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**DEPARTMENT OF CIVIL ENGINEERING**

**B.Tech Course Structure – Regulation: A-22**

**III Year I Semester**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max Marks** | |
| **CIE** | **SEE** |
| 1 | 9K577 | Summer Internship –I (Done after II\_II: 2 internal reviews + external) | **---** | --- | 3 | 1 | 40 | 60 |
| 2 | 9K510 | Reinforced Concrete Design | 2 | 1 | 0 | 2.5 | 40 | 60 |
| 3 | 9K511 | Structural Analysis-II | 2 | 1 | 0 | 3 | 40 | 60 |
| 4 | 9K512 | Geotechnical Engineering | 2 | 1 | 0 | 3 | 40 | 60 |
| 5 | 9ZC01 | Business Economics and Financial Analysis | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | 9EC41 | Artificial Intelligence | 3 | 0 | 0 | 0 | 40 | 60 |
| 7 | --- | **Professional Elective – I** | 3 | 0 | 0 | 3 | 40 | 60 |
| 8 | 9K578 | Geotechnical Engineering Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 9 | 9K579 | STAAD Pro Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 10 | 9K580 | Concrete Technology Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| **Total** | | | | | | **20.0** | **360** | **540** |

**Professional Elective – I: List of Subjects (III-I)**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Subject Code** | **Subject Name** |
| 1 | 9K551 | Disaster Mitigation Management |
| 2 | 9K552 | Advanced Structural Analysis |
| 3 | 9K553 | Green Buildings |

**III Year II Semester**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max Marks** | |
| **CIE** | **SEE** |
| 1 | 9K613 | Design of Steel Structures | 2 | 1 | 0 | 3 | 40 | 60 |
| 2 | 9K614 | Environmental Engineering | 3 | 0 | 0 | 2 | 40 | 60 |
| 3 | 9K615 | Foundation Engineering | 2 | 1 | 0 | 3 | 40 | 60 |
| 5 | 9K616 | Transportation Engineering | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | --- | **Professional Elective –II** | 3 | 0 | 0 | 3 | 40 | 60 |
| 7 | --- | **Open Elective – I** | 3 | 0 | 0 | 3 | 40 | 60 |
| 8 | 9K681 | Geographical Information Systems Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 9 | 9K682 | Environmental Engineering Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 10 | 9K683 | Transportation Engineering Lab | 0 | 0 | 3 | 1 | 40 | 60 |
| 11 | 9K684 | Comprehensive Test and Viva voce | --- | --- | --- | 1 | 40 | 60 |
| **Total** | | | | | | **22.0** | **400** | **600** |

**Open Elective – I: List of Subjects (III-II)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Subject Name** | **Subject Name** |
| 1 | 9EC42 | Computer Science Stream | Programming in JAVA |
| 2 | 9ZC22 | Entrepreneurship Stream | Basics of Entrepreneurship |
| 3 | 9ZC05 | Finance Stream | Banking Operations and Insurance |
| 4 | 9ZC08 | Innovation and Design Thinking Stream | Design Literacy and Design Thinking |

**Professional Elective – II: List of Subjects (III-II)**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Subject Code** | **Subject Name** |
| 1 | 9K654 | Geographic Information Systems |
| 2 | 9K655 | Environmental Impact Assessment |
| 3 | 9K656 | Repair and Rehabitation of Structures |

**IV Year I Semester**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max Marks** | |
| **CIE** | **SEE** |
| 1 | 9K785 | Summer Internship – II (Done after III\_II; 2 internal reviews + external) | 0 | 0 | 3 | 1 | 40 | 60 |
| 2 | 9K717 | Estimation, Costing and Specification | 3 | 1 | 0 | 3 | 40 | 60 |
| 3 | 9K718 | Hydrology and Water Resources Engineering | 3 | 0 | 0 | 3 | 40 | 60 |
| 4 | --- | **Professional Elective-III** | 3 | 0 | 0 | 3 | 40 | 60 |
| 5 | --- | **Professional Elective – IV** | 3 | 0 | 0 | 3 | 40 | 60 |
| 6 | --- | **Open Elective-II** | 3 | 0 | 0 | 3 | 40 | 60 |
| 7 | 9K786 | MAT Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 8 | 9K787 | Revit and Quantity Estimation Lab | 0 | 0 | 3 | 1.5 | 40 | 60 |
| 9 | 9K788 | Project Phase-I |  |  | 3 | 2 | 40 | 60 |
| **Total** | | | | | | **21** | **360** | **540** |

**Open Elective – II: List of Subjects (IV-I)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Name of Stream** | **Subject Name** |
| 1 | 9FC79 | Computer Science Stream | Data Base System Concepts |
| 2 | 9ZC23 | Entrepreneurship Stream | Advanced Entrepreneurship |
| 3 | 9ZC15 | Finance Stream | Financial Markets and services |
| 4 | 9ZC09 | Innovation and Design Thinking Stream | Co-Creation and Product Design |

**Professional Elective** – **III:List of Subjects (IV-I)**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Subject Code** | **Subject Name** |
| 1 | 9K757 | Finite Element Methods for Civil Engineering |
| 2 | 9K758 | Solid Waste Management |
| 3 | 9K759 | Prestressed Concrete Design |

**Professional Elective** – **IV: List of Subjects (IV-I)**

|  |  |  |
| --- | --- | --- |
| **S. No** |  | **Subject Name** |
| 1 | 9K760 | Ground Improvement Techniques |
| 2 | 9K761 | Construction Technology and Management |
| 3 | 9K762 | Pavement Analysis and Design |

**IV Year II Semester**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Subject** | **L** | **T** | **P/D** | **C** | **Max Marks** | |
| **CIE** | **SEE** |
| 1 | --- | **Professional Elective – V** | 3 | 0 | 0 | 3 | 40 | 60 |
| 2 | --- | **Open Elective-III** | 3 | 0 | 0 | 3 | 40 | 60 |
| 3 | 9K889 | Major Project | 0 | 0 | 4 | 10 | 40 | 60 |
| **Total** | | | | | | **16** | **120** | **180** |

**Professional Elective – V:**

|  |  |  |
| --- | --- | --- |
| **S. No** | **Subject Code** | **Subject Name** |
| 1 | 9K863 | Airports, Railways and Waterway (offered in IV-I) |
| 2 | 9K864 | Irrigation and Hydraulic Structures (offered in IV-I) |
| 3 | 9K865 | Geosynthetics |

**Open Elective-III**

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No** | **Subject Code** | **Name of Stream** | **Subject Name** |
| 1 | 9EC43 | Computer Science Stream | Operating System Concepts |
| 2 | 9ZC24 | Entrepreneurship Stream | Product and Services |
| 3 | 9ZC19 | Finance Stream | Project and Risk Management |
| 4 | 9ZC10 | Innovation and Design Thinking Stream | Entrepreneurship & Business Design |

**9K510: REINFORCED CONCRETE DESIGN**

**L T P/D C**

**B.Tech III Year I Sem. 2 1 - 2.5**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| X | X | X | X |  | X |  |  |  |  |  |  |

**Course Objectives:**

To enable the student

1. Understand the applications of concrete, basic requirements of concrete structures and learn the fundamentals of design philosophies.
2. Familiarize with relevant codes of practice (IS 456:2000), professional approaches, working stress method, ultimate load method, limit state method and field problems.
3. Is able to learn Design of flexure failures in beams and deflections in beams.
4. Understand the Design of Reinforced concrete Slabs with different types support conditions.
5. Understand the Design of RC Columns, Footing and Stair cases.
6. Acquire ability to draw, understand and interpret the structural drawings for various RC elements such as beams, slabs, columns and footings, including aspects of detailing.

**Course Outcomes:**

At the end of the course the student

1. Is able to use and suggest concrete for various practical applications.
2. Is able to interpret various specifications of relevant standards, to field problems and professional practices.
3. Is able to design beams in singly reinforced, doubly reinforced rectangular and flanged beams.
4. Is able to design slabs with different conditions and different supports.
5. Is able to design axial loading, Uni-axial and biaxial bending of columns and Design of isolated square, rectangular and circular footings.
6. Interprets and communicates the design and detailing of rc beams, slabs, columns, stair cases and footings, through appropriate structural drawings.

**UNIT-I:**

**Introduction to Reinforced Cement Concrete:**

Applications of Concrete, Need for Reinforcement in Concrete ,Types and Properties of Concrete and Steel, Tests on concrete and steel, RCC as a material, Basic requirements of an RCC Structure ,stability, strength, serviceability and durability.

**Principles of Limit state design and Ultimate strength of R.C. Section:** Development of design philosophies-Working stress method (WSM), Ultimate load method, and Limit state method (LSM) relative merits and demerits. Basic concepts and characteristics loads and strengths, Partial safely factors. Stress strain relationship for concrete and steel.

**UNIT –II:**

**Limit state of collapse (flexure):** Limit State analysis of rectangular RCC beams, balanced, under-reinforced and over reinforced sections; Analysis and design of singly and doubly reinforced rectangular sections.

**UNIT-III:**

**Limit state of collapse (Shear & Torsion):** Limit State analysis of section for shear and torsion. Assumptions, Analysis and design of flanged beams. Anchorage and development length, Curtailment of reinforcement in beams.

**Limit states of serviceability:** Short term, long term and total deflections, check for deflection and cracking.

**UNIT-IV:**

**Analysis and design of slabs:** Definition of a Slab, Types of Slabs, one way, two way simply supported slabs subjected to only uniformly distributed loads. IS Code method - Design of solid rectangular slabs as per IS 456:2000, Detailing of reinforcement in slabs.

**Design of staircases:** Types of stair case, loads on stair cases, effective span as per IS code provisions, distribution of loading on stairs, with waist slabs.

**UNIT-V:**

**Analysis and design of columns**: Assumptions, axially loaded circular, square and Rectangular columns, Uni axial and biaxial bending of columns- subjected to a axial load & bending. Design as per IS 456:2000 code and Interaction diagrams.

**UNIT-VI:**

**Analysis and Design of Footings:** Design of isolated square, rectangular and circular footings, sloped footings as per IS code 456:2000.

**TEXT BOOKS:**

1. N.KrishnaRaju &R N Praneesh “Reinforced Concrete Design” New Age International(P) Limited, Publishers 1st Edition 2003
2. Unni Krishnan Pillai and Devadass Menon,“Reinforced Concrete Design” ,Tata McGraw-Hill Publishing Co Ltd,3rd Edition 2017.

**REFERENCES:**

1. IS 456 (2000): Plain and Reinforced Concrete - Code of. Practice
2. SP16: Design Aids For Reinforced Concrete related to IS : 456.
3. V.L.Shah & S.R.Karve, "Limit State Theory and Design of Reinforced Concrete”, Structures Publications, 7th Edition, 2014.
4. Limit State Design of Reinforced concrete-by P.C. Varghese, PHI Learning Private Limited 2008-2009.
5. Fundamentals of Reinforced concrete Design-by M.L.Gambhir, PHI Learning Private Limited 2008-2009.

**9K511 STRUCTURAL ANALYSIS – II**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
|  | **H** | **M** | **L** |  |  |  |  |  |  |  |  |

**B.Tech III Year I Sem. L T P C**

**2 1 0 3**

**Course Objectives:** The objective of the course is to

CO1 Able to identify the various actions in arches and find the moments according to moment distribution method.

CO2 Able to find the moments from Kani's Method and different between the cantilever and portal frame method.

CO3 Able to distinguish between flexibility and stiffness matrix methods and understand the significance of influence lines in solving the continuous beams.

**Course Outcomes:** At the end of the course the student will able to

CO1 Analyze the various actions in arches and the moments according to moment distribution method.

CO2 Analyze the moments from Kani's Method and frames in the cantilever and portal frame method.

CO3 Analyze the continuous beams using flexibility and stiffness matrix methods and using with influence lines

**UNIT – I**

**Two Hinged Arches:** Introduction – Classification of Two hinged Arches – Analysis of two hinged

parabolic arches – Secondary stresses in two hinged arches due to temperature and elastic shortening

of rib.

**UNIT – II**

**Moment Distribution Method -** Analysis of continuous beams with and without settlement of supports

using - Analysis of Single Bay Single Storey Portal Frames including side Sway - Analysis of inclined

frames - Shear force and Bending moment diagrams, Elastic curve.

**UNIT – III**

**Kani’s Method**: Analysis of continuous beams including settlement of supports - Analysis of single bay

single storey Frames including Side Sway using Kani’s Method - Shear force and bending moment diagrams - Elastic curve.

**UNIT – IV**

**Approximate Methods Of Analysis:** Introduction – Analysis of multi-storey frames for lateral loads:

Portal Method, Cantilever method.

**UNIT – V**

**Matrix Methods Of Analysis:** Introduction to Flexibility and Stiffness matrix methods of analyses using

‘system approach’ upto three degree of indeterminacy– Analysis of continuous beams including

settlement of supports using flexibility and stiffness methods.

**UNIT- VI**

**Influence Lines For Indeterminate Beams:** Introduction – influence line diagram for shear force and

bending moment for two span continuous beam with constant and influence line diagram for shear force and bending moment for propped cantilever beams.

**TEXT BOOKS:**

1. Structural Analysis Vol –I &II by Vazarani and Ratwani, Khanna Publishers.

2. Structural Analysis Vol I & II by G.S. Pandit S.P. Gupta Tata McGraw Hill Education Pvt. Ltd.

3. Indeterminate Structural Analysis by K.U. Muthu et al., I.K. International Publishing House Pvt. Ltd

**REFERENCES:**

1. Structural analysis T. S Thandavamoorthy, Oxford university Press.

2. Mechanics of Structures Vol –II by H.J. Shah and S.B. Junnarkar, Charotar Publishing House Pvt. Ltd.

3. Basic Structural Analysis by C.S.Reddy., Tata McGraw Hill Publishers.

4. Examples in Structural Analysis by William M.C. McKenzie, Taylor & Francis.

5. Structural Analysis by R. C. Hibbeler, Pearson Education.

6. Structural Analysis by Devdas Menon, Narosa Publishing House.

**9K512**: **Geotechnical Engineering**

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| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **x** | **x** | **X** |  |  |  | **X** |  |  |  |  |  |

**B.Tech III Year I Sem.**  **L T P/D C**

**2 1 - 3**

**Course Objectives:** To enable the student to

1. Understand the importance of formation and basic properties of soil
2. To learn about index properties of soil and available soli classification methods
3. Understand flow process through porous media.
4. Understand concepts of Stress distribution in soil and Effective stress of soil
5. Get an idea of Compaction and consolidation of soil
6. Understand the concepts of shear strength of soil

**Course Outcomes:** At the end of the course, the student

1. Can depict the various phases and fabric of soil
2. Can able to determine the index properties and classify the soil
3. Is able to apply the concepts of water flow through soil in the context of design and construction of embankments, canals etc.
4. Is able to Apply stress distribution and effective stress in soil for designing the foundation.
5. Can compute the compressibility of different types of soil.
6. Is able to draw the Mohr’s circle and find out shear strength parameters of soil

**SYLLABUS**

**UNIT I**

**Introduction:** Origin and formation of soil, History of soil mechanics, Phase diagrams, Basic Definitions-Voids ratio, Porosity, Degree of saturation, Moisture content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density - inter relationships.

**Structure of soil: C**lay mineralogy, Flocculated and dispersed structure, single grained and honey comb structures, Double diffuse layer

**UNIT-II:**

**Index Properties of Soils:** Definitions and importance of Index properties, particle size distribution, sedimentation analysis (Hydrometer analysis only) Importance of consistency limits, Classifications of Soils: Necessity, IS classification of soils, plasticity chart and its importance, field identification of soils.

**UNIT-III:**

**Flow of Water Through Soil:** Darcy's law - Assumptions and validity, seepage velocity, superficial velocity and their relationships, coefficient of percolation Coefficient of permeability and its determination (excluding field method). Factors affecting permeability – Permeability of stratified soils.

**UNIT-IV:**

**Effective stress in Soils -** Total pressure and effective stress and its importance, Quick sand phenomenon, Soil moisture and modes of occurrence, capillary phenomenon**.**

**Stresses in Soil:** Boussinesq's and Westergaard's theories for concentrated, circular, rectangular loads, strip load - Newmark's chart. Pressure bulb. Contact pressure.

**UNIT - V**

**Compaction of Soils:** Definition; objects, concept of compaction, factors affecting compaction, Effect of compaction on soil properties. Field compaction methods -Rollers and vibrators; Field compaction control - Procter's needle.

**Compressibility of Soils:** Meaning, fundamental definition, Mass-spring analogy - Terzaghi's one dimensional consolidation theory - Assumptions, limitations and applications (Derivation and mathematical solution not required) – Normal, under and over consolidated soils, Pre-consolidation pressure, coefficient of consolidation and their importance.

