		
Unit IV	**Strategic and Integrated Planning Approaches**	**(7 Hours)**
Infrastructure planning to identify and prioritize preferred areas for development, Integration of strategic planning for infrastructure at urban, regional and national levels, Case studies in infrastructure planning.		
Unit V	**Infrastructure Management Systems**	**(7 Hours)**
Concepts of infrastructure management, Common aspects of urban and rural infrastructure management systems, Pavement and bridge management systems, Integrated infrastructure management, Case studies.		
Unit VI	**Sectoral Overview of Infrastructure**	**(8 Hours)**
Sectoral overview – highways, railways, waterways, airports, Urban and rural infrastructure – roads, housing, water supply, sanitation – Case study examples.		

Learning Resources

Text Books:

1. J. Brian Ellis and Mark H. Sanders, *Infrastructure Planning*, Thomas Telford Publishing, 1st Edition, 1997, ISBN: 9780727725841.
2. Vikas V. Mone and S.S. Pimplikar, *Infrastructure Planning and Management*, Pearson Education, 1st Edition, 2015, ISBN: 9789332581241.
3. A. Kumar and R. S. Khurana, *Infrastructure Development and Management*, Himalaya Publishing House, Revised Edition, 2013, ISBN: 9789351420495.
4. Neil S. Grigg, *Infrastructure Finance: The Business of Infrastructure for a Sustainable Future*, Wiley, 1st Edition, 2010, ISBN: 9780470481783.

Reference Books:

1. Michael D. Meyer and Eric J. Miller, *Urban Transportation Planning: A Decision-Oriented Approach*, McGraw Hill, 2nd Edition, 2001, ISBN: 9780072423326.
2. Jonathan Levine, *Zoning and the American Dream: Promises Still to Keep*, APA Planners Press, 1st Edition, 2006, ISBN: 9781884829983.
3. Bent Flyvbjerg (Ed.), *The Oxford Handbook of Megaproject Management*, Oxford University Press, 1st Edition, 2017, ISBN: 9780198732242.

MOOC / NPTEL Courses:

NPTEL Course: Infrastructure Planning and Management
Link: https://nptel.ac.in/courses/105106115

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V-

Course Type: HSSM	Course Title: Engineering Economics	
Course Code: 230UEEB19	Teaching Scheme: (Hrs./Week)	Examination Scheme:
Credits: 2	Lecture (L): 2 Tutorial (T): 0 Practical (P): 0 Experiential Learning (EL): 0	Theory (TH): 50 Marks

Course Objectives:

- To provide the students with knowledge of basic economic problems and the relationship between engineering technology and economics.
- To guide the students for accounting the depreciation and providing the funds for replacement of necessary and depreciated machinery and equipment.

Course Outcomes: On completion of the course, learner will be able to

CO1: understand the introduction to the concepts of demand and supply and cost analysis.
CO2: interpret the value engineering procedures as well as interest rate calculations.
CO3: solve the cash flow methods.
CO4: analyze the replacement and maintenance problems.
CO5: evaluate the depreciation methods.
CO6: develop the procedures to adjust to inflation.

Course Contents

Unit I	Introduction to Economics	(5 Hrs)

Law of Demand and Supply, Concept of Engineering Economics-Engineering efficiency, Economic Efficiency, Scope of engineering economics – Elements of Costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis.

Unit II	Value Engineering	(5 Hrs)

Make or buy decision, Value engineering- Function, aims, Value engineering procedure. Interest formulae and their application – Time value of money, single payment compound amount factor, Single payment present worth factor, Equal payment series payment, present worth factor equal payment series, Effective interest rate.

Unit III	Cash Flow	(5 Hrs)

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method with examples.

Unit IV	Replacement and Maintenance Analysis	(5 Hrs)

Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender.

Unit V	Depreciation	(6 Hrs)

Introduction, straight line method of depreciation, declining balance method of depreciation – Sum of the year's digits method of depreciation, sinking fund method of depreciaition / Annuity method of depreciation, service output method of depreciation

Unit VI	Inflation	(4 Hrs)
Introduction to inflation, types, effects, impact, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life asset.		
Learning Resources		
Textbooks: **5.** Panneer Selvam. R. “Engineering Economics”, Prentice Hall of India Ltd, New Delhi 2001. **6.** Suma Damodaran, “Managerial economics”, Oxford University press 2006.		
Reference Books: 1. Chan S. Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2002. 2. Donald.G.Newman, Jerome P. Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2002. 3. Degarmo, E.P.,Sullivan, W.G. and Canada, J.R., “Engineering Economy”, Macmillan, New York, 1984. 4. Grant.E.L., Ireson.W.G., and Leavenworth. R.S. “Principles of Engineering Economy”, Ronald Press, New York, 1976. 5. Smith.G.W., “Engineering Economy”, Lowa State Press, Iowa, 1973.		
MOOC / NPTEL Courses: https://nptel.ac.in/courses/110105067 **Additional Web Resources**:		

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: IOC	**Course Title: Fundamentals of Business Law**	
Course Code: 250ULBB01	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2	**Lecture (L): 2** **Tutorial (T): 0** **Practical (P): 0** **Experiential Learning (EL): 0**	**Theory (TH): 100 Marks**

Prerequisite Courses, if any: Nil

Course Objectives:

- To introduce and familiarize students with the fundamental legal concepts of the Indian Contract Act, Sale of Goods Act, and Partnership Act, which form the foundation of business transactions and agreements.
- To help students understand the basics of Intellectual Property Rights (IPR) and recognize their importance in protecting innovation, especially in design and creative work.
- To apply the basic provisions of the IT Act and Cyber Law to practical and professional scenarios involving digital transactions, data protection, and cybersecurity.
- To analyze the roles and functions of companies, SEBI, and RERA, and evaluate their impact on projects.
- To evaluate the significance of consumer protection laws and the legal remedies available to aggrieved consumers in services.
- To create legal awareness among budding engineers regarding their rights, responsibilities, and the importance of compliance with laws relevant to project management, and entrepreneurship.

Course Outcomes:

After completing this course, students will be able to:

CO1 : Identify fundamental principles of contract and partnership law.
CO2 : Interpret provisions of sale of goods and their application in daily transactions.
CO3 : Explain the significance of IPR and IT laws in engineering and innovation.
CO4 : Apply basic knowledge of consumer rights and legal recourse mechanisms.
CO5 : Understand regulatory frameworks under RERA, SEBI, and Company Law.
CO6 : Create basic plans or solutions to handle cyber issues by using the rules of the Information Technology Act.

Course Contents

Unit I	**Indian Contract Act, 1872**	**(5 Hrs)**
Definition and essentials of a Valid contract ; Offer, acceptance, consideration, and consent ; Void and voidable contracts ; Breach of Contract and Remedies		
Unit II	**Sale of Goods Act, 1930 & Indian Partnership Act, 1932**	**(5 Hrs)**

Conditions and warranties ; Rights of unpaid seller; Nature and definition of Partnership ; Registration of Partnership; Rights and duties of partners; LLP (Limited Liability Partnership) Act, 2008 : Formation and Incorporation, Comparison with Partnership under Partnership Act 1932		
Unit III	**Labour and Employment Laws**	**(5 Hrs)**
Introduction to Labour laws in India; Industrial Disputes Act: Layoff, retrenchment, strikes, lockouts; Factories Act: Safety, health, and welfare measures; Minimum Wages Act and Payment of Wages Act		
Unit IV	**Information Technology Act, 2000 & Cyber Law**	**(4 Hrs)**
Key terms: digital signature, E-contracts; Cybercrimes: phishing, hacking, data theft; Legal provisions for protection against Cyber Threats; Role of certifying authorities and penalties		
Unit V	**Law Relating to Corporate Business Entities**	**(6 Hrs)**
Types of companies: Pvt. Ltd., Public Ltd., One-person company; Incorporation and legal structure; Company management and meetings; Concept of limited liability; Need for regulation in real estate under RERA (Real Estate Regulation and Development Act, 2016); Roles: Promoter, Agent, Buyer; SEBI's role in protecting investors; Consumer Protection Act, 2019: Rights, responsibilities, redressal mechanisms at district/state/national levels		
Unit VI	**Negotiable Instruments Act, 1881**	**(5 Hrs)**
Meaning and types: Promissory note, bill of exchange, cheque; Characteristics and presumptions; Endorsement and negotiation; Dishonor of instruments and legal consequences; Protection to paying banker and liability of parties		

Learning Resources
Textbooks: 1. Avtar Singh, Business Law, 12th Edition, Eastern Book Company, 2022. 2.M.C. Kuchhal & Vivek Kuchhal, Business Law, 8th Edition, Vikas Publishing House, 2020.
Reference Books: 1.N.D. Kapoor, Elements of Mercantile Law, 38th Edition, Sultan Chand & Sons, 2022. 2. K.R. Bulchandani, Business Law for Management, 8th Edition, Himalaya Publishing House, 2020. 3.V.K. Agarwal, Consumer Protection Law and Practice, 6th Edition, Bharat Law House, 2021. 4.R.K. Bangia, A Handbook of Company Law, 15th Edition, Allahabad Law Agency, 2023. 5. Pavan Duggal, Cyber Law: The Indian Perspective, 6th Edition, Saakshar Law Publications, 2023
MOOC / NPTEL Course : **1.**https://archive.nptel.ac.in/courses/110/105/110105159/ **2.**https://onlinecourses.swayam2.ac.in/cec21_mg02/preview **WEB Resources :** **1.**https://www.britannica.com/money/business-law **2.**https://wbconsumers.gov.in/writereaddata/ACT & RULES/Relevant Act & Rules/the-indian-contract-act-1872.pdf **3.**https://infosecawareness.in/cyber-laws-of-india

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: MMC	**Course Title: PYTHON SCRIPTING**	
Course Code:230GCSB114_05	**Teaching Scheme:2 (Hrs./Week)**	**Examination Scheme:**
Credits: 2	**Lecture (L): 1** **Tutorial (T):** **Practical (P): 2** **Experiential Learning (EL):0**	**Practical (PR): 50 Marks** **Oral (OR): 50 Marks**

Course Objectives:

This course will enable students to

- Scripting fundamentals and applications
- Python syntax and data types
- Control structures and problem-solving
- Data structure manipulation
- Modular programming and error handling
- Advanced applications (GUI, networking, multithreading)
- Real-world project development

Course Outcomes

- Develop algorithms and flowcharts for effective problem solving.
- Write and execute basic Python programs using proper syntax.
- Apply control statements and functions for modular programming.
- Manipulate data using strings and lists in Python.
- Use tuples, dictionaries, and sets for structured data handling.
- Handle files, use modules, and perform array operations with NumPy.

Course Contents

Unit I	**Introduction**	**2 hr**

Problem Solving: General Problem-Solving Concepts, Problem solving using computers, Problem solving steps.

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms, algorithmic problem solving, simple strategies for developing algorithms (Iteration, recursion). Illustrative problems: find minimum/maximum in a list, searching, etc.

Programming Languages: Language as a tool, types of languages, the compilation process

Unit II	Basics of Python Programming	3 hr
The Python Programming Language, History, versions, features, Applications, The Python programming environment, Basic Syntax, Writing and executing a Python program, Comments, Keywords and identifiers, Data types and Variables, Getting and setting the data type, Constants, Lines and indentation, Input/output with print and input, Command line arguments, Operators and expressions, Precedence of operators, type conversion. Strings declaration, manipulation, special operations, escape character, string formatting. operator, Built-in String functions		
Unit III	**Control Statements and Functions**	**2 hr**
Conditional Statements: if, if-else, nested if, if-elif-else statements, Looping- for, while, nested loops, the break, continue, pass, and else statement used with loops. Understanding and Using Ranges Functions - Need for functions, Function: definition, call, variable scope and lifetime, the return statement, passing arguments, arbitrary arguments, keyword arguments, default arguments, recursion, Lambda or anonymous function, difference Between user define and predefined functions		
Unit IV	**String & List**	**2 hr**
Strings declaration, manipulation, special operations, escape character, string formatting. operator, Built-in String functions List Concept, creating and accessing elements, traversing a List, List operations: modifying, adding, deleting items, Built-in List functions, List comprehension and slicing. Conceptual Idea about how class and Object Works, class definition with syntax, object definition With Example.		
Unit V	**Tuple & Dictionary**	**2 hr**
Tuple: Concept, Creating and Accessing a tuple, Basic tuples operations, unpacking a tuple, Concatenation, Repetition, in Operator, Iteration, Built-in tuple functions, indexing, slicing Dictionary Concept, Creating and Accessing dictionary elements, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods. Set-Concept, set operations (Adding, Union, intersection), working with sets		
Unit VI	**Files, Modules and Packages**	
files introduction to modules, standard library modules, importing modules in python program, using the dire) Function Working with Random Modules. E g. - time, date time, calendar, sys, etc. NumPy Introduction to numpy, creating arrays, Array Input and Output, Indexing and slicing Arrays, Array Transposition, Array shape, reshape, split, search, sort, filter.		

Learning Resources

- **Interactive Learning:** Codecademy, Coursera, edX (MIT course)
- **Coding Environments:** Replit, Google Colab, Trinket
- **Video Content:** Programming with Mosh, freeCodeCamp
- **Practice Platforms:** HackerRank, w3 school ,Programiz
- **Reference:** Stack Overflow, Python.org documentation

Lab Manual Programs List:

Program No.	Description / Aim
1	Accept name, age, and percentage from the user and display them using formatted output.
2	Check whether a given number is even or odd, and whether it is prime or not.
3	Display the multiplication table of a number and calculate the sum of its digits.
4	Find the factorial of a given number using both iteration and recursion.
5	Perform various operations on lists and tuples, including finding max, min, and average.
6	Demonstrate adding, updating, deleting, and searching elements in a dictionary.
7	Perform union, intersection, and difference operations between two sets.
8	Read and write data to files and extract specific information based on conditions.
9	Use Python's built-in modules to display current date, time, and monthly calendar.
10	Create and manipulate NumPy arrays to calculate average, maximum, and minimum values.
11	Create functions to calculate the area of a circle, rectangle, and triangle using parameters.
12	Write a function that returns the sum, average, and product of three numbers.
13	Generate the Fibonacci series using a recursive function.
14	Create a class Student with attributes like name, roll number, and marks, and display details using methods.
15	Create a class Bank Account to perform deposit, withdrawal, and balance display operations.

