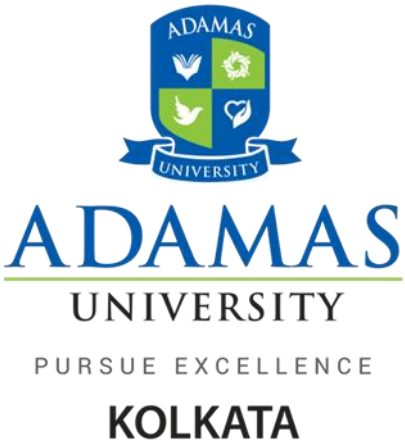


ADAMAS UNIVERSITY

SCHOOL OF ENGINEERING & TECHNOLOGY

Department of Civil Engineering

M.Tech (Structural Engineering)

Course Structure & Syllabus

2024-2025

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE UNIVERSITY

To be an internationally recognized university through excellence in inter-disciplinary education, research and innovation, preparing socially responsible well-grounded individuals contributing to nation building.

MISSION STATEMENTS OF THE UNIVERSITY

M.S 01: Improve employability through futuristic curriculum and progressive pedagogy with cutting-edge technology

M.S 02: Foster outcomes-based education system for continuous improvement in education, research and all allied activities

M.S 03: Instill the notion of lifelong learning through culture of research and innovation

M.S 04: Collaborate with industries, research centers and professional bodies to stay relevant and up-to-date

M.S 05: Inculcate ethical principles and develop understanding of environmental and social realities

CHANCELLOR / VICE CHANCELLOR

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE SCHOOL

To develop well-grounded, socially responsible engineers and technocrats in a way to create a transformative impact on Indian society through continual innovation in education, research, creativity and entrepreneurship.

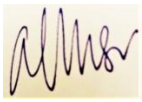
MISSION STATEMENTS OF THE SCHOOL

M.S 01: Build a transformative educational experience through disciplinary and inter-disciplinary knowledge, problem solving, communication and leadership skills.

M.S 02: Develop a collaborative environment open to the free exchange of ideas, where research, creativity, innovation and entrepreneurship can flourish among individual students.

M.S 03: Impact society in a transformative way – regionally and nationally - by engaging with partners outside the borders of the university campus.

M.S 04: Promote outreach programs which strives to inculcate ethical standards and good character in the minds of young professionals.



DEAN / SOET

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

VISION OF THE DEPARTMENT

To impart quality higher education in Civil Engineering for a continuously changing societal demands with credibility, integrity and ethical standards.

MISSION STATEMENTS OF THE DEPARTMENT

M.S 01: Produce well qualified and employable engineers by imparting quality education through industry based flexible curriculum.

M.S 02: Enhance the skills of entrepreneurship, innovativeness, management and life-long learning in young engineers.

HOD

DEAN / SOET

ADAMAS UNIVERSITY,
SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Name of the Programme: M. Tech (Structural Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1: Engage in analysis and design of various structures, tools and its applications in the field of Construction and allied engineering industries.

PEO2: Apply the knowledge of Civil Engineering to solve problems of social relevance, and/or pursue higher education and research.

PEO3: Work effectively as individuals and as team members in multidisciplinary projects.

HOD **DEAN / SOET**

ADAMAS UNIVERSITY, KOLKATA
SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING

Name of the Programme: M. Tech (Structural Engineering)

GRADUATE ATTRIBUTE / PROGRAMME OUTCOME (PO)

PO1: Domain Knowledge: Apply comprehensive knowledge of theories, concepts and principles for effective control and management of construction industry projects.

PO2: Problem Analysis: Identify and analyze the strategic importance of construction projects and its problems in the perspectives of client, context and constraints and obtain solution using mathematics, engineering and management principles.

PO3: Design/Development of Solutions: Planning, scheduling, and control of construction projects by managing resources and constraints with appropriate consideration for the public health and safety, and the cultural, societal, and economical considerations.

PO4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern IT prediction and simulation tools for construction projects.

PO6: Project Management, Governance and Finance: Create comprehensive understanding of the techniques associated with the management of resources and finance, assessment and management of risk and subsequent corporate governance as appropriate to a project manager operating in the construction industry.

