# MK UNIVERSITY

## PATAN, GUJARAT

**ESTABLISHED BY THE GUJARAT GOVT.** **RECOGNIZED BY UGC UNDER SECTION 2(f) OF UGC ACT,1956**

MK University, Patan
Faculty of Engineering Technology,
Department of Civil Engineering

| DIPLOMA (CIVIL ENGINEERING) SEM-I | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSE CODE | COURSE NAME | LECTURE (HRS.)/WEEK | PRACTICAL (HRS.)/WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE101 | ENGINEERING MATHEMATICS-I | 4 | 0 | 4 | 40 | 60 | 100 |
| 2 | MAJOR | DCE102 | ENGINEERING PHYSICS | 4 | 2 | 6 | 90 | 60 | 150 |
| 3 | MAJOR | DCE103 | ENGINEERING CHEMISTRY | 4 | 2 | 6 | 90 | 60 | 150 |
| 4 | MAJOR | DCE104 | ENGINEERING GRAPHICS & CAD | 4 | 2 | 6 | 90 | 60 | 150 |
| 5 | MINOR | DCE105 | WORKSHOP PRACTICE | 0 | 2 | 2 | 50 | 00 | 50 |
| TOTAL | | | | 16 | 8 | 24 | 360 | 240 | 600 |

| DIPLOMA (CIVIL ENGINEERING) SEM-II | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSE CODE | COURSE NAME | LECTURE (HRS.)/WEEK | PRACTICAL (HRS.)/WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE201 | ENGINEERING MATHEMATICS-II | 4 | 0 | 4 | 40 | 60 | 100 |
| 2 | MAJOR | DCE202 | APPLIED MECHANICS | 4 | 2 | 6 | 90 | 60 | 150 |
| 3 | MAJOR | DCE203 | BUILDING MATERIALS & CONSTRUCTION | 4 | 2 | 6 | 90 | 60 | 150 |
| 4 | MINOR | DCE204 | SURVEYING & LEVELLING | 4 | 2 | 6 | 90 | 60 | 150 |
| 5 | SEC | DCE205 | COMMUNICATION SKILL | 2 | 0 | 2 | 00 | 50 | 50 |
| TOTAL | | | | 18 | 6 | 24 | 310 | 290 | 600 |

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| DIPLOMA (CIVIL ENGINEERING) SEM-III | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSE CODE | COURSE NAME | LECTURE (HRS.)/ WEEK | PRACTICAL (HRS.)/ WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE301 | STRENGTH OF MATERIALS | 4 | 2 | 6 | 90 | 60 | 150 |
| 2 | MAJOR | DCE302 | CONCRETE TECHNOLOGY | 4 | 2 | 6 | 90 | 60 | 150 |
| 3 | MAJOR | DCE303 | FLUID MECHANICS & HYDRAULIC MACHINES | 4 | 2 | 6 | 90 | 60 | 150 |
| 4 | MINOR | DCE304 | INDUSTRIAL VISIT REPORT | 0 | 2 | 2 | 50 | 00 | 50 |
| 5 | IKS | DCE305 | IKS-ANNCIENT INDIAN ENGINEERING PRACTICE | 0 | 2 | 2 | 50 | 00 | 50 |
| TOTAL | | | | 12 | 10 | 22 | 370 | 180 | 550 |

| DIPLOMA (CIVIL ENGINEERING) SEM-IV | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSE CODE | COURSE NAME | LECTURE (HRS.)/ WEEK | PRACTICAL (HRS.)/ WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE401 | STRUCTURAL ANALYSIS | 4 | 2 | 6 | 90 | 60 | 150 |
| 2 | MAJOR | DCE402 | GEOTECHNICAL ENGINEERING | 4 | 2 | 6 | 90 | 60 | 150 |
| 3 | MAJOR | DCE403 | COMPUTER FUNDAMENTALS & PROGRAMMING | 4 | 0 | 4 | 40 | 60 | 100 |
| 4 | MINOR | DCE404 | ENVIRONMENTAL ENGINEERING | 4 | 0 | 4 | 40 | 60 | 100 |
| 5 | VAC | DCE405 | ENVIRONMENTAL SCIENCE | 2 | 0 | 2 | 00 | 50 | 50 |
| TOTAL | | | | 18 | 4 | 22 | 260 | 290 | 550 |

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| DIPLOMA (CIVIL ENGINEERING) SEM-V | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSECODE | CORSENAME | LECTURE (HRS.)/ WEEK | PRACTICAL (HRS.)/WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE501 | DESIGN OF CONCRETE STRUCTURES | 4 | 2 | 6 | 90 | 60 | 150 |
| 2 | MAJOR | DCE502 | DESIGN OF STEEL STRUCTURES | 4 | 0 | 4 | 40 | 60 | 100 |
| 3 | MAJOR | DCE503 | CONSTRUCTION PROJECT MANAGEMENT | 4 | 2 | 6 | 90 | 60 | 150 |
| 4 | MINOR | DCE504 | TRANSPORTATION ENGINEERING | 4 | 0 | 4 | 40 | 60 | 100 |
| 5 | SEC | DCE506 | MIN PROJECT | 0 | 2 | 2 | 50 | 00 | 50 |
| TOTAL | | | | 16 | 6 | 22 | 310 | 240 | 550 |

| DIPLOMA (CIVIL ENGINEERING) SEM-VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SR NO. | COURSE TYPE | COURSECODE | CORSENAME | LECTURE (HRS.)/ WEEK | PRACTICAL (HRS.)/WEEK | CREDITS | EXAMINATION | | TOTAL MARKS |
| | | | | | | | INTERNAL | EXTERNAL | |
| 1 | MAJOR | DCE601 | IRREGATION ENGINEERING | 4 | 2 | 6 | 90 | 60 | 150 |
| 2 | MAJOR | DCE602 | TOWN PLANNING & SMART CITIES | 4 | 2 | 6 | 90 | 60 | 150 |
| 3 | MAJOR | DCE603 | CONSTRUCTION TECHNOLOGY & EQUIPMENT | 4 | 2 | 6 | 90 | 60 | 150 |
| 4 | MINOR | DCE604 | DIPLOMA PROJECT | 0 | 6 | 6 | 150 | 00 | 150 |
| TOTAL | | | | 12 | 12 | 24 | 420 | 180 | 600 |

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## SEMESTER-I

**COURSE CODE: DCE101**

**COURSE NAME: ENGINEERING MATHEMATICS-I**

**Course Objectives:**

- To develop foundational mathematical skills essential for mechanical engineering applications
- To apply algebraic, trigonometric, and calculus concepts to solve engineering problems
- To interpret and analyze data using statistical methods
- To build problem-solving abilities through applied mathematics
- To prepare students for advanced engineering mathematics in subsequent semesters

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Solve** algebraic equations and apply them to engineering problems |
| CO2 | **Apply** trigonometric functions to analyze mechanical systems |
| C03 | **Perform** basic differentiation and integration relevant to engineering applications |
| C04 | **Analyze** data using measures of central tendency and dispersion |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Algebra and Trigonometry**<br>**Topics:**<br>• **Algebra:** Quadratic equations, simultaneous linear equations (2 and 3 variables)<br>• Arithmetic and geometric progressions<br>• **Trigonometry:** Trigonometric ratios, identities, compound angles<br>• Heights and distances (engineering applications)<br>• Complex numbers: basics and operations<br>• **Applications:** Simple harmonic motion, projectile motion, force resolution | 1 | 25% |
| II | **Differential Calculus**<br>**Topics:**<br>• Functions, limits, and continuity<br>• Derivatives: Standard formulas<br>• Rules of differentiation: Product, quotient, chain rule<br>• Applications of derivatives:<br>  ○ Rate of change (velocity, acceleration)<br>  ○ Maxima and minima (optimization problems)<br>  ○ Tangents and normals<br>• Partial differentiation (introduction)<br>• **Applications:** Optimization in design, motion analysis, slope of curves | 1 | 25% |
| III | **Integral Calculus**<br>**Topics:**<br>• Indefinite integrals: Standard formulas | 1 | 25% |

| | | | |
|---|---|---|---|
| | • Methods of integration: Substitution, integration by parts<br>• Definite integrals and properties<br>• Applications of integration:<br>  ○ Area under curves<br>  ○ Volume of solids of revolution<br>  ○ Center of gravity/centroid (basic concepts)<br>• **Applications:** Area calculation in engineering drawings, volume of tanks/containers | | |
| IV | **Statistics and Probability**<br>**Topics:**<br>• **Statistics:** Data classification, frequency distribution<br>• Measures of central tendency: Mean, median, mode<br>• Measures of dispersion: Range, standard deviation, variance<br>• Graphical representation: Histogram, frequency polygon, ogive<br>• **Probability:** Basic concepts, addition and multiplication theorems<br>• **Applications:** Quality control, measurement analysis, manufacturing data interpretation | 1 | 25% |

**Textbooks:**

- Primary: *Engineering Mathematics* — NP Bali & Dr. Manish Goyal
- Primary: *A Textbook of Engineering Mathematics* — B.S. Grewal

**Reference books:**

- *Advanced Engineering Mathematics* — H.K. Das
- *Engineering Mathematics* — D. G. Gupta
- *Basic Technical Mathematics with Calculus* — Allyn J. Washington
- *Mathematics for Mechanical Engineering* — B.V. Ramana

**Online Platforms:**

1. NPTEL Videos: "Basic Course in Mathematics" for engineering
2. Coursera: "Pre-Calculus" by University of California, Irvine

**COURSE CODE: DCE102**

**COURSE NAME: ENGINEERING PHYSICS**

**Course Objectives:**

- To understand fundamental physics principles relevant to mechanical engineering
- To apply physics concepts to solve practical engineering problems
- To develop skills in measurement, experimentation, and data analysis
- To correlate theoretical physics with mechanical systems and applications
- To build foundation for advanced engineering courses

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Apply** mechanics principles to analyze forces, motion, and energy in mechanical systems |
| CO2 | **Explain** thermal physics concepts relevant to heat engines and refrigeration |
| C03 | **Demonstrate** understanding of optics and acoustics in |

| | |
|---|---|
| | engineering contexts |
| C04 | **Perform** measurements using physical instruments and analyze experimental data |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Mechanics & Properties of Matter**<br>**Topics:**<br>• Scalars and vectors, force resolution, moment of force<br>• Laws of motion, friction, work, energy, power<br>• Circular motion, centripetal force<br>• Elasticity: Stress, strain, Hooke's law, Young's modulus<br>• Surface tension and viscosity (basic concepts)<br>• **Applications:** Machine design, material strength, fluid mechanics basics | 1 | 25% |
| II | **Thermal Physics & Thermodynamics**<br>**Topics:**<br>• Heat and temperature, thermal expansion<br>• Calorimetry, specific heat capacity<br>• Laws of thermodynamics (zeroth, first, second)<br>• Heat transfer: conduction, convection, radiation<br>• Kinetic theory of gases (basic)<br>• **Applications:** Heat engines, refrigeration, insulation materials | 1 | 25% |
| III | **Waves, Optics & Acoustics**<br>**Topics:**<br>• Simple harmonic motion, wave motion<br>• Sound: characteristics, intensity, Doppler effect<br>• Ultrasonics and applications<br>• Reflection, refraction, lenses, optical instruments<br>• Fiber optics (basic principles)<br>• **Applications:** Machine vibration, NDT, optical measurements, noise control | 1 | 25% |
| IV | **Modern Physics & Material Science**<br>**Topics:**<br>• Quantum physics basics: photons, matter waves<br>• Lasers: principles, types, applications<br>• Semiconductors: basics<br>• Superconductivity (elementary concepts)<br>• Nanotechnology introduction<br>• **Applications:** Laser machining, sensors, advanced materials | 1 | 25% |

**Textbooks:**

- Primary: *Engineering Physics* — D. R. Khanna & H. N. Srivastava
- Primary: *Engineering Physics* — R. K. Gaur & S. L. Gupta

**Reference books:**

- *Fundamentals of Physics* — Halliday, Resnick & Walker
- *Concepts of Physics* — H. C. Verma

- *Engineering Physics* — M. N. Avadhanulu & P. G. Kshirsagar
- *Practical Physics* — C. L. Arora

**Online Platforms:**

- SWAYAM/NPTEL: "Engineering Physics" courses by IITs/NITs

**PRACTICAL LIST:**

**Section A: Mechanics**

1. Vernier Calipers & Screw Gauge: Measurement of dimensions of given objects
2. Simple Pendulum: Determination of 'g' and study of laws of pendulum
3. Young's Modulus: By Searle's method or cantilever
4. Coefficient of Friction: Using inclined plane
5. Force Table: Verification of law of parallelogram of forces

**Section B: Thermal Physics**

6. Specific Heat Capacity: Of solid/liquid using calorimeter
7. Thermal Conductivity: Of good conductor (Searle's apparatus)
8. Mechanical Equivalent of Heat: Using Joule's calorimeter
9. Coefficient of Linear Expansion: Using optical lever

**Section C: Waves & Optics**

10. Sonometer: Verification of laws of vibrating strings
11. Melde's Experiment: Transverse and longitudinal modes
12. Compound Pendulum: Determination of 'g' and radius of gyration
13. Optical Bench: Focal length of convex lens
14. Prism: Refractive index using spectrometer