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V"

Course Type:	Course Title: Innovation	
Course Code: 230IINB02_05	**Teaching Scheme: (Hours/Week)**	**Examination Scheme:**
Credits: 1.5	**Lecture (L): 1** **Tutorial (T): 0** **Practical (P): 0** **Experiential Learning (EL): 2**	**Oral (OR): 50 Marks**

Prerequisite Courses, if any: Nil

Course Objectives:

- To understand the concept of innovation and creativity
- To familiarize with the tools for innovation
- To understand fundamentals of innovation management
- To get overview of real-world implementation of innovation and creativity

Course Outcomes: On completion of the course, learner will be able to…

CO1: Apply the concepts of creativity and innovation in all walks of life.
CO2: Inculcate and incorporate individual creativity and innovative skill set at conceptual, product design and management level.
CO3: Solve real time problems with enhanced ability in respective sectors of work for increased productivity and improved organizational behaviour.
CO4: Perform with improved skill set in entrepreneurship and start up ecosystem.
CO5: To find solutions to social, corporate and personal problems with de novo approach.

Course Contents

Unit I	Innovation & Creativity	(3Hrs)

Innovation: Meaning, Concept, Characteristics, Importance, Principles of Innovation, Process of Innovation.
Creativity: Meaning, Concept, Importance, Creativity Process, Components of creative performance, Hurdles to Creativity

Unit II	Tools for Innovation	(5Hrs)

Creative Thinking: Traditional V/S Creative Thinking,
Individual Creativity Techniques: Meditation, Self-Awareness, & Creative Focus
Group Creative Techniques: Brainstorming, Off The Wall Thinking &Thinking Hats Method.
Dimensions of Innovation:
Innovation Eco-system in India and abroad, Social Innovation, Grass root Innovation, Frugal Innovation, Global Innovation- Global Innovation Index framework, GII, Case studies in India and abroad.

Unit III	**Innovation Management**	**(3Hrs)**
Concept, Scope, Characteristics, Evolution of Innovation Management, Significance, Factors Influencing Innovation, Commercialization of Innovation, Innovation and Start up ecosystem		
Unit IV	**Areas of Innovation**	**(2Hrs)**
Innovation in Entrepreneurship, Product innovation, Process Innovation, Social Innovation, Case studies highlighting types, implementation imperatives and sector specific impact.		
Unit V	**Group innovation study**	**(1Hrs)**
Each student group will prepare a case study on one innovation topic either from their area of work or through participation in the exposition, symposia, workshop of any relevant forum. The project report will be submitted for the study.		
Unit VI	**Presentation and Closure**	**(1Hrs)**
The student group will give the presentation of the project in the chosen area. The report will highlight the process of exploring executing and exploiting the innovation. It will also mention methodology to manage the innovation.		

Learning Resources

Text Books:

1.Wagner, Tony. Creating Innovators: The Making of Young People Who Will Change the World. New York: Scribner, 2012.

2. “Managing Creativity and Innovation” Harvard Business School Press

Reference Books:

1. “Organizational Innovation”, SAGE Publication, London, 2001.
2. “Jugaad Innovations, Navi Radjou and Jaideep Prabhu, Random House India
3. “Kelley, Tom, Jonathan Littman, and Tom Peters. The Art of Innovation: Lessons in Creativity from IDEO, America’s Leading Design Firm. New York: Doubleday, 2001.
4. “Innovation Management & New Product Development”, Paul Trott, published by Pitman, 2000.

MOOC / NPTEL Courses:

1. NPTEL Course “*Innovation, Business Models and Entrepreneurship”,* Prof Rajat Agrawal, Prof Vinay Sharma, IIT Roorkee.

Link of the Course: https://onlinecourses.nptel.ac.in/noc23_mg116/preview

Additional Web Resources:

https://youtu.be/FXJUDyqobbM
https://youtu.be/FF_38_ZuRbQ
https://youtu.be/33JjV_NDbpY
https://youtu.be/DNUwZctwwhw
https://youtu.be/_PC1qbAhKz0
https://youtu.be/wbFVNBNl7Bk
https://youtu.be/kfpERveB8kM
https://youtu.be/Y6R9ps2E1oM
https://youtu.be/66N5SM73AEc
https://youtu.be/1YLtkc6U3Rs

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: LC	**Course Title:** Concrete Structures Lab	
Course Code: 230GCEB04_05	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 Marks

Prerequisite Courses, if any:

1. Concrete Structures.

List of Practical

1	**Detailing of Beams**	**(4 Hours)**
Longitudinal detailing, Sectional detailing		
2	**Detailing of Slabs**	**(6 Hours)**
Longitudinal reinforcement, distribution reinforcement		
3	**Detailing of Columns**	**(6 Hours)**
Longitudinal and sectional detailing		
4	**Detailing of Footing**	**(6 Hours)**
Reinforcement detail of different footings		
5	**Design of a building**	**(8 Hours)**
Design and detailing of a building using industry grade software		

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: LC	**Course Title:** Flow through Pipes and Open Channels Lab	
Course Code: 240GCEB05	**Teaching Scheme: 2 (Hours/Week)**	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 marks **Oral (OR):** 50 marks

Prerequisite Courses, if any: Engineering Mechanics, Basics of fluid flow

Course Objectives:

The objective of this laboratory is to provide practical exposure to fundamental concepts of fluid mechanics and hydraulics through experiments, assignments, and field visits. analyzing flow behavior, and understanding real-world hydraulic systems.

1. To understand fluid properties and their measurement techniques such as viscosity, surface tension, and pressure.
2. To verify fundamental principles like Bernoulli's theorem and develop skills in calibration of flow measuring devices (Venturimeter, Orifice meter, notches).
3. To study flow behavior in pipes and open channels, including friction losses, velocity distribution, and uniform flow conditions.
4. To analyze fluid flow problems using analytical/computational methods and gain practical exposure through models, software, and site visits.

Course Outcomes:

Upon completion of this laboratory, students will be able to apply fluid mechanics concepts to practical problems and analyze hydraulic systems effectively.

CO1: Measure fluid properties like viscosity, surface tension, and pressure.
CO2: Verify basic principles such as Bernoulli's theorem and energy losses.
CO3: Use and calibrate flow measuring devices (Venturimeter, Orifice meter, notches).
CO4: Analyze flow in pipes and open channels (friction, velocity, uniform flow).
CO5: Solve hydraulic problems using analytical and computational methods.
CO6: Understand real-life hydraulic systems through models and site visits.

List of Laboratory Experiments

The Term work shall consist of Experiments (09), Assignments (02) and Visit Report (01)

A) Any nine experiments of below mentioned experiments, out of which first seven are compulsory:

1. Measurement of viscosity of fluid by Redwood/Saybolt viscometer.
2. Experimental verification of Bernoulli's theorem with reference to loss of energy.
3. Calibration of Venturimeter / Orifice meter.
4. Determination of Darcy-Weisbach friction factor (f) for a given pipe and study of variation off with Reynolds Number (Re).
5. Flow around a Circular Cylinder/Aerofoil.
6. Study of Uniform Flow Formulae for Open channel.
7. Velocity Distribution in Open Channel Flow.
8. Calibration of Rectangular and Triangular Notch.
9. Determination of Stability of Floating Bodies using Ship Model
10. Drawing Flow net by Electrical Analogy for flow below Weir (with & without sheetpile)
11. Measurement of Pressure using different Pressure Measuring Devices (including Transducers /state of arts Digital Instruments also).
12. Measurement of Surface Tension.
13. Determination of Minor Losses in Pipes

B) Assignments: Any two assignments of below mentioned. First assignment is compulsory.

1. Analysis of pipe network using Hardy Cross Method (minimum two loops) – both by hand calculations and using computer any language/software solution.
2. Developing a Demo Model related to any fluid flow phenomenon (physical model/soft model).
3. Demonstration of any Software related to Fluid Mechanics/Hydraulics.
4. GVF computation using any computer Language/Software

C) Site visit: Report on Site visit to any one of the Research Institute like CWPRS, WALMI, MERI etc.

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- V

Course Type: MLC#	**Course Title:** Environmental Audit	
Course Code: 240GCEB09_05	**Teaching Scheme:** (Hrs. / Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 1 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any: -

Course Objectives:

1. To understand the definition, purpose, and importance of environmental audit, along with relevant national and international guidelines.
2. To familiarize students with major environmental legislations, standards, and compliance mechanisms at national and international levels.
3. To learn the process, stages, and methodologies of conducting environmental audits using tools, techniques, and stakeholder interactions.
4. To develop skills in analyzing environmental data, assessing impacts, and preparing statutory environmental audit reports.
5. To explore environmental management strategies, cleaner production techniques, and integration of ISO 14001 with audit practices.
6. To analyze real-world industrial and infrastructure case studies and understand best practices in environmental audits for sustainable development.

Course Outcomes: On completion of the course, learner will be able to:

CO1: Explain the concept, purpose, and types of environmental audits with examples.

CO2: Summarize Indian and international environmental laws, agreements, and standards relevant to compliance.

CO3: Apply audit methodologies, conduct site inspections, collect data, and interact with stakeholders effectively.

CO4: Analyze environmental monitoring data, identify non-conformities, and prepare statutory audit reports.

CO5: Recommend pollution prevention, waste minimization, and resource optimization measures for industries.

CO6: Evaluate case studies and discuss corrective actions and sustainability practices in environmental audits.

Course Contents

Unit I	**Introduction to Environmental Audit**	**2 Hrs**
Definition & Purpose of Environmental Audit, Types of Environmental Audits – Compliance audit; management audit, functional audit; Importance for sustainable development and regulatory compliance; National & International Guidelines – MoEF&CC, CPCB, ISO 14001 framework; Legal requirements under Environment Protection Act 1986 and related rules and Examples of environmental incidents and the role of audits in prevention.		
Unit II	**Environmental Laws, Standards & Compliance**	**2 Hrs**
Overview of Indian environmental legislations: Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment (Protection) Act, 1986, Hazardous Waste Management Rules, 2016; CPCB & SPCB roles in environmental compliance; International agreements – Paris Agreement, Kyoto Protocol; Environmental standards (emission norms, effluent discharge standards).		
Unit III	**Environmental Audit Process & Methodology**	**3 Hrs**
Stages of Environmental Audit – Pre-audit, onsite audit, post-audit; Audit tools & techniques – Checklists, questionnaires, observation sheets, NCR; Site inspection methods and sampling protocols; Data collection – Pollution load, resource consumption, waste generation; Interaction with stakeholders and staff during audits.		
Unit IV	**Data Analysis, Impact Assessment & Reporting**	**2 Hrs**
Analysis of monitoring data – Air, water (Drinking & Ground Water), soil quality, Waste Water, Noise; Comparison with permissible limits; Identification of non-conformities & environmental risks; Basics of Environmental Impact Assessment (EIA) for audit findings; Preparation of Environmental Audit Report as per statutory format (Form V, GPCB / SPCB formats).		
Unit V	**Environmental Management & Improvement Measures**	**3 Hrs**
Cleaner production techniques; Waste minimization and resource optimization; Pollution prevention & control measures; Water & energy conservation in industries; Adoption of renewable energy and green technologies; Integration of ISO 14001 Environmental Management Systems with audit findings.		
Unit VI	**Case Studies & Best Practices in Environmental Audit**	**2 Hrs**

Industrial case studies – Manufacturing, chemical, textile, food processing; Infrastructure case studies – Large construction projects, mining, transportation; Discussion of audit findings and corrective actions; Role of audits in corporate sustainability reporting; Open discussion & Q&A session.

Learning Resources

Text Books:

1. *Environmental Auditing*, by S.M. Shafi, Discovery Publishing House Pvt. Ltd.
2. *Environmental Impact Assessment Methodologies*, by Y. Anjaneyulu, CRC Press.
3. *Environmental Management*, by N.K. Uberoi, Excel Books.

Reference Books:

1. *Handbook of Environmental Auditing*, by R.D. Gupta, Discovery Publishing Pvt. Ltd., New Delhi, 2011.
2. *Textbook of Environmental Studies for Undergraduate Courses*, by Erach Bharucha, Universities Press, 2005.

MOOC / NPTEL Courses:

1. *Environmental Impact Assessment* by Prof. Harshit Sosan Lakra, IIT Roorkee.

Link: https://onlinecourses.nptel.ac.in/noc22_ar07/preview

JSPM University Pune

Faculty of Science and Technology

School of Civil and Environmental Sciences

NEP aligned Syllabus

for

TY B. Tech (Civil Engineering)

(Effective from AY: 2026-27)

JSPM University Pune

T.Y. B. Tech. "Civil Engineering"

Semester-VI

Course Type: PCC	**Course Title:** Steel Structures	
Course Code: 241GCEB10	**Teaching Scheme: 2 (Hours/Week)**	**Examination Scheme:** **ESE = 100 marks**
Credits: 2.5	**Lecture (L): 0**2 **Practical (P):** 0 **Experiential Learning (EL):**02	

Prerequisite Courses, if any: Strength of Materials, Engineering Mechanics

Course Objectives:

- This course aims to impart knowledge of IS code provisions, basic principles of structural steel design, and their application in designing various steel components.
- Students will be able to identify and explain the components of steel structures and their structural arrangements.
- Students will be able to design steel beams, columns, column bases, roof trusses, gantry girders, and plate girders.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO-1	Explain the types of steel structures, relevant steel design codes, and the p for selecting suitable steel sections subjected to tensile forces
CO-2	Identify and design appropriate steel sections for compression members, incl design of built-up columns with lacing and battening systems.
CO-3	Design eccentrically loaded columns considering section capacity, and desig bases subjected to axial load and uniaxial bending.
CO-4	Design laterally restrained and unrestrained beams, with and without flang using rolled steel sections.
CO-5	Analyze industrial trusses for dead, live, and wind loads, and design gantr subjected to moving loads.
CO-6	Explain the function of welded plate girder components and design the wel girder cross-section, including stiffeners and their connections.