**UNIT - VI**

**Shear Strength of Soil: Concept of shear strength -** Mohr’s strength theory, Mohr - Coulomb theory. Shear strength tests under different drainage conditions. Shear strength parameters, factors affecting shear strength of soils.

**TEXT BOOKS:**

1. Gopal Ranjan and Rao A.S.R, Basic and Applied Soil Mechanics, (2000), New Age International (P) Ltd., New Delhi. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering, (2009), “Tata Mc Graw Hill.

2.Punmia, B.C. Ashok Kumar Jain & Arun Kumar Jain, "Soil Mechanics and Foundations", Laxmi Publishing Co., New Delhi. 2003.

3. Murthy, V.N.S., " Principles of Soil Mechanics and Foundation Engineering", 5th Revised Ed., UBS Publishers and Distributors ltd, New Delhi, 2001.

**REFERENCES:**

1. Bowles, J.E, “Foundation Analysis and Designs” 5th Ed. Mc Graw Hill Publishing, New York – 2008.

2. Venkatramaiah, C.,"Geotechnical Engineering”, revised third Ed., New Age International publishers, 2006.

3. Alam Singh and Chowdhary G.R, Soil Engineering in Theory and Practice, (1994), CBS Publishers and Distributors Ltd., New Delhi.

**9ZC01 BUSINESS ECONOMICS AND FINANCIAL ANALYSIS**

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| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** | **l** |
|  |  |  |  |  |  |  |  | **x** |  | **x** |  |

**L T P/D C**

**3 0 0 3**

**Course Objectives:**

Co 1: To understand the nuances of Business and its relation to economics

Co 2: To understand the production function and cost concepts

Co 3: To learn the basic market structures and their relevance to business

Co 4: To learn the fundamentals of financial accounting concepts

Co 5: To apply the fundamental concepts of financial accounting in preparation of financial           statements.

Co 6: To understand the financial ratios that are used to analyze the financial performance of the           company.

After completion of the courses the student will be above to:

Co 1: Explain the Basic of Economics and its relation to Business Economics (L2)

Co 2: Analyze the production function in terms of cost and revenue (L4)

Co 3: Examine the basic market structures and their relevance to business (L4)

Co 4: Outline the fundamentals of financial accounting and prepare financial statements (L2)

Co 5: Apply financial ratios to analyze the financial performance of the company (L3)

**UNIT I**

**INTRODUCTION TO BUSINESS ECONOMICS:**

Definition, Nature and Scope of Business Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions, Elasticity of Demand, Types of Elasticity of Demand and Demand Forecasting – Statistical and Non-Statistical techniques.

**UNIT II**

**THEORY OF PRODUCTION AND COST ANALYSIS:**

Production Function – Isoquants and Isocosts, Internal and External Economies of Scale, Law of Returns Cost Analysis: Cost concepts, different types of costs, Break-even Analysis (BEA)- Determination of Break-Even Point (simple problems).

**UNIT III**

**INTRODUCTION TO MARKETS**

Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition, Pricing Methods and strategies.

**UNIT IV**

**FINANCIAL ACCOUNTING - I:**

Accounting concepts and Conventions, Double-Entry system of Accounting, Accounting Cycle, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance.

**UNIT V**

**FINANCIAL ACCOUNTING – II:**

Introduction to Final accounts, Revenue and Capital Expenditure, elements of Financial Statements, Preparation of Final Accounts with simple adjustments (simple problems).

**UNIT-VI**

**FINANCIAL ANALYSIS THROUGH RATIOS:**

Concept of Ratio Analysis, Various Types of Ratios: Liquidity Ratios (short term solvency ratios), Leverage Ratios (long term solvency ratios), Turnover Ratios and Profitability Ratios (simple problems).

**Essential Readings:**

* Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.

**References:**

* Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
* H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
* Suma Damodaran, Managerial Economics, Oxford University Press.

**ARTIFICIAL INTELLIGENCE**

**L T P C**

**2 0 0 0**

**Code: 9EC41**

**Course objective:**

To learn the distinction between optimal reasoning vs human like reasoning. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities. To learn different knowledge representation techniques. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

**COUR****SE OUTCOMES:**

**At the end of this course the student will be able to**

1. Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
2. Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
3. Learn different knowledge representation techniques.
4. Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
5. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
6. Analyze Supervised Learning Vs. Learning Decision Trees

**UNIT - I**

Introduction to AI, Intelligent Agents, Problem-Solving Agents, Searching for Solutions, Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

**UNIT-II**

Games, Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic, Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

**UNIT-III**

Representation, Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

**Knowledge Representation:** Ontological Engineering, Categories and Objects, Events.

**UNIT-IV**

Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

**UNIT-V**

Acting under Uncertainty, Basic Probability Notation Bayes’ Rule and Its Use, Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The

Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability, Other Approaches to Uncertain Reasoning; Dempster-Shafer theory.

**Unit-VI**

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees.

**TEXT BOOKS**:

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

**REFERENCES:**

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

**9K551: DISASTER MITIGATION AND MANAGEMENT**

**(Professional Elective – I)**

**B. Tech III Year I Sem.**  **L T P/D C**

**3 - - 3**

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| a | b | c | d | e | f | g | h | i | j | k |
| X |  | X |  | X |  |  |  |  |  |  |

**Course objectives:**

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. To impart knowledge in students about the nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro meteorological and geological based disasters.
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. To equip the students with the knowledge of various chronological phases in the disaster management cycle.
5. To create awareness about the disaster management framework and legislations in the context of national and global conventions.
6. To enable students to understand the applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

**Course outcomes**

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local, national and international levels
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness regarding the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans.
5. Applying the concepts of remote sensing and geographical information systems for their effective application in disaster management

**SYLLABUS**

**UNIT-I**

**Introduction**- Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

**UNIT-II**

**Natural disasters**– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.

**UNIT III**

**Geographical based disasters**- Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

**UNIT IV:**

**Human induced hazards**: Risks and control measures in a chemical industry, Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents and traffic accidents .

**UNIT V:**

**Use of remote sensing and gis**- in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

**UNIT VI:**

**Concept of disaster management**- Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

**TEXT BOOKS:**

1. Rajib, S and Krishna Murthy, R.R (2012) “Disaster Management Global Challenges and Local Solutions" Universities Press Hyderabad.
2. Battacharya, T. (2012), Disaster Science and Management. Tata McGraw Hill Company, New Delhi.
3. Navele, P & Raja, C.K. (2009), Earth and Atmospheric Disasters Management, Natural and Manmade. B.S. Publications, Hyderabad.

**REFERENCES:**

1. Fearn-Banks, K (2011), Crises computations approach: A case book approach. Route ledge Publishers, Special Indian Education, New York & London.
2. Notes / Reading material published by National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.

**9K552ADVANCED STRUCTURAL ANALYSIS**

**(Professional Elective – I)**

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**B.Tech III Year I Sem. L T P C**

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**Course Objectives:** The objective of the course is to

CO1 Able to Understand the matrix method of analysis statically indeterminate frames and trusses.

CO2 Know the transformation of coordinates and assembly of stiffness matrices

CO3 Differentiate between flexibility and stiffness methods of analysis of beams, frames and plane

trusses

**Course Outcomes:** At the end of the course the student will able to

CO1 Analyze the multistory building frames by various approximate methods.

CO2 Solve the continuous beams, portal frames by matrix methods of analysis.

CO3 Analyze and design of large frames with or without shear walls

**UNIT- I**

Introduction to matrix methods of analysis statically indeterminacy and kinematics indeterminacy degree

of freedom-coordinate system-structure idealization stiffness and flexibility matrices-suitability

element stiffness equations-elements.

**UNIT- II**

flexibility equations-mixed force-displacement equations-for truss element, beam element and tensional element

Transformation of coordinates-element stiffness matrix-and load vector-local and global coordinates.

**UNIT- III**

Assembly of stiffness matrix from element stiffness matrix-direct stiffness method-general procedure bank

matrix-semi bandwidth-computer algorithm for assembly by direct stiffness matrix method.

**UNIT- IV**

Analysis of plane truss-continuous beam-plane frame and grids by Flexible methods.

**UNIT- V**

Analysis of plane truss-continuous beam-plane frame and grids by stiffness methods.

**UNIT- VI**

Special analysis procedures-static condensation and sub structuring-initial and thermal stresses.

Shear Walls Necessity-structural behavior of large frames with and without shear walls-approximate

methods of analysis of shear walls.

**TEXT BOOKS:**

1. Matrix methods of structural analysis by Willam Weaver and gere, CBS Publishers.

2. Advanced Structural Analysis by A.K. Jain Nemchand Publishers

**REFERENCES:**

1. Advanced Structural Analysis by Devdas Menon, Narosa publishing house.

2. Matrix methods of structural analysis by Pandit and gupta

3. Matrix methods of structural analysis by J Meek

4. Structural Analysis by Ghali and Neyveli

**Code: 9K553. GREEN BUILDINGS**

**L T P C**

**3 0 0 3**

**(Professional Elective – I)**

**B.Tech III Year I Sem.**

**Course Objectives**

* This course introduces the concepts of sustainability in the context of energy and resource efficient buildings. It also intends to make students aware of rating systems like LEED, GRIHA etc.
* Itdiscusses the role of low carbon cements and recycled aggregate in minimizing consumption ofnatural resources.
* The course also emphasizes the concepts of embodied, operational, life cycleenergy and minimizing energy consumption.

**Course Outcomes (COs)**

**After the completion of the course, the student will be able to:**

1. Recall the necessity of environmentally sustainable buildings and contrast the green building with the traditional building
2. Summarize green building concepts and different rating agencies to classify the type of building
3. Identifygreen building materials and practices
4. Explainkey design principles of green buildings
5. examine green design concepts for air conditioning.
6. Dissect methods for material conservation.

**Unit – IGLOBAL WARMING:**

Definition - Causes and Effects - Contribution of Buildings towards Global Warming – Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in MaterialsGreen Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.

**Unit – IIGREEN BUILDING**

Concept of Green building, Principles of green buildings, Eco-friendly materials;key requisites of a Green Building, Important Sustainable features for Green Building; Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership inEnergy and Environmental Design (LEED)**.**

**Unit – III GREEN BUILDING MATERIALS AND PRACTICES:**

Green Building Materials and Equipment in India, Green Building Features, Materials and Resources, Water Efficiency, Optimum EnergyEfficiency, Typical Energy Saving Approach in Buildings.

**Unit – IVGREEN BUILDING DESIGN:**

Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise SystemEfficiency, steps to reduce Energy Demand; Use of Renewable Energy Sources;Eco-friendly captive power generation for Building requirement.

**Unit – VAIR CONDITIONING:**

Introduction,CII Godrej Green business centre,Design philosophy,Design interventions,Energy

modeling, HVAC System design,Chiller selection,pump selection,Selection of coolingtowers,Selection of air handing units,Precooling of fresh air,Interior lighting system,Key featureof the building.

**Unit – VI MATERIAL CONSERVATION:**

Handling of non-process waste, waste reduction during construction,materials with recycled

content,local materials,material reuse,certified wood, Rapidly renewable building materials and

furniture.

**Text Books:**

1. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
2. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air Conditioning Engineers, 2009.

**References:**

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Bradley A. Striebig, Adebayo A. Ogundipe and Maria Papadakis, Engineering Applications inSustainable Design and Development. First edition, 2016.

**Code: 9K578 -Geotechnical Engineering lab**

**L T P C**

**0 0 3 1.5**

**B.Tech III Year I Sem.**

**Course Objectives**

1. This Lab Course will enable the students to understand the Different test need to be done in order to know the Geotechnical Properties of soil and use them in real time civil engineering problems

**Course Outcomes:**

1. Students are able to Determine the Index Properties of Soil.
2. Students are able to Determine the Engineering Properties of Soil.

**List of Experiments**

**1.** Determination of specific gravity of soil sample by pycnometer method

2. Grain size analysis of soil sample by sieve analysis

3. Determination of in situ density by core cutter method

4. Determination of in situ density by sand replacement method

5. Determination of liquid limit and plastic Limit of soil samples by Casagrande method

6. Determination of compaction characteristics of soil by standard proctor compaction test

7. Determination of compaction characteristics of soil by Modified proctor compaction test

8. Determination of coefficient of permeability of soil sample by constant and variable head method

9. Determination of shear strength parameters of soil by direct shear test

10. Determination of shear strength parameters of soil sample by unconfined compression test.

11. Determination of shear strength parameters of soil sample by Triaxial shear test

12. Determination of compression index and coefficient of consolidation by consolidation test

**Code:9K579 - STAAD PRO LABORATORY**

**B.Tech III Year I Sem.**

**L T P/D C**

**0 0 3 1.5**

**Course Objectives:**

1. To expose the students to various computer programming skills related to Civil Engineering field.
2. To empower the students to develop programs using Excel /other related software's.

**Course Outcomes:**

At the end of the course the student will be able to:

1. Use Excel sheets for Civil Engineering applications.
2. Write computer programs for structures with various loading and support conditions using Civil Engineering related software such as STAAD Pro.

**LIST OF EXPERIMENTS:**

**Using -STAADPRO. Software**

1. Analysis of continuous beam with different loading conditions.
2. Analysis of Frame with different loading conditions.
3. Analysis and Design of Column.
4. Analysis and Design of a single storied Building.
5. Analysis and Design of a multi storied Building under seismic and wind load.
6. Analysis and Design of a Simple Truss.
7. Determine the stresses in footing to the given loads.
8. Design of footing for the given loading condition.
9. Analysis of slab in **STAAD**
10. pre engineered building PEB structures.
11. Design of RCC beams and slabs.
12. Design of Axially loaded short column.

**Code:9K580---CONCRETETECHNOLOGYLAB**

**L T P/D C**

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**B.TechIIIYearI Sem.**

**CourseObjectives:**

1. PerformthetestprocedurestofindPhysicalpropertiesofCement
2. UnderstandthetestprocedurestofindSpecificGravity,BulkingofAggregates.
3. Evaluatefreshconcreteproperties
4. UnderstandthetestprocedurestofindpropertiesofHardenedConcrete

**CourseOutcomes:**

Thestudentwill beableto:

1. TestFineness,SpecificGravity,SettingTime,SoundnessandCompressiveStrengthofCement
2. TestSpecificGravityofCoarseAggregateandFineAggregate,BulkingofFineAggregate.
3. DesignConcreteMixProportioningbyUsingIndianStandardMethod.
4. TestWorkabilityofFreshConcreteandCompressivestrength,SplitTensileStrengthofHardenedConcrete.

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|  | **ExpNo.** | **EXPERIMENTNAME** |
| **Cycle–I** | **TestsonCement:** | |
| 1 | StandardConsistency |
| 2 | Initial&finalSetting Time |
| 3 | SpecificGravityofcement |
| 4 | FinenessandSoundnessofcement |
| 5 | CompressiveStrengthofcement |
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| **TestsonAggregates:** | |
| 6 | Specific GravityofCoarse Aggregate |
| 7 | SpecificGravityofFineAggregate. |
| 8 | BulkingofFineAggregate. |
|  | |
| **Cycle –II** | 9 | IS methodofmixdesignofconcrete. |
|  | |
| **TestsonFreshConcrete:** | |
| 10 | SlumpconeTest |
| CompactionfactorTest |
| VeeBeeTest |
|  | |
| **TestsonHardenedConcrete:** | |
| 11 | Compressive&SplitTensile&FlexuralstrengthTests. |
| 12 | ModulusofElasticity&NonDestructive Testsonconcrete. |

**III YEAR II SEMESTER**

**9k613: Design of Steel Structures**

**B.Tech III Year II Sem.**  **L T P/D C**

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**Course Objectives:**

To Enable the students

1. Learn and apply the design philosophies (working stress method and limit state method) for various steel structural components and their connections, as per the relevant standards.
2. Understand the Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members.
3. Understand the design principles of tension members design of lug angles staggered bolting of Steel Structures to field problems.
4. To learn plastic analysis plastic hinge, plastic moment and design of laterally supported beams and laterally unsupported Beams
5. Understand the types of trusses, Estimation of loads and design of purlins, design of its members with angle sections
6. To learn design of simple slab base and gusseted base and design of plate girders optimum depth design of main section.

**Course Outcomes:**

At the end of the course, the student

1. Attains fundamental knowledge of the design of various Steel Structures and connections and is able to interpret the specifications of relevant codes.
2. Gets adequate knowledge and skills to apply the design principles to field problems.
3. Is able to design principles to field problems of tension members.
4. Is able to draw, understand and interpret the detailing aspects of steel structural drawings.
5. Is able to investigate into the critical issues of steel structures, compare various options and chose the best solution for the problems in the area of steel structures.
6. Is able to design the end bearing Stiffness and intermediate stiffness.