**Section D: Modern Physics**

15. LASER: Determination of wavelength using diffraction grating
16. Photoelectric Effect: Verification of Einstein's equation
17. PN Junction Diode: Characteristics
18. Thermistor: Temperature-resistance characteristics

**COURSE CODE: DCE103**

**COURSE NAME: ENGINEERING CHEMISTRY**

**Course Objectives:**

- To provide fundamental knowledge of chemistry relevant to mechanical engineering applications
- To understand material properties, corrosion, fuels, and lubricants from chemical perspective
- To develop skills in chemical analysis, quality control, and material testing
- To correlate chemical principles with mechanical systems and manufacturing processes
- To build foundation for materials science, metallurgy, and environmental engineering

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Explain** water treatment processes for industrial applications |
| CO2 | **Analyze** properties of fuels and lubricants used in mechanical systems |
| C03 | **Identify** corrosion mechanisms and prevention methods |
| C04 | **Apply** principles of electrochemistry to batteries and corrosion control |

| Unit | Content | Credit | Weightage |
|---|---|---|---|

| | | | |
|---|---|---|---|
| I | **Water Chemistry & Treatment**<br>**Topics:**<br>• Water impurities: hardness, alkalinity, pH<br>• Water softening methods: lime-soda, ion exchange<br>• Boiler feed water treatment: scale and sludge formation, prevention<br>• Cooling water treatment<br>• Drinking water standards<br>• **Applications:** Boiler operations, cooling systems, industrial water supply | 1 | 25% |
| II | **Fuels & Combustion**<br>**Topics:**<br>• Classification of fuels: solid, liquid, gaseous<br>• Calorific value determination: bomb calorimeter<br>• Solid fuels: coal analysis (proximate & ultimate)<br>• Liquid fuels: petroleum refining, petrol, diesel, octane/cetane number<br>• Gaseous fuels: LPG, CNG, biogas<br>• Combustion calculations<br>• **Applications:** IC engines, furnaces, power generation | 1 | 25% |
| III | **Lubricants & Corrosion**<br>**Topics:**<br>• Lubrication: mechanisms, types of lubricants<br>• Properties: viscosity index, flash point, pour point<br>• Additives in lubricants<br>• Corrosion: types, mechanisms (electrochemical)<br>• Factors affecting corrosion<br>• Corrosion prevention methods<br>• **Applications:** Machine maintenance, automotive, industrial equipment | 1 | 25% |
| IV | **Engineering Materials & Polymers**<br>**Topics:**<br>• Cement: composition, setting and hardening<br>• Refractories: properties, classification<br>• Polymers: addition, condensation, engineering plastics<br>• Composite materials: introduction<br>• Batteries: primary, secondary, fuel cells<br>• **Applications:** Construction materials, polymers in engineering, energy storage | 1 | 25% |

**Textbooks:**

- Primary: *Engineering Chemistry* — Jain & Jain
- Primary: *Engineering Chemistry* — Dr. O. P. Verma

**Reference books:**

- *A Textbook of Engineering Chemistry* — S. S. Dara & S. S. Umare
- *Engineering Chemistry* — R. P. Mani & K. N. Mishra
- *Chemistry for Engineering Students* — B. S. Jai Prakash & R. Venugopal
- *Applied Chemistry* — H. D. Gesser

**Online Platforms:**

- SWAYAM/NPTEL: "Engineering Chemistry" courses by IITs
- Khan Academy: Chemistry fundamentals
- MERLOT: Chemistry learning materials

**PRACTICAL LIST:**

**Section A: Water Analysis**

1. Determination of Hardness: By EDTA titration method
2. Alkalinity Determination: Using acid-base titration
3. pH Measurement: Using pH meter/universal indicator
4. Chloride Content: By argentometric method

**Section B: Fuels & Lubricants**

5. Viscosity Measurement: Using Ostwald viscometer/Redwood viscometer
6. Flash Point Determination: Using Abel/Pensky Martens apparatus
7. Calorific Value: Bomb calorimeter demonstration
8. Saponification Value: Of oil sample

**Section C: Corrosion & Electrochemistry**

9. Corrosion Rate Measurement: Weight loss method
10. Galvanic Series Determination
11. Electroplating: Copper plating on iron
12. EMF Measurement: Of simple galvanic cell

**Section D: Materials & Polymers**

13. Cement Setting Time: Initial and final setting time
14. Polymer Identification Tests
15. Preparation of Polymer: Phenol-formaldehyde/Bakelite
16. Refractory Properties: Porosity, thermal shock resistance

**COURSE CODE: DCE104**

**COURSE NAME: ENGINEERING GRAPHICS AND CAD**

**Course Objectives:**

- To develop skills in engineering drawing and visualization
- To understand and apply standards in technical drawing (BIS/ISO)
- To master basic CAD software for 2D drawing creation
- To prepare production-ready engineering drawings
- To bridge manual drafting skills with digital CAD competence

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Create** engineering drawings using manual drafting instruments |
| CO2 | **Apply** BIS/ISO standards in dimensioning and tolerancing |
| C03 | **Develop** orthographic projections from pictorial views |
| C04 | **Generate** 2D drawings using CAD software |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Fundamentals & Manual Drafting**<br>**Topics:**<br>• Drawing instruments and their uses | 1 | 25% |

| | | | |
|---|---|---|---|
| | • BIS/ISO conventions and standards<br>• Lettering, line types, dimensioning rules<br>• Geometric constructions<br>• Scales: plain, diagonal, vernier<br>• **Practical:** Manual drafting exercises, sheet layout | | |
| II | **Projections & Views**<br>**Topics:**<br>• Orthographic projections (First angle vs Third angle)<br>• Projection of points, lines, and planes<br>• Projection of solids: prism, pyramid, cylinder, cone<br>• Sectional views: full, half, offset sections<br>• Auxiliary views<br>• **Practical:** Drawing orthographic views from isometric | 1 | 25% |
| III | **CAD Fundamentals**<br>**Topics:**<br>• Introduction to CAD: advantages, applications<br>• AutoCAD interface: workspace, toolbars, commands<br>• Basic drawing commands: Line, Circle, Arc, Polygon<br>• Modify commands: Copy, Move, Rotate, Mirror, Array<br>• Layers, colors, linetypes<br>• Dimensioning and annotation in CAD | 1 | 25% |
| IV | **Applications & Advanced CAD**<br>**Topics:**<br>• Blocks and attributes<br>• Hatching and pattern filling<br>• Plotting and printing to scale<br>• Introduction to 3D modeling basics<br>• Industrial drawing examples: machine parts<br>• **Practical:** Complete drawing projects | 1 | 25% |

**Textbooks:**

- Primary: *Engineering Drawing* — N. D. Bhatt
- Primary: *Engineering Drawing with AutoCAD* — Goutam Pohit & Goutam Ghosh

**Reference books:**

- *Engineering Drawing* — Basant Agrawal & C. M. Agrawal
- *A Textbook of Engineering Drawing* — R. K. Dhawan
- *AutoCAD for Engineers and Designers* — Sham Tickoo
- *Machine Drawing* — K. L. Narayana & P. Kannaiah

**Online Platforms:**

- SWAYAM/NPTEL: "Engineering Drawing" courses by IITs
- Coursera: "Autodesk CAD/CAM/CAE" specialization

**PRACTICAL LIST:**

**Section A: Manual Drafting (Drawing Sheets)**

1. Sheet 1: Lines, lettering, dimensioning practice
2. Sheet 2: Geometric constructions
3. Sheet 3: Orthographic projections of simple solids

4. Sheet 4: Sectional views of machine parts
5. Sheet 5: Development of surfaces

**Section B: CAD Exercises - Basic**

6. CAD-1: AutoCAD interface familiarization
7. CAD-2: Basic shapes using drawing commands
8. CAD-3: Modification exercises
9. CAD-4: Layer management exercise
10. CAD-5: Dimensioning practice

**Section C: CAD Exercises - Intermediate**

11. CAD-6: Orthographic projections in CAD
12. CAD-7: Sectional views in CAD
13. CAD-8: Creating blocks and attributes
14. CAD-9: Plotting and printing
15. CAD-10: Title block creation

**Section D: Project Work**

16. Project 1: Machine component drawing (manual)
17. Project 2: Same component drawing in CAD
18. Project 3: Assembly drawing with parts list
19. Project 4: Complete drawing set: part + assembly
20. Portfolio: Compilation of best work

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# SEMESTER-II

**COURSE CODE: DCE201**

**COURSE NAME: ENGINEERING MATHEMATICS-II**

**Course Objectives:**

- To build advanced mathematical skills for engineering problem-solving
- To apply differential equations to model mechanical systems
- To understand vector algebra and its applications in mechanics
- To develop skills in numerical methods for engineering computations
- To prepare mathematical foundation for subjects like Mechanics, Thermodynamics, and Machine Design

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Solve** ordinary differential equations relevant to engineering systems |
| CO2 | **Apply** vector algebra to analyze forces and motions in 3D space |
| C03 | **Perform** numerical computations using interpolation, differentiation, and integration methods |
| C04 | **Analyze** data using probability distributions and statistical methods |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Differential Equations**<br>**Topics:**<br>• First order differential equations: variable separable, homogeneous, exact<br>• Linear differential equations of first order<br>• Applications: Newton's law of cooling, growth and decay, simple circuits<br>• Second order linear differential equations with constant coefficients<br>• Complementary function and particular integral methods<br>• **Applications:** Spring-mass systems, electrical circuits, vibration analysis | 1 | 25% |
| II | **Vector Algebra & 3D Geometry**<br>**Topics:**<br>• Vectors: dot product, cross product, scalar triple product<br>• Vector differentiation<br>• Gradient, divergence, curl (basic concepts)<br>• Lines and planes in 3D space<br>• Direction cosines and ratios<br>• **Applications:** Force analysis, moment of force, work done by force | 1 | 25% |
| III | **Numerical Methods**<br>**Topics:**<br>• Solution of algebraic equations: Bisection method, | 1 | 25% |

| | | | |
|---|---|---|---|
| | Newton-Raphson method<br>• Interpolation: Newton's forward and backward difference formulas<br>• Numerical differentiation and integration<br>• Trapezoidal rule and Simpson's rules<br>• **Applications:** Root finding in design equations, area calculations, data analysis | | |
| IV | **Probability & Laplace Transforms**<br>**Topics:**<br>• **Probability:** Basic concepts, addition and multiplication theorems<br>• Random variables, probability distributions (Binomial, Poisson, Normal)<br>• Mean, variance, standard deviation<br>• **Laplace Transforms:** Definition, basic transforms<br>• Properties: linearity, shifting, differentiation<br>• Application to differential equations<br>• **Applications:** Quality control, reliability analysis, system dynamics | 1 | 25% |

**Textbooks:**

- Primary: *Higher Engineering Mathematics* — B.S. Grewal
- Primary: *Engineering Mathematics* — NP Bali & Dr. Manish Goyal

**Reference books:**

- *Advanced Engineering Mathematics* — H.K. Das
- *Numerical Methods* — S.S. Sastry
- *Probability and Statistics for Engineers* — Dr. J. Ravichandran
- *Mathematical Methods* — B.V. Ramana

**Online Platforms:**

- NPTEL Videos: "Differential Equations for Engineers"
- Khan Academy: Complete probability and statistics
- MIT OCW: "Single Variable Calculus" continuation
- Coursera: "Introduction to Numerical Methods"

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**COURSE CODE: DCE202**

**COURSE NAME: APPLIED MECHANICS**

**Course Objectives:**

- To understand fundamental principles of mechanics and their applications in engineering
- To analyze forces, moments, and equilibrium in mechanical systems
- To study kinematics and dynamics of particles and rigid bodies
- To apply concepts of friction, work, energy, and power to mechanical systems
- To develop problem-solving skills for engineering mechanics applications

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Apply** principles of statics to analyze equilibrium of forces |
| CO2 | **Calculate** centroids, center of gravity, and moments of inertia |
| C03 | **Solve** problems in kinematics: displacement, velocity, acceleration |
| C04 | **Analyze** dynamic systems using Newton's laws and energy methods |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Statics - Forces & Equilibrium**<br>**Topics:**<br>• Introduction to mechanics: statics and dynamics<br>• System of forces: coplanar concurrent, parallel, non-concurrent<br>• Resolution and composition of forces<br>• Moment of a force, couple, Varignon's theorem<br>• Equilibrium of forces: conditions, free body diagrams<br>• **Applications:** Truss analysis, machine component design | 1 | 25% |
| II | **Centroid, Friction & Virtual Work**<br>**Topics:**<br>• Centroid and center of gravity: simple and composite areas<br>• Moment of inertia: area moment, parallel axis theorem<br>• Friction: laws of friction, angle of repose, wedge friction<br>• Belt friction: flat and V-belts<br>• Virtual work principle<br>• **Applications:** Structural design, machine stability, belt drives | 1 | 25% |
| III | **Kinematics**<br>**Topics:**<br>• Rectilinear motion: displacement, velocity, acceleration<br>• Curvilinear motion: projectile motion<br>• Relative motion<br>• Rotation: angular displacement, velocity, acceleration | 1 | 25% |

| | | | |
|---|---|---|---|
| | • Simple harmonic motion<br>• **Applications:** Mechanism analysis, vehicle dynamics, vibration basics | | |
| IV | **Dynamics**<br>**Topics:**<br>• Newton's laws of motion: application to engineering problems<br>• Work, energy, power: definitions and applications<br>• Impulse and momentum: conservation principles<br>• Collision of elastic bodies: direct and oblique impact<br>• Introduction to vibration: free vibrations<br>• **Applications:** Impact loading, energy calculations, machine dynamics | 1 | 25% |