Course Contents

Unit I	Design Philosophy and Tension Members	(5 Hrs)

Types of steel structures; chemical composition and grades of structural steel; rolled steel sections; relevant IS codes including IS:800–2007, IS:808–1989, IS:875 (Parts I–III), SP:6(1), SP:6(6), SP:38, IS:4000–1992, and IS:816–1969; maintenance of steel structures and repair methods. Limit state design philosophy for strength and serviceability, partial safety factors for loads and materials, and design load combinations. Tension members: forms such as rods, cables, and angle sections; limit states of yielding, rupture, and block shear; design of single and double angle tension members and their connections.

Unit II	Compression Members and Built-Up Columns	(5Hrs)

Buckling behavior and classification, buckling curves, and cross-section classification; effective length concepts for compression members and columns; evaluation of design compressive stress; design of truss compression members using single and double angle sections along with their connections; design of axially loaded columns using rolled steel sections; and design of built-up columns including lacing, battening, and their connections.

Unit III	Eccentric Loaded Columns and Column Bases	(5Hrs)
Design of eccentrically loaded columns considering uniaxial and biaxial bending for section strength; design of column bases including slab base, gusseted base, and moment-resisting base subjected to axial load and uniaxial bending.		
Unit IV	**Design of Flexural Members**	**(5 Hrs)**
Design bending strength of beams under laterally restrained and unrestrained conditions; design of laterally restrained beams using single rolled steel sections with and without flange plates, including flange plate curtailment, low and high shear checks, web buckling, web crippling, and deflection. Design of laterally unrestrained beams using single rolled steel sections, including checks for lateral–torsional buckling and deflection.		
Unit V	**Industrial Trusses and Gantry Girders**	**(5 Hrs)**
Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports. Design of gantry girder: selection and design of cross section, check for moment capacity, buckling resistance, bi-axial bending, serviceability and fatigue strength.		
Unit VI	**Welded Plate Girders**	**(5 Hrs)**
Concept of plate girder, components of welded plate girder, intermittent weld, design of cross section, curtailment of flange plates, end bearing, load bearing, and intermediate stiffeners, design of connection between flange & web plate and web plate & stiffeners, check for shear buckling of web, shear capacity of end panel and serviceability condition.		

Learning Resources
Text Books: 1. Limit State Design of Steel Structures, S K Duggal, Tata McGraw Hill Education, New Delhi 2. Design of Steel Structure by Limit State Method as per IS: 800- 2007, Bhavikatti S S, I. K. International publishing house, New Delhi 3. Design of Steel Structures, K. S. Sai Ram, Pearson, New Delhi

Reference Books:

1. Design of Steel Structure, N Subramanian, Oxford University Press, New Delhi
2. Limit State Design in Structural Steel, M. R. Shiyekar, PHI, Delhi
3. Fundamentals of structural steel design, M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.

MOOC / NPTEL Courses:

Design of Steel Structures by Prof. Damodar Maity (IIT Kharagpur)
https://nptel.ac.in/courses/105105162

Indian Standard Codes:

i. IS 800-2007: Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi
ii. IS 808-1989: Dimensions for hot rolled steel beam, column, channel and angle sections, Bureau of Indian Standards, New Delhi
iii. IS 875- Part 1 and 2 (1987) and Part 3 (2015): Code of practice for design loads (other than earthquake) for building and structures, Bureau of Indian Standards, New Delhi
iv. IS 4000-1992: Code of practice for high strength bolts in steel structures, Bureau of Indian Standards, New Delhi
v. IS 816-1969: Code of practice for use of metal arc welding for general construction in mild steel, Bureau of Indian Standards, New Delhi
vi. SP-6(1) and 6(6): ISI handbook for Structural Engineers, Bureau of Indian Standards, New Delhi
vii. SP-38: Handbook for typified design for structures with steel roof trusses, Bureau of Indian Standards, New Delhi

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- VI

Course Type: PCC	**Course Title:** Environmental Engineering	
Course Code: 241GCEB11	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory= 50 marks**

Prerequisite Courses, if any:

1. Basic knowledge of environmental sustainability

Course Objectives:

- This course explores how fundamental principles are applied for environmental problems i.e. water quality engineering, air quality engineering, and hazardous waste management.
- The main elements of assessing environmental impacts of human activities, projects and plans will be explained. Students will conduct an environmental impact assessment and apply environmental design techniques for a specific problem definition.

Course Outcomes: Students completing the course will be able to:

CO1: Understand interaction between environment and human activities, identify environmental imbalances

CO2: Analyze water quality parameters and apply appropriate water treatment processes for safe and sustainable water supply systems.

CO3: Select wastewater treatment processes, including sludge handling and disposal methods.

CO4: Predict and assess the impact of environmental pollution and mitigation strategies

CO5: Select appropriate processing, recovery, and disposal methods of solid waste management.

CO6: Understand the EIA as integral part of planning process

Course Contents

Unit I	**Introduction to Environmental Engineering**	**(5 Hours)**

Environment and its interaction with human activities – Environmental imbalances, Scope and importance of environment, Components of environment, Environmental Sustainability, Environmental pollution, National environmental policies & regulatory frameworks		
Unit II	**Water Supply Engineering**	**(5 Hours)**
Water quality parameters – physical, chemical, biological, Water demand: population forecasting, Sources of water, Water intake structures & conveyance systems, Water treatment processes, Distribution systems		
Unit III	**Wastewater Engineering**	**(5 Hours)**
Characteristics of domestic and industrial wastewater, Primary, secondary and tertiary treatment processes, Activated sludge process & trickling filters, anaerobic treatment, Sludge handling and disposal		
Unit IV	**Environmental pollution**	**(6 Hours)**
Environmental pollution, classifications, Natural and anthropogenic sources of pollution, pollutants, types of pollutants, effect and causes of pollution, need and importance of environmental monitoring, Air pollution, Water pollution, Soil contamination, Noise pollution		
Unit V	**Solid Waste Management**	**(5 Hours)**
Classification, characteristics, and sources of municipal solid waste, Collection, segregation, storage and transportation systems, Processing & recovery techniques: composting, biomethanation, incineration, Landfill design, leachate management		
Unit VI	**Environmental Impact Assessment**	**(4 Hours)**
Environmental policies, EIA concept, Environmental Impact Assessment & Sustainability, environmental clearance and EIS report, Comprehensive EIA, Environmental management plan, Environmental monitoring.		

Learning Resources

Text Books:

1. Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw Hill, New Delhi, 2003.
2. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., "Chemistry for Environmental Engineering and Science", Tata McGraw – Hill, Fifth edition, New Delhi 2003

Reference Books:

1. Punmiya B.C., Ashok kumar Jain and A.K. Jain, “Waste Water Engineering and Air Pollution”,Laxmi Publications Pvt Ltd, New Delhi
2. Environmental Impact Analysis – A Decision Making Tool by R K Jain

MOOC / NPTEL Courses:

1. Swayam Course “Environmental Engineering”, Dr. V. C. Srivastava, (Link of the Course: https://nptel.ac.in/courses/103107084)
2. NPTEL course “Basic Environmental Engineering and Pollution Abatement”, Prof. P. Mondal (Link of Course: https://nptel.ac.in/courses/103107215)

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- VI

Course Type: PCC	**Course Title:** Soil Mechanics	
Course Code: 240GCEB12_06	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory = 50 marks**

Prerequisite Courses, if any:

2. Engineering Mechanics

Course Objectives:

- To understand soil mechanics principles.
- To equip learners with the skill to classify soil.
- To apply permeability and seepage computations.
- To understand compaction and consolidation's effect on soil.
- To learn methods to determine and interpret shear strength parameters of soil for stability analysis and design purposes.
- To analyze earth pressure and its impact.

Course Outcomes: Students completing the course will be able to:

CO1: Apply basic soil mechanics principles to identify various properties of soil.
CO2: Classify the soil based on various soil classification systems.
CO3: Compute permeability, seepage and draw flow net.
CO4: Understand concept of compaction & Consolidation and will be able to select suitable compaction equipment for field compaction.
CO5: Determine shear strength parameters of soil.
CO6: Identify various forces/pressure acting on the retaining wall.

Course Contents

Unit I	**Properties of Soil & Weight volume relationship**	**(5 Hours)**

Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits, and desert soils. Mechanical analysis of soil. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance.

Unit II	**Classification of Soil & Soil structures**	**(5 Hours)**

Introduction, Particle size classification, Textural classification, Classification by engineering behavior, AASHTO classification system, Unified soil classification system. Soil structure: single grained and honey combed, flocculated and dispersed.		
Unit III	**Permeability and Seepage**	**(5 Hours)**
Darcy's law, Permeability, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, Permeability of layered soils, Seepage forces, General flow equation. Flow net and its application.		
Unit IV	**Soil Compaction & Consolidation**	**(5 Hours)**
Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship, zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils. Fundamentals of consolidations, One-dimensional laboratory consolidation test, Void ratio-pressure relationship, normally consolidated and over consolidated soil, Determination of coefficient of consolidation.		
Unit V	**Shear Strength of Soil**	**(5 Hours)**
Mohr strength theory, Mohr-coulomb's strength theory, Direct shear test, Tri-axial compression test, unconfined compression test, vane shear test, Shear test based on drainage condition**.**		
Unit VI	**Earth Pressure**	**(5 Hours)**
Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Introduction to Coulomb's theory.		

Learning Resources

Text Books:

1. P. R. Rethaliya, "Soil Mechanics", Atul Prakashan, 1st edition 2020.
2. P. R. Rethaliya, Geotechnical Engineering-I, Atul Prakashan, 1st edition 2020.
3. Punamia, B.C., Soil Mechanics & Foundation Engineering, Laxmi Publication Pvt. Ltd., Delhi, 16th edition, 2005.

Reference Books:

1. Arora, K.R., Soil Mechanics & Foundation Engineering, Standard Publication, New Delhi, 1st edition, 1997.
2. VNS Murthy, Soil Mechanics & Foundation Engineering, SaiKripa Technical Consultants, Bangalore, 4th edition, 2002.
3. Shroff, A. V., Shah D., Fratta, J., Aguettant, J., and Smith, L. R., Soil Mechanics Laboratory Testing, CRC Press, USA, 2007.
4. Ranjan Gopal and Rao, A.S.R., Basic and Applied Soil Mechanics, New Age International Pvt. Ltd., 2nd edition, 2007.

5. Braja Das, M., Principles of Geotechnical Engineering, Thomson Asia Pvt. Ltd., 8th edition, 2010.

MOOC / NPTEL Courses:

1. NPTEL Course “Geotechnical Engineering-1”, Dr. D. N. Singh, IIT Bombay (Link of the Course: https://onlinecourses.nptel.ac.in/noc22_ce03/preview#)

Additional Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ce03/preview#

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- VI

Course Type: HSSM	**Course Title: Finance for Engineers**	
Course Code: 231VBCB27	**Teaching Scheme: Hrs./Week**	**Examination Scheme:**
Credits: 2	**Lecture (L): 1** **Tutorial (T): 0** **Practical (P): 0** **Experiential Learning (EL): 4**	**Oral = 50 marks**

Prerequisite Courses, if any:

- Engineering Mathematics
- Basic Economics
- Introduction to Engineering Management

Course Objectives:

1. To equip engineering students with fundamental concepts of finance relevant to engineering projects and businesses.
2. To develop an understanding of financial statements, cash flow analysis, and capital budgeting.
3. To enable students to apply financial management principles in real-world engineering scenarios.
4. To prepare students for making informed financial decisions in their professional engineering careers.

Course Outcomes:

CO1: Understand and explain key financial principles and their relevance to engineering (Aligned with PO1, PO2)

CO2: Analyze financial statements and evaluate the financial health of engineering projects (Aligned with PO2, PO3)

CO3: Apply capital budgeting techniques to assess the viability of engineering projects (Aligned with PO3, PO4)

CO4: Manage working capital and understand its importance in engineering firms (Aligned with PO4, PO5)

CO5: Evaluate and manage financial risks associated with engineering projects (Aligned with PO1, PO2, PO5)

CO6: Integrate financial principles into engineering decision-making processes (Aligned with PO5, PO6)

Course Contents

Unit I	**Introduction to Finance**	**(5 Hrs)**

- Overview of Finance and its Importance in Engineering
- Key Financial Concepts: Time Value of Money, Risk and Return
- Introduction to Financial Markets and Instruments

Unit II	Financial Statements and Analysis	(5 Hrs)

- Understanding Financial Statements: Balance Sheet, Income Statement, Cash Flow Statement
- Ratio Analysis: Liquidity, Solvency, and Profitability Ratios
- Case Studies on Financial Statement Analysis

Unit III	Capital Budgeting	(5 Hrs)

- Capital Budgeting Process and Techniques
- Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period
- Project Evaluation and Selection

Unit IV	Working Capital Management	(5 Hrs)

- Components of Working Capital
- Cash Management and Inventory Control
- Short-term Financing and Credit Management

Unit V	Financial Risk Management	(5 Hrs)

- Types of Financial Risks: Market Risk, Credit Risk, Operational Risk
- Risk Assessment and Mitigation Strategies
- Role of Derivatives in Risk Management

Unit VI	Financial Decision Making for Engineers	(5 Hrs)

- Financial Planning and Forecasting
- Cost of Capital and Capital Structure
- Case Studies on Financial Decision Making in Engineering Projects

Learning Resources

Text Books:

1. Brigham, Eugene F., and Michael C. Ehrhardt. “Financial Management: Theory & Practice.” Cengage Learning.
2. Ross, Stephen A., Randolph W. Westerfield, and Bradford D. Jordan. “Fundamentals of Corporate Finance.” McGraw-Hill Education.

