VARDHAMAN
COLLEGE OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

List of Course Outcomes

Semester No:	I M.Tech-I Sem (R25)		
Course Title:	Advanced Structural Analysis	**Course Code:**	B7801
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify determinate and indeterminate structures.		
CO2	Solve flexibility and stiffness matrices for all types of structures.		
CO3	Apply various methods to assemble the direct stiffness matrix from member stiffness matrix.		
CO4	Analyse flexural members and portal frames using matrix methods.		
CO5	Evaluate solutions for set of equations using various methods.		
Course Title:	Theory of Elasticity and Plasticity	**Course Code:**	B7802
Course Outcome No.	**Course Outcome Statement**		
CO1	Demonstrate theory, concepts, principles, and governing equations of elasticity.		
CO2	Illustrate concepts of plasticity and its governing equations.		
CO3	Develop equations of equilibrium and compatibility for two-dimensional problems in rectangular and polar coordinates.		
CO4	Analyse three-dimensional elasticity problems to determine principal stresses and planes.		
CO5	Solve elastic problems using equilibrium and compatibility equations under various boundary conditions.		
Course Title:	Research Methodology and IPR	**Course Code:**	B7001
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify an appropriate research problem in their suitable domain.		
CO2	Construct a well-structured research paper and scientific presentations.		
CO3	Express the importance of research ethics in scientific community.		
CO4	Explore on various component of IPR and process of filing.		
CO5	Gain knowledge on patents and copyrights.		

Course Title:	Advanced Concrete Technology	**Course Code:**	B7851
Course Outcome No.	**Course Outcome Statement**		
CO1	Evaluate properties of concrete manufacturing materials to check their quality.		
CO2	Apply appropriate concreting methods and special techniques under various field conditions.		
CO3	Measure properties of concrete in fresh and hardened states.		
CO4	Design different grades of concrete mixes for specific field applications.		
CO5	Illustrate various types of special concretes and their uses.		
Course Title:	Construction Technology and Project Management	**Course Code:**	B7852
Course Outcome No.	**Course Outcome Statement**		
CO1	Select appropriate tools, equipment, and techniques for project execution.		
CO2	Identify key issues of building contracts, documentation, specifications, and regulations.		
CO3	Apply construction planning and management techniques during project execution.		
CO4	Examine quality and safety aspects involved in construction projects.		
CO5	Analyze resources, costs, claims, and disputes in project environments.		
Course Title:	Advanced Design of Reinforced Concrete Structures	**Course Code:**	B7854
Course Outcome No.	**Course Outcome Statement**		
CO1	Determine the stress behaviour of RC deep beams and corbels, and design them as per IS 456 guidelines.		
CO2	Design rectangular bunkers and cylindrical silos as per IS 4995 (Part I) 1974.		
CO3	Design and analyse at slabs using direct design and moment distribution methods as per IS 456:2000.		
CO4	Assess ribbed slabs for strength, serviceability, and develop reinforcement detailing.		
CO5	Evaluate and design cantilever and counterfort retaining walls for stability and safety.		
Course Title:	Structural Health Monitoring	**Course Code:**	B7855
Course Outcome No.	**Course Outcome Statement**		
CO1	Illustrate various structural sensing technologies used for health monitoring.		
CO2	Identify and differentiate between various SHM techniques and their applications.		
CO3	Apply appropriate field-testing and monitoring methods for data collection.		
CO4	Utilize different data acquisition systems for structural assessment.		
C05	Integrate IoT-based hardware and software for remote monitoring and data analysis using machine learning.		