**Textbooks:**

- Primary: *Engineering Mechanics* — S. S. Bhavikatti & K. G. Rajashekarappa
- Primary: *Applied Mechanics* — R. S. Khurmi

**Reference books:**

- *Engineering Mechanics: Statics & Dynamics* — I. H. Shames
- *Vector Mechanics for Engineers* — Beer & Johnston
- *Engineering Mechanics* — D. S. Kumar
- *Problems in Engineering Mechanics* — S. P. Timoshenko & D. H. Young

**Online Platforms:**

- SWAYAM/NPTEL: "Engineering Mechanics" courses by IITs

**PRACTICAL LIST:**

Section A: Statics Experiments

1. Law of Parallelogram of Forces: Verification using force table
2. Law of Polygon of Forces: Experimental verification
3. Jib Crane Analysis: Forces in members using graphical method
4. Simple Truss Analysis: Using method of joints

Section B: Friction & Center of Gravity

5. Coefficient of Friction: Using inclined plane
6. Angle of Repose: Determination for different materials
7. Center of Gravity: Of irregular lamina using plumb line method
8. Moment of Inertia: Compound pendulum method

Section C: Kinematics Experiments

9. Projectile Motion: Study using projectile apparatus
10. Simple Pendulum: Determination of 'g' and laws verification
11. Flywheel: Moment of inertia determination
12. Atwood's Machine: Verification of laws of motion

Section D: Dynamics & Impact

13. Conservation of Energy: Using inclined track and trolley
14. Coefficient of Restitution: Using ball drop test
15. Impact of Bodies: Direct central impact demonstration
16. Spring Constant: Determination using Hooke's law

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**COURSE CODE: DCE203**

**COURSE NAME: BUILDING MATERIALS AND CONSTRUCTION**

**Course Objectives:**

- To understand the properties, testing methods, and applications of various building materials.
- To study the fundamentals of building construction techniques and practices.
- To learn about masonry, foundations, floors, roofs, stairs, doors, windows, and finishing works.
- To develop skills in selecting appropriate materials and construction methods for different building types.
- To prepare students for practical field applications in construction projects.

**Course Outcomes:** At the end of the course students shall be able to

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| CO1 | **Identify** and **classify** different building materials based on their properties and applications. |
| CO2 | **Explain** the construction procedures for various building components. |
| C03 | **Select** appropriate materials and construction methods for given building requirements. |
| C04 | **Perform** basic tests on building materials and interpret the results. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Building Materials**<br>• **Introduction to Building Materials:**<br>o Classification of building materials: natural, artificial, modern<br>o Requirements of good building materials<br>o Sustainability in material selection<br>• **Stones:**<br>o Classification of rocks<br>o Properties of good building stone<br>o Quarrying, dressing, and uses of stones<br>• **Bricks:**<br>o Composition of brick earth<br>o Manufacturing process: preparation, molding, drying, burning<br>o Classification, properties, and tests on bricks<br>• **Tiles:**<br>o Types of tiles: roofing, flooring, wall tiles<br>o Manufacturing and uses<br>**Applications:** Selection of materials for foundations, walls, and flooring. | 1 | 25% |
| II | **Cement, Concrete and Mortar**<br>• **Cement:**<br>o Types of cement: OPC, PPC, rapid hardening, low heat, etc.<br>o Composition, manufacturing process<br>o Properties and tests on cement | 1 | 25% |

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| | • **Aggregates:**<br>  ○ Classification: fine and coarse aggregates<br>  ○ Properties: shape, texture, strength, durability<br>  ○ Grading and sieve analysis<br>• **Concrete:**<br>  ○ Ingredients of concrete and their functions<br>  ○ Properties of fresh and hardened concrete<br>  ○ Mix design basics (nominal mix)<br>  ○ Types of concrete: plain, reinforced, precast, ready-mix<br>• **Mortar:**<br>  ○ Types: lime, cement, gypsum, mud mortar<br>  ○ Preparation and uses<br>**Applications:** Concrete mix preparation, mortar for masonry, plastering. | | |
| III | **Building Components & Construction**<br>• **Foundations:**<br>  ○ Types: shallow and deep foundations<br>  ○ Spread footing, combined footing, raft, pile, well foundation<br>• **Masonry:**<br>  ○ Stone masonry: rubble and ashlar masonry<br>  ○ Brick masonry: bonds (English, Flemish), junctions<br>  ○ Composite masonry<br>• **Floors and Roofs:**<br>  ○ Types of floors: ground floor, upper floor<br>  ○ Flooring materials: tiles, marble, granite, terrazzo<br>  ○ Types of roofs: flat, pitched, trussed<br>• **Doors, Windows and Ventilators:**<br>  ○ Types of doors: paneled, glazed, flush, sliding<br>  ○ Types of windows: casement, sliding, pivoted<br>  ○ Materials: timber, aluminum, UPVC<br>**Applications:** Construction of foundations, walls, floors, and roofs. | 1 | 25% |
| IV | **Finishing Works & Special Construction**<br>• **Finishing Works:**<br>  ○ Plastering: types, materials, procedure<br>  ○ Pointing: types and methods<br>  ○ Painting: types of paints, preparation of surfaces, application<br>  ○ Damp-proofing: causes, materials, methods<br>• **Formwork and Scaffolding:**<br>  ○ Types of formwork, materials, requirements<br>  ○ Types of scaffolding: single, double, | 1 | 25% |

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| | cantilever<br>• **Modern Construction Methods:**<br>○ Prefabricated construction<br>○ Composite construction<br>○ Green building materials and techniques<br>• **Building Services Basics:**<br>○ Plumbing and sanitary fittings<br>○ Electrical conduits and fittings in buildings<br><br>**Applications:** Surface finishing, waterproofing, modern construction techniques. | | |

**Textbooks:**

- Primary: *Building Construction* — B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain
- Primary: *Building Materials* — S.K. Duggal

**Reference books:**

- *Building Materials and Construction* — Rangwala
- *Construction Technology* — Roy Chudley
- *Civil Engineering Materials* — N. Subramanian
- *Handbook of Building Construction* — V.N. Vazirani & S.P. Chandola

**Online Platforms:**

- NPTEL/SWAYAM: *Building Materials and Construction* by IITs/NITs
- Coursera: *Construction Management* by Columbia University
- edX: *Building Materials and Human Health* by Harvard

**PRACTICAL LIST:**

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| Section A: Material Testing<br>4. Tests on Bricks:<br>○ Water absorption test<br>○ Compressive strength test<br>○ Efflorescence test<br>5. Tests on Cement:<br>○ Consistency test<br>○ Initial and final setting time<br>○ Fineness test<br>6. Tests on Aggregates:<br>○ Sieve analysis<br>○ Specific gravity and water absorption<br>○ Aggregate crushing value test | Section C: Construction Practice<br>7. Brick Masonry:<br>○ Construction of English bond (1 brick thick)<br>○ Construction of Flemish bond (1½ brick thick)<br>8. Plastering and Pointing:<br>○ Application of cement plaster on brick wall<br>○ Practice of different types of pointing<br>9. Formwork and Scaffolding:<br>○ Demonstration of wooden formwork for column<br>○ Erection of simple scaffolding |
| Section B: Concrete and Mortar<br>4. Concrete Mix Preparation:<br>○ Nominal mix proportioning<br>○ Workability test: slump test<br>○ Compaction factor test | Section D: Field Visits & Reporting<br>10. Site Visit Report:<br>○ Visit to ongoing construction site<br>○ Observation of materials, |

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| 5. Mortar Preparation:<br>○ Preparation of cement mortar (1:3, 1:6)<br>○ Preparation of lime mortar<br>6. Compressive Strength Test:<br>○ Casting and testing of concrete cubes<br>○ Casting and testing of mortar cubes | methods, and machinery<br>11. Market Survey Report:<br>○ Survey of building materials available in local market<br>○ Comparison of prices and quality<br>12. Model Making:<br>○ Model of different types of foundations<br>○ Model of roof truss<br>○ Model of brick bonds |

**COURSE CODE: DCE204**

**COURSE NAME: SURVEYING AND LEVELLING**

**Course Objectives:**

- To understand the fundamental principles and classifications of surveying.
- To learn the use of basic surveying instruments and their applications.
- To study various methods of linear, angular, and level measurements.
- To develop skills in conducting chain, compass, and levelling surveys.
- To prepare students for fieldwork in surveying and mapping.

**Course Outcomes:** At the end of the course students shall be able to

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| CO1 | **Use** basic surveying instruments such as chain, compass, dumpy level, and theodolite. |
| CO2 | **Perform** linear and angular measurements in field surveys. |
| C03 | **Conduct** levelling operations and prepare contour maps. |
| C04 | **Calculate** areas and volumes from survey data for engineering projects. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Fundamentals of Surveying and Chain Surveying**<br>• **Introduction to Surveying:**<br>○ Definition, objectives, and classifications<br>○ Principles of surveying<br>○ Units of measurements<br>• **Linear Measurements:**<br>○ Direct methods using chains and tapes<br>○ Types of chains: metric chain, Gunter's chain, engineer's chain<br>○ Ranging: direct and indirect ranging<br>○ Errors in chaining and corrections<br>• **Chain Surveying:**<br>○ Instruments: chain, tape, arrows, ranging rods, offset rod, cross-staff<br>○ Survey stations, base lines, check lines, tie lines | 1 | 25% |

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| | ○ Field work: reconnaissance, station selection, chaining, offsetting<br>○ Booking and plotting of chain survey<br>• **Obstacles in Chaining:**<br>○ Obstacles to ranging and chaining<br>○ Methods to overcome obstacles<br>**Applications:** Land measurement, boundary marking, small area mapping. | | |
| II | **Compass and Theodolite Surveying**<br>○ **Compass Surveying:**<br>▪ Types of compass: prismatic and surveyor's compass<br>▪ Bearings: whole circle bearing, reduced bearing, fore bearing, back bearing<br>▪ Magnetic declination and local attraction<br>▪ Traversing: open and closed traverse<br>▪ Plotting of traverse and balancing of traverse (Bowditch's rule)<br>○ **Theodolite Surveying:**<br>▪ Types of theodolite: vernier, micrometer, digital<br>▪ Components and adjustments of theodolite<br>▪ Measurement of horizontal and vertical angles<br>▪<br>• **Traverse Computations:**<br>○ Latitude and departure<br>○ Closing error and its adjustment<br>○ Area computation by coordinate method<br>**Applications:** Route surveying, traverse for construction layout, angular measurements. | 1 | 25% |
| III | **Levelling and Contouring**<br>• **Levelling:**<br>○ Basic definitions: datum, benchmark, level surface, reduced level<br>○ Types of levelling: simple, differential, profile, cross-sectional<br>○ Instruments: dumpy level, tilting level, auto level, levelling staff<br>○ Temporary adjustments of level<br>○ Booking and reduction of levels: height of instrument method, rise and fall method<br>• **Contouring:**<br>○ Characteristics and uses of contours | 1 | 25% |

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| | ○ Methods of contouring: direct and indirect<br>○ Interpolation of contours<br>○ Drawing contour maps and interpretation<br>• **Applications of Levelling:**<br>○ Longitudinal and cross-sectioning for roads and canals<br>○ Setting out gradients<br>○ Earthwork calculations<br>**Applications:** Road alignment, irrigation canals, site grading, contour mapping. | | |
| IV | **Modern Surveying and Calculations**<br>• **Plane Table Surveying:**<br>○ Instruments and accessories<br>○ Methods: radiation, intersection, traversing, resection<br>○ Advantages and limitations<br>• **Area and Volume Calculations:**<br>○ Area computation: mid-ordinate rule, average ordinate rule, trapezoidal rule, Simpson's rule<br>○ Volume computation: trapezoidal and prismoidal formulas<br>○ Calculation of earthwork for road and canal projects<br>• **Modern Surveying Instruments:**<br>○ Introduction to Total Station: components and working<br>○ Global Positioning System (GPS) basics<br>○ Introduction to remote sensing and GIS in surveying<br>• **Setting Out Works:**<br>○ Setting out buildings, roads, and culverts<br>○ Use of pegs, profiles, and batter boards<br>**Applications:** Construction layout, land development, modern mapping techniques. | 1 | 25% |

**Textbooks:**

- Primary: *Surveying Vol. 1* — Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain
- Primary: *Textbook of Surveying* — S.K. Duggal

**Reference books:**

- *Surveying and Levelling* — R. Subramanian
- *Plane Surveying* — A.M. Chandra
- *Surveying Theory and Practice* — James M. Anderson & Edward M. Mikhail
- *Fundamentals of Surveying* — S.K. Roy