Reference Books:

1. Brealey, Richard A., Stewart C. Myers, and Franklin Allen. “Principles of Corporate Finance.” McGraw-Hill Education.
2. Gitman, Lawrence J., and Chad J. Zutter. “Principles of Managerial Finance.” Pearson.
3. Higgins, Robert C. “Analysis for Financial Management.” McGraw-Hill Education.
4. Damodaran, Aswath. “Corporate Finance: Theory and Practice.” Wiley.

MOOC Course:

1. NPTEL Course: Financial Management for Managers

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- VI

Course Type: VSC	**Course Name:** Entrepreneurship	
Course Code: 230IESB03	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 1.5	**Lecture (L):** 1 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 2	**Oral (OR):** 50 Marks

Prerequisite Courses, if any: Design Thinking and Creativity, Innovation

Course Objectives:

- To understand the fundamental concepts of entrepreneurship and its role in economic development.
- To develop the ability to identify and evaluate business opportunities.
- To cultivate creative and critical thinking skills for solving entrepreneurial challenges.
- To familiarize students with the entrepreneurial ecosystem and startup culture.
- To enable students to prepare a business plan and learn funding strategies.

Course Outcomes: On completion of the course, learner will be able to

CO1: Understand the fundamental concepts of entrepreneurship, including the types of entrepreneurs and ventures, and develop a foundational knowledge of entrepreneurial thinking.

CO2: Analyze the entrepreneurial ecosystem and demonstrate the ability to identify and evaluate viable business opportunities through effective idea generation and opportunity recognition techniques.

CO3: Design and evaluate business models using lean startup principles and apply financial management concepts to develop sustainable startup plans.

CO4: Apply marketing strategies, legal frameworks, and operational planning to address the practical challenges faced by entrepreneurs in running startups.

CO5: Develop comprehensive business plans and effective funding strategies while preparing professional investor pitches and growth strategies for scaling startups.

CO6: Exhibit leadership and team management skills, leverage innovation and technology in entrepreneurial ventures, and critically analyze startup challenges and failures through case studies and industry interactions.

Course Contents		
Unit I	**Introduction to Entrepreneurship**	**(2 Hours)**
Introduction to Entrepreneurship, Types of Entrepreneurs and Ventures		
Unit II	**Entrepreneurial Ecosystem and Opportunity Identification**	**(2 Hours)**
Entrepreneurial Ecosystem , Idea Generation and Opportunity Recognition		
Unit III	**Business Models and Startup Planning**	**(2 Hours)**
Business Models and Lean Startup, Financial Management for Startups		
Unit IV	**Marketing, Legal, and Operational Aspects**	**(2 Hours)**
Marketing for Entrepreneurs, Legal Aspects of Entrepreneurship		
Unit V	**Business Plan Development and Growth Strategies**	**(3 Hours)**
Building a Business Plan, Funding Strategies and Investor Pitch, Growth Strategies for Startups		
Unit VI	**Innovation, Leadership, and Case Studies**	**(4 Hours)**
Leadership and Team Management, Innovation and Technology in Entrepreneurship, Challenges and Failures in Startups, Case Studies and Industry Interaction		

Learning Resources

Textbooks:

1. Entrepreneurship & Management Concepts by Dr. Vikas Saraf, Pawan Thakur, Lata Yadav, S.K. Kataria & Sons
2. Entrepreneurial Development, S. S. Khanka, S. Chand Publications

Reference Books:

1. Business Model Generation by Osterwalder, A., & Pigneur, Y. (2010), Wiley publications.
2. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company by Blank, S. (2020), Wiley publications.
3. Innovation and Entrepreneurship: Practice and Principles by Drucker, P. F. (2006), Harper Business.

JSPM University Pune

T.Y. B.Tech. "Civil Engineering"

Semester- VI

Course Type: LC	**Lab Course Title: Soil Mechanics Lab**	
Course Code: 240GCEB13	**Teaching Scheme:**	**Examination Scheme:**
Credits: 1	**Lecture (L):** **Tutorial (T):** **Practical (P): 2** **Experiential Learning (EL):**	**Practical: 50 Marks**

Prerequisite Courses, if any: -

List of Laboratory Experiments

1.	Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method
2.	Specific gravity determination by Pycnometer /density bottle.
3.	Sieve analysis, particle size determination and classification of soil using various codes.
4.	Determination of Consistency limits and their use in soil classification using various codes.
5.	Determination of Field density of soil by a) Core cutter b) Sand Replacement and c) Clod method
6.	Determination of coefficient of permeability of soil by a) Constant head and b) Variable head method.
7.	Determination of Compaction Characteristic of soil using Standard/Modified Proctor test.
8.	Determination of shear strength of soil using Direct shear test apparatus.
9.	Determination of shear strength of soil using Unconfined compression test apparatus.
10.	Determination of shear strength of soil using Vane Shear test apparatus.
11.	Determination of shear strength of soil using Triaxial test apparatus
12.	Study of any soil investigation report of any construction project and write report about interpretation of index properties of soil.

Virtual LAB Links:

1. **Lab Name:** Geotechnical Engineering
   Link of the Virtual Lab: https://www.nitm.ac.in/department/civil-engineering/geotechnical-engineering-lab

JSPM University Pune

T.Y. B. Tech Civil Engineering

Semester- VI

Course Type: LC	**Lab Course Title:** Environmental Engineering Lab	
Course Code: 240GCEB14_06	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 1	**Lecture (L):** 0 **Tutorial (T):** 0 **Practical (P):** 2 **Experiential Learning (EL):** 0	**Practical (PR):** 50 Marks

Prerequisite Courses, if any: -

List of Laboratory Experiments

1.	Study of water quality indices for water testing
2.	Determination of pH, alkalinity and acidity of sample
3.	Determination of total suspended and dissolved solids.
4.	Determination of optimum dose of coagulants by Jar Test Apparatus.
5.	Determination of hardness and chlorides of given sample
6.	Determination of COD of sample
7.	Determination of turbidity and conductivity.
8.	Determination of residual chlorine
9.	Soil moisture determination
10.	Field Visit of Water/ Sewage Treatment Plant of a nearby area.

JSPM University Pune T.Y. B.Tech. Civil Engineering Semester-VI		
Course Type: LC	**Lab Course Title: Steel Structures Laboratory**	
Course Code:	**Teaching Scheme: Hrs./Week**	**Examination Scheme:**
Credits: 1	**Lecture (L):** **Tutorial (T):** **Practical (P): 2** **Experiential Learning (EL):**	**Practical: 50 Marks** **Oral:**
Prerequisite Courses, if any: -		

Course Objectives: The objective of this course is to develop practical skills in structural analysis, design, and documentation of steel structures through laboratory work, design projects, and field exposure.

1. To introduce students to the design of steel structures as per IS 800:2007 provisions.
2. To develop the ability to analyze and design industrial buildings, bridges, and low-rise steel structures.
3. To train students in preparing detailed design reports including load calculations, analysis, and design.
4. To enhance skills in preparing structural drawings and connection details using standard practices.
5. To provide practical exposure through site visits for understanding real-life structural systems and connections.
6. To promote teamwork and project-based learning through group assignments.

Course Outcomes: At the end of the course, students will be able to:

CO-1	Apply principles of structural engineering to analyze and design steel structures as relevant codes (IS 800:2007)
CO-2	Prepare detailed design reports including assumptions, load calculations, struct analysis, and design
CO-3	Develop structural drawings such as plans and connection details using stanc engineering practices
CO-4	Interpret real-life structural systems and connections through site visits and docum observations with sketches
CO-5	Work effectively in small groups to complete assigned laboratory and design tasks
CO-6	Integrate theoretical knowledge with practical applications in the design of indus buildings, bridges, and low-rise steel structures

List of Laboratory Experiments

Batch will be divided into groups. Each group will have maximum three students, and will perform following lab works.

Part A: Design of any ONE of the following structures as per IS 800- 2007

1. Industrial building with roof supported by steel trusses (Angle sections/ Tubular Sections). Some part of building may be of G+1 system.
2. Pedestrian steel bridge (Through type or Deck type)

Lab No.	Title	Description
1	Problem Definition & Planning	Selection of structure and identification of design assumptions, and loading criteria.
2	Load Calculation	Calculation of dead, live, wind loads and preparation o combinations as per IS codes.
3	Structural Analysis	Modelling and analysis of structure to determine forc members using suitable methods/software.
4	Member Design	Design of steel members and selection of suitable sectic per IS 800:2007.
5	Connection Design & Detailing	Design of connections and preparation of structural dra with necessary details.

6	Report Preparation & Presentation	Compilation of design report including calculations, drawings, and presentation of results.

Part B: Design of small steel building G+1 system.

Lab No.	Title	Description
7	Problem Definition & Load Calculation	Study of building data, assumptions, and calculation of dead and wind loads with load combinations.
8	Structural Analysis	Modelling and analysis of G+1 steel building to dete member forces using suitable methods/software.
9	Member Design	Design of beams, columns, and other structural member selection of suitable steel sections as per IS 800:2007.
10	Connection Design & Report Preparation	Design of connections, preparation of structural drawings compilation of final design report.

Part C: Report of a site visit mentioning structural details with relevant sketches of structural connections.

Lab No.	Title	Description
11	Site Visit & Data Collection	Visit to construction site to observe structural sys components, and connections; note key details and sketches/photos (if permitted).
12	Report Preparation	Preparation of site visit report including structural d sketches of connections, observations, and conclusions.

Virtual LAB Links:
https://iitb.vlabs.co.in/discipline.html?discipline=Civil_Engineering

Reference Books:

1. SP: 6 (1995): Handbook for Structural Engineers
2. 2. IS 800 (2007) General Construction in Steel — Code of Practice
3. 3. IS 808 (1989) Dimensions for Hollow Rolled Steel Beam, Column, Channel and Angle Sections
4. 4. IS 875 (Part-I)-1997 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 1: Dead Loads — Unit Weights of Building Materials and Stored Materials (Reaffirmed 1997)
5. 5. IS 875 (Part-II)-1987 Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Part 2: Imposed Loads (Reaffirmed 1997)
6. 6. IS 875 (Part-III)-1987 – Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures Part 3: Wind Loads (Reaffirmed 2003)

JSPM University Pune

School of Civil and Environmental Sciences

Semester- VI

Course Type: PEC	**Course Title:** Waste Management	
Course Code: 250GCEB29	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L): 3** **Tutorial (T):** **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH): 100** Marks

Prerequisite Courses, if any:

1 Required basic knowledge of environmental engineering

Course Objectives: This course will enable students to

- To introduce different types of wastes and their characteristics.
- To understand waste management practices and regulatory frameworks.
- To familiarize students with treatment, disposal, and resource recovery methods.
- To promote sustainable and environmentally responsible waste management practices.

Course Outcomes: Students completing the course will be able to:

CO1: Understand sources, characteristics, and management of liquid wastes.
CO2: Explain municipal solid waste management systems and practices.
CO3: Identify types and treatment methods of biological waste.
CO4: Analyze e-waste generation and management strategies.
CO5: Understand industrial waste handling and regulatory approaches.
CO6: Apply waste-to-resource and sustainable waste management concepts.

Course Contents

Unit I	**Liquid Wastes**	**(6 Hours)**

Sources of liquid waste: domestic, industrial and stormwater, basic characteristics of wastewater, overview of treatment processes (primary, secondary, tertiary), disposal and reuse practices, introduction to discharge standards and regulations

Unit II	**Municipal Solid Waste**	**(6 Hours)**

Sources and classification of MSW, segregation, collection and transportation systems, processing methods such as composting and recycling, sanitary landfill, overview of Solid Waste Management Rules and current urban practices

Unit III	**Biological Waste**	**(5 Hours)**

Types of biological waste: biomedical, agricultural and organic waste, characteristics and risks, treatment methods including composting, anaerobic digestion and incineration, handling and disposal practices, overview of Biomedical Waste Management Rules

Unit IV	**E-Waste**	**(6 Hours)**

Sources and components of e-waste, hazardous materials and environmental impacts, recycling and recovery techniques, extended producer responsibility (EPR), overview of E-Waste Management Rules		
Unit V	**Industrial and Process Wastes**	**(5 Hours)**
Types of industrial wastes (hazardous and non-hazardous), sources and characteristics, treatment and disposal methods, waste minimization and cleaner production, overview of Hazardous Waste Management Rules		
Unit VI	**Waste to Resource**	**(5 Hours)**
Concept of waste valorization, waste-to-energy technologies (biogas, incineration, RDF), recycling and reuse practices, circular economy principles, sustainable waste management case studies		
Learning Resources		
Text Books: 1. Environmental Engineering – Peavy & Row		
Reference Books: 1. CPHEEO Manual on Solid Waste Management 2. Municipal Solid Waste Management – K.K. Singh		
MOOC / NPTEL Courses: NPTEL: Solid Waste Management – IIT Kharagpur SWAYAM: Waste Management and Sustainability		

JSPM University Pune

TY B.Tech. Civil Engineering

Semester- VIII

Course Type: PEC	**Course Title: Air Pollution and Control**	
Course Code: **250GCEB30**	**Teaching Scheme:** Hrs./Week	**Examination Scheme:**
Credits: 3	**Lecture (L):** 3 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):**	**Theory (TH):** 100 Marks

Prerequisite Courses, if any: Environmental Engineering

Course Objectives:

- To know the fundamentals, sources, and types of air pollutants.
- To understand air quality standards, AQI, and meteorological effects on dispersion.
- To learn air quality monitoring and dispersion modeling.
- To understand emission inventory and source apportionment techniques.
- To discuss indoor air pollution and global environmental issues.
- To study control technologies, regulations, and air quality management strategies.