PO7: Ethics and Environment: Understand the impact of residential, commercial, industrial and infrastructural projects in societal, ethical and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO9: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO10: Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

HOD

DEAN / SOET

ADAMAS UNIVERSITY
SCHOOL OF ENGINEERING & TECHNOLOGY
M.Tech in Structural Engineering

ADAMAS UNIVERSITY
SCHOOF ENGINEERING & TECHNOLOGY
Course Structure of M. Tech (Structural Engineering)

SEMESTER I								
Sl. No.	**Type**	**New Course Code**	**Title of the Course**	**L**	**T**	**P**	**Contact Hours/Week**	**Credits**
1	Theory	MTH21525	Advanced Engineering Mathematics	3	1	0	4	4
2	Theory	MGT21401	Industrial Management	3	0	0	3	3
3	Theory	STR21001	Advanced Structural Analysis	3	0	0	3	3
4	Theory	STR21002	Soil Structure Interaction	3	0	0	3	3
5	Theory	STR 21003 STR21004 STR21005	Elective – I Bridge Engineering Structural Optimization Repair & Rehabilitation of Structure	3	1	0	4	4
6	Practical	STR22006	Structural Laboratory I	0	0	3	3	2
7	Practical	STR22007	CAD LAB	0	0	3	3	2
8	Sessional	STR25008	Seminar - I	0	2	0	2	1
			Total	**15**	**4**	**6**	**25**	**22**

SEMESTER II								
Sl. No.	**Type**	**Course Code**	**Title of the Course**	**L**	**T**	**P**	**Contact Hours/Week**	**Credits**
1	Theory	STR21009	Advanced Structural Design	3	1	0	4	4
2	Theory	STR21010	Structural Dynamics & Earthquake Engineering	3	1	0	4	4
3	Theory	STR21011	Theory of Elasticity & Plasticity	3	0	0	3	3

ADAMAS UNIVERSITY
SCHOOL OF ENGINEERING & TECHNOLOGY
M.Tech in Structural Engineering

4	Theory	STR21012 STR21013 STR21014	Elective – II Advanced Foundation Engineering Prestressed Concrete Structures Composite Material & Structures	3	1	0	4	4
5	Theory	STR21015 STR21016 STR21017 STR21018	Elective – III Environmental Impact Assessment Advanced Concrete Technology Construction Technology & Management Theory of Elastic Stability and Behaviour of Metal Structure	3	1	0	4	4
6	Practical	STR22019	Structural Laboratory II	0	0	3	3	2
7	Sessional	STR25020	Seminar-II	0	2	0	2	1
			Total	**15**	**6**	**3**	**24**	**22**

SEMESTER III								
Sl. No.	**Type**	**Course Code**	**Title of the Course**	**L**	**T**	**P**	**Contact Hours/ Week**	**Credits**
1	Viva	STR25021	SE-Pre-submission Defense of Dissertation	0	0	0	0	4
2	Thesis	STR25022	SE-Pre-Dissertation	0	0	0	24	18
			Total	**0**	**0**	**0**	**24**	**22**

SEMESTER IV								
Sl. No.	**Type**	**Course Code**	**Title of the Course**	**L**	**T**	**P**	**Contact Hours/ Week**	**Credits**
1	Thesis	STR25023	SE-DISSERTATION	0	0	0	24	18
2	Viva	STR25024	SE-DEFENSE OF DISSERTATION	0	0	0	0	6
3	Viva	STR25025	SE-COMPREHENSIVE VIVA	0	0	0	0	4
			Total	**0**	**0**	**0**	**24**	**28**

TOTAL CREDITS = 94

SEMESTER- I

MTH21525	**Advanced Engineering Mathematics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Differential Calculus and Matrix Algebra (B. Tech.)				
Co-requisites	Probability and Statistics (B. Tech.)				