**Online Platforms:**

**PRACTICAL LIST:**

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|---|---|
| **Section A: Chain Surveying**<br><br>1. **Chain Survey of a Small Area:**<br>○ Ranging and chaining of lines<br>○ Taking offsets with cross-staff and optical square<br>○ Plotting of chain survey on drawing sheet<br>2. **Overcoming Obstacles in Chaining:**<br>○ Chaining across a pond (by similar triangles)<br>○ Chaining across a building (by right-angle offsets) | **Section C: Levelling and Contouring**<br>5. **Differential Levelling:**<br>○ Temporary adjustments of dumpy level<br>○ Determining difference in elevation between two points<br>○ Booking by height of instrument and rise & fall methods<br>6. **Profile and Cross-Section Levelling:**<br>○ Longitudinal levelling along a road alignment<br>○ Cross-section levelling at regular intervals<br>○ Plotting longitudinal section and cross-sections |
| **Section B: Compass and Theodolite Surveying**<br><br>3. **Compass Traverse:**<br>○ Measurement of bearings with prismatic compass<br>○ Conducting closed compass traverse<br>○ Plotting and balancing of traverse<br>4. **Theodolite Traverse:**<br>○ Measurement of horizontal angles by repetition method<br>○ Measurement of vertical angles<br>○ Conducting closed theodolite traverse | **Section D: Modern Surveying and Computations**<br>8. **Plane Table Survey:**<br>▪ Radiation method for small area<br>▪ Intersection method for inaccessible points<br>▪ Traversing with plane table<br>9. **Area and Volume Computation:**<br>▪ Area calculation using planimeter<br>▪ Calculation of area from plotted map using trapezoidal rule<br>▪ Earthwork volume calculation for road formation |

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## SEMESTER-III

**COURSE CODE: DCE301**

**COURSE NAME: STRNGTH OF MATERIALS**

**Course Objectives:**

- To understand stress, strain, and mechanical behavior of materials
- To analyze stresses and deformations in beams, shafts, and columns
- To study theories of failure and their applications
- To learn experimental methods for material strength testing
- To apply strength principles to design simple machine components

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | **Calculate** stresses and strains in loaded members |
| CO2 | **Analyze** bending and shear stresses in beams |
| C03 | **Determine** torsional stresses in circular shafts |
| C04 | **Evaluate** buckling loads in columns |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Simple Stresses & Strains**<br>**Topics:**<br>• Concept of stress and strain: normal, shear<br>• Hooke's law, elasticity, Poisson's ratio<br>• Stress-strain diagram for ductile and brittle materials<br>• Factor of safety, working stress<br>• Thermal stresses, compound bars<br>• **Applications:** Axially loaded members, temperature effects | 1 | 25% |
| II | **Shear Force & Bending Moment**<br>**Topics:**<br>• Types of beams and supports<br>• Shear force and bending moment diagrams for:<br>  ○ Cantilever beams<br>  ○ Simply supported beams<br>  ○ Overhanging beams<br>• Point of contraflexure<br>• Relationship between load, shear force and bending moment<br>• **Applications:** Beam design, structural analysis | 1 | 25% |
| III | **Stresses in Beams & Torsion**<br>**Topics:**<br>• Theory of simple bending: assumptions, derivation<br>• Bending stress distribution, section modulus<br>• Shear stress distribution in beams<br>• Torsion of circular shafts: solid and hollow<br>• Power transmitted by shafts<br>• **Applications:** Shaft design, machine elements | 1 | 25% |
| IV | **Columns & Combined Stresses** | 1 | 25% |

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| | **Topics:**<br>• Columns: short and long columns<br>• Euler's theory, Rankine's formula<br>• Combined bending and direct stresses<br>• Principal stresses and strains<br>• Theories of failure: maximum principal stress, maximum shear stress<br>• **Applications:** Machine frames, structural columns | | |

**Textbooks:**

- Primary: *Strength of Materials* — R. S. Khurmi
- Primary: *Strength of Materials* — B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain

**Reference books:**

- *Mechanics of Materials* — R. C. Hibbeler
- *Strength of Materials* — S. Ramamrutham
- *Strength of Materials* — D. S. Prakash Rao
- *A Textbook of Strength of Materials* — R. K. Bansal

**Online Platforms:**

- SWAYAM/NPTEL: "Strength of Materials" courses by IITs
- edX: "Mechanics of Materials" by Georgia Tech

**PRACTICAL LIST:**

Section A: Tension & Compression Tests

1. Tensile Test: On mild steel using UTM
   - Determination of yield point, ultimate strength, percentage elongation
2. Compression Test: On concrete cubes
3. Proof Stress Determination: For materials without yield point
4. Stress-Strain Curve Plotting: From test data

Section B: Hardness & Impact Tests

5. Hardness Tests: Brinell, Rockwell, Vickers
6. Impact Test: Izod and Charpy tests
   - Comparison of impact strength for different materials
7. Spring Testing: Determination of stiffness

Section C: Beam Testing

8. Deflection Test: On simply supported beam
   - Verification of beam deflection formula
9. Shear Force Diagram: Experimental verification
10. Bending Moment Diagram: Experimental verification
11. Beam Deflection: Using dial gauges

Section D: Torsion & Column Tests

12. Torsion Test: On circular shafts
- Determination of modulus of rigidity

13. Column Test: Buckling of columns
- Verification of Euler's formula

14. Helical Spring Test: Under axial load
15. Universal Testing Machine: Demonstration of various tests

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**COURSE CODE: DCE302**

**COURSE NAME: FLUID MECHANICS AND HYDRAULIC MACHINES**

**Course Objectives:**

- To understand fundamental properties and behavior of fluids
- To study fluid statics, dynamics, and flow measurement techniques
- To analyze flow through pipes and channels
- To learn working principles of hydraulic machines: pumps and turbines
- To develop skills in fluid mechanics experimentation and data analysis

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | **Apply** fluid properties and principles to engineering problems |
| CO2 | **Calculate** forces on submerged surfaces and buoyancy effects |
| C03 | **Analyze** fluid flow using continuity, energy, and momentum equations |
| C04 | **Measure** flow rate using various flow measurement devices |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Fluid Properties & Fluid Statics**<br>**Topics:**<br>• Properties of fluids: density, viscosity, surface tension<br>• Pressure measurement: manometers, pressure gauges<br>• Hydrostatic forces on submerged surfaces<br>• Buoyancy and flotation<br>• Stability of floating bodies<br>• **Applications:** Dam design, ship stability, pressure vessels | 1 | 25% |
| II | **Fluid Dynamics & Flow Measurement**<br>**Topics:**<br>• Types of fluid flow: steady/unsteady, laminar/turbulent<br>• Continuity equation, Bernoulli's equation<br>• Venturimeter, orifice meter, pitot tube<br>• Flow through pipes: major and minor losses<br>• Darcy-Weisbach equation, Moody's chart<br>• **Applications:** Pipe network design, flow measurement | 1 | 25% |
| III | **Hydraulic Pumps**<br>**Topics:**<br>• Classification of pumps<br>• Centrifugal pumps: working principle, components<br>• Performance characteristics: head, discharge, efficiency<br>• Cavitation and NPSH<br>• Reciprocating pumps: working principle<br>• **Applications:** Water supply, irrigation, industrial processes | 1 | 25% |

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| IV | **Hydraulic Turbines & Hydraulic Systems**<br>**Topics:**<br>• Classification of turbines<br>• Impulse turbines: Pelton wheel<br>• Reaction turbines: Francis, Kaplan<br>• Performance characteristics<br>• Hydraulic systems: accumulators, presses<br>• **Applications:** Hydroelectric power, industrial power transmission | 1 | 25% |

**Textbooks:**

- Primary: *Fluid Mechanics and Hydraulic Machines* — R. K. Bansal
- Primary: *Hydraulics and Fluid Mechanics* — P. N. Modi & S. M. Seth

**Reference books:**

- *Fluid Mechanics* — Frank M. White
- *A Textbook of Fluid Mechanics and Hydraulic Machines* — R. K. Rajput
- *Engineering Fluid Mechanics* — K. L. Kumar
- *Hydraulic Machines* — Jagdish Lal

**Online Platforms:**

- SWAYAM/NPTEL: "Fluid Mechanics" courses by IITs
- edX: "Fluid Mechanics" by MIT

**PRACTICAL LIST:**

Section A: Fluid Properties & Statics

1. Viscosity Measurement: Using Saybolt/Ford cup viscometer
2. Bernoulli's Theorem: Verification using Bernoulli's apparatus
3. Metacentric Height: Determination for floating bodies
4. Hydrostatic Pressure: On submerged surfaces

Section B: Flow Measurement

5. Venturimeter: Calibration and coefficient determination
6. Orifice Meter: Coefficient of discharge measurement
7. Pitot Tube: Velocity measurement in pipe
8. Reynolds Experiment: Demonstration of laminar and turbulent flow

Section C: Pipe Flow & Losses

9. Major Losses: Friction factor determination in pipes
10. Minor Losses: Sudden expansion/contraction, bends
11. Flow Visualization: Using dye injection
12. Notches & Weirs: Discharge measurement

Section D: Hydraulic Machines

13. Centrifugal Pump: Performance characteristics test
14. Reciprocating Pump: Performance test
15. Pelton Wheel Turbine: Performance characteristics
16. Francis Turbine: Performance test
17. Hydraulic Ram: Demonstration
18. Gear Oil Pump: Performance test

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**COURSE CODE: DCE303**

**COURSE NAME: CONCRETE TECHNOLOGY**

**Course Objectives:**

- To understand the properties, behavior, and applications of concrete as a construction material.
- To study the composition, manufacturing, and testing of concrete and its constituents.
- To learn concrete mix design methods and quality control techniques.
- To develop skills in concrete production, placement, compaction, curing, and testing.
- To prepare students for practical applications in concrete construction and quality assurance.

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | **Identify** and **test** the properties of concrete ingredients: cement, aggregates, and water. |
| CO2 | **Design** nominal concrete mixes for given specifications. |
| C03 | **Perform** tests on fresh and hardened concrete and interpret results. |
| C04 | **Apply** proper concreting practices: batching, mixing, transporting, placing, compacting, and curing. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Concrete and Its Constituents**<br>• **Introduction to Concrete:**<br>  ○ Historical background, advantages and disadvantages<br>  ○ Types of concrete: plain, reinforced, prestressed, lightweight, etc.<br>• **Cement:**<br>  ○ Types: OPC, PPC, Rapid hardening, Low heat, etc.<br>  ○ Chemical composition and hydration process<br>  ○ Tests on cement: fineness, consistency, setting time, soundness, compressive strength<br>• **Aggregates:**<br>  ○ Classification: fine and coarse aggregates<br>  ○ Properties: shape, texture, strength, durability, gradation<br>  ○ Sieve analysis and gradation curves<br>• **Water:**<br>  ○ Quality requirements for mixing and curing<br>  ○ Effects of impurities in water<br>**Applications:** Selection of materials for quality concrete production. | 1 | 25% |
| II | **Properties of Fresh and Hardened Concrete**<br>• **Fresh Concrete Properties:**<br>  ○ Workability: definition, factors affecting workability | 1 | 25% |

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| | ○ Measurement of workability: slump test, compaction factor test, flow test, Vee-Bee test<br>○ Segregation and bleeding: causes, effects, prevention<br>• **Hardened Concrete Properties:**<br>○ Strength: compressive, tensile, flexural<br>○ Factors affecting strength: w/c ratio, curing, age, compaction<br>○ Durability: permeability, chemical attack, frost action, carbonation<br>○ Creep and shrinkage: types, causes, effects<br>• **Concrete Mix Design Basics:**<br>○ Nominal mix and design mix concepts<br>○ Introduction to IS 10262 (mix design guidelines)<br>○ Factors influencing mix design<br>**Applications:** Quality control in field concrete, mix proportioning. | | |
| III | **Concrete Production and Quality Control**<br>• **Concrete Production Process:**<br>○ Batching: volume and weight batching<br>○ Mixing: types of mixers, mixing time, efficiency<br>○ Transportation: methods and precautions<br>• **Placing, Compaction and Curing:**<br>○ Placing techniques for different structural elements<br>○ Compaction: methods, importance, vibration techniques<br>○ Curing: methods (water curing, membrane curing, steam curing), duration, importance<br>• **Quality Control and Testing:**<br>○ Sampling of concrete<br>○ Non-destructive testing: rebound hammer, ultrasonic pulse velocity<br>• **Admixtures:**<br>○ Types: plasticizers, superplasticizers, accelerators, retarders, air-entraining agents<br>○ Functions and applications<br>**Applications:** Site concreting operations, quality assurance, use of admixtures. | 1 | 25% |
| IV | **Special Concretes and Concrete Practices**<br>• **Special Concretes:**<br>○ Ready-mix concrete (RMC)<br>○ Self-compacting concrete (SCC)<br>○ High-performance concrete (HPC)<br>○ Fiber-reinforced concrete<br>○ Lightweight and heavyweight concrete | 1 | 25% |

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| | • **Concrete Construction Practices:**<br>○ Joints in concrete: construction joints, expansion joints, contraction joints<br>○ Formwork: requirements, materials, stripping time<br>○ Repair and rehabilitation of concrete structures<br>• **Concrete in Extreme Conditions:**<br>○ Hot weather and cold weather concreting<br>○ Underwater concreting<br>• **Sustainability in Concrete:**<br>○ Green concrete concepts<br>○ Use of recycled materials: fly ash, GGBS, recycled aggregates<br>**Applications:** Specialized construction, sustainable practices, repair works. | | |