Course Outcomes: Students completing the course will be able to:

CO1: Identify and classify different air pollutants and their sources.
CO2: Interpret air quality standards, AQI, and meteorological effects.
CO3: Apply monitoring techniques and basic modeling.
CO4: Analyze emission inventories and source apportionment.
CO5: Evaluate the impacts of indoor and global air pollution issues.
CO6: Design and assess air pollution control systems and understand regulatory standards.

Course Contents

Unit I	**Introduction to Air Pollution**	**(7 Hours)**
Definition, scope, and importance of air pollution studies, Types of air pollutants: primary and secondary pollutants, Sources of air pollution: natural and anthropogenic, Classification of pollutants: particulate and gaseous, Effects of air pollution on human health, vegetation, and materials		
Unit II	**Air Quality Standards and Meteorology**	**(8 Hours)**
Ambient air quality standards (National and International), Air Quality Index (AQI), Meteorological parameters: wind speed, wind direction, temperature, humidity, Atmospheric stability, lapse rate, and Plume Behavior.		
Unit III	**Air Quality Monitoring and Modelling**	**(7 Hours)**

Air quality monitoring methods, the concept and calculation of the Air Quality Index (AQI), Air Quality Modelling, Gaussian dispersion models: point, line and area source models		
Unit IV	**Emission Inventory and Source Apportionment**	**(7 Hours)**
Sector wise emissions Inventory for Transport, Industrial, Agricultural, Residential and Commercial sectors, Use remote sensing and satellite data, and apply receptor modeling for source apportionment.		
Unit V	**Indoor Air Pollution and Global Environmental Issues**	**(8 Hours)**
Indoor air pollution: sources, types and health impacts. Sampling, assessment and evaluation of Indoor air quality, Global and regional environmental issues of air pollution: Ozone depletion, Climate change, Global warming, Acid rain.		
Unit VI	**Air Pollution Control and Management**	**(8 Hours)**
Air pollution control devices, equipment and their design, Air pollution emission standards, National and international policies, acts, rules and regulations, Technologies and strategies to mitigate air pollution and Current challenges, Lab-based measurements of air pollutants.		

Learning Resources

Text Books:

1. Rao, M. N., & Rao, H. V. N. (2007). *Air Pollution*. Tata McGraw-Hill.
2. Wark, K., Warner, C. F., & Davis, W. T. (1998). *Air Pollution: Its Origin and Control*. Addison Wesley.

Reference Books:

1. Seinfeld, J. H., & Pandis, S. N. (2016). *Atmospheric Chemistry and Physics*. Wiley.
2. Garg, S. K. (2010). *Environmental Engineering Vol. II*. Khanna Publishers.
3. Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), “Air Pollution: Health and Environmental Impacts”, CRC Press. 2010.

MOOC / NPTEL Courses:

1. Air pollution and Control by Prof. Bhola Ram Gurjar, IIT Roorkee (Duration: 12 Week) Link: https://onlinecourses.nptel.ac.in/noc23_ce14
2. Fundamental of Air Pollution: Sources, Effects and Mitigation by Prof. Kripa Ram (BHU) Link: https://onlinecourses.swayam2.ac.in/e-learning/preview/ini26_es02

JSPM University Pune

TY B.Tech. "Civil Engineering"

Semester- VI

Course Type: PEC	**Course Title:** Waste to Energy Approaches	
Course Code: 250GCEB31	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):** 3 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 100 Marks

Prerequisite Courses, if any:

1. Basic knowledge of environmental engineering

Course Objectives:

The objective of the course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. This course is designed to provide an understanding of the various aspects of Waste to Energy.

Course Outcomes: Students completing the course will be able to:

CO1: Understand the principles of waste management, waste utilization, and the 3R hierarchy, and classify different waste sources based on their characteristics.

CO2: Apply biochemical and thermochemical conversion technologies such as anaerobic digestion, pyrolysis, and gasification for energy generation from waste, and interpret relevant case studies.

CO3: Analyze various waste-to-energy options including landfill gas recovery, RDF, and AFR, and differentiate their applications in industrial and power sectors.

CO4: Demonstrate the processes of bioenergy recovery through various systems with case studies.

CO5: Select appropriate biomass energy technologies based on performance and suitability.

CO6: Assess environmental impacts of waste-to-energy systems and formulate strategies for carbon footprint reduction, compliance with standards

Course Contents

Unit I	**Introduction to Waste Management and Utilization**	**(7 Hours)**

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source, Waste Sources & Characterization

Unit II	**Technologies for Waste to Energy**	**(8Hours)**

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; and advanced technologies, Case studies of existing plants		
Unit III	**Waste to Energy Options**	**(8 Hours)**
Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to fuel resources for other useful energy applications.		
Unit IV	**Bioenergy recovery**	**(7 Hours)**
Bio-Chemical Conversion: Energy production from organic wastes through anaerobic digestion and fermentation, biogas production, landfill gas generation and utilization. A few Case studies of existing plants.		
Unit V	**Biomass energy technologies**	**(8 Hours)**
Biomass characterization; Biomass pyrolysis and gasification; Biofuels – biodiesel, bioethanol, biobutanol; Algae and biofuels; Hydrolysis & hydrogenation; Biomass based thermal power plants; Biomass as boiler fuel, microbial electrochemical system		
Unit VI	**Waste To Energy & Environmental Implications**	**7 Hours)**
Case studies on waste to energy recovery, Environmental standards for Waste to Energy Plant operations and gas clean-up, Savings on non-renewable fuel resources, Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms		

Learning Resources

Text Books:

1. Efstratios N. Kalogirou, Waste-to-Energy Technologies and Global Applications, CRC Press, Taylor & Francis Group, 2018
2. Pichtel John, Waste Management Practices Municipal, Hazardous and Industrial, Taylor & Francis, 2005.

Reference Books:

1. Desai Ashok V., Non-Conventional Energy, Wiley Eastern Ltd., 1980.
2. Jadhav D.A., Behera, M., Sevda, S., Shah M. 2024. Advances in Environmental Electrochemistry, Elsevier Publications

MOOC / NPTEL Courses:

1. Swayam Course “Waste to Energy Conversion”, Prof. P. Mondal, (Link of the Course: https://onlinecourses.nptel.ac.in/noc20_ch16/preview)

JSPM University Pune

Faculty of Science and Technology

School of Civil and Environmental Sciences

NEP aligned Syllabus

for

Final Year B. Tech (Civil Engineering)

(Effective from AY: 2026-27)

JSPM University Pune

L.Y. B.Tech. "Civil Engineering"

Semester- VII

Course Type: PCC	**Course Title: Transportation Engineering**	
Course Code: 240GCEB20	**Teaching Scheme:**	**Examination Scheme:**
Credits: 2.0	**Lecture (L): 02** **Tutorial (T): --** **Practical (P): --** **Experiential Learning (EL): 00**	**Theory: 100 Marks**

Prerequisite Courses, if any:
1. Engineering mechanics, 2. Surveying and 3. Basics of Civil Engineering

Course Objective: After completion of this course, students will be able to

- Understand the principles of highway planning, development policies, and alignment surveys in India.
- Apply geometric design principles for safe and efficient highway alignment.
- Evaluate the properties and performance of pavement materials used in highway construction.
- Understand construction techniques and specifications of flexible and rigid pavements.
- Analyze highway drainage systems and design appropriate surface and subsurface drainage.
- Understand traffic engineering principles, traffic studies, and control mechanisms.

Course Outcomes: On completion of the course, learner will be able to

CO1: Demonstrate and conduct alignment surveys.
CO2: Design highway geometric elements.
CO3: Analyze and test pavement materials.
CO4: Describe and apply pavement construction methods and specifications.
CO5: Design highway drainage system.
CO6: Conduct traffic studies and apply traffic regulation and control measures.

Course Contents

Unit I	**Highway Planning**	**(5 Hrs)**

Principles of Transportation Engineering: Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute. **Highway Development and Planning:** Road types and classification, road patterns, planning surveys, Twenty-year Road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY). **Highway Alignment and Surveys**: Factors affecting the alignment, Engineering surveys- Map study, Reconnaissance, Preliminary and Final location & detailed survey.		
Unit II	**Highway Geometric Design**	**(5 Hrs)**
Highway Geometric Design of horizontal alignment elements: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Radius of curve, Transition curve, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves.		
Unit III	**Pavement Materials**	**(5 Hrs)**
Pavement Materials: Sub grade soil - desirable properties-HRB soil classification-determination of CBR and modulus of sub grade reaction with Problems Aggregates-Desirable properties and tests, Bituminous materials- Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material. Uses and properties of bituminous mixes and cement concrete in pavement construction		
Unit IV	**Pavement Construction**	**(5 Hrs)**
Pavement Construction: Pavement types, Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base iii) WMM base, iv) Bituminous Macadam v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete subbase and PQC viii) Concrete roads.		
Unit V	**Highway Drainage**	**(5 Hrs)**
Highway Drainage: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location and Drainage in hill roads.		
Unit VI	**Traffic Engineering**	**(5 Hrs)**
Introduction to Traffic Engineering; Traffic Characteristics- Human, Road and Vehicle; Traffic Surveys- Importance and Methods; Traffic Regulation and Control- Traffic signs and types of control; Road Intersection- Types; Pavement marking and lighting- Importance and types.		

Learning Resources

Textbooks:

1. S K Khanna and C E G Justo, "*Highway Engineering*", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "*Highway Engineering*", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "*Highway Engineering*", University Press.

Reference Books:

1. Relevant IRC Codes
2. Specifications for Roads and Bridges-MoR T&H, IRC, New Delhi.
3. C. JotinKhisty, B. Kentlal, "*Transportation Engineering*", PHI Learning Pvt. Ltd. New Delhi.

MOOC / NPTEL Courses for basic knowledge:

1. NPTEL Course "*Introduction to Transportation Engineering*", Dr. K.S. Reddy and Dr. Bhargab Maitra, IIT Kharagpur

Link of the Course: https://nptel.ac.in/courses/105105107

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: PCC	**Course Title:** Estimation and Quantity Surveying	
Course Code: **240GCEB21**	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any:
Knowledge of building planning, roads and its structural components, construction materials

Course Objectives:

1. To develop the ability to prepare approximate and detailed estimates for various Civil Engineering works.
2. To explain the concepts of the tendering process, contract documents, and arbitration procedures.
3. To enable drafting of detailed specifications and preparation of rate analysis based on material and labour requirements as per standard norms.
4. To explain the concepts of the tendering process, contract documents, and arbitration procedures.

Course Outcomes: On successful completion of this course, the learner will be able to,

CO-1	Demonstrate understanding of the fundamental principles of estimation and prepare approximate estimates for various Civil Engineering works.
CO-2	Prepare detailed estimates for different items of work using appropriate methods and compute reinforcement quantities through Bar Bending Schedule (BBS).
CO-3	Apply engineering principles to prepare detailed estimates for infrastructure projects such as roads, culverts, and elevated water storage tanks.
CO-4	Develop brief and detailed specifications and perform detailed rate analysis based on standard norms of materials and labour.
CO-5	Evaluate depreciation and determine the valuation of properties considering physical condition, specifications, and prevailing market trends.
CO-6	Explain the procedures involved in tendering, construction contracts, and arbitration, and develop standard tender documents in accordance with established practices.

Course Contents

Unit I	Introduction and Approximate Estimating	(6 Hrs)
Concepts of estimation and valuation, purpose and data required for estimation, types of estimates, and items of work in buildings. Units and methods of measurement, preparation of measurement sheet and Bill of Quantities (BOQ). Administrative approval and technical sanction; prime cost, provisional sums, contingencies, rate analysis, lead statement, work-charged establishment, centage charges, and contents of S.S.R. Methods of approximate estimation for buildings, roads, irrigation, water supply, and sanitary works with numerical examples.		
Unit II	**Taking out quantities & Detailed estimate**	**(4 Hrs)**
Preparation of detailed estimates, including factors influencing detailed estimation and methods such as PWD method and Centre Line method. Quantity take-off for load-bearing and RCC framed structures as per IS 1200. Preparation of Bill of Quantities (BOQ). Introduction to Bar Bending Schedule (BBS), its significance, and preparation of BBS for RCC members of buildings.		
Unit III	**Estimation of Other Construction Works**	**(4 Hrs)**
Estimation of earthwork for road construction, road and highway works, steel roof trusses, culverts, and elevated water storage tanks.		
Unit IV	**Specifications and Rate Analysis**	**(6 Hrs)**
Importance and types of specifications; drafting detailed specifications for major civil engineering works such as earthwork, PCC, masonry (stone and brick), RCC, plastering, flooring, painting, and roads. Concept, purpose, and procedure of rate analysis; factors affecting item rates, overheads, task work, and preparation of rate analysis for major civil engineering items.		
Unit V	**Valuation**	**(6 Hrs)**
Principles and purpose of valuation; types of property; distinction between price, cost, and value; factors influencing value; gross and net income; outgoings; and forms of value. Concepts of freehold and leasehold property, depreciation and its methods, obsolescence, sinking fund, years' purchase, and annuity. Methods of valuation of land and buildings including rental method, direct comparison method, profit method, development method, rent fixation, and belting method of land valuation.		
Unit VI	**Tenders, Contracts and Arbitration**	**(4 Hrs)**
Basics of tendering including procedure, EMD, security deposit, contractor qualification, and bid systems. Overview of tender evaluation, e-tendering, BOT, and PWD procedures for execution of works. Fundamentals of contracts covering essentials of a valid contract, types, key conditions, payments, and termination. Introduction to arbitration, its need, and role of an arbitrator.		