Course Title:	Microstructure Analysis of Concrete	**Course Code:**	B7856
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify suitable methods and equipment for characterisation of materials.		
CO2	Illustrate the operation principles of different characterisation tools.		
CO3	Interpret the results from various characterisation techniques.		
CO4	Examine rheological behaviour of cement paste and concrete.		
CO5	Assess influence of corrosion on reinforced concrete structures.		
Course Title:	Numerical Analysis Laboratory	**Course Code:**	B7803
Course Outcome No.	**Course Outcome Statement**		
CO1	Apply error approximations to fit data in a curve.		
CO2	Determine the roots of nonlinear equations.		
CO3	Solve systems of linear equations using Gauss methods.		
CO4	Evaluate integrals using trapezoidal and Simpson's rules.		
CO5	Estimate numerical solutions of ordinary differential equations.		
Course Title:	Advanced Concrete Technology Laboratory	**Course Code:**	B7804
Course Outcome No.	**Course Outcome Statement**		
CO1	Evaluate properties of concrete manufacturing materials to check their quality.		
CO2	Classify properties of various types of admixtures and their applications.		
CO3	Measure properties of fresh and hardened states of concrete.		
CO4	Design normal and special concretes and evaluate the parameters affecting performance.		
CO5	Conduct Non-Destructive Tests on existing concrete structures.		

Semester No:	I M.Tech-II Sem (R25)		
Course Title:	Finite Element Analysis	**Course Code:**	B7805
Course Outcome No.	**Course Outcome Statement**		
CO1	Illustrate concepts of Finite Element Analysis (FEA) and relate energy principles in functional approximations.		
CO2	Develop shape functions and stiffness matrices for 1D and 2D elements.		
CO3	Solve problems using 2D and 3D iso-parametric elements.		
CO4	Analyse Lagrange and axisymmetric 2D and 3D elements.		
CO5	Evaluate plate elements using plate bending concepts.		
Course Title:	Structural Dynamics	**Course Code:**	B7806
Course Outcome No.	**Course Outcome Statement**		
CO1	Apply equilibrium equations of motion in dynamic systems.		
CO2	Determine dynamic characteristics of systems subjected to various loadings.		
CO3	Analyse multi-degree-of-freedom systems using discrete approach.		
CO4	Estimate natural frequencies using approximate methods.		
CO5	Deduce natural frequencies and mode shapes for continuous systems.		

Course Title:	Bridge Engineering	**Course Code:**	B7857
Course Outcome No.	**Course Outcome Statement**		
CO1	Classify various types of bridges and load patterns based on IRC standard recommendations.		
CO2	Select suitable bearings and expansion joints for different structural conditions.		
CO3	Analyse cables and towers under various loadings and perform design of bridge superstructure.		
CO4	Estimate forces and moments acting on bridge components such as abutments and piers.		
CO5	Design structural elements for both substructure and superstructure considering codal provisions.		
Course Title:	Design of Prestressed Concrete Structures	**Course Code:**	B7858
Course Outcome No.	**Course Outcome Statement**		
CO1	Describe basic concepts and principles of prestressed concrete systems.		
CO2	Calculate losses of prestress in pre-tensioned and post-tensioned members.		
CO3	Analyse prestressed concrete beams for flexure under various tendon profiles.		
CO4	Design prestressed members for flexure and shear according to IS code provisions.		
CO5	Assess anchorage stresses and stress distribution in prestressed concrete members.		
Course Title:	Advanced Design of Steel Structures	**Course Title:**	B7859
Course Outcome No.	**Course Outcome Statement**		
CO1	Classify the different structural design philosophies.		
CO2	Determine the strength parameters of different connection types.		
CO3	Apply design principles, procedures, and current IS code requirements.		
CO4	Identify failure modes and assess design strength of axial steel members.		
CO5	Design various members and connections in steel structural systems.		
Course Title:	Earthquake Resistant Design of Structures	**Course Title:**	B7860
Course Outcome No.	**Course Outcome Statement**		
CO1	Discuss the causes of earthquakes and the principles of seismic-resistant building architecture.		
CO2	Apply fundamental concepts of seismic design philosophy to structural systems.		
CO3	Implement ductility provisions for earthquake-resistant RC design as per IS 13920.		
CO4	Evaluate and estimate seismic forces in RC buildings using IS 1893 recommendations.		
CO5	Categorize structural performance levels and apply performance-based design principles.		