**UNIT- I:**

**Materials and Specifications**: Chemical composition of steel, types of Structural

Steel - classification of Rolled Steel Sections.

**Loads and Load Combinations**: Design Loads & load Combinations; Characteristic Loads, Partial safety factors for materials and loads.

**Bolted Connections (Limit State Method):** Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG).

**Welded Connections (Limit State Method):** Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections.

**UNIT –II:**

**Design of Compression Members:** Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members.

**UNIT- III:**

**Design of tension members (Limit State Method):** Introduction to tension members - Applications of tension members, Modes of Failure, Design of Tension Members –Design of Lug Angles - Staggered bolting.

**UNIT –IV:**

**Plastic Analysis**  : Plastic moment-plastic section modulus Plastic Analysis of continuous beams – design of flexural members Design of Laterally Supported beams and unsupported beams- bending and shear strength /buckling -built-up sections beam splice .

**UNIT –V: Design Of Welded Plate Girders**

-Elements economical depth design of main section- connections between web and flanges design of end bearing Stiffeners and intermediate Stiffeners design of web splice and flange splice .

**UNIT –VI:**

**Design Of Industrial Structures**

**(Limit State Method):** Types of Roof trusses, loads on trusses wind load, purlin Design, truss design of welded Gantry girder .

.

**TEXT BOOKS**

1. Design of Steel Structures -, S.S Bhavikatti 5thEDITION IK International publishing house( P)limited 2012
2. Limit State Design of Steel Structures 2nd EDITION –S.K .Duggal. TATA Megra Hill 2015

**REFERENCE BOOKS**

1. Design of steel structure – K. S Sai Ram, Person Education.2010
2. Design of steel structure Ashok Kumar Jain ,B.C Punmia, Arun Kumar Jain LAXMI PUBLICATIONS (P)LTD.1998
3. IS800-2007, General Construction in Steel - Code of Practice.
4. Steel Tables as per IS 800, Birla Publications Pvt. Ltd.
5. IS 875 –2015 PART 3 - Code of Practice.

**9K614: ENVIRONMENTAL ENGINEERING**

**B.Tech. III Year II Sem.**

**L T P/D C**

**3 0 0 2**

**Course Objectives:** This subject provides the knowledge of water sources, water treatment, design of distribution system waste water treatment, and safe disposal methods. The topics of characteristics of waste water, sludge digestion is also included.

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

* Assess characteristics of water and wastewater and their impacts
* Estimate quantities of water and waste water and plan conveyance components
* Design components of water and waste water treatment plants
* Be conversant with issues of air pollution and control

**Unit – I**

Introduction: Waterborne diseases – protected water supply – Population forecasts, design period – types of water demand – factors affecting – fluctuations – fire demand – water quality and testing – drinking water standards: sources of water - Comparison from quality and quantity and other considerations – intakes – infiltration galleries.

**Unit – II**

Layout and general outline of water treatment units – sedimentation – principles – design factors – coagulation-flocculation clarifier design – coagulants - feeding arrangements. Filtration – theory – working of slow and rapid gravity filters – multimedia filters – design of filters – troubles in operation - comparison of filters – disinfection – theory of chlorination, chlorine demand - other disinfection practices–Design of distribution systems–pipe appurtenances.

**Unit – III**

Characteristics of sewage –waste water collection–Estimation of waste water and storm water – decomposition of sewage, examination of sewage – B.O.D. Equation – C.O.D. Design of sewers – shapes and materials – sewer appurtenances, manholes – inverted siphon – catch basins – flushing tanks – ejectors, pumps and pump houses – house drainage – plumbing requirements – sanitary fittings-traps – one pipe and two pipe systems of plumbing – ultimate disposal of sewage – sewage farming –self-purification of rivers.

**Unit – IV**

Waste water treatment plant – Flow diagram - primary treatment Design of screens – grit chambers – skimming tanks – sedimentation tanks – principles of design – Biological treatment – trickling filters – ASP– Construction and design of oxidation ponds. Sludge digestion – factors effecting – design of Digestion tank – Sludge disposal by drying – septic tanks working principles and design – soak pits.

**Unit –V**

Air pollution– classification of air pollution– Effects air pollution–Global effects–Meteorological parameters affecting air pollution–Atmospheric stability–Plume behavior –Control of particulates – Gravity settlers, cyclone filters, ESPs–Control of gaseous pollutants–automobile pollution and control.

**Unit-VI**

Solid Waste: Definitions, Types of solid wastes, sources of solid wastes, Characteristics, and perspectives; properties of solid wastes, Sampling of Solid wastes, Elements of solid waste management - Integrated solid waste management, Solid Waste Management Rules 2016.

**Text books:**

1. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) Pvt Ltd, 2014
2. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
3. Environmental Engineering, I and II by BC Punmia, Std. Publications.
4. Environmental Engineering, I and II by SK Garg, Khanna Publications.
5. Environmental Pollution and Control Engineering CS Rao,Wiley Publications.

**Reference books:**

1. Water and Waste Water Technology by Steel, Wiley
2. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
3. Water and Waste Water Engineering by Fair Geyer and Okun, Wiley, 2011
4. Water and Waste Water Technology by Mark J Hammar and Mark J. HammarJr.Wiley, 2007.
5. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
6. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
7. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication.

**9K615: Foundation Engineering**

**B Tech III Year II Sem L T P/D C**

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**Prerequisite – Geotechnical Engineering**

**Course Objectives:** To enable the student to

1. To Plan and execute the Soil exploration program for civil Engineering Projects.
2. Get an idea of analysing the stability of slopes.
3. To determine the lateral earth pressures and design retaining walls.
4. To determine the Bearing capacity of Soils.
5. Understanding the concepts of pile foundation.

**Course Outcomes**: At the end of the course the student will able to

1. Can Depict the principles and methods of Geotechnical Exploration
2. Assess the stability of slopes
3. Compute the lateral earth pressures and check the stability of retaining walls
4. Analyse and design the shallow and deep foundations

**SYLLABUS**

**Unit – I**

**Soil Exploration:** Need – methods of soil exploration – boring and sampling methods –penetration tests – plate load test– planning of soil exploration programme, Bore logs and preparation of soil investigation report.

**Unit – II**

**Slope Stability**: Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish slip circle method, method of slices, Bishop’s Simplified method of slices – Taylor’s Stability Number.

**Unit – III**

**Earth Pressure Theories**: Active, Passive and at rest soil pressures Rankine’s theory of earth pressure –Coulomb’s earth pressure theory.

**Retaining Walls**: Types of retaining walls – stability of gravity and cantilever retaining walls against overturning, sliding and, bearing capacity, filter material for drainage.

**Unit – IV**

**Bearing Capacity**: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi and Brinch Hansen are bearing capacity equations - assumptions and limitations. Bearing capacity of footings subjected to eccentric loading. Effect of ground water table on bearing capacity.

**Unit – V**

**Shallow Foundations** - Types - choice of foundation – location and depth - safe bearing capacity – shear criteria – Terzaghi’s, and IS code methods - settlement criteria – allowable bearing pressure based on SPT N value and plate load test – allowable settlements of structures.

**Unit – VI**

**Pile Foundation**: Types of piles – load carrying capacity of piles based on static pile formulae – dynamic pile formulae – Pile Capacity through SPT results - pile load tests - load carrying capacity of pile groups in sands and clays – Settlement of pile groups – negative skin friction

**Textbooks**

1. Murthy, V. N. S. Advanced Foundation Engineering. CBS Publishers & Distributors, 2007.
2. Arora, K. R. (2008). Soil mechanics and foundation engineering (geotechnical engineering). Standard Publishers Distributors, Nai Sarak, Delhi, 953p.
3. Gopal Ranjan and Rao A.S.R, Basic and Applied Soil Mechanics, (2000), New Age International (P) Ltd., New Delhi. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering, (2009), “Tata Mc Graw Hill.

**References**

1. Punmia, B.C. Ashok Kumar Jain & Arun Kumar Jain, "Soil Mechanics and Foundations", Laxmi Publishing Co., New Delhi. 2003Braja M Das, Principles of soil dynamics, Cengage Engineering, 2014.

2. Bowles, J.E., (2001) Foundation Analysis and Design – 4th Edition, McGraw-Hill Publishing company, Newyork.

3. Das, Braja M. Principles of foundation engineering. Cengage learning, 2015

**Code: 9K616-Transportation Engineering**

**B Tech III Year II Sem**

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**Course Objectives:**

The student is being exposed to the subject with following Objectives:

1. Understand the design concepts of highways, the quality of the materials required for the construction of highways
2. To learn about the different techniques used in construction of flexible and rigid pavements.
3. Know how to collect the field data for the evaluation of traffic patterns.
4. Know the requirements for designing the railway tracks and the material required for the construction of permanent way.
5. Get an idea for the planning of airports and fixing of run way orientation.
6. Applying the various corrections while constructing Airports and runway lighting.

**Course Outcomes:**

On successful completion of the course, the student shall:

1. Applies the Pavement design concepts to different types of pavements
2. Takes precautions required for the execution of construction of pavements and applies relevant IRC standards.
3. Analyze the collected field data and design suitable traffic management system
4. Is able to apply the design concepts of super elevation of railway curves.
5. Knows how to select a site for airport construction and have working knowledge of run way orientation methods,
6. Apply the corrections to the run way length and understands the circumstances in which they are to be applied.

**SYLLABUS**

**Unit – I:**

Highway Development and Planning: Development in India, necessity for highway planning, different road development plans, classification of roads, road network patterns, highway alignment, factors affecting highway alignment, engineering surveys, drawings and reports, highway project - Importance of geometric design, design controls and criteria, highway cross section elements, sight distance elements, stopping sight distance, overtaking sight distance and intermediate sight distance.

**Unit – II:**

Design of horizontal alignment, design of super elevation and extra widening, design of transition curves, design of vertical alignment, gradient, vertical curves. Traffic Engineering and Regulations: Basic parameters of traffic, volume, speed and density, traffic volume studies, data collection and presentation, speed studies, data collection and presentation, origin and destination studies, parking studies, on street and off street parking,

**Unit – III:**

Road accidents, causes and preventive measures, accident data recording, condition diagram and collision diagram, traffic signs, types and specifications, road markings, need for road markings, types of road markings, design of traffic signals – Webster method.

**Unit – IV:**

Permanent way components, cross section of permanent way, functions of various components like rails, sleepers, and ballast, gauge, creep of rails, theories related to creep, sleeper density- Geometric design of railway track: Gradients, grade compensations, cant and negative super elevation

**Unit – V:**

Cant deficiency, degree of curve, points and crossings, rail joints and welding of joints railway stations and yards, signalizing and interlocking.

Airport Engineering: Airport site selection, runway orientation, basic runaway length.

**Unit – VI:**

Corrections for elevation, temperature, airport classification, runway geometric design, factors controlling taxiway layout - Terminal area, apron, hangar, blast consideration, typical airport layouts, wind rose diagram, runway lighting system and marking.

**TEXTBOOKS**

1. Khanna, S. K. and Justo, C. E. G (1994), "Highway Engineering", Nemchand & Bros, New Delhi. India.
2. Chandra, S and Agarwal, M. M. (2007) "Railway Engineering" Oxford Higher Education, University Press New Delhi
3. Khanna. S. K. Arora, M. G. and Jain. S. S. (1994) "Airport Planning and Design" Fifth edition. Nem Chand & Bros, Roorkee, India.

**REFERENCES**

1. Saxena S.C and Arora, S, “Text book of railway Engineering” Dhanpat Rai and Sons., 1988.
2. Yang, H. and Huang., “Pavement Analysis and Design”, Prentice Hall India Ltd-2004.
3. McShane, W.R., Roess, R.P. and Prassas, E.S., Traffic Engineering. Prentice Hall. Englewood Cliffs, 1997.

**9K654: Geographic Information Systems**

**(professional elective-II)**

**B Tech III Year II Sem.** **L T P/D C**

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**CourseObjectives:**

Thestudent is beingexposedto thesubjectwith followingObjectives:

1. To gain insights into the Remote sensing process
2. Toprovide thebasic definition of GIS and itsapplication.
3. Tounderstandthevariousmodelgenerationpattern.
4. Tounderstandthedata formatswitheditinganderrorrectificationof topology.
5. Tolearnthe basicanalysisofdataandinterpretationofthesame.
6. Tounderstand the application ofGIS in Project PlanningandExecution. And understand the wideareasofapplicationinCivilEngineeringarena.

**CourseOutcomes:**

Onsuccessfulcompletionofthe course,thestudentshall:

1. Understand the Image capturing process
2. knowthe basicdefinition ofGIS.
3. be abletogeneratevariousmodel fromrawdata.
4. beabletoeditandrectify thetopography data.
5. be capable to analyzeand interpret thedatagenerated.
6. be abletoknow theconcept of application ofGISinProjects. And variousspheresofapplications forCivilEngineers.

**UnitI**

Concepts of Remote Sensing – Basics of remote sensing – elements involved in remote sensing – electromagnetic spectrum – remote sensing terminology & units – energy resources – energy interactions with earth surface features & atmosphere – atmospheric effects, satellite orbits – Sensor Resolution – types of sensors – Remote Sensing Platforms and Sensors – IRS satellites

**UnitII**

Introduction – GIS Definition – Development – application areas – Map Concept –MapDefinition–ElementsofMaps –Typesof Maps–Advantagesand Disadvantagesofanalog/ digital maps – Coordinate systems – geometric models of earth – global / local coordinate system – Transformations

**UnitIII**

Projection systems – classification – cylindrical projection – conical projection – selectionofaparticularprojection –Fundamentalconcepts ofGIS –ModelingReal WorldFeatures – Raster data model – Data Analysis, Local Operations, Neighborhood Operations, Zonal Operations Physical Distance Measurement – Vector Data model – Comparison of Raster and Vector Based Data Analysis

**UnitIV**

Data formats – Spatial and non-spatial data – data collection and input – dataconversion– hardwareand software requirements – Topology – Types of Topology – Rules of Topology – Slivers – Editing and error rectification – Topological relationships, TIN and DEM

**UnitV**

SpatialAnalysis –Buffer Analysis–Variationsinbuffering–Applicationsinbuffering-overlay analysis – Feature type and Overlay – Vector Overlay Methods – Network Analysis – Impedance – Shortest Path analysis – Closest facility – concepts ofproximityanalysis

**UnitVI**

GISProjectPlanning–Steps in GIS Project – Software engineering as applied to GIS, GIS Project Planning, Systems Development Life Cycle (SDLC – 7 Step Process), Systems analysis and user requirement studies, Problem Identification and Implementation of a GIS Project (only process identification).

GISApplicationareas–Transportation–WaterResources –Environment –Geology–Emergency Management – Agriculture – Real Estate (only the concepts and ideas);Advancesin GIS–Concepts, Application ofmobile and WebGIS.

**Textbooks:**

1. Kang-TsungChang, IntorductiontoGeographicInformationSystems,TataMcGrawHill PublishingCompanyLtd, New Delhi,2008.
2. PeterA.BurroughandRachaelA.McDonnell,PrinciplesofGeographicalInformationSystems, Oxford UniversityPress,2005.

**References:**

1. C.P.Lo, AlbertK.W.Yeung,ConceptsandTechniquesofGeographicInformationSystems,PrenticeHall IndiaPvt.Ltd, NewDelhi,2002

**Code: 9K655. Environmental Impact Assessment**

**(professional elective-II)**

**L T P/D C**

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**B Tech III Year II Sem.**

**Course Objectives:** The objectives of the course are to

* Define and Classify Environmental Impacts and the terminology
* Introduce and explainthe environmental Impact assessment procedure and methodology
* List and describe environmental audits

**Course Outcomes:** At the end of the course the student will be able to

1. Relate the importance of EIA
2. Identify the environmental attributes to be considered for the EIA study
3. Formulate objectives of the EIA studies
4. Identify the methodology to prepare rapid EIA
5. Summarize the new changes introduced in the new 2020 EIA draft
6. Prepare EIA reports and environmental management plans

**UNIT- I**

**EIA**: The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures,Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation ofMitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the ClearanceConditions, Components of EIA, Roles in the EIA Process.

**UNIT- II**

**EIA Methodologies**: Environmental attributes-Criteria for the selection of EIA methodology, impactidentification, impact measurement, impact interpretation & Evaluation, impact communication,Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlaysmethods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts.

**UNIT- III**

**Environmental Management Plan:** EMP preparation, Monitoring Environmental Management Plan,Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief &Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal andAppraisal.