Learning Resources

Text books

1. A Textbook of Estimating and Costing (Civil), D D Kohli and R C Kohli, S. Chand & company, New Delhi.
2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities press

3. A Text Book of Estimating and Costing for Civil Engineering, G.S. Birdie, Dhanpat Rai Publishing Company

Reference Books

1. Estimating and Costing in Civil Engineering: Theory and Practice, B. N Dutta and S. Dutta , 28th revised edition, CBS Publishers and distributors.
2. Estimating, Costing Specifications & valuation in Civil Engineering, M. Chakraborty.
3. Estimating and Costing, R. C. Rangwala, Charotar Publishing House Pvt Ltd, Anand.
4. Theory and Practice of Valuation, Dr. Roshan Namavati, Lakhani Publications.
5. Valuation Principles and Procedures, Ashok Nain, Dewpoint Publication.
6. Laws for Engineers, Dr. Vandana Bhat and Priyanka Vyas, ProCare.

Hand books and Indian Standards

1. Standard contract clauses for domestic bidding contracts: ministry of statistics and program implementation, Government of India.
2. Document: Federation International Des Ingenieurs Conseils (FIDIC) i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
3. Indian Practical Civil Engineers Handbook: P. N. Khanna, UBS Publication Distri. Pvt. Ltd.
4. Quantity Surveyor's Pocket Book by Duncan Cartlidge.
5. IS 1200: --- (Part 1 to 25): Methods of Measurement of Building & Civil Engineering Works, Bureau of Indian Standards, New Delhi.
6. IS 3861:1966, Method of measurement of areas and cubical contents of buildings, Bureau of Indian Standards, New Delhi. 07 D. S. R. (District Schedule of Rates) for current year. 08 PWD Redbooks, Vol 1 & 2.

MOOC / NPTEL Courses:

1. NPTEL Course- Quantity Surveying and Valuation – Prof. S.K. Bhattacharjee, IIT Kharagpur Link of the course**:** https://nptel.ac.in/courses/105105205

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: PCC	**Course Title:** Foundation Engineering	
Course Code: 240GCEB22	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 2	**Lecture (L):** 2 **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH):** 50 Marks

Prerequisite Courses, if any:
1. Soil Mechanics/Geotechnical Engineering

Course Objectives:
- To provide knowledge of various types of foundations, their selection criteria, and methods of soil exploration.
- To develop the ability to analyze and design shallow and deep foundations using theoretical approaches and codal provisions.
- To introduce solutions for foundations on problematic soils.

Course Outcomes: Students completing the course will be able to:
CO1: Classify various types of foundations and select suitable foundation types based on soil conditions and site investigations.
CO2: Compute the bearing capacity of shallow foundations using classical theories and IS code provisions.
CO3: Estimate settlement of shallow foundations and determine allowable bearing pressure using codal methods and in-situ test data.
CO4: Analyze the types, functions, and installation methods of pile foundations, and compute load carrying capacity of single piles using static and dynamic formulae.
CO5: Compute load carrying capacity of pile groups and analyze group efficiency, and settlement.
CO6: Identify challenges associated with problematic soils and propose suitable foundation solutions.

Course Contents

Unit I	**Foundation Classification and Soil exploration**	**(5 Hours)**

Types of foundation, Factors affecting the selection of types of foundations, steps in choosing types of foundation based on soil condition.
Soil exploration – boring, Standard Penetration Test (SPT), Cone Penetration Test (CPT), Types of samples, Geophysical Exploration.

Unit II	**Shallow Foundation - I**	**(6 Hours)**

Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Meyerhoff, Terzaghi, Skempton, Vesic etc), bearing

capacity determination using IS Code (IS 6403), Bearing capacity of layered soil. Presumptive bearing capacity.		
Unit III	**Shallow Foundation – II**	**(6 Hours)**
Settlements: components of settlement & its estimation (IS 8009), permissible settlement, Allowable bearing pressure. Bearing capacity from in-situ SPT test, Factors affecting bearing capacity. Bearing capacity of raft/mat foundation as per codal provisions, Contact pressure under rigid and flexible footings.		
Unit IV	**Pile Foundation-I**	**(5 Hours)**
Introduction, use of piles, load transfer mechanism, types of piles and their function, factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formula (ENR and Hiley).		
Unit V	**Pile Foundation-II**	**(4 Hours)**
Pile group: Load carrying capacity of pile group, Group Efficiency of piles, settlement of pile group. Negative skin friction.		
Unit VI	**Foundations on problematic soil**	**(4 Hours)**
Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures. Introduction to geosynthetics-types and uses.		

Learning Resources

Text Books:

1. P. R. Rethaliya, “Soil Mechanics”, Atul Prakashan, 1st edition 2020.
2. P. R. Rethaliya, Geotechnical Engineering-II, Atul Prakashan, 1st edition 2020.
3. Punamia, B.C., Soil Mechanics & Foundation Engineering, Laxmi Publication Pvt. Ltd., Delhi, 16th edition, 2005.

Reference Books:

1. Foundation Engineering, Peck hanson & Thronburg(1974). John Wiley & Sons.
2. Analysis and design of Subsructures- Swami Saran (2009), Oxford & IBH
3. Foundation Engineering Naryana S Naik(2012), Dhanphat Rai publishers, New Delhi
4. Winterkorn, H.F. and Fang, Y.F., Foundation Engineering Handbook, Van Nostrand Reinhold, 1994.
5. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
6. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
7. Grigorian, Pile Foundation for Buildings and Structures in collapsible Soil, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1999.
8. Bowles, J.E., "Foundation Analysis and Design, 5th Edition, McGraw Hill, New York, 1995.
9. Braja Das, M., Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., 8th edition, 2010.

MOOC / NPTEL Courses:

1. NPTEL Course “Foundation Engineering-1”, Dr. Kousik Deb, IIT Kharagpur (Link of the Course: https://archive.nptel.ac.in/courses/105/105/105105176/)

Additional Web Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ce03/preview#

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: PEC	**Course Title: Hydrology and Water Resource Engineering**	
Course Code: 240GCEB26	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 3 Hrs./ week**	**Theory: 100 Marks**

Prerequisite Courses, if any:

1. Fundamentals of Physics, Mathematics and Engineering Mechanics

Course Objectives:

- To introduce the fundamental concepts of hydrology, including the hydrologic cycle, precipitation, and their measurement and analysis for engineering applications.
- To develop an understanding of evaporation, evapotranspiration, infiltration, and runoff processes, and their role in the hydrological cycle.
- To impart knowledge of hydrograph analysis, unit hydrograph theory, and methods for estimation of runoff and flood discharge.
- To familiarize students with groundwater hydrology, flood routing techniques, and their applications in water resources planning and management.

Course Outcomes: On completion of the course, learner will be able to

CO1: Understand the fundamentals of the hydrologic cycle and analyze different forms of precipitation, including their measurement, distribution, and statistical analysis for engineering applications.

CO2: Evaluate evaporation and evapotranspiration processes and apply appropriate methods to estimate water losses and consumptive use under varying climatic conditions.

CO3: Analyze soil-water relationships, infiltration processes, and runoff generation, and assess their impact on catchment hydrology and streamflow characteristics.

CO4: Develop and interpret hydrographs, and apply unit hydrograph theory and related methods for runoff estimation in gauged and ungauged catchments.

CO5: Estimate flood discharge and perform flood frequency analysis using statistical methods, and apply hydrologic and hydraulic routing techniques for flood prediction and management.

CO6: Understand groundwater occurrence and movement and apply principles such as Darcy's law to analyze flow in confined and unconfined aquifers.

Course Contents

Unit I	**Introduction to Hydrology and Precipitation, Evaporation, Evapotranspiration**	**(8 Hrs)**
Description of Hydrologic Cycle, Overview of application of hydrology in engineering, Forms and types of precipitation, basic concepts of weather systems, characteristics of precipitation in India. Measurement of precipitation, types of rain gauges, rain gauge network, collection and presentation of rainfall data, Test for consistency and continuity of data, analysis of rainfall data, average precipitation over an area, intensity-duration-frequency analysis and depth-area-duration analysis.		
Unit II	**Evaporation and Evapotranspiration**	**(7 Hrs)**
Evaporation and Evaporation Process, measurement, estimation and control of evaporation. Evapotranspiration, measurement and estimation of evapotranspiration, Consumptive use of water, Factors affecting evapotranspiration.		
Unit III	**Infiltration and Runoff**	**(8 Hrs)**
Soil classification, Soil moisture, Field capacity, Permanent, and temporary wilting point, Available moisture, Measurement of soil moisture, Soil moisture tension, Infiltration process, measurement of infiltration, infiltration models and infiltration indices and effective rainfall. Methods of measurement of stream flow, stage-discharge relationship, Runoff characteristics, catchment characteristics effecting the runoff, yield from a catchment, flow duration curve and flow mass curve.		
Unit IV	**Hydrograph Theory**	**(7 Hrs)**
Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph, S-hydrograph and instantaneous unit hydrograph, Derivation of unit hydrograph for ungauged catchments, conceptual models, synthetic unit hydrograph and its derivation.		
Unit V	**Floods and Flood Routing**	**(8 Hrs)**
Estimation of peak discharge, rational method, SCS method and unit hydrograph method, Design flood, return period, flood frequency analysis, probabilistic and statistical concepts. Gumbel's methods. Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Channel routing, Muskingum and Muskingum-Cunge methods of channel routing and flood forecasting.		
Unit VI	**Groundwater**	**(7 Hrs)**
Occurrence of groundwater, types of aquifers, aquifer properties, Groundwater movement, Darcy's law, Conductivity and Transmissivity, Steady Groundwater Flow Analysis, Groundwater flow in confined and unconfined aquifers		

Learning Resources

Text Books:

1. Chow V.T., Maidment D., Mays L.W., Applied Hydrology, Tata McGraw Hill Publications, 2010, Second Edition.
2. Todd, D.K., and Mays, L.W., Groundwater Hydrology, John Wiley & Sons, Singapore, 2018

Reference Books:

1. Subramanya K., Engineering Hydrology, Tata McGraw Hill Publications, 2018, Fifth Edition.
2. Mays L.W., Water Resources Engineering, Wiley Publications, 2012, Second Edition.

Website Links:

Hydrology NPTEL Course: https://nptel.ac.in/courses/105103213

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: PEC	Course Title: Groundwater Hydrology	
Course Code: 240GCEB27	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 3 Hrs./ week**	**Theory: 100 Marks**

Prerequisite Courses, if any: Fundamentals of Physics, and Mathematics

Course Objective:

- To introduce the fundamental concepts of groundwater, aquifer properties, and methods of groundwater exploration.
- To develop understanding of groundwater flow principles and analytical methods for solving steady and unsteady flow problems.
- To impart knowledge of aquifer evaluation techniques, well design, construction, and performance analysis.
- To familiarize students with groundwater modeling, resource assessment, and sustainable development and management practices.

Course Outcomes: On completion of the course, learner will be able to

CO1. Explain the fundamental concepts of groundwater, including aquifer properties, water table behavior, and methods of groundwater exploration.
CO2. Apply principles of groundwater flow, including Darcy's law and governing equations, to analyze flow in confined and unconfined aquifers.
CO3. Evaluate aquifer characteristics using pumping test data and apply analytical methods to determine aquifer parameters.
CO4. Describe the design, construction, and performance evaluation of wells, and assess factors affecting well efficiency.
CO5. Analyze groundwater flow systems using physical, analog, and numerical modeling techniques with emphasis on finite difference methods.
CO6. Assess groundwater resources and develop sustainable groundwater management strategies, including recharge methods and resource evaluation.

Course Contents

Unit I	Introduction to Groundwater	(8 Hrs)

Ground water and surface water advantages and disadvantages, porosity, specific yield and specific retention of water in rocks/aquifers, compressibility of rock, zone of aeration and saturation, fluctuation of water table and piezometric surfaces, storage coefficients of aquifers, specific yield, specific retention, unconfined and confined aquifer, ground water potential in India, geophysical methods for groundwater explorations.

Unit II	Groundwater Flow	(7 Hrs)

Laminar and turbulent flow, Darcy's law, Reynolds number, permeability and transmissibility, Groundwater flow potential, Ground water theory for one, two and three dimensional problem, Differential equations governing groundwater flow for steady and unsteady state problems, Theim and Dupuit's theory for unconfined and confined aquifers, use of finite difference method to solve simple ground water flow problem		
Unit III	**Evaluation of Aquifer Properties**	**(8 Hrs)**
Aquifer tests, control well, observation well, Solution of aquifer parameters for confined aquifer by Theis method, Jacob and Chow's method, Theis' recovery method, bounded aquifer, interference among wells, aquifer properties for bounded aquifers by theory of images.		
Unit IV	**Construction of Wells**	**(7 Hrs)**
Types of wells and method of construction, tube well design and well drilling: well screen, development and completion of wells, well performance test, well loss, Rotary drilling and Rotary percussion drilling, maintenance of wells.		
Unit V	**Groundwater Modeling Techniques**	**(8 Hrs)**
Groundwater flow, objectives of ground water modeling, physical models, analog models such as viscous flow models, membrane model, thermal model, electric analog model, numerical model with emphasis on finite difference method		
Unit VI	**Groundwater Development and Management**	**(7 Hrs)**
Components of ground water balance, estimation of recharge component, ground water storage changes, conjunctive use, artificial recharge of groundwater- different methods, subsurface dam, recharge by urban storm runoff, percolation from tanks, recharge from irrigated fields, groundwater quality, estimation of ground water discharge, ground water resource evaluation in India.		