Course Objectives

1. To study about concept of statistics with application in Engineering Science.
2. To understand about matrix theory operations and related problems.
3. To understand about different type of ordinary and partial differential equations and its numerical solutions using different techniques.
4. To obtain knowledge about Laplace and Fourier transforms and its engineering applications.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	**Details/Statement**	**Knowledge Level**
CO1	Illustrate the fundamentals of statistics and testing of hypothesis to analyse engineering systems.	Remember (L1)
CO2	Build the basic concept of matrix operations and its uses in Structural engineering.	Understand (L2)
CO3	Classify different types of ordinary and partial differential equations and construct mathematical models of engineering problems.	Applying (L3)
CO4	Demonstrate concept of Laplace and Fourier transforms and its applications.	Analyzing (L4)
CO5	Examine the solution of different mathematical models using different numerical techniques.	Evaluating (L5)
CO6	Create mathematical models for complex real-world problems	Creating (L6)

Catalog Description

This course has been designed to understand the mathematical tools for solving problem related to structural engineering. The courses include basic ideas of descriptive statistics along with probability theory and hypothesis testing. Course also includes topics related to matrix theory, differential equation Laplace and Fourier transform and numerical techniques with engineering applications. Concept of

ordinary and partial differential equation is use to formulate the physical problems in mathematical models. Laplace and Fourier transform and numerical techniques tools help to find the solution of different engineering problems. After successful completion of this course students will gain fundamental knowledge about construction of mathematics models and solution using different analytical and numerical techniques.

Course Content

Unit I: **14 Lecture Hours**

Statistic: Elements of statistic, frequency distribution; Concept of mean, median, mode, Standard deviation and variance; Correlation and Regression, Curve fitting by least square method; Random variable, different types of distribution; Testing of Hypothesis; Basic type of factorial design and Analysis of Variance.

Unit II: **8 Lecture Hours**

Matrix operation: Matrix operation Eigen value and Eigen vector by iterative methods, diagonalisation and square matrix.

Unit III: **14 Lecture Hours**

Ordinary Differential Equation: Introduction, Second order homogeneous and non-homogeneous linear differential equation. Euler-Cauchy equation, Legendre differential equation.

Partial differential equation: Solution of one and two dimensional heat equation and wave equation.

Unit IV: **14 Lecture Hours**

Laplace Transform: Existence conditions for the Laplace Transform, Shifting theorems, Laplace transform of derivatives and integrals, Inverse Laplace transform and their properties, Convolution theorem, Applications of Laplace transform to solve ODEs and PDEs.

Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals, Complex form of Fourier integral representation, Fourier transform, Fourier transform of derivatives and integrals, Fourier sine and cosine transforms and their properties, Convolution theorem, Application of Fourier transforms to Boundary Value Problems.

Unit V: **10 Lecture Hours**

Numerical method: Interpolation by Polynomial, Error analysis, Solution iterative method, Newton Rapson method, Numerical Integration by Gauss quadrature methods, Rayligh-Ritz method.

Text Books

1. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI
2. M. K. Jain, S. R. K. Lyengar, R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age

3. M. Goon, M. K. Gupta, B. Dasgupta, An Outline of Statistical Theory, Vol. I, II, The World Press Pvt. Ltd.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc
2. Stanley Grossman & William R. Derrick, Advanced Engineering Mathematics, Harper & Row Publishers

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	1	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: MTH21525– Advanced Engineering Mathematics

Program: M.Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt All Questions from **Section A** (Each Carrying 1 Marks); any **Three Questions** from **Section B** (Each Carrying 5 Marks)**.** Any **Two Questions from Section C** (Each Carrying 10 Marks)**.**