**UNIT- IV**

**Environmental Legislation**: Environmental laws and protection acts,Constitutional provisions-powers and functions of Central and State government, The Environment(Protection) Act 1986, The Water Act 1974, The Air act 1981, Wild Life act 1972, Guidelines for controlof noise, loss of biodiversity, solid and Hazardous waste management rules.

**UNIT-V**

**Life Cycle Assessment:** Life cycle analysis, Methodology, Management, Flow of materials-cost criteria.Changes introduced in India’s EIA new draft Notification of 2020 compared with the EIA notification of 2006; List of projects requiring Environmental clearance, Application form,Composition of Expert Committee, Ecological sensitive places, International agreements.

**UNIT- VI**

**Case Studies**: Preparation of EIA for developmental projects- Factors to be considered in makingassessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuelcomplex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

**TEXT BOOKS:**

1. Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S.Publications, Hyderabad, 2007

2. Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers.

**REFERENCES:**

1. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold

Co., New York, 1991.

2. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New

York, 1996.**Code: 9K656Repair and Rehabilitation of Structures**

**(Professional Elective – II)**

**B Tech III Year II Sem.**

**L / T / P / D / C**

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**Course Objectives:**

To introduce the students to,

1. Familiarize Students with deterioration of concrete in structures

2. Equip student with concepts of NDT and evaluation

3. Understand failures and causes for failures in structures

4. Familiarize different materials and techniques for repairs

5. Understand procedure to carryout Physical evaluation of buildings and prepare report.

6. Understand the retrofitting strategies and technique.

**Course Out comes:**

At the end of the course, the student will be able to,

1. Explain deterioration of concrete in structures
2. Carryout analysis using NDT and evaluate structures
3. Assess failures and causes of failures in structures
4. Carryout Physical evaluation.
5. Submit report on condition of the structure.
6. Carryout analysis using preliminary test methods and Case studies.

UNIT – I

Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes, Mechanism, Effect, preventive measures. - Cracks: Cracks in concrete, type, pattern, quantification, measurement & preventive measures.

UNIT- II

Non-Destructive Testing- Nondestructive test methods for concrete including Rebound hammer, Ultrasonic pulse velocity, Rebar locator, Corrosion meter, Penetration resistance and pull-out test, Core cuttingCorrosion: Methods for corrosion measurement and assessment including half-cell potential and resistivity, Mapping of data.

UNIT-III

Failure of buildings: Definition of building failure-types of failures- Causes of Failures- Faulty Design, Accidental over Loading, Poor quality of material and Poor Construction practices- Fire damage - Methodology for investigation of failures-diagnostic testing methods and equipment’s-repair of cracks in concrete.

UNIT-IV

Materials for repair and rehabilitation -Admixtures- types of admixturespurposes of using admixtures- chemical composition- Natural admixturesFibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT: V

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipment’s, Precautions and Processes.

UNIT: VI

Investigation of structures: Distress, observation and preliminary test methods. Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.

**TEXT BOOKS:**

1. ‘Maintenance & Repair of Civil Structures’ by B.L. Gupta & Amit Gupta.

2. ‘Rehabilitation of Concrete Structures’ by B. Vidivelli, Standard Publishers.

3. ‘Concrete Bridge Practice Construction, Maintenance & Rehabilitation’ by V. K. Raina.

**REFERENCES:**

1. ‘Concrete Structures- protection Repair and Rehabilitation’ by R. Doodge Woodson, BH Publishers.
2. Daniel Balageas, Claus – Peter Fritzenaml Alfredo Guemes, Structural Health Monitoring, Published by ISTE Ltd., U.K. 2006
3. Guide book on Non‐destructive testing of concrete structures, Training course series No. 17. International Atomic Energy Agency, Vienna, 2002
4. Hand Book on “Repair and Rehabilitation of RCC Buildings”. Published by Director General, CPWD, Govt. of India, 2002
5. Hand Book on Seismic Retrofitting of Buildings, published by CPWD & Indian Building Congress in association with IIT, Madras, Narosa Publishing House, 2008.
6. Santha Kumar, A.R., (1996), Concrete Chemical Theory and Applications, Indian Society for Construction Engineering and Technology, Madras.
7. Diagnosis and treatment of structures in distress by R.N.Raikar, Published by R&D Centre of Structwel Designers & Consultants Pvt.Ltd., Mumbai, 1994.
8. Garas, F.K,.Clarke, J.L, Armer, GST (1997), Structural assessment, Butterworths, UK.
9. R.T. Allen and S.C.Edwards, (1998), Repair of Concrete St
10. uctures, Blakie and Sons, UK

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## Programming in Java

**Code: 9EC42**

**CourseObjectives:**

1. UnderstandtheconceptsofObjectorientedprogrammingprinciplesofJava.
2. Write the programs and execute using OOP Principles such as garbage collection,overloading methods, constructors, recursion, string handling, StringTokenizer,inheritanceandits types,packages,multithreadingand threads.

## CourseOutcomes:

Aftercompletionofthe course,the studentwillbe ableto:

1. Comprehend the fundamentals of Java, Classes, and Objects and design the javaprograms usingconstructorsandStringhandlingmethods.
2. Designtheprogramsusinginheritance,polymorphismandinterface.
3. DevelopprogramsusingPackages,I/OStreamsandcollections.
4. Apply the concepts of Exception handling and Multithreading for various scenarios.
5. CreateprogramsusingAWT,Swingsanddevelopapplicationsusingeventhandling.
6. Designapplicationsusing Appletsandclientserver programsusingnetworking

concepts.

## UNITI

History of Java, Java buzzwords, datatypes, variables, simple java program, scope and lifetime of variables, operators, expressions, control statements, type conversion and costing,arrays,,classes and objects– concepts of classes, objects,constructors, methods,accesscontrol, this keyword, garbage collection, overloading methods and constructors, recursion,stringhandling,StringTokenizer.

Applications:Basicoperationsonthebank accountofacustomer.

## UNITII

Inheritance –Definition, single inheritance, benefits of inheritance, Member access rules,super class, polymorphism- method overriding, Dynamic method dispatch, using final withinheritance,abstractclasses,Baseclassobject.

Interfaces: definition, variables and methods in interfaces, differences between classes andinterfaces, usage of implements and extends keyword, interfaces, uses of interfaces, packagesApplications:Extendingthe bankingoperations tothe loanapplicants.

## UNITIII

Packages: Definition, types of packages, Creating and importing a user defined package.IntroductiontoI/Oprogramming:DataInputStream,DataOutputStream,FileInputStream,

FileOutputStream,BufferedReader.

Collections:interfaces,Implementationclasses,andAlgorithms(suchassortingandsearching).

Applications:Searchingforastringinthetext.PNRstatuscheck,students’resultsorting.

## UNITIV

Exceptionhandling-exceptiondefinition,benefitsofexceptionhandling,exceptionhierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating ownexceptionsubclasses.

Multi-Threading: Thread definition, types of multitasking, uses of multitasking, thread lifecycle, creating threads using Thread class and Runnable interface, synchronizing threads,daemonthread.

Applications: Illegal entry handling in the registration form. (Example: entering incorrectintermediate hall-ticketnumberinEAMCETRegistrationform)

## UNITV

Advantages of GUI over CUI ,The AWT class hierarchy, Introduction to Swings, SwingsElements:- JComponent, JFrame, user interface components- JLabels, JButton, JScrollbars,text components, check box, check box groups, choices, lists panels – scrollpane, menubar,graphics,layout,managers–boarder,grid,flow,cardandgridbag.

Eventhandling: Delegation eventmodel,closing a Frame,mouse and keyboard events,Adapterclasses.

Applications:developingcalculator,developingfeedbackform,developingbiodata.

## UNITVI

Applets–Conceptsof Applets,differencesbetweenappletsandapplications,lifecycleof anapplet,typesofapplets,creatingapplets,passingparameterstoapplets.

Applications:Developingofsimpleadvertisements.

Networking–Basicsofnetworkprogramming,addresses,ports,sockets,simpleclientserverprogram,multiple clients,sendingfilefromservertoclient.

Applications:OnetooneChatapplication

## TEXTBOOKS:

1. Java;thecompletereference, 6thedition, HerbertSchildt,TMH.
2. IntroductiontoJavaprogramming6thedition, Y.DanielLiang, Pearsoneducation.

## REFERENCEBOOKS:

1. CoreJava2,Vol1,Fundamentals,Cay.S.HorstmannandGaryCornell,seventhEdition,PearsonEducation.
2. CoreJava2,Vol2,AdvancedFeatures,Cay.S.HorstmannandGaryCornell,SeventhEdition,PearsonEducation

**9ZC22 – BASICS OF ENTREPRENEURSHIP**

**Entrepreneurship Stream**

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**Course Objective:** The objective of the course is to make students understand the nature of Entrepreneurship, and its importance to business to the engineering students, which will allow them to get the required intuition and interest in starting their own start-up’s

**Course Outcomes:**

C01 Demonstrate the basic knowledge and skill set required for entrepreneurship.[L2]

C02 Distinguish business models and their validation in entrepreneurship.[L4]

C03 Examine cost and financial structures and decide suitable pricing strategies.[L4]

C04 Relate team building and project management styles to project management and               entrepreneurship.[L2]

C05.Identify different marketing strategies and understand business regulations for startups.[L3]

**UNIT I: Introduction to Entrepreneurship & Self Discovery: -** Define Entrepreneurship, Entrepreneurship as a Career option, Find your Flow, Stock of Your Means, Characteristics, Qualities and Skills of Entrepreneurship, Effectuation, Principles of Effectuation, Life as an Entrepreneur, Stories of Successful Entrepreneurs.

**UNIT II: Opportunity & Customer Analysis: -** Identify your Entrepreneurial Style, Methods of finding and understanding Customer Problems, Run Problem Interview, Process of Design Thinking, Identify Potential Problems worth Solving, Customer Segmentation, Niche Marketing and Targeting, Craft your Values Proportions, Customer-driven Innovation.

**UNIT III: Business Model & Validation: -** Introduction to Business Models, Lean approach to Business Model Canvas, Blue and Red Ocean Strategies, the Problem-Solution Fit, Build your Solution Demo, Solution Interview Method, Identify Minimum Viable Product (MVP), Product-Market fit test.

**UNIT IV: Economics & Financial Analysis: -** Revenue Analysis, Identify different Revenue Streams and Costs Analysis – Startup Cost, Fixed Cost and Variable Cost, Break Even Analysis, Profit Analysis, Introduction to Pricing, different Pricing Strategies, Sources of Finance, Bootstrapping and Initial Financing, Practice pitching to Investors and Corporate.

**UNIT V: Team Building & Project Management: -** Leadership Styles, Shared Leadership Model, Team Building in Venture, Roles and Responsibilities of team in venture, Explore collaboration tools and techniques, Brainstorming, Introduction to Project Management, Project Life Cycle, Create a Project Plan.

**UNIT VI: Marketing & Business Regulations: -** Positioning, Positioning Strategies, Branding, Branding Strategies, Selecting and Measuring Channels , Customer Acquisition, Selling Process, Selling Skills, Sales Plans. Business regulations – List of Required Registrations, Compliance Check List, Business Structures and Legal Entities.

**Essential Readings:**

* Robert D Hisrich, Michael P Peters, Dean A Shepherd, Entrepreneurship, Sixth Edition, New Delhi, 2006.
* Thomas W. Zimmerer, Norman M. Scarborough, Essentials of Entrepreneurship And Small Business Management, Fourth Edition, Pearson, New Delhi, 2006
* Alfred E. Osborne, Entrepreneur’s Toolkit, Harvard Business Essentials, HBS Press, USA, 2005.
* MadhurimaLall, ShikhaSahai, Entrepreneurship, Excel Books, First Edition, New Delhi, 2006.

**References:**

* S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, New Delhi, 2007.
* H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.

• S.R. Bhowmik, M. Bhowmik, Entrepreneurship-A tool for Economic Growth   And A   
 key to Business Success, New Age International Publishers, First Edition,  (formerly   
 Wiley Eastern Limited), New Delhi, 2007.

* *https://www.wfglobal.org/*
* [*https://www.learnwise.org/#/IN/en/home/login*](https://www.learnwise.org/#/IN/en/home/login)*,*

**9ZC05 BANKING OPERATIONS AND INSURANCE**

**Finance Stream**

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**Course Objectives:** To make the students understand the concepts and principles of Indian Banking and Insurance Business and the role of RBI in regulating the Indian Financial System.

1. Describe the Indian Banking System in detail
2. Gain awareness about the prudential norms and capital requirements of banks in India
3. Understand the role of RBI as a regulator of Indian Banking
4. Describe the new dimensions and products served by the banking system in INDIA
5. Provide awareness on Insurance industry and its principles
6. Recognize the importance of regulatory and legal frame work of IRDA

**UNIT I**

**INTRODUCTION TO BANKING BUSINESS:** Introduction to banking services - History of banking business in India, Structure of Indian banking system: Types of accounts, advances and deposits in a bank, KYC norms.

**UNIT II**

**BANKING REGULATIONS:** Banking Sector Reforms with special reference to Prudential Norms, Capital Adequacy Norms, Classification of Assets and NPA’s, Functions of RBI, Role of RBI in regulating Indian Banking, Banking Ombudsman scheme

**UNIT III**

**CREDIT CONTROL BY RBI:** Definition, Objectives of Credit Control, Quantitative methods of Credit Control by RBI: Bank Rate Policy, Open Market Operations, Variation of Reserve Ratio, Qualitative methods of Credit Control by RBI: Fixation of Margin Requirements, Regulation of consumer Credit, Rationing of Credit, Direct Action, Moral Suasion and Publicity

**UNIT IV**

**NEW DIMENSIONS IN BANKING:** Financial Inclusion – Micro finance, E-Banking: Mobile-Banking, Net Banking, Digital Banking, Artificial Intelligence in Banking, CIBIL Score, Negotiable Instruments: Cheque Truncation system.

**UNIT V**

**INTRODUCTION TO INSURANCE:** Introduction to insurance, Need and importance of Insurance, principles of Insurance, characteristics of insurance contract, types of insurance: Life insurance and its products, General Insurance and its variants.

**UNIT VI**

**INSURANCE BUSINESS ENVIRONMENT:** Procedure for issuing an insurance policy –Nomination - Surrender Value - Policy Loans – Assignment - Revivals and Claim Settlement; Insurance as a tax mitigation tool, Role of IRDA in Insurance Regulation.

**Essential Readings:**

* Varshney, P.N., Banking Law and Practice, Sultan Chand & Sons, New Delhi.
* General Principles of Insurance Harding and Evantly
* Mark S. Dorfman: Risk Management and Insurance, Pearson, 2009.

**References:**

* Scott E. Harringam Gregory R. Nichanus: Risk Management & Insurance, TMH, 2009.
* Geroge E. Rejda: Principles of risk Management & Insurance, 9/e, pearson Education. 2009.
* G. Koteshwar: Risk Management Insurance and Derivatives, Himalaya, 2008.

**9ZC08DESIGN LITERACY AND DESIGN THINKING**

**Innovation and Design Thinking**

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**L T P/D C**

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**Course Objective:** The objective of the course is to make students understand the fundamental concepts of design thinking, and to familiarize with product design process and to motivate the students to ideate new products and services.

**Course Outcomes:**

1. The students gain the knowledge on the inputs required for design thinking and also gain familiarity on concepts related to design thinking.
2. The students learn the techniques of idea generation
3. The students gain knowledge on different phases of design thinking
4. The students realize the product design process.
5. The students gain familiarity on design thinking for service design.
6. The students gain knowledge on variouscases related to design thinking.

**UNIT I: Design Thinking –** Introduction to Design thinking, Principles of design thinking, Benefits of design thinking, Applications of Design thinking, Social Innovation, Impact of Design thinking, Design thinking tools and techniques. Innovation and Design thinking.

**UNIT II: Idea Generation**: New Idea generation methods - Principles of Idea Generation, Techniques, Creativity thinking techniques and tools, types of creative thinking, select ideas from ideation methods.

**UNIT III: Design Thinking Foundations:**The Design Double Diamond: Discover-Define-Develop-Deliver, User-centric design approaches: Importance of user-centricity for design, Empathisation, Empathy Maps, Data collection from users and for users, Data Validation Responsible Innovation and Ethical Design:

**UNIT IV: Product Design Process**: Identification of opportunities, Problem Statement, Product planning, Characteristics of Successful product Development, New product development process, Stanford design thinking iterative model

**UNIT V: Design Thinking for Service Design:** Attributes of a good service design, service design tools – blueprint, customer journey mapping Identifying the user needs in a service-driven economy; Process Flows and Customer Experience considerations for designing and improving services; 5 Whys; Service Delivery Pathways

**UNIT VI: Case Studies on Design thinking:** Case 1: Arcturus IV by John E.Arnold, Case – 2: How can we make AI to make things better for humans. Case – 3: User Centered Helmet Design by Prof. B.K. Chakravarthy- Part 1 and Part 2; Case – 4: Challenges of Reaching a Million Users by Prof. Chetan Solanki and Prof Jayendran V.