Learning Resources

Text Books:

4. Karamouz, M., Ahmadi, A., and Akhbari, M., Groundwater Hydrology: Engineering, Planning and Management, CRC Press, Taylor and Francis Group, 2020
5. Todd, D.K., and Mays, L.W., Groundwater Hydrology, John Wiley & Sons, Singapore, 2018

Reference Books:

1. Rastogi, A.K., Numerical Groundwater Hydrology, Penram International Publishing Pvt. Ltd., 2012

2. Davis, S. N., and De Weist, R. J. M., Hydrogeology, John Wiley & Sons, New York, 2013

3. Chahar, B. R., Groundwater Hydrology, McGraw Hill Education (India) Private Limited, New Delhi, 2015

Website Links:
Groundwater Hydrology NPTEL Course: https://nptel.ac.in/courses/105103026

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: PEC	**Course Title: Water Resources Planning And Management**	
Course Code: 240GCEB28	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 3 Hrs./ week**	**Theory: 100 Marks:**

Prerequisite Courses, if any:

2. Fundamentals of Physics, Mathematics and Engineering Mechanics

Course Objectives:

- To introduce the concepts of reservoir planning, water policies, and methods for estimating reservoir capacity, yield, and flood routing.
- To develop understanding of irrigation and hydropower planning, including water requirements, reservoir operation, and energy generation.
- To impart knowledge of systems analysis, optimization techniques, and economic evaluation methods used in water resources planning.
- To familiarize students with watershed management, basin planning, and environmental aspects of sustainable water resources development.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the principles of reservoir planning, including water policies, reservoir capacity estimation, sedimentation analysis, and flood routing methods.

CO2: Analyze irrigation water requirements and apply reservoir operation strategies such as standard operating policies, hedging rules, and rule curves.

CO3: Evaluate hydropower potential and plan different types of hydropower plants using flow and load duration curves.

CO4: Apply systems analysis and optimization techniques, including linear programming and simulation methods, for water resources planning and management.

CO5: Assess economic feasibility of water resources projects using discounting techniques such as benefit-cost ratio, internal rate of return, and present worth methods.

CO6: Analyze watershed management practices and basin-level planning, including water balance, inter-basin transfer, and environmental considerations.

Course Contents

Unit I	**Introduction**	**(8 Hrs)**

Introduction, National water policy, Development stages for conservation and flood protection purpose, reservoir yield and capacity, mass curve, sequent peak method, reservoir sediment distribution by various methods, flood routing and various methods.		
Unit II	**Reservoir Planning for Irrigation**	**(7 Hrs)**
Planning for irrigation, evapotranspiration, methods of evapotranspiration, crop irrigation requirement, Reservoir operation- standard operating policy, Hedging rules and rule curves, reservoir regulation.		
Unit III	**Reservoir Planning for Hydropower**	**(8 Hrs)**
Planning for hydropower, flow duration curve and load duration curve, Planning for run-of-the river plant, planning of storage plant, base load plant, peak load plant and its planning, reservoir regulation.		
Unit IV	**Systems Analysis in Water Resources Planning**	**(7 Hrs)**
Concepts, optimizing techniques, conventional and evolutionary, simulation, applications of soft computing techniques for water resources planning and management. Linear programming, Formulation of model, solution by Graphical method and software		
Unit V	**Water Resources Economics**	**(8 Hrs)**
Water resources economics- cash flow diagram, discounting Factors, discounting techniques-benefit- cost ratio, internal rate of return, Annual cost and Present worth method, Evaluation of discounting techniques		
Unit VI	**Watershed Management and Basin Planning**	**(7 Hrs)**
Concept and principles of watershed management, Water balance of a basin, integrated river basin development, River water disputes, Inter-basin river water transfers, Environmental considerations in water resources planning.		

Learning Resources

Text Books:

1. S. K. Jain and V. P. Singh, “Water Resources Systems Planning and Management,” Elsevier Science B.V, Amsterdam, 2003.
2. Bhave, P. R., Water Resources Systems, Narosa Pub. House Pvt. Ltd., India, 2011.

Reference Books:

1. Daniel P. Loucks and Eelco van Beek, “Water Resource Systems Planning and Management” Springer Cham, 2017.
2. Vedula, S. and Majumdar, P. P., Water Resources Systems. Modelling Techniques and Analysis, TATA Mc Graw Hill, 2005

Website Links:
Water Resources Systems Planning and Management NPTEL Course:
https://nptel.ac.in/courses/105108081

JSPM University Pune Final. Year. B.Tech. Semester- VII		
Course Type: RMC	**Course Title: Research Methodology**	
Course Code:	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):3** **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH): 100** Marks

Prerequisite Courses, if any:
To undertake this course, students are expected to possess:

- A foundational understanding of statistical concepts including mean, median, mode, and standard deviation.
- Basic proficiency in using spreadsheets (MS Excel or Google Sheets).
- Prior exposure to laboratory work, project-based learning, or technical documentation.
- A general awareness of scientific and technical communication formats.

Course Objectives: This course is designed to:

1. To understand and apply fundamental concepts, types, and methodologies of research in solving real-world problems.
2. To develop the ability to formulate research problems, objectives, and testable hypotheses.
3. To design and implement appropriate data collection methods, sampling techniques, and research instruments ensuring reliability and validity.
4. Cultivate ethical research practices and skills in technical report writing and documentation.

Course Outcome:
Upon completion of this course, students will be able to:
CO1: Understand and explain fundamental concepts of research, including its objectives, characteristics, types, and methodologies.
CO2: Identify and formulate research problems, objectives, and hypotheses for a given research scenario.
CO3: Employ appropriate data collection methods and tools relevant to engineering and technological research.
CO4: Apply suitable sampling techniques and determine appropriate sample size for research studies.

CO5: Analyze and interpret data using basic statistical tools, graphical methods, and concepts of correlation and regression.

CO6: Develop and present a structured research report adhering to scientific writing standards, citation styles, and ethical practices.

Course Contents

Unit I	**Introduction to Research**	**(7 Hours)**
Meaning and Definition of Research, Objectives of Research, Characteristics of Research, Need of Research, Importance of Research, Types of Research, Research Methods vs. Research Methodology		
Unit II	**Research Design and Problem Formulation**	**(7 Hours)**
Research Design, Identification and formulation of research problems - Research objectives and research questions, Research Hypothesis: Concepts, types, characteristics of a good hypothesis, null and alternative hypotheses,		
Unit III	**Data Collection and Instrumentation**	**(8 Hours)**
Types and sources of data, Data collection techniques: Questionnaires, Interviews, Observations, Online surveys, Construction and characteristics of data collection instruments - Concepts of reliability and validity in instrument design - Introduction to digital tools for data collection (Google Forms, Microsoft Forms, SurveyMonkey).		
Unit IV	**Sampling Techniques**	**(8 Hours)**
Concepts of population, sampling frame, sample, and sample size - Probability sampling methods: Simple Random, Systematic, Stratified, Cluster - Non-probability sampling methods: Convenience, Judgmental, Snowball, Quota - Characteristics of a good sample; sampling and non-sampling errors - Practical considerations in sample selection.		
Unit V	**Data Analysis and Presentation**	**(7 Hours)**
Data preparation: Editing, coding, tabulation, Measures of central tendency and dispersion - Graphical representation: Bar charts, pie charts, histograms, line graphs, scatter plots, Basic interpretation of correlation and regression outputs - Conceptual understanding of statistical significance and confidence levels.		
Unit VI	**Scientific writing**	**(8 Hours)**
Structure and components of a research paper: Abstract, Introduction, literature review Methodology, Results, Conclusion - Presentation of findings and use of visuals in technical documentation - Citation and referencing styles (IEEE and APA) - Use of reference management software (Mendeley/Zotero) - Understanding plagiarism, authorship, copyright, and research misconduct.		

Learning Resources

Textbooks:

1. C. R. Kothari , "*Research Methodology: Methods and Techniques*" , New Age International Publishers.
2. Deepak Chawla & Neena Sondhi , "*Research Methodology: Concepts and Cases",* Vikas Publishing House.

Reference Books:

1. Ranjit Kumar, "*Research Methodology: A Step-by-Step Guide for Beginners*", SAGE Publications India

2. P. C. Tripathi, "*Research Methodology in Social Sciences"* , Sultan Chand & Sons
3. Satyabhushan Dash & Naresh Malhotra, "*Marketing Research: An Applied Orientation",* Pearson India

MOOC / NPTEL Courses:

NPTEL Course: "Business Research Methods", Dr G Parameshwari, Department of Commerce, PES College of Science Arts and Commerce, Mandya, Karnataka
Link: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec20_mg14

JSPM University Pune Final Year B. Tech. Civil Engineering Semester- VII		
Course Type: MMC	**Course Title:** 3D Printing and Special Concrete Lab	
Course Code: 240GCEB23	**Teaching Scheme:** Hrs./Week	**Examination Scheme:**
Credits: 1	**Practical (P):** 2	**Practical: 50 marks**

Experiment No.	Experiment Name (Any 10)
1.	Creation of 3D Models Using CAD Software (AutoCAD / Fusion 360 / TinkerCAD)
2.	Conversion of CAD Models into STL Format and Verification
3.	Slicing of STL Models Using Simplify3D Software
4.	Visualization and Error Checking of G-code in Simplify3D
5.	Dry Run of 3D Printing Operation Using Generated G-code
6.	Printing of a Basic CAD Model Using 3D Concrete Printer
7.	Preparation of 3D Printable Mortar Mix
8.	Flow Table Test for Determining Flowability of Printable Mortar
9.	Evaluation of Shape Retention and Buildability of Printable Mix
10.	Compressive Strength Test on 3D Printed and Conventionally Cast Specimens
11.	Study of Non-Destructive Testing (NDT) – Rebound Hammer Test
12.	Mix Design of High-Strength Concrete (HSC)
13.	Preparation of Lightweight Concrete

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VII

Course Type: LC	**Lab Course Title: Transportation System Lab**	
Course Code: 240GCEB24	**Teaching Scheme:**	**Examination Scheme:**
Credits: 1	**Lecture (L):** **Tutorial (T):** **Practical (P): 2** **Experiential Learning (EL):**	**Practical (PR): 50 Marks**
Prerequisite Courses, if any: -		

List of Laboratory Experiments	
Tests on Aggregate	
1	Aggregate Impact Value Test
2	Aggregate Crushing Strength Test
3	Los Angeles Abrasion Test
4	Shape Test (Flakiness and Elongation Index)
5	Specific Gravity and Water Absorption Test
Tests on Binder	
1	**Penetration Test**
2	Ductility Test
3	Softening Point Test
4	Flash Point & Fire Point Test
5	Viscosity Test
Tests on Bituminous Mix	
1	Demonstration of Marshall Stability Test
2	Bitumen Extraction Test
Road Design Software	
1	Demonstration of Open Roads Designer

BOOKS:

1. Dr. S.K. Khanna and C.E.G. Justo “Highway Engineering”
2. S.K. Khanna “Laboratory Manual in Highway Engineering”
3. Relevant IS Codes, ASTM, AASHTO and IRC

SEMESTER-VIII

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VIII

Course Type: PEC	**Course Title: Railway, Airport, Docks and Harbor Engineering**	
Course Code: 240GCEB30	**Teaching Scheme:** (Hrs./Week)	**Examination Scheme:**
Credits: 3	**Lecture (L):3** **Tutorial (T):** 0 **Practical (P):** 0 **Experiential Learning (EL):** 0	**Theory (TH): 50** Marks

Prerequisite Courses, if any: Transportation Engineering

Course Objectives: This course is designed to:

5. To develop understanding of railway track components, turnouts, signalling, and interlocking systems.
6. To analyze planning and design principles of runways, taxiways, and airport layouts.
7. To evaluate terminal area requirements, airport pavements, and operational systems.
8. To understand planning, design, and functional requirements of docks and harbours under environmental conditions.

Course Outcome:

Upon completion of this course, students will be able to:

CO1: Analyze railway track components and points and crossing systems for or safe and efficient railway operations.

CO2: Assess signalling and interlocking systems for effective train control.

CO3: Analyze runway and taxiway design parameters for optimal airport planning.

CO4: Evaluate terminal area, pavement, and operational systems in airports.

CO5: Explain the components of Docks and harbours

CO6: Design layouts of docks and harbours considering functional and environmental factors.

Course Contents

Unit I	**Introduction to Railways Track and turnouts**	**(8 Hours)**

Track structure and its components, Coning of wheels, Rail fastenings, Creep, Types of Sleepers, Sleeper density, Ballast, Points and Crossings, Switches, Heel divergence, Types of crossings, Crossing clearance and angle, Laying and maintenance of points and crossings

Unit II	**Signalling and Interlocking in Railways**	**(7 Hours)**

Signal classification, Special signal, layout, Control of movements on track, Telecommunication and electrification, Methods of interlocking, Slotting of signals, Detectors, Interlocking of level crossing		
Unit III	**Airport Runway and Taxiway Design**	**(8 Hours)**
parts of aeroplane, aircrafts characteristics, aerodromes, airport classifications as per ICAO. Wind rose and orientation of runway ,wind coverage and crosswind component, factors affecting runway length, basic runway length, runway geometrics and runway patterns, Runway marking, taxiway geometric elements, layout, exit taxiway, Loading aprons, Holding aprons, Separation Clearance.		
Unit IV	**Terminal Area and Airport Pavement**	**(8 Hours)**
Terminal area elements and requirements, systems of air parking, gate position and capacity design aircraft parking, Hangars, Typical Airport layouts, maintenance and evaluation of airport pavement, Classification of Aircraft pavement as per ICAO, airport drainage characteristics and requirement, airport markings, Elements of airport lighting, Runway Visibility.		
Unit V	**Docks and Harbours**	**(7 Hours)**
Classification of docks and Harbours, Indian ports, Requirement of a good ports and harbours, Facilities in ports, port design, Natural phenomenon affecting the design of Docks and Harbours- Tides, winds and Waves.		
Unit VI	**Planning and layout of Docks and Harbours**	**(7 Hours)**
Layout of docks and Harbours, River ports, Design and Construction of dock walls, Dock entrances, Protection facilities: mount backwater, wall type and special breakwaters, Comparison of mound type and wall type breakwater.		