**Textbooks:**

- Primary: *Concrete Technology* — M.S. Shetty
- Primary: *Concrete Technology* — A.M. Neville & J.J. Brooks

**Reference books:**

- *Properties of Concrete* — A.M. Neville
- *Concrete: Microstructure, Properties, and Materials* — P.K. Mehta & Paulo J.M. Monteiro
- *IS 456:2000 Plain and Reinforced Concrete - Code of Practice*
- *IS 10262:2019 Concrete Mix Proportioning - Guidelines*

**Online Platforms:**

- NPTEL/SWAYAM: *Concrete Technology* by IIT Madras/Delhi
- Coursera: *Construction Engineering and Management* by Columbia University
- edX: *Concrete and Steel Technology* by Purdue University

**PRACTICAL LIST:**

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| Section A: Tests on Concrete Ingredients<br>1. Tests on Cement:<br>○ Standard consistency test<br>○ Initial and final setting time<br>○ Fineness test by sieving<br>○ Soundness test (Le Chatelier method)<br>2. Tests on Aggregates:<br>○ Sieve analysis of fine and coarse aggregates<br>○ Specific gravity and water absorption test<br>○ Aggregate impact value test | Section C: Tests on Hardened Concrete<br>5. Compressive Strength Test:<br>○ Casting and curing of concrete cubes (150mm)<br>○ Testing at 7 days and 28 days<br>○ Interpretation of results<br>6. Flexural Strength Test:<br>○ Casting and testing of concrete beams (100×100×500mm)<br>7. Non-Destructive Testing:<br>○ Rebound hammer test on concrete cubes<br>○ Ultrasonic pulse velocity test demonstration |
| Section B: Tests on Fresh Concrete<br>3. Workability Tests:<br>○ Slump test | Section D: Special Concretes and Applications<br>8. Admixture Demonstration: |

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| ○ Compaction factor test<br>○ Flow test<br>○ Vee-Bee consistency test<br>4. Concrete Mix Design Exercise:<br>○ Nominal mix design as per IS 10262<br>○ Calculation of mix proportions for given grade (M20, M25) | ○ Effect of plasticizer on workability<br>○ Effect of accelerator/retarder on setting time<br>9. Special Concrete Preparation:<br>○ Preparation of fiber-reinforced concrete<br>○ Demonstration of self-compacting concrete mix<br>10. Field Visit and Report:<br>○ Visit to RMC plant or concrete batching plant<br>○ Observation of production, quality control, and transportation |

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## SEMESTER-IV

**COURSE CODE: DCE401**

**COURSE NAME: STRUCTURAL ANALYSIS**

**Course Objectives:**

- To understand the fundamental principles of structural analysis and behavior of different structural elements.
- To analyze determinate beams, frames, and trusses under various loading conditions.
- To study shear force and bending moment diagrams for statically determinate structures.
- To develop skills in analyzing simple indeterminate structures and understanding influence lines.
- To prepare students for designing structural components and solving practical engineering problems.

**Course Outcomes:** At the end of the course students shall be able to

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| CO1 | **Determine** support reactions and internal forces in statically determinate beams and frames. |
| CO2 | **Draw** shear force and bending moment diagrams for beams under different loads. |
| C03 | **Analyze** determinate trusses using method of joints and method of sections |
| C04 | **Understand** basic concepts of indeterminate structures and influence lines. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction and Analysis of Determinate Beams**<br>• **Introduction to Structural Analysis:**<br>  ○ Types of structures: beams, frames, trusses, arches, cables<br>  ○ Types of supports: fixed, hinged, roller, guided<br>  ○ Types of loads: concentrated, distributed, moments<br>  ○ Equilibrium conditions: ∑Fx=0, ∑Fy=0, ∑M=0<br>• **Analysis of Determinate Beams:**<br>  ○ Static determinacy and indeterminacy<br>  ○ Calculation of support reactions<br>  ○ Shear force and bending moment concepts<br>  ○ Relationship between load, shear force and bending moment<br>• **Shear Force and Bending Moment Diagrams:**<br>  ○ Cantilever beams with point loads and UDL<br>  ○ Simply supported beams with point loads, UDL, and couple<br>  ○ Overhanging beams<br>**Applications:** Design of beams in buildings, bridges, and industrial structures. | 1 | 25% |
| II | **Analysis of Determinate Frames and Trusses** | 1 | 25% |

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| | • **Analysis of Plane Frames:**<br>  ○ Types of frames: portal frames, gable frames<br>  ○ Calculation of support reactions for frames<br>  ○ Axial force, shear force and bending moment in frame members<br>• **Analysis of Trusses:**<br>  ○ Types of trusses: roof trusses, bridge trusses<br>  ○ Assumptions in truss analysis<br>  ○ Methods of analysis:<br>  ▪ Method of joints<br>  ▪ Method of sections<br>• **Determinacy and Stability of Trusses:**<br>  ○ Conditions for determinacy: m = 2j - 3<br>  ○ Stability criteria<br>**Applications:** Roof truss design, bridge truss analysis, industrial shed frames. | | |
| III | **Deflection of Beams and Energy Methods**<br>• **Deflection of Beams:**<br>  ○ Importance of deflection in design<br>  ○ Double integration method<br>  ○ Macaulay's method for beams with multiple loads<br>  ○ Moment area method (Mohr's theorems)<br>  ○ Conjugate beam method<br>• **Energy Methods:**<br>  ○ Strain energy in axial loading, bending and shear<br>  ○ Castigliano's theorems (first theorem only)<br>  ○ Principle of virtual work<br>  ○ Unit load method for deflection calculation<br>• **Deflection Calculations for:**<br>  ○ Simply supported beams with central point load<br>  ○ Cantilever beams with end load<br>  ○ Beams with UDL<br>**Applications:** Serviceability check, vibration analysis, design for stiffness. | 1 | 25% |
| IV | **Introduction to Indeterminate Structures and Influence Lines**<br>• **Indeterminate Structures:**<br>  ○ Degree of static indeterminacy for beams, frames and trusses<br>  ○ Introduction to force method and displacement method<br>  ○ Analysis of propped cantilever beams | 1 | 25% |

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| | ○ Analysis of fixed beams (with concentrated load at center only)<br>• **Influence Lines:**<br>○ Concept of influence lines<br>○ Influence lines for simply supported beams:<br>▪ Reaction at support<br>▪ Shear force at a section<br>• **Moving Loads:**<br>○ Single concentrated load<br>○ Uniformly distributed load longer than span<br>○ Two concentrated loads<br>• **Introduction to Matrix Methods:**<br>○ Flexibility and stiffness matrix concepts (qualitative only)<br>**Applications:** Bridge design, moving load analysis, preliminary design of continuous beams. | | |

**Textbooks:**

- Primary: *Basic Structural Analysis* — C.S. Reddy
- Primary: *Structural Analysis* — R.C. Hibbeler

**Reference books:**

- *Theory of Structures* — S. Ramamrutham
- *Structural Analysis* — Aslam Kassimali
- *Structural Analysis* — S.S. Bhavikatti
- *Strength of Materials and Theory of Structures* — B.C. Punmia

**Online Platforms:**

- NPTEL/SWAYAM: *Structural Analysis* by IIT Madras/Kharagpur
- Coursera: *Mechanics of Materials* by Georgia Tech
- edX: *Structural Analysis and Design* by MIT

**PRACTICAL LIST:**

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|---|---|
| **Beam Analysis Experiments**<br>1. **Support Reactions Verification:**<br>○ Simply supported beam with point loads<br>○ Measurement of reactions using load cells<br>○ Comparison with theoretical calculations<br>2. **Shear Force Distribution:**<br>○ Experimental determination of shear force at sections<br>○ Using shear force apparatus<br>○ Plotting experimental vs theoretical SF diagrams<br>3. **Bending Moment Distribution:**<br>○ Experimental determination of bending moment | **Section C: Truss Analysis**<br>7. **Truss Analysis Apparatus:**<br>○ Determination of forces in truss members<br>○ Using model truss with load cells<br>○ Comparison with method of joints calculations<br>8. **Zero Force Member Verification:**<br>○ Experimental identification of zero force members<br>○ Under different loading conditions<br>9. **Bridge Model Testing:**<br>○ Simple bridge truss model<br>○ Load testing and member force measurement |

| | |
|---|---|
| ○ Using bending moment apparatus | |
| **Deflection Studies**<br>4. **Deflection of Beams:**<br>○ Deflection measurement of simply supported beam under central load<br>○ Using dial gauges or LVDT<br>○ Comparison with theoretical deflection using double integration method<br>5. **Cantilever Beam Deflection:**<br>○ Measurement of end deflection under point load<br>○ Effect of load position on deflection<br>6. **Modulus of Elasticity Determination:**<br>○ Using beam deflection formula<br>○ Calculation of E from deflection data | **Section D: Computer Applications and Modeling**<br>10. **Software Analysis:**<br>○ Introduction to structural analysis software basics)<br>○ Simple beam analysis using software<br>○ Comparison with manual calculations<br>11. **Influence Line Demonstration:**<br>○ Experimental determination of influence lines for reactions<br>○ Using moving load on beam model<br>12. **Model Making and Testing:**<br>○ Construction of simple frame model<br>○ Load testing and failure pattern observation<br>13. **Photoelasticity Demonstration (Optional):**<br>○ Stress distribution in beams under load<br>Using photoelastic models |

**COURSE CODE: DCE402**

**COURSE NAME: GEOTECHNICAL ENGINEERING**

**Course Objectives:**

- To introduce basic principles of soil mechanics and foundation engineering.
- To classify soils and evaluate their engineering properties.
- To analyze soil compaction, permeability, shear strength, and consolidation.
- To design simple shallow foundations and slopes.
- To perform standard geotechnical laboratory tests.

**Course Outcomes:** At the end of the course students shall be able to

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| CO1 | Classify soils using index properties and IS classification system. |
| CO2 | Determine engineering properties like permeability, compaction, and shear strength. |
| C03 | Analyze stress distribution, consolidation, and settlement of soils. |
| C04 | Design shallow foundations and evaluate slope stability. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|

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|---|---|---|---|
| I | **Introduction to Soil Mechanics & Soil Classification**<br>• **Topics:**<br>○ Formation and types of soils<br>○ Three-phase system, basic definitions, relationships<br>○ Index properties: Specific gravity, water content, void ratio, porosity, density<br>○ Particle size distribution (sieve analysis, hydrometer analysis)<br>○ Consistency limits (Atterberg limits)<br>○ IS soil classification system (IS 1498) | 1 | 25% |
| II | **Soil Permeability, Compaction & Stress Distribution**<br>• **Topics:**<br>○ Darcy's law, permeability measurement (constant & variable head tests)<br>○ Factors affecting permeability<br>○ Compaction: OMC, MDD, Proctor test, field compaction methods<br>○ Effective stress principle<br>○ Boussinesq's and Westergaard's theories for vertical stress distribution | 1 | 25% |
| III | **Shear Strength & Consolidation**<br>• **Topics:**<br>○ Concept of shear strength, Mohr-Coulomb failure theory<br>○ Types of shear tests: Direct shear, Triaxial, UCC test<br>○ Consolidation: Terzaghi's theory, consolidation test, settlement calculation<br>○ Pre-consolidation pressure, coefficient of consolidation | 1 | 25% |
| IV | **Foundation Engineering & Slope Stability**<br>• **Topics:**<br>○ Types of foundations (shallow & deep)<br>○ Bearing capacity: Terzaghi's equation, IS code method<br>○ Settlement of foundations<br>○ Slope stability: Types of failures, infinite slope analysis, method of slices<br>○ Introduction to retaining walls and sheet piles | 1 | 25% |

**Textbooks:**

- Soil Mechanics & Foundation Engineering – V.N.S. Murthy
- Geotechnical Engineering – B.M. Das
- Soil Mechanics & Foundation Engineering – Dr. K.R. Arora
- Basic & Applied Soil Mechanics – Gopal Ranjan & A.S.R. Rao

**Reference books:**

- Soil Mechanics & Foundation Engineering – P. Purushothama Raj
- Geotechnical Engineering – S.K. Gulhati & M. Datta
- IS Codes: IS 2720 (Various parts for lab tests), IS 1498, IS 6403, IS 1888

**Online Platforms:**

- NPTEL: Geotechnical Engineering courses by Prof. N. Sivakugan, Prof. K. R. Saxena
- Coursera: "Soil Mechanics" by Georgia Tech

**PRACTICAL LIST:**

- Determination of water content (oven drying method).
- Determination of specific gravity of soil solids (pycnometer method).
- Grain size analysis (sieve analysis).
- Determination of Atterberg limits (liquid limit, plastic limit).
- Field density test (sand replacement method).
- Standard Proctor compaction test.
- Permeability test (constant head & falling head).
- Direct shear test on cohesionless soil.
- Unconfined compression test on cohesive soil.
- One-dimensional consolidation test (demonstration).