Course Title:	Theory of Plates and Shells	**Course Title:**	B7861
Course Outcome No.	**Course Outcome Statement**		
CO1	Illustrate concepts, displacement relations and boundary conditions of shells.		
CO2	Evaluate rectangular plates for various loading and boundary conditions.		
CO3	Analyse circular plates under axi-symmetric loading.		
CO4	Apply membrane theory to analyse shells structures of different shapes.		
CO5	Outline structural behaviour of different types of folded plates.		
Course Title:	Fracture Mechanics	**Course Title:**	B7862
Course Outcome No.	**Course Outcome Statement**		
CO1	Classify cracking in concrete structures based on fracture mechanics principles.		
CO2	Evaluate stress intensity factor and implement to notched members.		
CO3	Make use of concepts of LEFM and compute J-Integral for various sections.		
CO4	Examine crack toughness properties for different crack openings.		
CO5	Apply fracture mechanics models to high strength concrete and FRC structures.		
Course Title:	Finite Element Analysis Laboratory	**Course Title:**	B7807
Course Outcome No.	**Course Outcome Statement**		
CO1	Solve for stresses, strains, and displacements using finite element software.		
CO2	Determine the stresses in brackets, plates with holes, and cylindrical components.		
CO3	Perform thermal stress analysis of bar elements and rectangular plates.		
CO4	Evaluate buckling and vibration behavior of structural members.		
CO5	Model structural components of varying geometric configurations.		
Course Title:	Structural Design Studio	**Course Title:**	B7808
Course Outcome No.	**Course Outcome Statement**		
CO1	Apply principles of structural mechanics for analysis and design of structures.		
CO2	Develop flowcharts and spreadsheet-based designs as per IS codes.		
CO3	Model various structural components using simulation tools.		
CO4	Analyse beams, trusses, and frames under different loading conditions.		
CO5	Design a multi-storey RC frame building for gravity loads as per IS codes.		

Semester No:	II M.Tech-I Sem (R25)		
Course Title:	Repair and Rehabilitation of Structures	**Course Title:**	B7863
Course Outcome No.	**Course Outcome Statement**		
CO1	Illustrate various maintenance and repair strategies.		
CO2	Categorize the causes and prevention mechanisms of corrosion and damages occur in structures.		
CO3	Apply various methods and techniques for damage assessment and diagnosis.		
CO4	Formulate the usage of different techniques for structural retrofitting.		
CO5	Estimate the structural damage and recommend suitable repair and strengthening methods.		
Course Title:	Design of Tall Structures	**Course Title:**	B7864
Course Outcome No.	**Course Outcome Statement**		
CO1	Discuss the design criteria of tall structures under height development architecture.		
CO2	Prepare tall building architecture with respect to environmental aspects.		
CO3	Illustrate material handling considerations for horizontal and vertical movements.		
CO4	Explain structural forms and flooring systems made of concrete and steel for tall structures.		
CO5	Analyse tall buildings using various approaches.		
Course Title:	Ground Improvement Techniques	**Course Title:**	B7865
Course Outcome No.	**Course Outcome Statement**		
CO1	Classify the soils based on index properties.		
CO2	Apply the principles of soil mechanics in order to find the permeability and compaction characteristics.		
CO3	Analyze the stress distribution of soil under various loading conditions.		
CO4	Estimate magnitude and rate of settlement of soil.		
CO5	Evaluate the shear strength of soil.		
Course Title:	Business Analytics	**Course Title:**	B7081
Course Outcome No.	**Course Outcome Statement**		
CO1	Describe the fundamentals and techniques of data analytics.		
CO2	Evaluate data and apply critical thinking to make informed decisions using deep analytics.		
CO3	Develop predictive models to support business decision-making.		
CO4	Design prescriptive models to recommend optimal business solutions.		
CO5	Interpret analytical results and present them as clear, actionable insights.		