**Essential Readings:**

1. Brown, T. (2008). Design thinking. *Harvard business review*, *86*(6), 84.
2. “Innovation by Design", Gerald H. (Gus) Gaynor, AMACOM {American Management Association), NYC, 2002
3. Ansell, C., &Torfing, J. (2014). Collaboration and design: new tools for public innovation. In *Public innovation through collaboration and design* (pp. 19-36). Routledge.
4. Lewrick, M., & Link, P. (2015). Design thinking tools: Early insights accelerate marketers’success. *Marketing Review St. Gallen*, *32*(1), 40-51.

**References:**

1. Mæhlum, A. R. (2017). *Extending the TILES Toolkit-from Ideation to Prototyping* (Master's thesis, NTNU).
2. Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic books.
3. Design Thinking – A primer,Prof: Dr. BalaRamadurai, Indian Institute of Technology, Madras.

**Websites:**

1. [**www.smashingmagazine**](http://www.smashingmagazine) **.com**
2. **www.ID**

**9K681: Geographic Information Systems Laboratory**

**B Tech III Year II Sem.** **L T P/D C**

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**Course Objectives:**

1. The student shall be trained to extract geographic data from Toposheet.
2. The student shall learn to digitize the various features and define their attributes.
3. The student shall learn to generate maps with defined patterns.

**Course Outcomes:**

1. The student will be able to extract various details from the topography survey map.
2. The student shall be able to convert the raw data into vector and raster forms.
3. The student shall be able to generate maps with various geographic features.

**Laboratory Experiments**

1. Georeferencing of Toposheet / satellite Imagery and verification
2. Digitization of Points and Lines
3. Digitization of polygons
4. Editing Map Elements
5. Attribute Date Entry and Manipulation
6. Cleaning, Building and Transformation
7. Vector data Analysis – Overlay
8. Vector data Analysis - Buffer
9. Raster data analysis
10. Map Generation With Patterns and Legends
11. Network Analysis
12. Interpolation Methods

**References**

1. Q GIS Documentations
2. Laboratory Manual

**9K682 Environmental Engineering Lab**

**L T P/D C**

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**B Tech III Year II Sem.**

**Course Objectives: the objectives of the course are to**

* Perform the experiments to determine water and waste water quality
* Understand the water & waste water sampling, their quality standards
* Estimate quality of water, waste water, Industrial water

**Course outcomes: After the completion of the course student should be able to**

* Understand about the equipment used to conduct the test procedures
* Perform the experiments in the lab
* Examine and Estimate water, waste water, air and soil Quality
* Compare the water, air quality standards with prescribed standards set by the local governments
* Develop a report on the quality aspect of the environment.

1. Determination of pH

2. Determination of Electrical Conductivity

3. Determination of Total Solids (Organic and inorganic)

4. Determination of Acidity

5. Determination of Alkalinity

6. Determination of Hardness (Total, Calcium and Magnesium Hardness)

7. Determination of Chlorides

8. Determination of optimum coagulant Dosage

9. Determination of Dissolved Oxygen (Winkler Method)

10. Determination of COD

11. Determination of BOD/DO

12. Determination of Residual Chlorine

13. Noise level measurement

**TEXT/REFERENCE BOOKS:**

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey. 2. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan, Thompson / Brooks/ Cole; Second Edition 2008.

3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.

4. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGrawHill, New Delhi.

5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999

7. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication

8. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

# 9K683: Transportation Engineering LabORATORY

**B Tech III Year II Sem** **L T P/D C**

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**Course Objectives**:

To enable the student

1. Assess the quality of the material used in pavement construction and compare with IRC specifications.
2. Identify the field data required for assessing the traffic parameters.

**Course Outcomes**

At the end of the course, student should have learnt

1. To apply methods for assessing various types of material to be used in the pavement construction.
2. To plan for the collection of field data, present the same for performing critical analysis and hence aid in taking decisions so as to enable smooth movement of traffic

**List of Experiments**

**Tests on Bitumen**

1. Penetration Test
2. Ductility test
3. Softening point test
4. Specific gravity test
5. Viscosity test
6. Flash and fire point test

**Tests on Aggregates**

1. Aggregate crushing value test
2. Los Angeles Abrasion test
3. Aggregate Impact Value test
4. Shape test (Flakiness Index & Elongation Index)
5. Water absorption test
6. Soundness

**Traffic Studies**

1. Traffic volume study
2. Spot speed study
3. O & D studies
4. Speed & delay studies

**Miscellaneous tests (Demonstration only)**

1. Determination of CBR
2. Preparation of representative sample by coning and quartering
3. Bitumen Extraction test
4. Marshall stability – concept and test

**TEXTBOOKS**

1. Khanna, S. K. and Justo, C. E. G, A Veeraraghavan (2013), “[Highway Materials & Pavement Testing](https://www.sapnaonline.com/books/highway-materials-pavement-testing-sk-khanna-8185240213-9788185240213)”, Nem Chand and Brothers.
2. Laboratory Manual

**IV YEAR I SEMESTER**

**9K717: Estimation COSTING AND SPECIFICATION**

**B. Tech IV Year I Sem.**

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**Course Objectives:**

To enable the students understand

1. The working of detailed estimates for a building.

2. The working of detailed estimates for roads and canals.

3. The rate Analysis for different items of works.

4. The working and scheduling of shuttering and bar bending.

5. About contract, Tenders, Earnest Money Deposit (EMD), M-Book and concept of present practices of tenders.

6. To introduce the student to the basic concept and procedure of valuation.

**Course Outcomes:**

After the successful completion of the course, the student will be able

1. To prepare detailed estimates for different buildings.

2. To do the rate analysis for different items of works of buildings.

3. To prepare the rate analysis for different items of works.

4. To prepare the schedules for shuttering and bar bending.

5. To work out different types of contracts, prepare tenders, to suit the present day practices of tendering.

6. To valuate buildings as per norms.

**UNIT –I:**

General items of works in a building- - Standard unit principles of working out quantities for detailed and abstract estimates- Approximate method of estimation.Detailed estimates of buildings.

**UNIT –II:**

Estimation of earthwork for roads and canals.

**UNIT –III:**

Rate Analysis- Working out data for various items of work- over head and contingent charges.

**UNIT –IV:**

Shuttering material requirements and schedules.  Estimation of reinforcement- bar bending scheduling and costing.

**UNIT –V:**

Contracts: Types of contracts- Contract documents- Conditions of contract- Sub contracting.

Bidding: Bid documents and bidding.

**UNIT –VI:**

Valuation of buildings.Standard specifications for different items of building construction.

**TEXT BOOKS:**

1. Estimating and Costing in Civil Engineering – Theory and Practice by B N Dutta, 28th Revised Edition, 2016, UBS Publishers Distributors Pvt. Ltd.

2. Textbook of Estimating and Costing: Civil Engineering by G S Birdie, DhanpatRai Publications, 1988.

**REFERENCES:**

1. Estimating and Costing in Civil Engineering by Jagjit Singh, Galgotia Publications, New Delhi, 1996.
2. Estimating, Costing, Specifications and Valuation in Civil Engineering by M. Chakraborthi, Publisher: M Chakraborti, 24th Edition, 2010.
3. Civil Engineering Contracts and Estimation by B S Patil, Universities Press III Edition, (2009), Hyderabad.
4. Standard scheduled rates and relevant BIS codes.

**9K718: HYDROLOGY AND WATER RESOURCES ENGINEERING**

**B.Tech. IV Year I Sem.**

**L T/P/D/ C**

**3 0/0/0 /3**

**Course Objectives:** This course provides the description of hydrological cycle and derive various formulas used in estimation of different basic components of surface and Ground water cycle. and its components. Further it will explain the water requirement for irrigation and connectivity of hydrology to the field requirement.

**Course Outcomes:** At the end of the course the student will be able to

• Understand the different concepts and terms used in engineering hydrology

• To identify and explain various formulae used in estimation of surface and Ground water hydrology components

• Demonstrate their knowledge to connect hydrology to the field requirement

**Unit-1**

Introduction: Concepts of Hydrologic cycle, Global Water Budget, Applications in Engineering. Sources of data. Precipitation Forms of precipitation, characteristics of precipitation in India, measurement of precipitation: Recording and non-recording types, rain gauge network: mean precipitation over an area: Arithmetic, Theissen’s and Isohyetal methods, Missing Rainfall Data – Estimation, Consistency of Rainfall records, depth area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

**Unit-2**

Abstractions from precipitation evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations: Penman and Blaney &Criddle Methods, potential evapotranspiration over India, actual evapotranspiration, , interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Runoff Components of Runoff, Factors affecting runoff, Basin yield, SCS-CN method of estimating runoff, Flow duration curves, Mass curve of runoff – Analysis.

**Unit - 3**

Hydrographs Hydrograph –Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

**Unit-4**

Hydrographs Hydrograph –Distribution of Runoff – Hydrograph Analysis Flood Hydrograph – Effective Rainfall – Base Flow- Base Flow Separation - Direct Runoff Hydrograph Unit pulse and Unit step function - Unit Hydrograph, definition, limitations and applications of Unit hydrograph, derivation of Unit Hydrograph from Direct Runoff Hydrograph and vice versa - S-hydrograph, Synthetic Unit Hydrograph.

**Unit-5**

Groundwater Hydrology Occurrence, movement and distribution of groundwater, aquifers – types, Specific Yield, Permeability, Storage coefficient, Transmissibility, Darcy’s Law. Well Hydraulics - Steady radial flow into well for confined and unconfined aquifers, Recuperation tests. Well constants. Crop Water Requirements – Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

**Unit-6**

Canal Systems: Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Regime channels, Kennedy’s and Lacey’s theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals-Types of lining-Advantages and disadvantages. Drainage of irrigated lands- necessity, methods.

**TEXT BOOKS:**

1. Hydrology by K. Subramanya (Tata McGraw-Hill)

2. Irrigation Engineering and Hydraulic structures by Santhosh Kumar Garg Khanna publishers

3. G L Asawa, Irrigation Engineering, Wiley Eastern

**REFERENCE BOOKS:**

1. Elements of Engineering Hydrology by V.P. Singh (Tata McGraw-Hill)

2. Engineering Hydrology by Jaya Rami Reddy (Laxmi Publications

3. Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.

4. Elements of Water Resources Engineering by K.N.Duggal and J.P.Soni (New Age 5. International).

**Code: 9K757: FINITE ELEMENT METHOD FOR CIVIL ENGINEERS**

**(professional Elective-III)**

**B.Tech. IV Year I Sem. L T P/D C**

**3 0 0/0 3**

**Course Objectives:** The subject provides introduction to finite element methods to analyse structural

elements

**Course Outcomes:** At the end of the course the student will be able to:

1. apply potential energy method to structural engineering problems
2. generate and solve the governing FE equations for one-dimensional problems
3. generate and solve the governing FE equations for beams and two-dimensional problems.
4. formulate FE equations using four nodded iso-parametric elements.
5. solve FEM equation using the numerical method Gauss quadrature.
6. analyze basic structural elements using ANSYS software

**Unit – I: Introduction to Finite Element Method:**

Introduction to Finite Element Method; Basic Equations in Elasticity – strain displacement relations – stress strain equations– concept of plane stress – plane strain; Concept of Potential energy principle – Rayleigh-Ritz method; advantages and disadvantages of FEM.

**Unit – II: Finite Element Analysis (FEA) of – one dimensional problems**. Bar element; shape functions, hermit polynomials; stiffness matrix.

**Unit – III:**

**FEA of Beam elements**. stress strain relation; shape functions; stiffness matrix; application for continuous beams.

**FEA of Two dimensional problems**.Concept of CST element and LST element; formulation of CST element; shape functions – stress strain relation; element stiffness and force matrices.

**Unit – IV: 4- node quadrilateral elements (Iso-parametric) formulation.**Formulation for 4-node CST element, about Lagrangian – Serendipity elements.

**Unit – V: Numerical Integration techniques for static loads:** One point and two point Gaussian Quadrature; Static condensation.

**Unit – VI: Introduction to ANSYS**, Illustration on different modules of ANSYS / Structural engineering applications of the package; creation of a simple 1-D model, 2-D model; analysis and post processing of the results.

**TEXT BOOKS:**

1. Tirupathi R-Chandrupatla: “Introduction to finite elements in engineering”, PHI publishers
2. Reddy, J. N, (1993). “An Introduction to the Finite Element Method”, McGraw Hill, New York.

**REFERENCES:**

1. Cook, R. D. (1981). “Concepts and Application of Finite Element Analysis”, John Wiley and Sons.
2. Zienkiewicz, O. C. And Taylor, R. L, (1989). “The Finite Element Method”, Vol.1, McGraw Hill Company Limited, London.

**Code: 9K758. Solid Waste Management**

**(professional Elective-III)**

**L T P/D C**

**3 0 0/0 3**

**B.Tech. IV Year I Sem.**

**Course Objectives:** The objectives of the course are to

* Teachthe necessity of solid waste management
* Explain the strategies for the collection of solid waste
* Describe the solid waste disposal methods
* Categorize Hazardous Waste

**Course Outcomes:** At the end of the course the student will able to:

1. Identify the physical and chemical composition of solid wastes
2. Analyze the functional elements for solid waste management.
3. Make use of techniques and methods used in transformation, conservation, and recovery of energy from solid waste
4. Apply methods of material and resource recovery from solid waste.
5. Design landfills as a waste disposal system
6. Identify safe disposal methods of hazardous waste

**UNIT- I**

**Solid Waste**: Definitions, Types of solid waste, sources of solid waste, Characteristics, andperspectives; properties of solid waste, Sampling of Solid waste, Elements of solid wastemanagement - Integrated solid waste management, Solid Waste Management Rules 2016.

**UNIT - II**

**Solid Waste Management**: Solid waste generation; on-site handling,storage and processing; collection of solid waste; Stationary container system and Hauled containersystems – Route planning - transfer and transport; processing techniques;

**UNIT- III**

**Engineering Systems Energy Recovery**: Processing techniques; recovery of thermal conversionproducts; Pyrolysis, Gasification, Refuge derived fuel (RDF) - recovery of energy from conversion products; energy recovery systems.

**UNIT- IV**

**Engineering Systems for Materials Recovery**: materialsrecovery systems; recovery of biological conversion products; Composting, pre and post processing,types of composting, Critical parameters, Problems with composting.

**UNIT- V**

**Landfills**: Evolution of landfills – Types and Construction of landfills; Design considerations – Life oflandfills, Problems with landfills; Lining of landfills – Types of liners; Leachate pollution and control; Monitoring landfills – Landfills reclamation.

**UNIT- VI**

**Hazardous waste Management**: – Sources and characteristics, Effects on environment, Riskassessment – Disposal of hazardous wastes – Secured landfills, incineration – Monitoring; Biomedicalwaste disposal, E-waste management, Nuclear Waste, Industrial waste Management.

**TEXT BOOKS:**

1. Tchobanoglous G, Theisen H and Vigil SA ‘Integrated Solid Waste Management, Engineering

Principles and Management Issues’ McGraw-Hill, 1993.

2. Vesilind PA, Worrell W and Reinhart D, ‘Solid Waste Engineering’ Brooks/Cole Thomson

Learning Inc., 2002.

**REFERENCE BOOKS:**

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, ‘Environmental Engineering’, McGraw Hill

Inc., New York, 1985.

2. Qian X, Koerner RM and Gray DH, ‘Geotechnical Aspects of Landfill Design and

Construction’ Prentice Hall, 2002.

**9K759Pre-stressed Concrete Design**

**(Professional Elective** – **III)**

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**B.Tech IV Year I Sem. L T P/D C**

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**Course Objectives:** The objective of the course is to

CO1 Able to Understand the principles & necessity of prestressed concrete structures and losses of prestress

CO2 Able to Understand Flexure and shear and transfer of prestress in pertensioned members.

CO3 Able to Understand the Composite and continuous beams and deflections on the prestressed members.

**Course Outcomes:** At the end of the course the student will able to

CO1 Analyze the losses of prestress in members.

CO2 Analyze the Flexure and shear and transfer of prestress in pertensioned members.

CO3 Analyze the Composite and continuous beams and deflections on the prestressed members.