**COURSE CODE: DCE403**

**COURSE NAME: COMPUTER FUNDAMENTALS AND PROGRAMMING**

**Course Objectives:**

- To understand computer fundamentals and architecture
- To learn programming concepts and problem-solving techniques
- To develop basic programming skills using Python language
- To apply programming to solve engineering problems
- To prepare students for CAD/CAM and automation technologies

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | **Explain** computer architecture and components |
| CO2 | **Apply** algorithmic thinking to solve problems |
| C03 | **Write** Python programs for engineering applications |
| C04 | **Use** data structures and functions in programming |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Computer Fundamentals & Problem Solving**<br>**Topics:**<br>• Computer generations and classifications<br>• Computer architecture: CPU, memory, I/O devices<br>• Number systems: binary, octal, hexadecimal<br>• Algorithms and flowcharts<br>• Problem-solving approaches<br>• Introduction to operating systems<br>• **Applications:** Understanding computer systems in manufacturing | 1 | 25% |

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|---|---|---|---|
| II | **Python Programming Basics**<br>**Topics:**<br>• Introduction to Python: features, installation<br>• Python IDE and interactive mode<br>• Basic syntax, variables, data types<br>• Input/output operations<br>• Operators: arithmetic, relational, logical<br>• Conditional statements: if, if-else, nested if<br>• **Applications:** Simple calculations, decision making | 1 | 25% |
| III | **Control Structures & Functions**<br>**Topics:**<br>• Looping statements: while, for loops<br>• Loop control statements: break, continue, pass<br>• Functions: definition, parameters, return values<br>• Built-in functions and modules<br>• Recursion basics<br>• Scope of variables<br>• **Applications:** Iterative calculations, modular programming | 1 | 25% |
| IV | **Data Structures & Engineering Applications**<br>**Topics:**<br>• Lists, tuples, dictionaries<br>• Strings and string operations<br>• File handling: reading, writing, appending<br>• Introduction to databases and SQL basics<br>• Simple engineering applications:<br>  ○ Stress calculations<br>  ○ Temperature conversions<br>  ○ Statistical analysis<br>• **Applications:** Data processing, engineering calculations | 1 | 25% |

**Textbooks:**

- Primary: *Computer Fundamentals and Programming in C* — Reema Thareja
- Primary: *Python Programming: A Modern Approach* — Vamsi Kurama

**Reference books:**

- *Let Us Python* — Yashavant Kanetkar
- *Computer Fundamentals* — P. K. Sinha
- *Python for Engineers* — Dr. R. R. Patil
- *Introduction to Computers* — Peter Norton

**Online Platforms:**

- SWAYAM/NPTEL: "Programming in Python" courses by IITs
- Coursera: "Python for Everybody" by University of Michigan
- edX: "Introduction to Computer Science" by Harvard

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**COURSE CODE: DCE404**

**COURSE NAME: ENVIRONMENTAL ENGINEERING**

**Course Objectives:**

- To understand the importance of environmental sanitation and public health.
- To learn the principles of water supply, treatment, and distribution systems.
- To study wastewater characteristics, collection, treatment, and disposal.
- To introduce solid waste management and air pollution control methods.
- To acquaint students with relevant environmental standards and regulations.

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | Estimate water demand and design simple water supply systems. |
| CO2 | Explain the principles and processes of water treatment. |
| C03 | Design sewerage systems and explain wastewater treatment processes. |
| C04 | Identify methods for solid waste management and air pollution control. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Water Supply Engineering**<br>• **Topics:**<br>o Importance of protected water supply.<br>o Water demand: Per capita demand, factors affecting demand, variations.<br>o Sources of water: Surface and groundwater, intake structures.<br>o Quality of water: Physical, chemical, and bacteriological parameters.<br>o Water conveyance: Pipes, pumps, and distribution systems (gravity, pumping). | 1 | 25% |
| II | **Water Treatment**<br>• **Topics:**<br>o Objectives of water treatment.<br>o Unit processes: Screening, plain sedimentation, coagulation-flocculation, sedimentation (clarifier), filtration (slow sand, rapid sand).<br>o Disinfection: Chlorination, other methods (UV, Ozonation).<br>o Water softening: Lime-soda process, ion exchange.<br>o Introduction to advanced treatments (RO, activated carbon). | 1 | 25% |
| III | **Wastewater Engineering**<br>• **Topics:**<br>o Wastewater characteristics: Physical, chemical, biological (BOD, COD). | 1 | 25% |

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| | ○ Sewerage systems: Types (separate, combined), sewer appurtenances.<br>○ Wastewater treatment:<br>▪ Primary: Screening, grit removal, sedimentation.<br>▪ Secondary: Activated sludge process, trickling filters, oxidation ponds.<br>▪ Sludge treatment: Thickening, digestion, disposal.<br>○ Standards for disposal (CPCB norms). | | |
| IV | **Solid Waste Management & Environmental Pollution**<br>• **Topics:**<br>○ Solid waste: Sources, classification, collection, and transportation.<br>○ Processing and disposal: Composting, incineration, sanitary landfilling.<br>○ Air pollution: Sources, effects, control methods (cyclones, scrubbers, ESP).<br>○ Noise pollution: Measurement, effects, control.<br>○ Environmental legislation: Introduction to Water Act, Air Act, EPA. | 1 | 25% |

**Textbooks:**

- Environmental Engineering (Vol I & II) – S.K. Garg (Khanna Publishers)
- Water Supply & Sanitary Engineering – G.S. Birdie & J.S. Birdie
- Environmental Engineering – P.N. Modi
- Water Supply & Wastewater Engineering – B.C. Punmia, A.K. Jain, A.K. Jain

**Reference books:**

- Wastewater Engineering – Metcalf & Eddy (Standard reference)
- Environmental Engineering – H.S. Peavy, D.R. Rowe, G. Tchobanoglous
- Solid Waste Management – M.N. Rao
- IS Codes: IS 1172, IS 10500 (Drinking Water), IS 1742, IS 2490 (Discharge Standards)
- Manual on Water Supply & Treatment – CPHEEO, Govt. of India

**Online Platforms:**

1. NPTEL:
   - "Environmental Engineering" by Prof. B. S. Murty, IIT Madras
   - "Water & Wastewater Engineering" by Prof. C. Venkobachar, IIT Bombay
2. SWAYAM: Courses on "Water and Wastewater Treatment"

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## SEMESTER-V

**COURSE CODE: DCE501**

**COURSE NAME: DESIGN OF CONCRETE STRUCTURES**

**Course Objectives:**

- To introduce the fundamentals of reinforced concrete design philosophy.
- To understand working stress and limit state design methods as per IS codes.
- To analyze and design basic RCC structural elements: beams, slabs, columns, and footings.
- To develop skills in preparing structural drawings and detailing.
- To apply code provisions (IS 456:2000) for safe and economical design.

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | Explain the concepts of working stress and limit state design methods. |
| CO2 | Design singly and doubly reinforced rectangular beams for flexure and shear. |
| C03 | Design one-way and two-way slabs for given loading conditions. |
| C04 | Design axially loaded short columns and isolated footings. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to RCC and Materials**<br>○ **Topics:**<br>▪ Introduction to Reinforced Cement Concrete (RCC).<br>▪ Properties of concrete and reinforcing steel (Fe 415, Fe 500).<br>▪ Design philosophies: Working Stress Method (WSM) and Limit State Method (LSM).<br>▪ Introduction to IS 456:2000 and other relevant codes.<br>▪ Loads on structures (dead, live, wind, seismic) as per IS 875.<br>○ Concept of stress-strain curves, modular ratio, neutral axis, lever arm. | 1 | 25% |
| II | **Design of Beams**<br>• **Topics:**<br>○ Limit state of collapse: Flexure (Singly and Doubly reinforced beams).<br>○ Design constants, balanced, under-reinforced, over-reinforced sections.<br>○ Shear reinforcement design: Shear strength of concrete, design of vertical stirrups.<br>○ Bond, anchorage, and development length (IS 456 provisions). | 1 | 25% |

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| | ○ Serviceability: Limit state of deflection and cracking (brief).<br>○ Design examples and detailing of beams. | | |
| III | **Design of Slabs and Columns**<br>• **Topics:**<br>○ Types of slabs: One-way and two-way slabs.<br>○ Design of simply supported one-way slabs.<br>○ Introduction to two-way slab design (IS code coefficients).<br>○ Columns: Classification, effective length, load carrying capacity.<br>○ Design of axially loaded short columns (with lateral ties).<br>○ Introduction to eccentric loading (concept only). | 1 | 25% |
| IV | **Design of Foundations and Drawings**<br>• **Topics:**<br>○ Types of foundations: Isolated, combined, raft.<br>○ Design of isolated square and rectangular footings for axial load.<br>○ Introduction to staircase design (dog-legged).<br>○ Reinforcement detailing as per IS 456 and SP 34.<br>○ Preparation of structural drawings: Plan, elevation, section with bar bending schedule (BBS).<br>○ Use of standard design aids (SP 16 for beams/columns, SP 34 for detailing). | 1 | 25% |

**Textbooks:**

- Reinforced Concrete Design – S. Unnikrishna Pillai & Devdas Menon
- Fundamentals of Reinforced Concrete Design – N.C. Sinha & S.K. Roy
- Reinforced Concrete Design – M.L. Gambhir
- Limit State Design of Reinforced Concrete – B.C. Punmia, A.K. Jain, A.K. Jain

**Reference books:**

- Design of Reinforced Concrete Structures – S. Ramamrutham
- Reinforced Concrete Design – H.J. Shah & V.L. Shah
- IS Codes: IS 456:2000 (Plain and Reinforced Concrete), IS 875 (Loads), SP 16 (Design Aids), SP 34 (Detailing)
- RCC Designs – B.C. Punmia

**Online Platforms:**

1. NPTEL:
   - "Design of Reinforced Concrete Structures" by Prof. N. Dhang, IIT Kharagpur
   - "Advanced RCC Design" by Prof. D. N. Sinha, IIT Kharagpur
2. SWAYAM: "Design of Concrete Structures" courses

**PRACTICAL LIST:**

- **Mix Design:** Conduct concrete mix design as per IS 10262 for given grades (M20, M25).

- **Test on RCC Beam:** Demonstration of flexural test on simply supported RCC beam.
- **Design Exercises:**
  1. Design and detailing of a singly reinforced rectangular beam.
  2. Design and detailing of a one-way slab.
  3. Design of an axially loaded short column with ties.
  4. Design of an isolated square footing.
- **Drawing Practice:**
  1. Preparation of detailed structural drawing of a beam-column junction.
  2. Preparation of bar bending schedule (BBS) for a simple slab.
- **Software Demonstration:**
  1. Introduction to STAAD.Pro for analyzing a simple frame.
  2. Use of AutoCAD for reinforcement detailing.
- **Site Visit Report:** Visit to RCC construction site focusing on formwork, reinforcement placement, and concreting.

**COURSE CODE: DCE502**

**COURSE NAME: DESIGN OF STEEL STRUCTURES**

**Course Objectives:**

- To introduce the properties and behavior of structural steel as a construction material.
- To understand the limit state design philosophy as per Indian standards (IS 800).
- To analyze and design basic steel structural elements: tension members, compression members, beams, and connections.
- To design simple steel structures: roof trusses and industrial buildings.
- To develop skills in preparing structural drawings and detailing for fabrication.

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | Explain the advantages, properties, and sections of structural steel as per Indian standards. |
| CO2 | Design tension members and compression members (struts, columns) using limit state method. |
| C03 | Design beams (laterally supported) for flexure, shear, and deflection. |
| C04 | Design bolted and welded connections for various members. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Steel Structures**<br>• **Topics:**<br>○ Advantages and disadvantages of steel structures.<br>○ Types of structural steel, grades, and properties as per IS 2062.<br>○ Types of rolled steel sections (ISA, ISMB, ISMC, ISHB, etc.) and built-up sections.<br>○ Loads on steel structures (as per IS 875).<br>○ Introduction to limit state design as per **IS 800:2007**. | 1 | 25% |

| | | | |
|---|---|---|---|
| | ○ Concept of yield stress, ultimate stress, partial safety factors. | | |
| II | **Design of Tension and Compression Members**<br>• **Topics:**<br>○ **Tension Members:** Modes of failure, net area, design strength, lug angles, tension splices.<br>○ **Compression Members:** Buckling behavior, effective length, slenderness ratio.<br>○ Design of axially loaded compression members (angles, struts, columns).<br>○ Built-up columns: Lacing and battening systems (concepts and design).<br>○ Introduction to column bases (simple slab base only). | 1 | 25% |
| III | **Design of Beams and Connections**<br>• **Topics:**<br>○ **Beams:** Classification (laterally supported/unsupported), modes of failure.<br>○ Design of laterally supported beams for flexure, shear, and deflection.<br>○ **Connections:**<br>▪ Bolted connections: Types (bearing type, friction grip), failure modes, design.<br>▪ Welded connections: Types (butt, fillet), design of fillet welds.<br>○ Design of beam-to-beam and beam-to-column connections (simple connections). | 1 | 25% |
| IV | **Roof Trusses and Industrial Buildings**<br>• **Topics:**<br>○ Types of roof trusses (King post, Pratt, Howe).<br>○ Load calculation on trusses (dead, live, wind).<br>○ Design of truss members (tension and compression).<br>○ Design of connections in trusses (gusseted connections).<br>○ Introduction to industrial buildings: Components (columns, roof trusses, bracings).<br>○ Introduction to plastic design (concept only). | 1 | 25% |

**Textbooks:**

- Design of Steel Structures – N. Subramanian (Oxford University Press)
- Limit State Design of Steel Structures – S.K. Duggal (McGraw Hill)
- Design of Steel Structures – S.S. Bhavikatti (I.K. International)
- Design of Steel Structures – M.R. Shiyekar (PHI Learning)

**Reference books:**

- Design of Steel Structures – P. Dayaratnam (S. Chand)
- Steel Structures: Design and Practice – N. Subramanian
- IS Codes:
  1. IS 800:2007 – General Construction in Steel – Code of Practice
  2. IS 875 – Code of Practice for Design Loads
  3. IS 808 – Dimensions for Hot Rolled Steel Sections
  4. IS 816 – Code of Practice for Use of Metal Arc Welding
  5. SP 6 (1) – Handbook for Structural Engineers (Steel Sections)
- Structural Steel Design – Jack C. McCormac & Stephen F. Csernak

**Online Platforms:**

1. NPTEL:
   - "Design of Steel Structures" by Prof. Damodar Maity, IIT Kharagpur
   - "Advanced Steel Structures" by Prof. S.R. Satish Kumar, IIT Madras
2. SWAYAM: "Design of Steel Structures" course by IITs

**COURSE CODE: DCE503**

**COURSE NAME: CONSTRUCTION PROJECT MANAGEMENT**

**Course Objectives:**

- To introduce the fundamental principles and phases of construction project management.
- To develop skills in project planning, scheduling, and resource management.
- To understand cost estimation, budgeting, and financial control in construction.
- To study quality, safety, and contract management in construction projects.
- To familiarize students with modern project management tools and software.