Course Title:	Waste to Energy	**Course Title:**	B7082
Course Outcome No.	**Course Outcome Statement**		
CO1	Classify different waste material produces from all sources.		
CO2	Analyze Bio energy systems resources, process and application.		
CO3	Apply emerging methods for Bio mass Pyrolysis, gasification and combustion to improve the efficiency.		
CO4	Analyze different case studies for understanding success and failure of waste to energy technologies.		
Course Title:	Operations Research	**Course Title:**	B7083
Course Outcome No.	**Course Outcome Statement**		
CO1	Gain knowledge in concepts and techniques of Operations Research.		
CO2	Determine the optimal solution for Linear Programming problems.		
CO3	Formulate and obtain the optimal solution for non- Linear Programming problems.		
CO4	Solve to get optimal solution using queuing and inventory models.		
CO5	Determine solution for non- Linear Programming problems using dynamic programming.		
Course Title:	Blockchain Technology	**Course Title:**	B7084
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify and explain the fundamental concepts, architecture, and working principles of blockchain technology.		
CO2	Demonstrate the process of cryptocurrency transactions using Bitcoin and analyze its underlying mechanisms.		
CO3	Compare and choose suitable blockchain platforms such as Ethereum for ensuring data security and integrity.		
CO4	Design and implement smart contracts based on given problem requirements using Ethereum or similar platforms.		
CO5	Evaluate blockchain applications and deployment on Testnet environments for real-world use cases.		
Course Title:	Cyber Security	**Course Title:**	B7085
Course Outcome No.	**Course Outcome Statement**		
CO1	Demonstrate the basics of cybercrime in computer, networked device or a network.		
CO2	Identify various cyber offences in real time.		
CO3	Identify the different attacks in cybercrime.		
CO4	Use various methods and tools to control cybercrimes and cyber offences.		
CO5	Examine how to protect organizations from intruders, attackers and cyber criminals.		

Course Title:	Disaster Management	**Course Title:**	B7091
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify concepts, hazards and vulnerabilities of different types of disasters.		
CO2	Examine the components of disaster management mechanism.		
CO3	Select suitable capacity building framework for disaster management.		
CO4	Interpret various disaster coping strategies.		
CO5	Develop Strategies for disaster management planning.		
Course Title:	Value Education	**Course Title:**	B7092
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify the importance of value-based living for character development.		
CO2	Emerge as responsible citizens with clear conviction to practice values and ethics in life.		
CO3	Interpret their role in nation building for a better tomorrow.		
CO4	Develop a sense of commitment and decision-making capability.		
CO5	Demonstrate ethical reasoning and leadership in personal and professional life.		
Course Title:	Constitution of India	**Course Title:**	B7093
Course Outcome No.	**Course Outcome Statement**		
CO1	Identify the important components of Indian Constitution.		
CO2	Explore the basics of Constitutional right in various domains .		
CO3	Illustrate the evolution of Indian Constitution.		
CO4	Analyze the Administrative process in India from grass-root level.		
CO5	Relate the basic concepts of democracy, liberty, equality, secular and justice.		
Course Title:	Stress Management by Yoga	**Course Title:**	B7094
Course Outcome No.	**Course Outcome Statement**		
CO1	Make use of yoga for stress management in educational environments.		
CO2	Improve emotional intelligence to better deal with stress.		
CO3	Develop flexibility through participation in yoga.		
CO4	Learn methods of performing asanas, pranayama, mudras and bandhas.		
CO5	Practice meditation for holistic living.		

Course Title:	Pedagogy Studies	**Course Title:**	B7095
Course Outcome No.	**Course Outcome Statement**		
CO1	Develop a positive attitude towards life and the teaching profession.		
CO2	Critically analyze classroom teaching, learning processes, and student behavior.		
CO3	Compare teaching and learning practices in educational institutes over the past decade.		
CO4	Summarize the aspects of an effective teaching process.		
CO5	Apply innovative strategies to enhance teaching and learning outcomes.		
Course Title:	English for Research Paper Writing	**Course Title:**	B7096
Course Outcome No.	**Course Outcome Statement**		
CO1	Develop effective planning and preparation skills for academic writing, including sentence structuring and paragraph development.		
CO2	Apply techniques to clarify meaning, avoid ambiguity, and maintain conciseness and coherence in writing.		
CO3	Demonstrate the ability to structure research papers, including abstracts, introductions, literature review, methods, results, discussion, and conclusions.		
CO4	Utilize skills for proper paraphrasing, citation, avoiding plagiarism, and critically analyzing findings in research writing.		
CO5	Employ advanced writing skills for finalizing papers, including crafting titles, abstracts, and ensuring first-time submission quality		

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