**UNIT I**

**Introduction**: Historic development- General principles of prestressing pretensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing materials- high strength concrete and high tensile steel their characteristics. Methods and Systems of prestressing: Pretensioning and Post-tensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system.

**UNIT II**

**Losses of Prestress:** Loss of prestress in pretensioned and post-tesnioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, slip in anchorage, frictional losses.

**UNIT III**

**Flexure:** Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons- stress diagrams- Elastic design of PSC beams of rectangular and I sections- Kern line — Cable profile and cable layout.

**Shear:** General Considerations- Principal tension and compression- Improving shear resistance of concrete by horizontal and vertical prestressing and by using inclined or parabolic cables- Analysis of rectangular and I beams for shear — Design of shear reinforcements- Bureau of Indian Standards (BIS) Code provisions.

**UNIT IV**

**Transfer of Prestress in Pretensioned Members** : Transmission of prestressing force by bond — Transmission length — Flexural bond stresses — IS code provisions — Anchorage zone stresses in post tensioned members — stress distribution in End block —Analysis by Guyon, Magnel, Zielinski and Rowe’s methods — Anchorage zone reinforcement- BIS Provisions

**UNIT V**

**Composite and Continuous Beams:** Different Types- Propped and unpropped- stress distribution- Differential shrinkage- Analysis of composite and continuous beams- General design considerations.

**UNIT VI**

**Deflections:** Importance of control of deflections- Factors influencing deflections — Short term deflections of uncracked beams- prediction of long time deflections- BIS code requirements.

**TEXT BOOKS:**

1.Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.

2.Dayaratnam. P., "Prestressed Concrete Structures", Oxford and IBH,2013

3.LinT.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures",Third Edition, Wiley India Pvt. Ltd.

**REFERENCES:**

1.KrishnaRajuN.,"Prestressedconcrete",5th Edition, Tata McGraw Hill Company,New Delhi,2012.

2.Andit. G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt.Ltd,2012.

3.IS1343:1980,Code of Practice for Prestressed Concrete, Bureau of Indian Standards,New Delhi,2012

**9K760**: **Ground Improvement Techniques**

**Professional Elective- IV**

**B.Tech: IV Year I Sem.**  **L T P/D C**

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**Prerequisites:** Geo-Technical Engineering, Foundation Engineering

**Course Objectives:**

• To Identify difficult ground conditions in engineering practice.

• To select suitable ground improvement techniques for problematic soils.

• To assess suitable physical, chemical, mechanical and hydraulic modifications.

. To get an Idea of Grouting techniques and Soil reinforcement

**Course Outcomes**: At the end of the course the student will able to

• Identify the suitable ground improvement methods for different types of soils

• Assess different compaction methods for ground modification.

• Design dewatering systems to reduce the settlements.

• Comprehend stabilizations with chemical and grouting techniques.

• Apply the principles of soil reinforcement and confinement in engineering constructions.

**UNIT I**

**Introduction to Ground Improvement:** Definition, Objectives of soil improvement, Classification of ground improvement techniques. Identification of soil types, In situ and laboratory tests to characterize problematic soils. Factors to be considered in the selection of the best soil improvement technique.

**UNIT II**

**Mechanical Modification:** Deep Compaction Techniques- Blasting Vibro -compaction, Dynamic Tamping and Compaction piles. Specification of compaction. Tolerance of compaction Shallow and deep compaction.

**UNIT III**

**Hydraulic Modification:** Definition, aim, principle, techniques, gravity drain, lowering of water table, multistage well point, vacuum dewatering. Discharge equations. Design of dewatering system including pipe line effects of dewatering.

**Drainage & Preloading:** Drainage of slopes, preloading, vertical drains, sand drains. Assessment of ground condition for preloading electro kinetic dewatering.

**UNIT IV**

**Chemical Modification-I,** Definition, aim, special effects, and methods Techniques – sandwich technique, admixtures, cement stabilization on permeability, Swelling and shrinkage, Criteria for cement stabilization, Stabilization using Fly ash

**UNIT V**

**Chemical Modification-II:** Lime stabilization, suitability, process, special effects, criteria for lime stabilization. Other chemicals, chlorides, hydroxides, lignin, hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen tar or asphalt in stabilization.

**UNIT VI**

**Grouting:** Introduction, Effect of grouting, Chemicals and materials used. Types of grouting, grouting procedure, Applications of grouting.

**Miscellaneous Methods :** Introduction, Soil reinforcement. Thermal methods, Soil reinforcement, reinforcement with strip and grid reinforced soil, In situ ground reinforcement, ground an anchor Ground improvement by confinement – Crib walls, Gabions and Mattresses. Anchors, Rock bolts and soil nailing.

**TEXT BOOKS:**

1. Purushothama Raj. P, “Ground Improvement Techniques” Laxmi Publications, New Delhi, 1999.
2. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis

**REFERENCES:**

1. Koerner.R.M. “Construction and Geotechnical Methods in Foundation Engineering” McGraw Hill Publ., New York, 1985.
2. Nelson. J.D and Miller. D.J, “Expansive Soils” John Wiley and Sons, 1992.

Bell, F.G. Butterworth, Methods of treatment of unstable ground-Butterworth, London.

3. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications

**Code:9K761-Construction Technology and Management**

(Professional Elective – IV)

**B.Tech: IV Year I Sem.**

L T P / D C

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**Course Objectives:**

To introduce the students to,

1. Study about the construction technology Materials, methods,technologies and their applications.
2. Understand quality planning and programs in construction industry.
3. Demonstrate procedures and quality assurance systems and safety management systems in construction projects.
4. Understand the fundamentals of Value, worth and value engineering and
5. Understand the general techniques in infraction valuation.
6. Understand the latest advances in construction technology and management practices.

Course Out comes:

At the end of the course, the student will be able to,

1. [Describe the properties of materials used in construction](https://www.ktunotes.in).
2. [Explain the properties of concrete and its determination](https://www.ktunotes.in).
3. [Describe the various elements of building construction](https://www.ktunotes.in).
4. [Explain the technologies for construction](https://www.ktunotes.in).
5. [Describe the procedure for planning and executing public works](https://www.ktunotes.in).
6. [Apply scheduling techniques in project planning and control](https://www.ktunotes.in).

**UNIT I**

**Construct**[**ionMaterials**](https://www.ktunotes.in)

Timberpr[oducts–propertiesandusesofveneer,plywood,fibreboard,particlebo](https://www.ktunotes.in)ard,multi wood

Ceme[nt: Manufacturing,chemical composition, Tests on cement –specificgravity,](https://www.ktunotes.in)standard consistency,initialandfinalsetting time,fineness,soundness,compressivestrength,IS specifications

Aggregate[s – types, Gradation, importanceofgradation, bulkingof fine aggregate](https://www.ktunotes.in)Qualityofwaterforconstruction(Briefdiscussiononly,Permissiblelimitsofchemical constituents not required)

Admixtures, uses – mineral admixtures – fly ash and ground granulated blast furnace slag and chemical admixtures – plasticizers, super plasticizers, accelerators, retarders (brief discussion

only).

**UNIT II**

**Concreteand BuildingConstruction**

Process of manufacturing concrete – batching, mixing, transportation, placing, compacting, finishing, curing

Properties of fresh concrete: Workability, factors affecting workability, test on workability

(slump te[st), segregation and bleeding (brief discussion)](https://www.ktunotes.in)

Propertie[s of hardened concrete: Strength, factors affecting strength, tests for strength](https://www.ktunotes.in) of concrete in compression, tension and flexure

Lintels and [arches: Types and construction details](https://www.ktunotes.in)

Damp proof [course (brief discussion only)](https://www.ktunotes.in)

Finishing [works: Plastering, pointing, painting – objectives and types](https://www.ktunotes.in)

Structura[l systems – load bearing and framed construction, RCC and steel framed struct](https://www.ktunotes.in)ures.

**UNIT III**

**Construct**[**ion Technology**](https://www.ktunotes.in)

Cost-effec[tive construction – rapid wall construction, soil-cement block masonry, vo](https://www.ktunotes.in)ided slab technology, filler slab technology (brief discussion only)

Scaffoldin[g – uses and classification (brief discussion only)](https://www.ktunotes.in).

**UNIT IV**

**Construct**[**ionTechniques**](https://www.ktunotes.in)

Formwor[k – requirements of good formwork, classification, slipform (brief discussion](https://www.ktunotes.in) only) Prefabricated construction – advantages and disadvantages, prefabricated building components. Basic concept of prestressing – fundamental understanding of pre-tensioned and post-tensioned construction

Constructi[on 3D printing (brief discussion only)](https://www.ktunotes.in) Building failures – general reasons

Causes of [failures in RCC, steel and masonry structures](https://www.ktunotes.in).

**UNIT V**

**ConstructionProjectManagement**

Construction projects, categories, life cycle of a project –pre-project phase, project phase, post- project phase, Detailed Project Report – contents.

Tendering: types of tenders, stages in tendering

Contracts: types of contracts – item rate contract, lumpsum contract, percentage rate contract, turnkey contracts, concession contracts – BOT.

**UNIT VI**

**Construction Planning**

Work brea[k down structure](https://www.ktunotes.in)

Types of [Schedules – Construction schedule, Material schedule, labour schedule, e](https://www.ktunotes.in)quipment schedule, financial schedule

Bar chart, Mile

Networ[ks, Network representation – Activity on Node (AON) Diagram](https://www.ktunotes.in)

Network [analysis – Critical Path Method (CPM), Programme Evaluation and](https://www.ktunotes.in) Review

Technique[(PERT) – concepts and problems](https://www.ktunotes.in)

**Textbooks:**

1. She[tty M.S. and A. K. Jain (2019), Concrete Technology: Theory and Practice,](https://www.ktunotes.in) S. Chand&C[ompany Pvt. Ltd.](https://www.ktunotes.in)

2. Va[rghese P. C. (2007), Building Construction, Prentice Hall India.](https://www.ktunotes.in)

3. Punm[ia B. C., Ashok Kumar Jain and Arun Kumar Jain (2016), Building Cons](https://www.ktunotes.in)truction, Laxmi Publications (P) Ltd.

4. Sh[arma S.C.and S.V.Deodhar (2019), Construction Engineering & Man](https://www.ktunotes.in)agement, Khanna Book Publishing Co. (P) Ltd.

5. K[umar Neeraj Jha (2015), Construction Project Management: Theory and P](https://www.ktunotes.in)ractice, Pearson India Education Services Pvt.Ltd.

**Reference**[**books:**](https://www.ktunotes.in)

1. SahuG.C.andJoy Gopal Jena (2015), Building Materials and Construction, McGraw HillEducation (India) Private Limited.

2. Gambhir M. L. (2004), Concrete Technology, Tata McGraw-Hill Publishing CompanyLimited.

3. Sharma S.K. (2019), Civil Engineering Construction Materials, Khanna Book Publishing Co. (P) Ltd.

4. Neville A.M. and BrooksJ.J. (2010), Concrete Technology, Pearson Education Ltd.

5. Mehta P. K. and Paulo J. M. Monteiro (2014), Concrete-Microstructure, Properties and

Materials, McGraw Hill Education.

6. SanthakumarR. (2006), Concrete Technology, Oxford Universities Press India.

7. Ton[y Bryan (2010), Construction Technology – Analysis and Choice, Wiley-Bla](https://www.ktunotes.in)ckwell.

8. J[oseph J. Moder, Cecil R. Philips and Edward W. Davis (1983), Project M](https://www.ktunotes.in)anagement with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company Inc.

9. Cha[rles Patrick (2012), Construction Project Planning and Scheduling,](https://www.ktunotes.in) Dorling

Ki[ndersley India Pvt. Ltd.](https://www.ktunotes.in)

10. Da[niel W. Halpin and Bolivar A. Senior (2011), Construction Management, John](https://www.ktunotes.in) Wiley and Sons Inc.

**9K762: Pavement ANALYSIS AND DESIGN**

**Professional Elective\_4**

**B Tech IV Year I Sem** **L T P/D C**

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**Course Objectives:**

1. Introduction to various factors affecting pavement design
2. Concepts of mechanistic and empirical methods of flexible pavements
3. Concepts of mechanistic and empirical methods of rigid pavements
4. Understand various verification techniques used for pavement designs
5. Knowledge of pavement evaluation
6. Will e able to understand theories related to pavement maintenance activities

**Course Outcomes:**

1. Application of basic principles in pavement design
2. Assimilation of mechanistic principles for the pavement design
3. Assimilation of empirical principles for the pavement design
4. Will be able to perform various verification techniques used for pavement designs
5. Explain about appropriate evaluation methods
6. Discuss about pavement maintenance measures for better serviceability of pavements

**UNIT - I**

**Introduction of Pavement Design**: Various Factors, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chasis and Articulated Commercial Vehicles, Legal Axle and Gross weights on single and multi units, Tire Pressure, Contact pressure, EAL and ESWL concepts, Equivalent Axle Load Factor, Traffic Analysis: ADT.AADT, Truck factor, Growth factor, Lane, Directional distributions & Vehicle Damage factors, Effect of Transient & Moving loads.

**UNIT - II**

**Stresses in Pavements:** Vehicle-Pavement Interaction, Stress inducing factors in flexible and Rigid pavements. Stress in Flexible Pavements: Visco-Elastic Theory and Assumptions. Layered system concepts, Stress solutions for one, two and three layered systems. Fundamental Design concepts. Stresses in Rigid Pavements: Westergaard's theory and Assumptions, Stresses due loading, warping and Frictional Stresses, Friberg's Analysis of Dowel Bars and deflection of dowel-joints.

**UNIT- III**

**Mechanistic Design Methodology for Pavements:** General Methodology, Classification of design Methods; Pavement Design Concepts; Flexible Pavements: Climatic Models, Structural models, Distress models: fatigue cracking, rutting and thermal cracking models; Rigid Pavements: Structural models, fatigue cracking: load and curling stress, Pumping and Erosion Models, Faulting Models, Joint Deterioration and Punch out models;

**UNIT - IV**

Need and verification of Flexible and Rigid pavement Mechanistic design procedures.

**Methods of Pavement Designs:** Flexible Pavement Design Concepts, Asphalt Institute Methods with HMA and other Base Combinations, AASHTO, IRC Methods as per IRC37 and IRC:SP:72. Design of Rigid Pavements: Introduction to Calibrated Mechanistic Design Process, PCA, AASHTO, IRC specifications,

**UNIT - V**

Introduction to pre-stressed and continuously Reinforced cement Concrete Pavement Design, Dowel bar design and design of tie bars as per IRC:58.

**Pavement Evaluation:** Types of pavement evaluation: Serviceability concepts, IRI, Quarter Car Model, skid resistance; Pavement Deflection - Different Methods of NDT, Benkelman Beam, LaCroix Deflectometer, Dynaflect, Road Ratar, Rolling Dynamic Deflectometer, Load man

**UNIT - VI**

Different Types of Falling Weight Deflectometers (FWD) for evaluation of rigid and flexible pavements. Design of overlays: Types & Design of overlays: Asphalt Institute's Principal Component Analysis, IRC Methods of Overlay Design.

**Text Books**

1. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications.
2. Teng, Functional Design of Pavements - McGraw hill - 1990.
3. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
4. Principles of Pavement Design, Yoder J. & Witzac Mathew W. John

Wiley & Sons.

**References**

1. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
2. Pavement and surfacing for Highway & Airports, Micheal Sargious, and

Applied science Publishers Limited.

1. Kadiyali and Lal, Principles of highway engineering, Khanna Publishers,

Delhi-6

1. IRC related Codes for Flexible and Rigid Pavements design

**Database Systems Concepts**

**Code: 9FC79 L T P C**

**3 0 0 3**

**Course Outcomes:**

1. Students will learn basics of databases and understand the architecture of database management systems.
2. Students will learn about good database design techniques and database theories behind.
3. Understand conceptual database designs, and functional dependencies and normalization.
4. Students will understand the Mathematical foundation for relational databases.
5. Student will be able to understand concept of Constraints, Views and will be able to create dynamic databases.
6. Learn transaction management, concurrency controls.