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | Explain the project life cycle, roles of project stakeholders, and organizational structures. |
| CO2 | Prepare work breakdown structures (WBS), bar charts, and network diagrams (CPM/PERT). |
| C03 | Estimate project costs, prepare budgets, and understand tendering processes. |
| C04 | Implement quality control and safety measures on construction sites. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Construction Project Management**<br>• **Topics:**<br>○ Definition, objectives, and importance of project management.<br>○ Project life cycle: Initiation, planning, execution, monitoring, closure.<br>○ Types of construction projects (residential, commercial, industrial, infrastructure).<br>○ Project stakeholders: Owner, contractor, consultant, authorities.<br>○ Organizational structures: Functional, | 1 | 25% |

| | | | |
|---|---|---|---|
| | matrix, projectized.<br>○ Roles and responsibilities of project manager. | | |
| II | **Project Planning and Scheduling**<br>• **Topics:**<br>○ Work Breakdown Structure (WBS).<br>○ Planning techniques: Bar charts (Gantt charts), milestone charts.<br>○ Network techniques:<br>▪ Critical Path Method (CPM) – activity-on-node.<br>▪ Program Evaluation and Review Technique (PERT).<br>○ Float calculation: Total float, free float, independent float.<br>○ Resource planning: Leveling and smoothing. | 1 | 25% |
| III | **Cost Estimation and Contract Management**<br>• **Topics:**<br>○ Types of estimates: Preliminary, detailed, revised.<br>○ Cost estimation methods: Unit rate, lump sum, approximate quantity method.<br>○ Budgeting and cost control: Earned Value Management (EVM) basics.<br>○ Tendering process: Types of tenders, bid documents, pre-qualification.<br>○ Types of contracts: Item rate, lump sum, turnkey, BOT.<br>○ Contract documents: Agreement, conditions of contract, specifications, drawings. | 1 | 25% |
| IV | **Quality, Safety & Modern Practices**<br>• **Topics:**<br>○ Quality management: Quality assurance (QA) vs. quality control (QC), IS codes.<br>○ Total Quality Management (TQM) in construction.<br>○ Safety management: Causes of accidents, safety regulations (OSHA, BOCA), PPE.<br>○ Material management: Procurement, storage, inventory control.<br>○ Introduction to modern practices:<br>▪ Lean construction.<br>▪ Building Information Modeling (BIM) in project management.<br>▪ Sustainable construction practices. | 1 | 25% |

**Textbooks:**

- Construction Project Management – K.K. Chitkara (McGraw Hill)
- Project Planning and Control with PERT and CPM – B.C. Pumnia & K.K. Khandelwal

- Construction Project Management: Theory and Practice – Kumar Neeraj Jha (Pearson)
- A Textbook on Construction Project Management – M.D. Patil (Pearson)

**Reference books:**

- Construction Project Management – S. Sengupta & H. Guha
- Estimating and Costing in Civil Engineering – B.N. Datta (UBS Publishers)
- Project Management for Engineering and Construction – Garold D. Oberlender
- IS Codes: IS 1200 (Method of Measurement), IS 456 (Concrete), CPWD Works Manual
- NICMAR Publications (National Institute of Construction Management)

**Online Platforms:**

1. NPTEL:
    - "Construction Project Management" by Prof. Debasis Sarkar, IIT Kharagpur
    - "Project and Production Management" by Prof. Arunachalam, IIT Madras
2. SWAYAM: "Construction Management" courses

**PRACTICAL LIST:**

- Project Charter Development: Prepare a project charter for a small residential building.
- WBS & Bar Chart: Develop WBS and bar chart for a given construction project.
- Network Analysis:
    1. Draw CPM network for a small project (10-15 activities).
    2. Calculate critical path, floats, and project duration.
- Cost Estimation: Prepare a preliminary cost estimate for a G+1 building using CPWD/State schedule of rates.
- Tender Document Study: Analyze a sample tender document (NIT, bid form, conditions).
- Software Practice:
    1. Create a project schedule using Microsoft Project (Gantt chart).
    2. Basic introduction to Primavera P6 interface.
- Quality & Safety Audit: Prepare a checklist for site quality and safety inspection.
- Case Study Report: Study of a local construction project (visit + report on planning, challenges, solutions).
- Material Management Exercise: Prepare material procurement schedule for RCC work.
- BIM Demonstration: Basic Revit session for 3D modeling and clash detection.

# MK UNIVERSITY

PATAN, GUJARAT

ESTABLISHED BY THE GUJARAT GOVT. RECOGNIZED BY UGC UNDER SECTION 2(f) OF UGC ACT,1956

**COURSE CODE: DCE504**

**COURSE NAME: TRANSPORTATION ENGINEERING**

**Course Objectives:**

- To introduce the importance and modes of transportation systems.
- To understand the planning, design, and construction of highway and railway alignments.
- To study pavement materials, design, and maintenance techniques.
- To learn traffic engineering fundamentals and management systems.
- To familiarize students with relevant IRC codes, MORTH specifications, and modern trends.

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | Explain the classification, planning, and surveys for highway projects. |
| CO2 | Design geometric elements of highways (cross-section, sight distances, horizontal & vertical curves). |
| C03 | Identify pavement materials, design flexible pavements (IRC method), and plan maintenance. |
| C04 | Analyze basic traffic parameters and design simple traffic control devices. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Transportation & Highway Planning**<br>• **Topics:**<br>○ Importance and modes of transportation (road, rail, air, water).<br>○ Highway development in India: Historical perspective, current road networks (NH, SH, MDR, ODR, VR).<br>○ Highway planning: Master plans, road development plans in India.<br>○ Highway surveys: Reconnaissance, preliminary, and detailed surveys.<br>○ Classification of roads as per IRC and MORTH.<br>○ Introduction to Intelligent Transportation Systems (ITS). | 1 | 25% |
| II | **Highway Geometric Design**<br>• **Topics:**<br>○ Factors controlling geometric design.<br>○ Cross-sectional elements: Carriageway, shoulder, camber, kerb, footpath.<br>○ Sight distances: Stopping sight distance (SSD), overtaking sight distance (OSD), intermediate sight distance.<br>○ Horizontal alignment: Design of horizontal curves, superelevation, extra widening. | 1 | 25% |

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| | ○ Vertical alignment: Gradients (ruling, limiting, exceptional), vertical curves (summit, valley).<br>○ Design speed and standards as per IRC 73, IRC 86. | | |
| III | **Pavement Materials & Design**<br>• **Topics:**<br>○ Types of pavements: Flexible and rigid pavements (components and differences).<br>○ Pavement materials: Subgrade soil, aggregates, bitumen, tests on materials.<br>○ Design of flexible pavements: CBR method (IRC 37 guidelines), group index method.<br>○ Introduction to rigid pavement design (IRC 58).<br>○ Highway drainage: Surface and subsurface drainage.<br>○ Pavement failures and maintenance: Types, causes, and remedial measures. | 1 | 25% |
| IV | **Traffic Engineering & Railways**<br>• **Topics:**<br>○ **Traffic Engineering:**<br>▪ Traffic characteristics: Volume, speed, density, PCU.<br>▪ Traffic studies: Volume, speed, origin-destination, parking, accident studies.<br>▪ Traffic control devices: Signs, signals, road markings (IRC 67, IRC 93).<br>▪ Intersections: Types, design principles of at-grade intersections.<br>○ **Railway Engineering:**<br>▪ Permanent way: Components, gauges, coning of wheels.<br>▪ Track geometry: Gradients, curves, superelevation. | 1 | 25% |

**Textbooks:**

- Highway Engineering – S.K. Khanna & C.E.G. Justo (Nem Chand & Bros)
- Transportation Engineering (Vol. I & II) – Dr. L.R. Kadiyali (Khanna Publishers)
- Principles of Transportation Engineering – Partha Chakraborty & Animesh Das
- Traffic Engineering and Transport Planning – Dr. L.R. Kadiyali

**Reference books:**

- Highway Engineering – S.C. Saxena & S.P. Arora
- Railway Engineering – S.C. Saxena & S.P. Arora
- IRC Codes:
  1. IRC 37: Guidelines for Flexible Pavement Design
  2. IRC 73: Geometric Design Standards for Rural (Non-Urban) Highways
  3. IRC 86: Geometric Design Standards for Urban Roads

4. IRC 93: Guidelines for Road Signs
5. IRC 67: Code of Practice for Road Signs

- MORTH Specifications (Ministry of Road Transport & Highways)
- Traffic Engineering – Roger P. Roess, Elena S. Prassas, William R. McShane

**Online Platforms:**

1. NPTEL:
   - "Transportation Engineering I" by Prof. Dr. K. Sudhakar Reddy, IIT Kharagpur
   - "Traffic Engineering and Management" by Prof. Tom V. Mathew, IIT Bombay
   - "Railway Engineering" by Prof. K. N. S. N. Sarma, IIT Kharagpur
2. SWAYAM: Courses on "Highway Engineering" and "Traffic Engineering"

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## SEMESTER-VI

**COURSE CODE: DCE601**

**COURSE NAME: IRRIGATION ENGINEERING**

**Course Objectives:**

- To introduce the importance, methods, and systems of irrigation.
- To understand soil-water-plant relationships and water requirements of crops.
- To study the design of irrigation canals, structures, and diversion works.
- To learn about storage works (dams), water distribution, and irrigation management.
- To familiarize students with modern irrigation techniques and water management practices.

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | Explain the necessity, types, and methods of irrigation systems. |
| CO2 | Calculate crop water requirements and irrigation scheduling. |
| C03 | Design irrigation canals (lined and unlined) using Kennedy's and Lacey's theories. |
| C04 | Analyze diversion headworks, dams, and canal regulation structures. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Introduction to Irrigation**<br>• **Topics:**<br>○ Definition, necessity, and benefits of irrigation.<br>○ History of irrigation in India.<br>○ Types of irrigation: Surface, subsurface, lift irrigation.<br>○ Soil-water-plant relationship: Soil moisture constants, infiltration, permeability.<br>○ Crop water requirement: Duty, delta, base period, relationship between duty and delta.<br>○ Irrigation efficiencies: Water conveyance, application, storage, and use efficiency. | 1 | 25% |
| II | **Canal Irrigation**<br>• **Topics:**<br>○ Types of canals: Permanent, inundation, lined, unlined.<br>○ Alignment of canals: Watershed, contour, side slope canals.<br>○ Design of irrigation canals:<br>▪ Kennedy's theory (critical velocity, silt grade).<br>▪ Lacey's theory (regime conditions, silt factor).<br>○ Canal lining: Necessity, types (concrete, PVC, boulder), advantages. | 1 | 25% |

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| | ○ Canal losses: Seepage, evaporation, control measures.<br>○ Canal regulation structures: Falls, cross-drainage works (aqueduct, syphon). | | |
| III | **Diversion Headworks & Dams**<br>• **Topics:**<br>○ Diversion headworks: Types (weir, barrage), components, design principles.<br>○ Weirs: Types (vertical drop, rock fill), design of weir crest, seepage prevention.<br>○ Dams:<br>▪ Types: Gravity, earth, rockfill, arch dams.<br>▪ Gravity dam: Forces acting, elementary profile, stability analysis (basic).<br>▪ Earth dam: Components, types, seepage control (phreatic line).<br>○ Spillways: Types (ogee, chute, siphon), energy dissipaters.<br>○ Reservoir planning: Storage zones, capacity, sedimentation. | 1 | 25% |
| IV | **Modern Irrigation & Drainage**<br>• **Topics:**<br>○ Waterlogging and drainage: Causes, effects, prevention, drainage systems.<br>○ Modern irrigation methods:<br>▪ Sprinkler irrigation: Components, layout, advantages.<br>▪ Drip irrigation: Components, emitters, design considerations.<br>○ Irrigation management: Participatory irrigation management, warabandi.<br>○ Water conservation: Rainwater harvesting, watershed management.<br>○ Environmental impact of irrigation projects.<br>○ Introduction to CAD in irrigation design (basic). | 1 | 25% |