SECTION A (Answer **All Questions)**

1.a	**Classify** Type I and Type II error in hypothesis Testing.	**R**	**CO1**
b	**Explain** eigen vector with suitable example.	**R**	**CO2**
c	**Find** the general solution of linear partial differential equation $y^2\frac{\partial z}{\partial x}-xy\frac{\partial z}{\partial y}=x(z-2y)$.	**Apply**	**CO3**
d	Use Laplace transform to **find** the value of $\int_0^\infty te^{-2t}\sin 3t dt$.	**Apply**	**CO4**
e	**Explain** the working procedure of Shooting method.	**Apply**	**CO5**
	SECTION B (Attempt any **Three Questions)**		
2.	Calculate the coefficient of correlation from the following data: *X:* 1 2 3 4 5 6 7 8 9 *Y:* 9 8 10 12 11 13 14 16 15 Also **find** the regression equations and then estimate *Y* which should correspond on an average to *X*=6.2.	**Apply**	**CO1**
3.	**Find** the characteristic equation of the matrix $A=\begin{bmatrix}2&-1&1\\-1&2&1\\1&-1&2\end{bmatrix}$ and verify that its satisfy Caley-Hamilton theorem and hence obtain A^{-1}.	**Apply**	**CO2**
4.	Using Monge's method to **solve** the partial differential equation $(x-y)\left(x^2\frac{\partial^2 u}{\partial x^2}-2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}\right)=2xy\left(\frac{\partial u}{\partial x}-\frac{\partial u}{\partial y}\right)$.	**Apply**	**CO3**
5.	Derive One-point Gaussian quadrature formula. Use two-point and three- point Gaussian	**Appl**	**CO5**

	quadrature formula **solve** the integral $\int_0^6 \frac{dx}{1+x^2}$	**y**	
	SECTION C (Attempt any **Two Questions)**		
6.	a) The probability that a computer manufactured by a company id defective is $\frac{1}{10}$. If 12 such computers are manufactured, **find** the probability that (i) Exactly two will be defective, (ii) At least two will be defective, (iii) None will be defective and (iv) mean and variance of the distribution. b) **Find** the modal matrix P that diagonalize $A=\begin{bmatrix}2 & 1 & 1\\ 2 & 3 & 2\\ 3 & 3 & 4\end{bmatrix}$.	**Apply**	**CO1+ CO2**
7	a) The temperature $u(x,t)$ in the semi-infinite rod $0 \le x < \infty$ is determined by the equation $\frac{\partial u(x,t)}{\partial t} = 4\frac{\partial^2 u(x,t)}{\partial x^2}$ under the conditions $u(x,0)=0$ and $\left(\frac{\partial u}{\partial x}\right)_{x=0} = -\mu(a\,\text{constant}),\ t>0$ then **find** $u(x,t)$ using suitable Fourier transform technique. b) A homogeneous string is stretched and fixed between two points $(0,0)$ and $(l,0)$. Motion is initiated by displacing the string in the form $u=\lambda\sin(\pi x/l)$ and released from rest at time $t=0$. **Find** the displacement of any point on the string at any time t by using Laplace transform technique.	**Apply**	**CO4**
8.	a) Discuss the Newton-Raphson method for non-linear simultaneous equations. Use it to **solve** the equations $x=x^2+y^2, y=x^2-y^2$ taking initial approximation solution $x_0=0.8,\ y_0=0.4$ correct up to three places of decimal point. Carry out two iterations. b) **Solve** the Poisson equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2} = -81xy,\ 0<x<1, 0<y<1$ given that $u(0,\ y)=0,\ u(x,0)=0,\ (1,\ y)=100,\ u(x,1)=100$ and $h=\frac{1}{3}$ with suitable numerical method.	**Apply**	**CO5**

MGT21401	Industrial Management	L	T	P	C
Version 1.0	Contact Hours - 45	3	0	0	3
Pre-requisites/Exposure	Management (B. Tech)				
Co-requisites	-				

Course Objectives:

1. To enable the students to study the evolution of Management.
2. To study the functions and principles of management.
3. To learn the application of the principles in an organization.
4. To enable the effective and barriers communication in the organization.
5. To study the system and process of effective controlling in the organization.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Understand the concepts related to Business.	Remember (L1)
CO2	Demonstrate the roles, skills and functions of management.	Understand (L2)
CO3	Analyze effective application of PPM knowledge to diagnose and solve organizational problems and develop optimal managerial decisions.	Applying (L3)
CO4	Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.	Analyzing (L4)
CO5	Understand controlling techniques and develop an efficient production and operations process to help business grow.	Evaluating (L5)
CO6	Demonstrate an understanding of control techniques and design efficient production and operational strategies to enhance organizational growth and productivity	Creating (L6)

Catalog Description

Principles and practices of management is an introductory course on management process from managers' perspective. The course seeks to help students acquire the requisite knowledge, skills and abilities needed to successfully manage the organization. The course examines the logic and working of organizations and outlines the major functions of management. The main objective of this course is to help the students to get aware towards varied management principles and practices. This course covers the explanations about the fundamentals of management discipline in organizational context. It details the different functions of management such as planning,

organizing, staffing, directing, and controlling. The course also emphasizes on identification of critical issues and framing of strategies and scenarios required to execute management functions.