**Unit–I**IntroductiontoDatabasesandTransactionsWhatisdatabasesystem,purposeofdatabasesystem,viewofdata,relationaldatabases,databasearchitecture,transactionmanagement

**Unit- II** Data Models: The importance of data models, Basic building blocks, Business rules,Evolutionofdatamodels,Degreesof data abstraction

**Unit-III** Database Design,ER-Diagram and Unified Modeling Language Database design andERModel:overview,ER-Model,Constraints,ER-Diagrams,ERDIssues,weakentitysets,Codd’s rules, Relational Schemas, Introduction to UML Relational database model: Logical viewof data, keys, integrity rules. Relational Database design: features of good relational databasedesign,atomicdomainandNormalization(1NF,2NF,3NF,BCNF)

**Unit-IV**RelationalAlgebraandCalculusRelationalalgebra:introduction,Selectionandprojection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping andungrouping,relationalcomparison.Calculus:Tuplerelationalcalculus,DomainrelationalCalculus,calculusvsalgebra,computationalcapabilities

**Unit-V**Constraints,ViewsandSQLWhatisconstraints,typesofconstrains,Integrityconstraints,Views:Introductiontoviews,dataindependence,security,updatesonviews,comparison between tables and views SQL: data definition, aggregate function, Null Values,nestedsubqueries,Joinedrelations.Triggers

**Unit-VI**TransactionmanagementandConcurrencycontrolTransactionmanagement:ACIDproperties,serializabilityandconcurrencycontrol,Lockbasedconcurrencycontrol(2PL,Deadlocks),Timestamping methods,optimisticmethods,databaserecovery management

## TEXTBOOKS:

1. ASilberschatz,HKorth,SSudarshan,“DatabaseSystemandConcepts”,McGraw-Hill
2. RaghuramaKrishnan,JohannesGehrke,“DatabaseManagement Systems”,TMH
3. Rob, Coronel,“DatabaseSystems design,implementationandmanagement”,CengageLearning

## REFERENCES:

1. “FundamentalsofDatabaseSystems”,ElmasriNavate,PearsonEducation
2. “IntroductiontoDatabaseSystems”, C.J.DatePearsonEducation

**9ZC23 - ADVANCED ENTREPRENEURSHIP**

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**L T P/D C**

**3 0 0 3**

**Course Objective:** The course is designed to impart the necessary managerial skills and tactics required for an emerging Entrepreneur for the Engineering students to enhance their prospects as an Entrepreneur.

**Course Outcomes:**

* Explains the students to gain knowledge on the need of revisitng business model and also learning about types of business models. (L2).
* Discovers the various types of business planning that are needed to implement the business model (L4)
* Identify various funding options for an entrepreneur and also the team members involved in it (L3)
* Explains the digital platforms and tools available for marketing and also for online storage of documents (L2).
* Evaluate the growth of the stratups using performance and financial metrics (L5)

**UNIT I: Fundamentals of Entrepreneurship & Refining Business Model and Product:**

Fundamentals and key concepts of entrepreneurship, refining the business model, products and services, pivoting, types of business models, business model evolution, generating new business models, analyzing the business model, adding new customer segment, product manager, significance and role of product manager.

**UNIT II: Business Planning & Exploring Revenue:**

Business plan, sales plan, hiring sale team, people plan, financial planning, financial forecasting, create a procurement plan, negotiating role play, understanding primary revenue sources, exploring customer lifecycle for growth customers, exploring and identify secondary sources of revenue.

**UNITIII: Funding the Growth & Building the A-Team:**

Overview of funding, funding options for an entrepreneur, explore the right funding options, create funding plan, pitch deck, introduction to building A-Team, pitching to attract the talent, setting your team, defining roles, hiring the A-Team members.

**UNITIV: Brand and Channel Strategy & Leveraging Technologies:**

Introduction to branding, drawn the venture’s golden circle, positioning and positioning statements, creating brand name, logo, social media handle, Identify right channels, leaping ahead with technology, digital marketing for startups, plan a social media campaign, digital collaboration, store documents online, other technology platforms, make tech plan, platform wish list.

**UNIT V: Measuring Progress and Legal Matters:**

Metrics for customer acquisition (CAC, CLV, and ARPU), metrics for customer retention and satisfaction, find CAC, CLV and ARPU, key financial metrics, communicate metrics, new revenue stream through key financial metrics, re-forecasting of financial plan, identify professional help for legal and compliance requirements, searching of trademark and brand name and company name.

**UNIT VI: Seeking Support and Final Project:**

Mentors help to create successful startups, identify mentors and advisors, importance of mentors and advisors, scout the board of directors, overview on final project, capstone project presentation, contents of capstone project.

**Essential Readings:**

* Entrepreneurship Rajeev Roy “” oxford ,2012
* Entrepreneurship Development Khanka, ,S.Chand 2012

**References:**

* Small Scale industries and Entrepreneurship Vasanth Desai “Himalya publishing 2012
* Robert Hisrich et al “enterpreneruship TMH 2012
* Entrepreneurship Development Khanka, ,S.Chand 2012
* Entrepreneurship Development B.Janikairam and M Rizwana
* e-source: - [www.learnwise.org](http://www.learnwise.org)

**Social Science Stream**

**9ZC15 FINANCIAL MARKETS AND SERVICES**

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**L T P/D C**

**3 0 0 3**

**Course Objective:** The objective of the course is to provide students an understanding of Financial Markets and the Services offered in Indian Financial System within this framework.

**Course Outcomes:**

1. Understand the structure of Indian Financial System and the investment Objectives
2. Understand the role of money market and its instruments
3. Provide awareness about Indian Capital Markets.
4. Describe various Fund based financial services provided in India
5. Gain knowledge on Indian Mutual Fund Industry.
6. Describe various fee based financial services provided in India

**UNIT I**

**INTRODUCTION:**Investment – Investment Attributes, Structure of Indian Financial System, Financial Markets, Classification of Financial Markets, Financial Sector reforms- 1991.

**UNIT II**

**FINANCIAL AND SECURITIES MARKETS:** Role and functions of SEBI, Structure and functions of Call Money Market, Government Securities Market – T-bills Market, Commercial Bills Market, Commercial paper and Certificate of Deposits.

**UNIT III**

**CAPITAL MARKETS:** Securities Market – Organization and Structure, Listing, Trading and Settlement, Buying and Selling of shares, Stock Market Quotations, Stock Market Indices, SEBI and Regulation of Primary and Secondary Markets.

**UNIT IV**

**FUND BASED FINANCIAL SERVICES:** Lease Finance, Hire purchase Finance, Factoring - Definition, Functions, Advantages, Evaluation, Forfeiting, Bills Discounting, Venture Capital Financing.

**UNIT V**

**MUTUAL FUNDS:** Definition, Structure and functioning of Unit Trust of India and Mutual Funds, Types of Mutual Fund Schemes, Growth of Indian Mutual funds and their Regulation, Role of AMFI.

**UNIT VI**

**FEE BASED FINANCIAL SERVICES:** Stock Broking, Credit Rating, Underwriting, Banker to an Issue, Debenture Trustees and Portfolio managers, Challenges faced by Investment Bankers.Merchant Banking: Definition, Services of Merchant Banks.

**Essential Readings:**

* L.M. Bhole: Financial Institutions and Markets, TMH, 2009.
* E. Gordon, K. Natarajan: Financial Markets and Services, Himalaya Publishing House, 2013.
* Vasant Desai: Financial Markets and Financial Services, Himalaya,2009
* Pathak: Indian Financial Systems, Pearson, 2009
* M.Y. Khan: Financial Services, TMH, 2009.

**References:**

* S. Gurusamy: Financial Services and System, Cengage,2009
* Justin Paul and Padmalatha Suresh: Management of Banking and Financial Services, Pearson, 2009.
* Gomez, Financial Markets, Institutions and Financial Services, PHI, 2012.
* R M Srivatsava: Dynamics of Financial Markets and Institutions in India, Excel, 2013.

**9ZC09 CO – CREATION AND PRODUCT DESIGN**

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**L T P/D C**

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**Course Objective:** The objective of the course is to make students understand the fundamental concepts of design thinking, and to familiarize with product design process and to motivate the students to ideate new products and services.

**Course Outcomes:**

**CO1**: Outline the significance of Human Centered Design from customer perspective. (L2)

**CO2**: Examine the scope of emerging technologies in the field of product design. (L4)

**CO3**: Designing the product prototypes and developing the testing solutions. (L6)

**CO4**: Determine the relevance of reverse engineering and ergonomics at work place. (L5)

**CO5**: Application of the knowledge into practice with regard to IPR’s. (L3)

**Unit – I: HUMAN CENTERED DESIGN:** Understanding user and Customer perspectives, Identify insights and opportunities, Interviewing, User Experience design. Frame your design challenge**.** Empathy tools and techniques.

**UNIT II: IDEATION PROCESS:** Articulation of Problem Statement, Visualizing Ideas, Communicating ideas and compelling story telling, Brainstorming, Divergent thinking in exploring solutions, 3- box thinking, 3-box framework and Box-3 ideation.

**UNIT III: EMERGING TECHNOLOGIES AND DESIGN:** Emerging technologies, utilization and growth, Automation through Industry 4.0, IOT for Network and Intelligent world, efficient and effective manufacturing aided by Robotics, Custom manufacturing by Additive / 3D printing, Augmented reality for product and process.

**UNIT IV: PROTOTYPING**: Introduction to Prototype, types of prototype, prototyping strategies, Design consideration in the five stages of the product life cycle. Prototype building by different engineering disciplines. Testing Solution and taking the solution to the users. Create a pitch for your design.

**UNIT V: REVERSE ENGINEERING IN PRODUCT DEVELOPMENT:** Reversing engineering methods, identifying the bad features in a product, reduction in size and weight, usage of new materials, importance of ergonomics in product development, environmental considerations in design, and safety considerations in design.

**UNIT VI: INTELLECTUAL PROPERTY RIGHTS:** Introduction to IPR, Patents – Types of Patents, elements of patentability, Patents registration Procedure, Patent office and Appellate Board, Rights and Duties of Patentee, Restoration of Lapsed patents.

**Essential Readings:**

1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, “Exploring Engineering: An Introduction to Engineering and Design”, 4th edition, Elsevier, 2016.
2. David Ralzman, “History of Modern Design”, 2nd edition, Laurence King Publishing Ltd., 2010 3. An AVA Book, “Design Thinking”, AVA Publishing, 2010.
3. Ingle, B. R. (2013). *Design thinking for entrepreneurs and small businesses: Putting the power of design to work*. Apress.
4. Norman, D. A. (2016). *Living with complexity*. MIT press.
5. Chapman, J. (2017). *Routledge handbook of sustainable product design*. Taylor & Francis.
6. Nithyananda, K.V. (2019), IPR, protection and Management, India, Cengage learning India.

**References:**

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, “Engineering Design: A Systematic Approach”, 3rd edition, Springer, 2007. 2. Tom Kelley, Jonathan Littman, “Ten Faces in Innovation”, Currency Books, 2006.
2. Kumar, V. (2012). *101 design methods: A structured approach for driving innovation in your organization*. John Wiley & Sons.
3. Chapman, J. (2012). *Designers Visionaries and Other Stories: A Collection of Sustainable Design Essays*. Taylor & Francis.
4. Garrett, J. J. (2010). *The elements of user experience: user-centered design for the web and beyond*. Pearson Education.
5. Neeraj, P. &Khusdeep, D (2014), IPR, India, IN: PHI Learning.

**Code: 9K786. MATLAB**

**B Tech IV Year I Sem L T P/D C**

**0 0 3 1.5**

**Course Objectives**

1. This Lab Course will enable the students to understand the basicsof programming knowledge in MATLAB and use them in civil engineering problems.

**Course Outcomes:**

1. Students are able to use MATLAB environment and its programming fundamentals.
2. Students are able to write Programs using commands and functions.
3. Students are able to use MATLAB for solving a problem encountered in Civil Engineering.

**LIST OF EXPERIMENTS**

1. Getting Started with Matlab and practicing basic operations; Data types, Constants and Variables, Character constants, operators, Assignment statements.
2. Matrix operations (Additions, subtractions, multiplications) with Control Structures, For/While Loops, If control structures, Switch, Break, Continue statements.
3. Finding Eigen Values and Eigen vectors of Matrices with Input-Output functions, Reading and Storing Data.
4. Determination of Stopping sight distance.
5. Determination of Overtaking sight distance.
6. Roots of quadratic equations
7. Limits, Derivatives, simple differential equations
8. 2D Plots of bar chart, pie chart and line graph.
9. Solve an Initial value problem using Runge-Kutta method
10. Program to perform the design of Beam for the user input values
11. Solving any Civil Engineering problem usingMatlab

**TEXT BOOKS**

1. Bansal .R.K, Goel .A.K, Sharma .M.K, “MATLAB and its Applications in Engineering”, Pearson Education, 2012.
2. Amos Gilat, “MATLAB-An Introduction with Applications”, Wiley India.

**REFERENCES**

1. Stephen J.Chapman, “Programming in MATLAB for Engineers”, Cenage Learning, 2011.

**9K787REVIT AND Quantity ESTIMATION LABORAToRY**

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**B.Tech IV Year I Sem. L T P C**

**0 0 3 1.5**

**Course Objectives:** The objective of the course is to

CO1 To empower the students for rate analysis for a given work.

CO2 To empower the students to develop building information modelling workflow.

**Course Outcomes:** At the end of the course the student will able to

CO1 Develop the documentation for material quantities and rate analysis for different structures.

CO2 Develop the architectural design for the structure based on the requirement of end user.

**Experiments:**

1. Estimate the quantities of steel in Bar-bending Schedule Of Beams
2. Estimate the quantities of steel in Bar-bending Schedule of rectangular and spiral Columns.
3. Estimate the quantities of steel in Bar Bending Schedule Of Slab
4. Estimate the quantities of steel in Bar-bending Schedule of Isolated Footing
5. Perform the Rate Analysis For earthwork quantities
6. Perform the Rate Analysis For Plain Cement Concrete (P.C.C)
7. Rate Analysis For Reinforcement Concrete (Column Beam And Slab)
8. Rate Analysis For Masonry Work
9. Rate Analysis For Plaster Work
10. Developing The basics building model by creating a Basic Floor Plan
11. Design of Exterior components using Revit Architecture
12. Design of Interior components using Revit Architecture

**TEXT BOOKS:**

1. Revit and Estimation and Quantity Survey Laboratory Manual.

2. Estimating and Costing in Civil Engineering – Theory and Practice by B N Dutta, 28th Revised Edition, 2016, UBS Publishers Distributors Pvt. Ltd.

**REFERENCES:**

1. Estimating and Costing in Civil Engineering by Jagjit Singh, Galgotia Publications, New Delhi, 1996.
2. Estimating, Costing, Specifications and Valuation in Civil Engineering by M. Chakraborthi, Publisher: M Chakraborti, 24th Edition, 2010.

**B Tech IV YearIISem**

**9K863: AIRPORT, RAILWAYS, AND WATERWAYS**

**(professional elective-V)**

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**L T P / D C**

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**Course Objectives:** the objectives of the course are to

* Deal with the characteristics of aircrafts related to airport design; runway and taxiway design, runway orientation, length, grading and drainage.
* Introduce component of railway tracks, train resistance, crossing, signaling, high speed tracks and MetroRail.
* Explain the classes of harbors, features, planning and design of portfacilities.

**Course Outcomes:** At the end of this course, the students will develop:

* An ability to design of runways and taxiways.
* An ability to design the infrastructure for large and smallairports
* An ability to design various crossings and signals in RailwayProjects.
* Anabilityplantheharborsandportsprojectsincludingtheinfrastructurerequiredfornew ports andharbors.

**UNIT – I**

**Airport Engineering:** Introduction to Air Transportation - Aircraft Characteristics - Factors Affecting SelectionofsiteforAirport–Aprons–Taxiway–Hanger –Geometricdesign-ComputationofRunway Length, Correction for Runway Length, Orientation of Runway, Wind RoseDiagram

**UNIT - II**

**Introduction to Railways:** Role of Indian Railways in national development – Railways for Urban Transportation – LRT, Mono Rail, Metro Rail & MRTS. Permanent Way: Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks Sleepers – Functions, Materials, Density – Functions, Materials, Ballast, Sub grade and Embankments, Ballast less Tracks.

**UNIT – III**

**GeometricDesignofRailwayTrack:**GradientsandGradeCompensation,Super-Elevation,Widening of Gauges in Curves, Transition Curves, Horizontal/VerticalCurves.

**UNIT – IV**

**Track maintenance and Operation:** Points and Crossings - Turnouts, Stations and Yards - Level Crossings. Signaling and Interlocking - Track Circuiting - Track Maintenance.

**UNIT – V**

**Dock & Harbour Engineering:** Water Transportation: Ports and Harbours - Types of water transportation, water transportation in India, Ports and harbours: requirements, classification. Harbour works: breakwaters, jetties, fenders, piers, wharves, dolphins, etc.,

**UNIT – VI**

Navigational aids: types, requirements, light house, beacon lights, buoys, Port facilities: general layout, development, planning, facilities, terminals. Docks and repair facilities: design, dry docks, wet docks, slipways, Locks and lock gates: materials, size, Dredging: classification, dredgers, uses of dredged materials.