**Textbooks:**

- Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publishers)
- Irrigation Engineering – Dr. R.K. Sharma & Dr. S.K. Sharma (Kataria & Sons)
- Irrigation and Water Power Engineering – B.C. Punmia & B.B. Pande (Laxmi Publications)
- Irrigation: Theory and Practice – A.M. Michael (Vikas Publishing)

**Reference books:**

- Water Resources Engineering – R.K. Sharma & T.K. Sharma
- Irrigation Engineering – G.L. Asawa (Wiley Eastern)
- IS Codes:
  1. IS 6966: Criteria for Design of Cross-Drainage Works
  2. IS 12182: Guidelines for Design of Canal Linings

3. IS 8413: Criteria for Design of Diversion Weirs
- Manual on Irrigation and Drainage – Central Water Commission (CWC)
- Water Resources Engineering – P. Novak, A.I.B. Moffat, C. Nalluri, R. Narayanan

**Online Platforms:**

1. NPTEL:
   - "Irrigation Engineering" by Prof. R. Singh, IIT Roorkee
   - "Water Resources Engineering" by Prof. R. Nagarajan, IIT Bombay
2. SWAYAM: "Irrigation and Drainage Engineering" courses

**PRACTICAL LIST:**

- Soil Moisture Determination: Gravimetric method using oven drying.
- Infiltration Test: Double-ring infiltrometer method.
- Canal Design Exercise:
  1. Design of unlined canal using Kennedy's theory.
  2. Design of lined canal using Lacey's theory.
- Weir Design: Design of a vertical drop weir for given discharge.
- Drip Irrigation Layout: Preparation of layout and bill of materials for a small farm.
- Sprinkler Irrigation Design: Calculation of sprinkler spacing, pressure, and discharge.
- Field Visit Report: Visit to an irrigation project (dam/canal system).
- CAD Exercise: Drawing of canal cross-section and irrigation structure using AutoCAD.
- Crop Water Requirement: Calculation using Penman-Monteith method (simplified).
- Sediment Analysis: Determination of silt concentration in canal water.

**COURSE CODE: DCE602**

**COURSE NAME: TOWN PLANNING AND SMART CITIES**

**Course Objectives:**

- To introduce the principles, objectives, and evolution of town planning.
- To understand urban planning standards, land use patterns, and zoning regulations.
- To study urban infrastructure planning (transport, water, waste, housing).
- To explore the concept, components, and technologies of smart cities.
- To familiarize students with Indian planning acts, schemes, and sustainable urban development.

**Course Outcomes:** At the end of the course students shall be able to

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|---|---|
| CO1 | Explain the principles, history, and necessity of town planning. |
| CO2 | Prepare and interpret land use plans, zoning maps, and neighborhood layouts. |
| C03 | Plan urban infrastructure systems (roads, water supply, drainage, housing). |
| C04 | Describe smart city components, technologies, and implementation strategies. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Fundamentals of Town Planning**<br>• **Topics:**<br>  ○ Definition, objectives, and principles of town planning. | 1 | 25% |

| | | | |
|---|---|---|---|
| | ○ History of town planning: Ancient, medieval, and modern (Garden City, Radiant City, Neighborhood Concept).<br>○ Planning process: Surveys (physical, social, economic), data collection, analysis.<br>○ Planning theories: Concentric zone, sector, multiple nuclei models.<br>○ Introduction to urban and regional planning in India.<br>○ Planning legislation overview: TCPO, 74th Constitutional Amendment Act. | | |
| II | **Urban Planning Standards & Land Use**<br>• **Topics:**<br>○ Land use planning: Residential, commercial, industrial, recreational, public/semi-public zones.<br>○ Zoning regulations: FAR, ground coverage, building height, setbacks.<br>○ Development plans and master plans: Preparation and implementation.<br>○ Urban standards:<br>▪ Roads and transportation (width, hierarchy).<br>▪ Water supply, drainage, solid waste management norms.<br>▪ Parks, open spaces, and amenities per population.<br>○ Housing: Types, density norms, affordable housing schemes (PMAY). | 1 | 25% |
| III | **Urban Infrastructure & Environmental Planning**<br>• **Topics:**<br>○ Urban transportation: Hierarchy of roads, traffic planning, public transit.<br>○ Water supply and sanitation: Demand estimation, distribution, sewage treatment.<br>○ Solid waste management: Collection, processing, disposal methods.<br>○ Environmental planning: Pollution control, green belts, EIA for urban projects.<br>○ Sustainable urban development: Green buildings, rainwater harvesting, energy efficiency.<br>○ Urban renewal and slum rehabilitation. | 1 | 25% |
| IV | **Smart Cities & Digital Governance**<br>• **Topics:**<br>○ Smart city concept: Definition, objectives, global examples.<br>○ Smart city components:<br>▪ Smart governance (e-governance, | 1 | 25% |

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| | citizen participation).<br>▪ Smart infrastructure (smart water, waste, energy, mobility).<br>▪ Smart IT & communication (IoT, sensors, data analytics).<br>o Smart Solutions: Intelligent traffic management, smart grids, Wi-Fi hotspots.<br>o Indian Smart Cities Mission: Selection criteria, features, case studies.<br>o Challenges in smart city implementation: Financial, technical, social. | | |

**Textbooks:**

- Town Planning – S.C. Rangwala (Charotar Publishing)
- Town Planning & Smart Cities – Dr. Rame Gowda & S.C. Sharma
- Fundamentals of Town Planning – G.K. Hiraskar (Dhanpat Rai)
- Introduction to Urban Planning – A.K. Jain (TCPO Publications)

**Reference books:**

- The Smart City in a Digital World – Anthony M. Townsend
- Urban Planning and Development – S.K. Garg (Khanna Publishers)
- Smart Cities: Foundations, Principles, and Applications – Houbing Song et al.
- Government Publications:
  1. Smart City Guidelines – Ministry of Housing and Urban Affairs (MoHUA)
  2. URDPFI Guidelines 2014 (Urban and Regional Development Plans Formulation and Implementation)
  3. NUTP 2006 (National Urban Transport Policy)
- Urban Development Plans Formulation and Implementation – TCPO

**Online Platforms:**

1. NPTEL:
   - "Urban Planning" by Prof. K. Ramachandra Rao, IIT Kharagpur
   - "Smart Cities" by Prof. T. V. Prabhakar, IIT Madras
2. SWAYAM: "Urban Planning and Development" courses

**PRACTICAL LIST:**

- Land Use Mapping: Prepare existing and proposed land use maps for a given area using QGIS.
- Neighborhood Layout: Design a neighborhood unit for 5000 population with all amenities.
- Zoning Exercise: Apply zoning regulations (FAR, setbacks, height) to a residential plot.
- Urban Infrastructure Plan:
  1. Design road network hierarchy for a small town.
  2. Prepare water supply and drainage layout for a residential sector.
- Smart City Component Study:
  1. Case study analysis of one Indian smart city (e.g., Surat, Pune, Ahmedabad).
  2. Prepare a report on smart solutions implemented.
- GIS Practical:
  1. Create thematic maps (population density, land use) using QGIS.
  2. Buffer analysis for locating public amenities.
- Traffic Survey & Analysis: Conduct a manual traffic count and propose improvements.

- Site Visit Report: Visit to a local town planning authority or smart city project.
- 3D Modeling: Basic mass modeling of a city block using SketchUp/Revit.
- Development Plan Critique: Review and present key aspects of a city's master plan.

**COURSE CODE: DCE603**

**COURSE NAME: CONSTRUCTION TECHNOLOGY AND EQUIPMENT**

**Course Objectives:**

- To introduce modern construction techniques, materials, and methodologies.
- To understand the selection, operation, and management of construction equipment.
- To study advanced construction methods for substructures, superstructures, and special structures.
- To learn equipment economics, maintenance, and safety practices.
- To familiarize students with sustainable construction practices and automation.

**Course Outcomes:** At the end of the course students shall be able to

| | |
|---|---|
| CO1 | Explain modern construction techniques and materials for various civil engineering works. |
| CO2 | Select appropriate construction equipment for earthwork, concreting, and material handling. |
| C03 | Plan construction sequences for substructures, superstructures, and finishing works. |
| C04 | Calculate equipment productivity, cost, and efficiency for construction projects. |

| Unit | Content | Credit | Weightage |
|---|---|---|---|
| I | **Modern Construction Techniques & Materials**<br>• **Topics:**<br>o Introduction to construction technology: Evolution and trends.<br>o Modern construction materials:<br>▪ Advanced concrete (self-compacting, high-performance, fiber-reinforced).<br>▪ Prefabricated and precast components.<br>▪ Composite materials, smart materials (brief).<br>o Sustainable construction: Green building materials, recycling in construction.<br>o Modular construction and 3D printing in construction (concepts).<br>o Construction documents: Drawings, specifications, method statements. | 1 | 25% |
| II | **Construction Equipment - Earthwork & Material Handling**<br>• **Topics:**<br>o Equipment selection factors: Project size, soil type, cost, availability.<br>o Earthmoving equipment:<br>▪ Excavators (types, attachments), bulldozers, graders, scrapers. | 1 | 25% |

| | | | |
|---|---|---|---|
| | ▪ Trenching machines, compactors (smooth wheel, sheepfoot, pneumatic).<br>○ Drilling and blasting equipment (for rock excavation).<br>○ Material handling equipment:<br>▪ Cranes (mobile, tower, crawler), hoists, conveyors.<br>▪ Concrete mixers, batching plants, pumps, transit mixers. | | |
| III | **Construction Methods for Structures**<br>• **Topics:**<br>○ **Substructure Construction:**<br>▪ Deep excavation: Dewatering methods, sheet piling, diaphragm walls.<br>▪ Foundation techniques: Pile driving (precast, bored), caissons, well foundations.<br>○ **Superstructure Construction:**<br>▪ Formwork systems: Traditional, modular, flying formwork.<br>▪ Scaffolding and shoring types.<br>▪ Concrete placement techniques: Pumping, tremie, slipforming.<br>• **Finishing Works:**<br>○ Flooring types (terrazzo, epoxy, tile), false ceiling, plastering, painting.<br>• Pre-stressed and post-tensioned construction methods. | 1 | 25% |
| IV | **Equipment Management, Safety & Advanced Topics**<br>• **Topics:**<br>○ Equipment management:<br>▪ Ownership vs. rental decisions.<br>▪ Maintenance schedules (preventive, breakdown).<br>▪ Depreciation methods, operating cost estimation.<br>○ Construction safety:<br>▪ OSHA standards, PPE, safety in excavation, scaffolding, equipment operation.<br>▪ Hazard identification and risk assessment (HIRA).<br>• Advanced topics:<br>○ Automation in construction: Robotics, drones, GPS-guided equipment. | 1 | 25% |

| | | | |
|---|---|---|---|
| | ○ Building Information Modeling (BIM) in construction planning.<br>○ Lean construction principles. | | |

**Textbooks:**

- Construction Equipment & Management – S.C. Sharma & B.K. Kaul (Khanna Publishers)
- Construction Planning & Equipment – M.S. Deodhar (Charotar Publishing)
- Construction Planning, Equipment, and Methods – R.L. Peurifoy & R. Schexnayder (McGraw Hill)
- A Textbook of Construction Technology – Vazirani & Chandola (Khanna Publishers)

**Reference books:**

- Construction Technology – Roy Chudley & Roger Greeno
- Equipment for Construction – Dr. Mahesh Varma (Standard Publishers)
- IS Codes:
  - IS 4130: Safety Code for Scaffolding and Ladders
  - IS 5121: Safety Code for Piling and Foundation Work
  - IS 3764: Safety Code for Excavation Work
- Construction Management & Equipment – Kumar Neeraj Jha
- CPWD Works Manual – Volume I & II (Construction techniques)

**Online Platforms:**

1. NPTEL:
   - "Construction Equipment and Management" by Prof. S. P. Mukherjee, IIT Kharagpur
   - "Advanced Construction Technology" by Prof. S. K. Bhattacharyya, IIT Kharagpur
2. SWAYAM: "Construction Technology & Equipment Management" courses

**PRACTICAL LIST:**

- Equipment Identification & Study:
  - Prepare a catalog of construction equipment with specifications and applications.
  - Visit to equipment dealership/rental agency.
- Productivity Calculation:
  - Calculate output and cost for excavator, bulldozer, and concrete mixer.
- Site Layout Planning:
  - Prepare equipment layout for a G+2 building construction site.
- Formwork Design Exercise:
  - Design formwork for a RCC column and slab (manual calculation).
- Safety Audit:
  - Prepare a safety checklist for excavation, scaffolding, and equipment operation.
- Concrete Technology Practical:
  - Demonstration of concrete mixing, pumping, and testing (slump, cube).
- Earthwork Calculation:
  - Calculate cut and fill volumes from given site contours using software/manual methods.
- Equipment Maintenance Schedule:
  - Prepare preventive maintenance schedule for a excavator and concrete mixer.
- Case Study Presentation