Course Content

Module 1: Introduction **8 Lecture Hours**

Basic concepts of management: Definition, Essence, Functions, Roles, Level, Evolution and Foundations of Management Theories - Classical and Neo - Classical Theories, Systems Approach to organization, Modern Organization Theory.

Module 2: Functions of Management **7 Lecture Hours**

Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.

Module 3: Staffing and Directing **15 Lecture Hours**

Staffing: Meaning, Job analysis, Manpower planning, Recruitment and selection, Retention: Transfers and Promotions, Appraisals, Management Development, Job Rotation, Training, Rewards and Recognition.

Leadership: Concept, Nature, Styles. Decision making: Concept, Nature, Process, Tools & techniques.

Directing: Concept, Principles, Process, and Elements. Motivation: Concepts and Theories (Maslow's Need Hierarchy Theory, Herzberg Two Factor Theory, Theory X & Y), ERG Theory.

Communication: Concept, Process, Types, Barriers, Effective Communication. Leadership: Concept, Qualities of a Good Leader, Coordination.

Module 4: Management and Society **7 Lecture Hours**

Management and Society: Concept, External Environment, CSR, Corporate Governance, Ethical Standards. People Management: Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. Managerial Competencies: Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Module 5: Controlling & Other Issues **8 Lecture Hours**

Management Control: Meaning, Nature, Features, Objectives and Process of Management Control and Behavioral Aspects of Management Control, Need for Control system, techniques of control and linkage between planning and control.

Operations & Technology Management: Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.

Reference Books

1. Management: Principles, Processes & Practices – A Bhat & A Kumar, Oxford University Press India (OUP).

2. Essentials for Management – H Koontz, Revised edition, Tata McGraw Hill (TMH).

3. Management – A. F. Stoner James, Pearson.

4. Management – K Ghuman, Tata McGraw Hill (TMH).

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	1	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:
Enrolment No:

Course: MGT21401– Industrial Management

Program: M. Tech. (CE) **Time: 03 Hrs.**
Semester: ODD 2020-21 **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

SECTION A (Answer **All the Questions) (5 x 1 = 5)**			
1.a	**Discuss** role of decision in management.	**U**	**CO2**
b	**Compare** Structured and Unstructured Decision.	**U**	**CO2**
c	**What** are the different types of Plan?	**R**	**CO1**
d	**Define** Slack.	**U**	**CO5**
e	**Explain** the term Pink Slip.	**U**	**CO4**
SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**			
2.	**Compare** between Recruitment and Selection.	**An**	**CO3**
3.	**How** Span of Management affects leadership decisions?	**R**	**CO2**
4.	**List** the merits of On the Job Training process.	**An**	**CO3**
5.	**Defend** the Scientific Management Theory.	**E**	**CO1**
SECTION C (Answer **Any Two Questions) (2 x 10 = 20)**			
6.	State the **relationship** between Maslow's Needs Hierarchy Theory and Herzberg's Two Factor Theory.	**An**	**CO3**
7.	**Justify** the Quality Control Process in sales maximization function.	**E**	**CO5**
8.	**Evaluate** the stages of industrial dispute resolution process.	**E**	**CO4**

STR21001	Advanced Structural Analysis	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Structural Mechanics-II (B. Tech.)				
Co-requisites	----------				