**TEXT BOOKS:**

1. Venkataramaiah C(2016), “Transportation Engineering Vol II – Railways, Airports, Docks, Harbors, Bridges and Tunnels”, Universities Press (India) Private Limited,Hyderabad
2. J S Mundrey, Railway Track Engineering (5th Edition) McGraw Hill Education2017

**REFERENCE BOOKS:**

1. Subhash C. Saxena (2008) Airport Engineering, Planning and Design, CBS Publishers and Distributors, New Delhi. (Reprint2015)
2. R.Srinivasan(2016),Harbour,DockandTunnelEngineering28thEdition,CharotarPublishing House Pvt.Ltd.
3. Saxena SC and Arora S C (2010) A Text Book of Railway Engineering Paperback – 2010, Dhanpat Rai Publications (Reprint2015)
4. Robert Horonjeff, Francis X. McKelvey, Willian J Sproule, Seth B. Young (2010), Planning & Design of Airports, McGraw-HillProfessional.
5. Transportaion Engineering by R. Srinivasa Kumar, University PressInd

**9K864: Irrigation and Hydraulic Structures**

**B.Tech. IV Year II Sem.**

**L T P/D C**

**3 0 0 3**

**Course Objectives:** To study various types of storage works and, diversion headwork, their components and design principles for their construction.

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

* Know types of water retaining structures for multiple purposes and its key parameters

considered for planning and designing

* Understand details in any Irrigation System and its requirements
* Know, Analyze and Design of an irrigation system components

**Unit - 1**

Storage Works-Reservoirs - Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve- Reservoir Sedimentation – Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

**Unit - 2**

Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile, and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety - Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.

**Unit- 3**

Earth dams: types of Earth dam, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage. Spillways: types of spillways, Design principles of Ogee spillways - Spillway gates. Energy Dissipaters and Stilling Basins Significance of Jump Height Curve and Tail Water Rating Curve - USBR and Indian types of Stilling Basins.

**Unit- 4**

Diversion Head works: Types of Diversion head works- weirs and barrages, layout of diversion head work - components. Causes and failure of Weirs and Barrages on permeable foundations, -Silt Ejectors and Silt Excluders Weirs on Permeable Foundations – Creep Theories - Bligh’s, Lane’s and Khosla’s theories, Determination of uplift pressure- Various Correction Factors – Design principles of weirs on permeable foundations using Creep theories - exit gradient, U/s and D/s Sheet Piles - Launching Apron.

**Unit- 5**

Canal Falls - types of falls and their location, Design principles of Notch Fall and Sarada type Fall. Canal regulation works, principles of design of cross and distributary head regulators, types of Canal escapes - types of canal modules, proportionality, sensitivity, setting and flexibility.

**Unit-6**

Cross Drainage works: types, selection of suitable type, various types, design considerations for cross drainage works, Design of Super passage.

**Text books:**

1. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers.

2. Irrigation engineering by K. R. Arora Standard Publishers.

3. Irrigation and water power engineering by Punmia& Lal, Laxmi publications Pvt. Ltd., New Delhi

**Reference books:**

1. Theory and Design of Hydraulic structures by Varshney, Gupta & Gupta

2. Irrigation Engineering by R.K. Sharma and T.K. Sharma, S. Chand Publishers 2015.

3. Irrigation Theory and Practice by A. M. Micheal Vikas Publishing House 2015.

4. Irrigation and water resources engineering by G.L. Asawa, New Age International Publishers.

**9K865:GEOSYNTHETICS**

**(Professional Elective-V)**

**B.Tech. IV Year II Sem. L T P/D C**

**3 0 0 3**

**COURSE OUTCOMES:**

At the end of the course, the students will develop ability to

1. Identify and recognize potential use of geo synthetics and understand the testing of mechanical endurance of properties of geosynthetics.
2. Exemplify and explain design of geotextiles.
3. Illustrate the geogrid properties and testing methods and analyze-distinguish the selection of geotextiles for drainage arrangements.
4. Justify and prioritize to use type of geonets in civil engineering works.
5. Create system of geomembrane
6. Elaborate and estimate sustainable design for improving the application for Geocomposites

**UNIT – I**

**Introduction:** An overview on the development and applications various geosynthetics - the geotextiles, geogrids, geonets, geomembranes and geocomposites.

**UNIT – II**

**Designing with Geotextiles:** Geotextile properties and test methods – functions - Designing for separation, reinforcement, stabilization, filtration, drainage.

**UNIT – III**

**Designing with Geogrid:** Geogrid properties and test methods – physical properties, mechanical properties, endurance properties and environmental properties – Designing for grid reinforcement and bearing capacity.

**UNIT – IV**

**Designing with Geonets:** Geonet properties and test methods – Physical properties, mechanical properties, hydraulic properties, endurance properties and environmental properties -Designing geonet for drainage.

**UNIT – V**

**Designing with Geomembranes:** Geomembrane properties and test methods – physical properties, mechanical properties, chemical properties and biological hazard - Applications for geomembranes.

**UNIT – VI**

**Geocomposites:** Definition, types, and applications; Ground improvement methods involving geocomposites, Use of geocomposites in drainage and filtration applications, Design considerations for geocomposite drainage systems, erosion control and sediment management; geocomposite applications.

**TEXTBOOKS:**

1. Robert M. Koerner, “Designing with Geosynthetics”, Prantice Hall, Eaglewood cliffs, NJ 07632.
2. Robert M. Koerner and Josoph P. Welsh, “Construction and Geotechnical Engineering Using Synthetic Fabries”, John Willey and Sons, New York.

**Reference BOOKS:**

1. G. Venkatappa Rao and G V S SuryanarayanaRaju, “Engineering with Geosynthetics”, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. J.E. Bowles, “Foundation Analysis and Design”, McGraw Hill Publications.

**OPERATING SYSTEMS**

##### Prerequisite: Computer Organization

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**COURSE OBJECTIVES:**

Learn basics of operating Systems. Understand the process management and synchronization that take place in the operating system. Learn the principles of memory, I/O and file management in a secured environment.

##### COURSE OUTCOMES:

At the end of this course, the students will be able to

1. Understand the functional architecture of an Operating System with usage of system calls.
2. Analyze various process scheduling algorithms & pragmatics of scheduling algorithms used by various Operating Systems.
3. Solve issues related to process synchronization and Deadlocks in the Operating System.
4. Illustrate the concepts of Memory Management.
5. Outline the directory structure & analyze disk scheduling algorithms.
6. Summarize the aspects of Protection and Security, and understand the concepts of I/O systems.

**UNITI:** Introduction to Operating System, Computer System Architecture: Single Processor System, Multiprocessor System, Clustered System, Multiprogramming System, Multitasking (Time sharing) system, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure: single structure, layered approach, micro kernels, modules.

Application: system calls in the file systems

**UNIT II:** Process Management: Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms -First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin(RR), Multilevel Queue Scheduling. Engg. Applications – Process scheduling in Windows, Linux.

**UNIT III:** Process-Synchronization & Deadlocks: Critical Section Problems, semaphores; Monitors; Deadlock Characterization, methods for handling deadlocks-deadlock prevention, Avoidance & Detection; Deadlock recovery. Applications: Handling deadlocks in computer system

**UNIT IV**: Memory Management: Logical& Physical Address Space, swapping, Contiguous memory allocation, Paging and Segmentation techniques, Segmentation with paging; Virtual memory: Demand Paging, Page-Replacement Algorithms, Thrashing. Engg. Applications – Memory management in Windows, Linux.

**UNIT V:** FileSystem: Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms.

Applications: File allocation, FAT

**UNIT VI:** I/O Systems: I/O Hardware, Application I/O Interface, Kernel, Transforming I/O requests, Performance Issues. Protection and Security: Goals of protection, Principles of protection, Access matrix, Access control list, Capability List. Security Attacks, Program threats. Applications: Handling I/O requests

##### TEXT BOOKS:

1. Operating System Concepts by Silberchatz Galvin, 8th edition.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings,4th edition, 2001, Prentice-Hall

##### REFERENCES:

1. Operating System By Peterson , 1985, AW.
2. Operating System ByMilankovic, 1990, TMH.
3. Operating System Incorporating With Unix& Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik& Donovan, TMH
5. Operating Systems ByDeitel, 1990, AWL.
6. Operating Systems – Advanced Concepts By MukeshSinghal , N.G. Shivaratri, 2003, T.M.H

**9ZC24 PRODUCT & SERVICES**

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**L T P/D C**

**3 0 0 3**

**Course Objectives**: This course helps to provide the basic concepts of Product and Services. This course will enable the students to study areas of basic insights in product management and Services Design.

**Course Out Comes**:

1. Explain the students about basic concepts of product (L2)
2. Demonstrate ten the students with the process of new product development and stages in the process. (L2)
3. Inspect the new product using testing, product planning and the preparatory groundwork for launching a new product (L4)
4. Explains the students to understand the nature of services, its differences with the goods and the application of marketing principles for services (L2)
5. Examines the quality of services and and also helps in knowing various forms of delivering services (L4)

**UNIT- I**

**INTERPRETATIONS ON PRODUCT**

Meaning of Product, Product Market Fit Analysis, Product Levels, Product Mix, Product Pruning, and Product Cannibalization.Types of Product Classification

**UNIT- II**

**PRODUCT INNOVATION and VALIDATION**

New products-What is a new product, New Product Development Process, Idea generationSystems,Concept test,Product testing, Pre-launch,Market test, Final evaluation using “Stage / Gate Process. Product Validity, Break Even Analysis, Financial and Market Analysis.

**UNIT- III**

LAUNCHING PRODUCT

Cost Analysis, Steps to fix the final price, Promotion planning, Digital Marketing and Methods, Retailing, Types of Retailing online Retailing, Post Market Analysis of the Launch

**UNIT - IV: INTRODUCTION TO SERVICE:**

Meaning and Definition of Service, Characteristics of Services, Classification of Service, Five levels of Service, Service verses Physical Goods, 7 P’s for Marketing of Services, Servicescape

**UNIT – V: SERVICE PROCESS DESIGN and SERVICE DISTRIBUTION:**

Service Design Meaning, Tools for Service Design, Attributes of a Good Design Customer involvement in the Production Process, Role of Intermediaries, Methods of Distribution of Services

**UNIT – VI: QUALITY OF SERVICE:**

Definition of Service Quality, Elements of Service Quality, Service Quality Measuring Tools; SERVQUAL Scale, Service Quality Gap Analysis, Objective Service Metrics, Cost of Quality in Service. Challenges and Problems of Service Quality in India.

**Essential Readings:**

* Dr. S.L. Gupta, Product Management, Wisdom Publications
* C.Merle Crawford ,New Product Management
* Valarie A.Zeithaml& Mary Jo-Bitner: Services Marketing—Integrating Customer Focus Across the Firm, 3/e, Tata McGraw Hill, 2007.

**References:**

* Thomas J.Delong&Asish Nanda: Managing Professional Servies—Text and Cases, McGraw-Hill International, 2006.
* Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2006

**9ZC19PROJECT AND RISK MANAGEMENT**

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**L T P/D C**

**3 0 0 3**

**Course Objective:** The objective of the course is to provide students with detailed knowledge of Project Management and Risk management avenues for making better financial decisions.

**Course Outcomes:**

1. Gain knowledge regarding project, its life cycle and organization
2. Understand the process of project formulation
3. Describe the procedure for project implementation
4. Identify the risk management process and methods
5. Understand the role of Derivatives as a risk management tool
6. Create awareness on Options and Swaps as a tool for risk mitigation

**UNIT I**

**BASICS OF PROJECT MANAGEMENT:** Concept and characteristics of a project - types of projects - Project life cycle - Challenges and problems of project management - Qualities & functions of a project manager.

**UNIT-II**

**PROJECT FORMULATION:** Generation of Project Ideas; Monitoring the environment; Preliminary Screening of Projects; Feasibility study; Project Selection, Detailed Project Report: Market, Technical, Financial and Economic aspects

**UNIT III**

**PROJECT IMPLEMENTATION:** Pre-requisites for Successful Project Implementation; Control of in-progress Projects (Gantt chart, PERT, CPM); Financing of Projects, Project Risk Management Process, Post-audit; Abandonment Analysis

**UNIT-IV**

**RISK MANAGEMENT:** Risk – Definition, Types of Risk, Approaches to Risk Management, Risk Management Process and Techniques.

**UNIT-V**

**DERIVATIVES – I:** Introduction to Financial Derivatives, Types of Derivative Instruments – Forwards, Futures, Differences between Forwards and Futures, Margin Limits.

**UNIT-V1**

**DERIVATIVES –II:**

**a)** Options: Definition, Operation of Option contracts, Call Option, Put Option, Factors determining Option values.

**b)** Swaps: Definition, Types of Swap agreements, Mechanics of Interest rate swaps, Mechanics of Currency swaps.

**Essential Readings:**

* H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
* Jeffrey K. Pinto “Project Management”, 2nd edition, Pearson
* DhandapaniAlagiri “Structured Finance – Concepts & Perspectives”, ICFAI University press.
* Projects by Prasanna Chandra, McGraw-Hill Publishing Co. Ltd

**References:**

* Project Management: Systems approach to Planning Scheduling and Controlling, H. Kerzner.
* The Complete Real Estate Documents by Mazyar M. Hedayat, John J. Oleary
* The Fundamentals of Listing and Selling Commercial Real Estate - By Keim K. Loren (Author)

**9ZC10 ENTREPRENEURSHIP AND BUSINESS DESIGN**

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**L T P/D C**

**3 0 0 3**

**Course Objective:** The objective of the course is to make students understand the essentials of building their startups and to familiarize with business design process develop business models, and market their product.

**Course Outcomes:**

1. Explains the students to understand knowledge on the essentials of entrepreneurship and the key role played by the entrepreneurs.(L2)
2. Distinguishes the different phases of UI /UX.(L4)
3. Develop the attentiveness on designing a business strategy(L6)
4. Demonstrates to understand reverse engineering methods in product development.(L2)
5. Explains the students to understand on IPR, and patent application.(L2)

**UNIT I: Introduction to Entrepreneurship**: Meaning of Entrepreneurship. Reasons feeding the Entrepreneurial fire. Understanding Entrepreneurship as a Process. Multiple roles of Entrepreneur: Intrapreneur, Inventor, Coordinator, Manager and Controller. Psychological and behavioral aspects of First-Generation Entrepreneur.

**UNIT II: Introduction to UI/UX:** Human centered design and benefits, the distinction between UX and UI, UX process – user research, prototyping strategies, UI principles, UI analysis, UI design, UI components and Responsive design.

**UNIT III: Designing a Business Strategy:** Define a problem and frame a strategic question, map the lives of users, journey mapping and ideation, color theory, killing the ideas through Stage Gate Models, pitching of full-fledged, idea, choosing the Start-Up Team.

**UNIT IV: Designing Services and Services Delivery:**Services as solutions, Service delivery pathways, rapid branding and marketing strategies, key metrics for Design thinking. Types of New services, Mix of core services and secondary and enhancing services, service flower and service design matrix.

**UNIT V: Business Model:** Meaning of business model, Difference between business model and business planning, the business model canvas, Risks and Assumptions, Validation of business models, building solution demo and MVP, revenue streams and pricing strategies.

**UNIT VI: Entrepreneurial Funding and Risk Management:**Bootstrapping, Angel Investors, Venture capitalists, Private equity funding, customer acquisition, return on equity and Break even analysis, Risk propensity Vs. Risk avoidance, Locus of control of entrepreneur, Risk estimation techniques, risk avoidance strategies.

**Essential Readings:**

1. Adrian McEwen, Hakim Cassimally – “Designing the Internet of Things”, Wiley Publications, 2012
2. Hedman, J., &Kalling, T. (2003). The business model concept: theoretical underpinnings and empirical illustrations. *European journal of information systems*, *12*(1), 49-59.
3. Cabrera, J. (2017). *Modular Design Frameworks: A Projects-based Guide for UI/UX Designers*. Apress.

**References:**

1. J. Chris Leach & Ronald W. Melicher “Entrepreneurial Finance, Fourth Edition”, South Western, Cengage Learning, 2012.
2. Robert D. Hisrich&VelandRamadani – “ E­ffective Entrepreneurial Management, Strategy, Planning, Risk Management, and Organization” , Springer, 2017.
3. Mæhlum, A. R. (2017). *Extending the TILES Toolkit-from Ideation to Prototyping* (Master's thesis, NTNU).
4. Norman, D. (2013). *The design of everyday things: Revised and expanded edition*. Basic