Learning Resources

Textbooks:

1. Rangwala, *"Railway Engineering*", Charothar Publishing House Pvt. Ltd.

2.S.C.Saxena and S.P.Arora, *"A textbook of Railway Engineering"*, Dhanpat Rai Publications

3. Robert Horonjeff, Francis X. McKelvey , William J. Sproule, Seth B. Young. Planning and Design of Airports. Tata McGraw Hill Pub. Co., New York

4. R. Srinivasan, Harbour, Dock and Tunnel Engineering, Charotar Publications

Reference Books:

1. Indian railways permanent way manual published by Indian Railways corrected upto ACS-4, June 2020
2. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
3. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
4. S.C.Rangwala and P.S.Rangwala. Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

MOOC / NPTEL Courses for basic knowledge:

NPTEL Course *"Railway Engineering",* Prof. Rajat Rastogi, IIT Roorkee

Link of the Course:

https://nptel.ac.in/courses/105107463

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VIII

Course Type: PEC	**Course Title: Urban Transportation Planning**	
Course Code: 240GCEB32	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3.0	**Lecture (L): 03** **Tutorial (T): --** **Practical (P): --** **Experiential Learning (EL): 00**	**CIE: 100 Marks** **ESE: 100 Marks**

Prerequisite Courses, if any:

Course Objective:

- To understand the fundamentals of urban transportation systems and their role in development.
- To introduce the transport planning process and various stages of analysis.
- To provide knowledge of travel demand modelling techniques such as trip generation, distribution, and mode choice.
- To develop understanding of route assignment methods and transportation surveys.
- To explain the relationship between land use, urban structure, and goods movement.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the fundamentals of transportation systems and their role in socioeconomic development.

CO2: Describe and apply the urban transportation planning process.

CO3: Analyze and apply trip generation and trip distribution techniques.

CO4: Evaluate mode choice behaviour using various modal split models.

CO5: Apply route assignment methods and interpret transportation survey data.

CO6: Explain transport–land use interaction and analyze urban goods movement.

Course Contents

Unit I	**Introduction to Transportation Systems**	**(7 Hrs)**

The role of transportation in socioeconomic development and its historical evolution. The characteristics of urban transportation systems, including passenger and freight movement. an overview of emerging trends and future developments in transportation.		
Unit II	**Urban Transportation Planning Process**	**(8 Hrs)**
The concept, objectives, and importance of urban transport planning. The planning steps such as problem identification, solution generation, analysis, evaluation, and selection. Implementation strategies and the sequence of activities involved in transport analysis.		
Unit III	**Trip Generation and Distribution**	**(7 Hrs)**
The travel demand estimation through trip production and attraction concepts along with category analysis. Trip distribution principles include conversion of PA to OD matrices. The gravity and growth factor models and discuss their applications and limitations.		
Unit IV	**Mode Choice Modelling**	**(8 Hrs)**
Factors influencing travel behaviour and mode choice decisions. Various modal split models such as trip-end and trip-interchange approaches. It also covers logit models (binary and multinomial) and basic concepts of model calibration.		
Unit V	**Route Assignment and Surveys**	**(7 Hrs)**
Transport network representation and route choice behaviour. It covers shortest path algorithms and traffic assignment techniques such as all-or-nothing, multipath, and capacity-restrained methods. Different types of transportation surveys, zoning, and movement classifications.		
Unit VI	**Land Use and Goods Movement**	**(8 Hrs)**
The interaction between transportation and land use, basic land-use models like the Lowry model. Different urban structure types such as grid, linear, centripetal, and directional patterns. Classification, analysis, and demand modelling of urban goods movement.		

Learning Resources

Text Books:

1. Kadiyali, L.R. – *Traffic Engineering and Transport Planning*, Khanna Publishers.
2. Khisty, C.J. and Lall, B.K. – *Transportation Engineering: An Introduction*, Prentice Hall.
3. Papacostas, C.S. and Prevedouros, P.D. – *Transportation Engineering and Planning*, Prentice Hall.

Reference Books:

1. Ortuzar, J. de D. and Willumsen, L.G. – *Modelling Transport*, Wiley.

2. Hutchinson, B.G. – *Principles of Urban Transport Systems Planning*, McGraw Hill.
3. Meyer, M.D. and Miller, E.J. – *Urban Transportation Planning: A Decision-Oriented Approach*, McGraw Hill.

MOOC / NPTEL Courses for basic knowledge:

2. NPTEL Course "**Urban Transportation Planning",** Dr. V. Thamizh Arasan, IIT Madras

Link of the Course: https://nptel.ac.in/courses/105106058

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VIII

Course Type: PEC	**Course Title: Introduction to Earthquake Engineering**	
Course Code: 240GCEB34	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 3 Hrs./ week** **Tutorial (T): 0 Hr./ week** **Experiential Learning (EL): 0 Hrs./ week**	**Theory: 100 Marks**

Prerequisite Courses, if any: Strength of Materials, Concrete Structures, Steel Structures Soil Mechanics

Course Objectives:

- To introduce the fundamentals of earthquakes and seismic hazards.
- To provide understanding of structural response under earthquake loading.
- To familiarize students with seismic design philosophy and codal provisions.
- To develop basic skills in earthquake-resistant design of structures.
- To introduce modern concepts in performance-based seismic design.

Course Outcomes: On completion of the course, learner will be able to

CO1: Explain the fundamentals of earthquakes, their causes, and measurement techniques.

CO2: Describe seismic wave propagation and evaluate different types of earthquake hazards.

CO3: Analyze the dynamic response of structures subjected to earthquake forces.

CO4: Interpret the response of structures under earthquake loading using response spectrum concepts.

CO5: Apply seismic design philosophy and codal provisions such as IS 1893 and IS 13920.

CO6: Evaluate performance-based seismic design concepts and suggest appropriate seismic mitigation techniques.

Course Contents

Unit I	**Introduction to Earthquakes and Seismology**	**(5 Hours)**

Definition and causes of earthquakes; Plate tectonics; Seismic zones of India; Focus, epicenter; Types of faults; Elastic rebound theory; Earthquake magnitude and intensity scales (Richter scale, Moment magnitude, Modified Mercalli Intensity); Seismographs and seismograms.

Unit II	**Seismic Waves and Hazard Assessment**	**(4 Hours)**

Types of seismic waves – Body waves (P and S waves), Surface waves (Love and Rayleigh waves); Wave propagation; Attenuation; Earthquake hazards – ground shaking, liquefaction, landslides; Introduction to seismic hazard maps and zoning.

Unit III	Structural Dynamics Basics	(5 Hours)
Degree of freedom; Free and forced vibration; Undamped and damped systems; Natural frequency and time period; Resonance; Concept of damping; Response of Single Degree of Freedom (SDOF) systems; Introduction to Multi Degree of Freedom (MDOF) systems.		
Unit IV	**Response of Structures to Earthquake Loading**	**(6 Hours)**
Concept of response spectrum; Design response spectrum; Effect of earthquake on different types of structures; Load combinations; Base shear concept; Distribution of lateral forces; Torsional effects; Structural irregularities (plan and vertical).		
Unit V	**Earthquake Resistant Design Philosophy**	**(5 Hours)**
Seismic design philosophy – Elastic and inelastic behavior; Ductility concept; Capacity design; Codal provisions as per IS 1893 and IS 13920; Design lateral force calculation; Importance of detailing in seismic design.		
Unit VI	**Introduction to Performance-Based Seismic Design and Mitigation**	**(5 Hours)**
Performance levels (Immediate Occupancy, Life Safety, Collapse Prevention); Interstorey drift; Plastic hinges; Basic concepts of pushover analysis; Seismic retrofitting and strengthening techniques; Base isolation and energy dissipation devices; Overview of modern design approaches.		

Learning Resources

Text Books:

1. S.K. Duggal - Earthquake Resistant Design of Structures
2. Pankaj Agarwal & Manish Shrikhande - Earthquake Resistant Design of Structures.
3. Anil K. Chopra - Dynamics of Structures
4. IS 1893 - Criteria for Earthquake Resistant Design of Structures.
5. IS 13920 - Ductile Detailing of Reinforced Concrete Structures.

Reference Books:

1. Kramer, S.L. - Geotechnical Earthquake Engineering, Pearson
2. Clough & Penzien - Dynamics of Structures, McGraw Hill

Website Links:
NPTEL Course: https://nptel.ac.in/courses/105101004

JSPM University Pune

Final Year B. Tech. Civil Engineering

Semester- VIII

Course Type: PEC	**Course Title: Building Retrofitting Techniques**	
Course Code: 240GCEB35	**Teaching Scheme:**	**Examination Scheme:**
Credits: 3	**Lecture (L): 3 Hrs./ week** **Tutorial (T): 0 Hr./ week** **Experiential Learning (EL): 0 Hrs./ week**	**Theory: 100 Marks**

Prerequisite Courses, if any: Concrete Technology, Reinforced Concrete Structures, Pre-stressed Concrete

Course Objectives:

- Introduce the fundamental concepts of structural deterioration, distress mechanisms, and durability of concrete structures.
- Familiarize students with condition assessment methods and basic Non-Destructive Testing (NDT) techniques used in practice.
- Develop understanding of evaluation of structural conditions and selection of appropriate repair materials and techniques.
- Enable students to understand rehabilitation, retrofitting strategies, and basic repair management practices through case studies.

Course Outcomes: On completion of the course, learner will be able to

CO1: Identify and explain causes of distress and deterioration in concrete structures.

CO2: Describe and apply basic Non-Destructive Testing (NDT) methods for structural assessment.

CO3: Evaluate structural condition and interpret test results for safety and serviceability.

CO4: Select appropriate repair materials based on properties and field requirements.

CO5: Apply suitable repair and rehabilitation techniques for damaged structural elements.

CO6: Plan repair strategies and analyze case studies for real-life structures.

Course Contents

Unit I	**Introduction to Structural Deterioration**	**(5 Hours)**

Overview of repair, rehabilitation and retrofitting, Causes of distress in concrete structures, Deterioration mechanisms: corrosion, carbonation, chemical attack, Durability of concrete: permeability and environmental effects, Condition survey: objectives and stages - Preliminary inspection, Visual inspection, Planning of investigation.

Unit II	**Condition Assessment and NDT Techniques**	**(4 Hours)**

Need for condition assessment, Visual inspection and damage identification, Non-Destructive Testing (NDT): Rebound Hammer Test, Ultrasonic Pulse Velocity (UPV) Test, Semi-destructive methods: Core testing, Pull-out and penetration tests, Chemical tests: carbonation and chloride content, Corrosion assessment: half-cell potential method.		
Unit III	**Evaluation of Structural Condition**	**(5 Hours)**
Structural integrity and safety assessment, Identification of cracks and defects, Evaluation of strength and serviceability, Fire damage assessment (basic concepts), Interpretation of test results, Identification of critical structural elements.		
Unit IV	**Repair Materials**	**(6 Hours)**
Properties of repair materials: compatibility, strength and durability, Conventional materials: cement mortar, micro-concrete, epoxy resins, Introduction to modern materials: Fiber Reinforced Polymer (FRP), polymer-modified mortars, Protective coatings and corrosion inhibitors, Selection criteria for repair materials.		
Unit V	**Concrete Mix Design**	**(5 Hours)**
Types of repairs: temporary and permanent, Crack repair methods: grouting and injection, routing and sealing, Concrete repair techniques: patching, jacketing (RC and steel), Strengthening of beams, columns and slabs, Foundation repair methods (basic), Introduction to retrofitting and seismic strengthening.		
Unit VI	**Repair and Rehabilitation Techniques**	**(5 Hours)**
Planning and execution of repair works, Steps in repair and rehabilitation process, Quality control and safety during repair, Cost considerations and material selection, Maintenance of repaired structures, Case studies: RCC buildings, water tanks and industrial structures.		

Learning Resources

Text Books:

1. Neville, A.M. — Properties of Concrete, 5th Edition (Pearson Education), 2011 / latest reprint, ISBN-13: 9780273755807.
2. Bungey, J.H., Millard, S.G. & Grantham, M.G. — Testing of Concrete in Structures, 4th Edition (Taylor & Francis), 2006 / latest reprint, ISBN-13: 9780415362108.
3. Emmons, P.H. — Concrete Repair and Maintenance Illustrated, 2nd Edition (RSMeans), 2001 / latest reprint, ISBN-13: 9780876290736.
4. Mailvaganam, N.P. — Repair and Protection of Concrete Structures, 1st Edition (CRC Press), 1992 / latest reprint, ISBN-13: 9780419190905.
5. Denison Campbell, Allen & Harold Roper — Concrete Structures: Materials, Maintenance and Repair, 1st Edition (Longman Scientific & Technical), 1991 / latest reprint, ISBN-13: 9780582049994.

Bhattacharjee, B. — Rehabilitation of Concrete Structures, 1st Edition (Woodhead Publishing India), 2014 / latest reprint, ISBN-13: 9789380308999.

Reference Books:

1. Central Public Works Department (CPWD) — Handbook on Repair and Rehabilitation of RCC Buildings, Latest Edition

2. Bureau of Indian Standards — IS 456: Plain and Reinforced Concrete – Code of Practice, Latest Revision
3. Bureau of Indian Standards — IS 15988: Seismic Evaluation and Strengthening of Existing Reinforced Concrete Buildings, Latest Edition, ISBN: Not Applicable.
4. Bureau of Indian Standards — IS 13311 (Part 1 & 2): Non-Destructive Testing of Concrete, Latest Revision

Indian Roads Congress — IRC SP-25: Guidelines on Repair and Rehabilitation of Bridges, Latest Edition

Website Links:

NPTEL Course: https://onlinecourses.nptel.ac.in/noc26_ce45/preview