Course Objectives

1. To introduce basic principles of Advanced Structural Mechanics, need of analysis of structures, different techniques of analysis.
2. To apply principles of basic and engineering sciences in analysis, design and operation of civil engineering systems.
3. To expose students to the challenges involved in analysis of structures through examples, numerical problems
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in structural engineering and resolve them effectively with best-practices
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Determine the boundary value problems.	Remember (L1)
CO2	Solve structural analysis problem in vibrational methods.	Understand (L2)
CO3	Analyse the Finite element for one dimensional problems.	Applying (L3)
CO4	Analyse the Finite element for two dimensional problems.	Analyzing (L4)
CO5	Model and analyze different structural systems by matrix method of analysis using force/ flexibility method	Evaluating (L5)
CO6	Demonstrate an understanding of control techniques and design efficient production and operational strategies to enhance organizational growth and productivity	Creating (L6)

Catalog Description

Theory of the engineering structures is a fundamental science. Statements and methods of this science are widely used in different fields of engineering. Among them are the civil engineering, ship-building,

aircraft, robotics, space structures, as well as numerous structures of special types and purposes – bridges, towers, etc. In recent years, even micromechanical devices become objects of structural analysis.

All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Module 1: **12 Lecture Hours**

Boundary value problems and Weighted residual methods: Introduction, weighted residual forms, weak formulation, Galerkin method, examples of one, two, and three-dimensional problems, examples of continuum problems.

Module II: **9 Lecture Hours**

Variational methods: Establishment of natural variational principles, approximate solution of differential equations by Rayleigh-Ritz method, the use of Lagrange multipliers, general variational principles, least-square method.

Module III: **12 Lecture Hours**

Finite Element analysis of one dimensional problems: One dimensional second order equations, discretisation of domain into elements, generalised coordinates approach, derivation of elements equations, assembly of elements equations, imposition of boundary conditions, solution of equations, Cholesky method, extension of the method to fourth order equations and their solutions, time dependant problems and their solutions.

Module IV: **12 Lecture Hours**

Finite Element analysis of two dimensional problems: Second order equation involving a scalar-valued function, Variational formulation, Finite element formulation through generalised coordinates approach, Triangular elements and quadrilateral, Elements matrices and vectors, Assembly of element matrices, boundary conditions, solution techniques.

Reference Books

1. Zienkiewicz, O.C., and Morgan, K., Finite Element Approximation, John Wiley & Sons, 1983. Reddy, J.N., The Finite Element Method for Engineers, John Wiley & Sons, 1995.
2. An Introduction to the Finite Element Method, McGraw Hill, 2006. Huebner, K.H., Thornton, E.A., and Byrom, T.G.
3. The Finite Element Method for Engineers, John Wiley & Sons, 1995.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

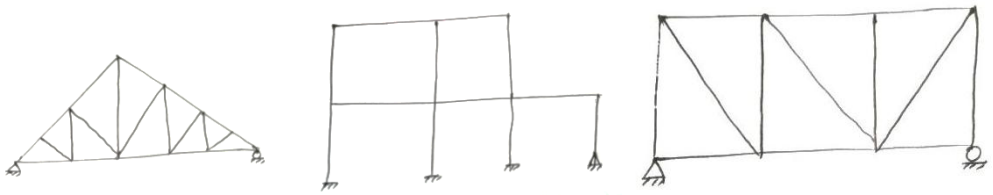
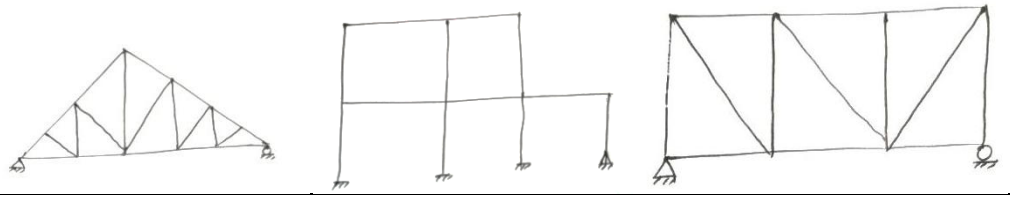
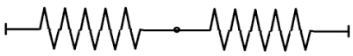
Name:

Enrolment No:

Course: STR21001– Advanced Structural Analysis

Program: B. Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt **All Questions** from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	Section A (Answer **All the Questions) (5 x 1 = 5)**		
1.	**Find** S.I. of a propped cantilever.	**Analyze**	**CO1**
2.	**Give** an example of one dimensional problem.	**U**	**CO4**
3.	**State** least square method.	**R**	**CO2**
4.	**Differentiate** force method and displacement method.	**Analyze**	**CO3**
5.	**What** is transformation matrix?	**R**	**CO4**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
6.	**Find** out S.I. for the following structures 	**Analyze**	**CO1**
7.	**Find** out K.I. for the following structures 	**Analyze**	**CO1**
8.	**What** is finite element method?	**R**	**CO3**
9.	**Form** the flexibility matrix for the following spring elements. 	**Apply**	**CO3**
10.	**Explain** with an example of common FEM software, the process of solving any structural engineering problems.	**Analyze**	**CO4**

	SECTION (Answer Any Two Questions) (2 x 10 = 20)		
11.	**Derive** the stiffness matrix for the beam element in global coordinate system.	**Apply**	**CO1**
12.	A vertical single cylinder diesel engine, of 500 kg mass is mounted on springs with k = 200 kN/m and damper with φ=0.2. The rotating parts are well balanced. The mass of the equivalent reciprocating parts is 10 kg and the stroke is 200mm. **Find** the synamik amplitude of the vertical motion, the transmissibility and the force transmitted to the foundation, if engine is operated at 200 rpm.	**Analyze**	**CO2**
13.	A piston of mass 5kg is travelling inside a cylinder with a velocity of 15 m/s and engages a spring and a damper. **Determine** maximum displacement of the piston after engaging the spring damper.	**Analyze**	**CO2**

STR21002	Soil Structure Interaction	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Soil Mechanics & Structural Mechanics (B.Tech)				
Co-requisites	----------				

Course Objectives

1. To explain the effects of soil flexibility in the response of the structure.
2. To analyse the structure with soil structure interaction effects to obtain the realistic response.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Illustrate the soil behavior with respect to the structure and analyze different parameters.	Remember (L1)
CO2	Analyse the elastic characteristics of soil half-space and understand the Infinite beam theory.	Understand (L2)
CO3	Analyse the behavior of the Plate on Elastic Medium.	Applying (L3)
CO4	Explain the Elastic analysis of differently load pile and discuss about the Sub-grade reaction and elastic analysis.	Analyzing (L4)
CO5	Apply soil-structure interaction models to different type of foundations like pile, sheet pile walls (cantilever and anchored sheet pile walls) by analytically and numerically.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

Most of the civil engineering structures involve some type of structural element with direct contact with ground. When the external forces, such as earthquakes, act on these systems, neither the structural displacements nor the ground displacements, are independent of each other. The process in which the response of the soil influences the motion of the structure and the motion of the structure influences the response of the soil is termed as soil-structure interaction (SSI).

Conventional structural design methods neglect the SSI effects. Neglecting SSI is reasonable for light structures in relatively stiff soil such as low rise buildings and simple rigid retaining walls. The effect of SSI, however, becomes prominent for heavy structures resting on relatively soft soils for example nuclear power plants, high-rise buildings and elevated-highways on soft soil

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Course Content

Module I: 15 Lecture Hours

General soil-structure interaction problems: Contact pressures and soil-structure interaction for shallow foundations, concept of sub grade modulus, effects/parameters influencing subgrade modulus. Soil behaviour, Foundation behaviour, Interface behaviour, Scope of soil foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models.

Unit II: 10 Lecture Hours

Beam on Elastic Foundation: Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness.

Unit III: 6 Lecture Hours

Plate on Elastic Medium: Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions.

Unit IV: 13 Lecture Hours

Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, Sub-grade reaction and elastic analysis, Interaction analysis.

Reference Books

1. Selva durai, A. P. S, Elastic Analysis of Soil-Foundation Interaction , Elsevier,1979.
2. Poulos, H. G., and Davis, E. H., Pile Foundation Analysis and Design, John Wiley,1980.
3. Scott, R. F., Foundation Analysis, Prentice Hall, 1981.
4. Structure Soil Interaction - State of Art Report, Institution of Structural Engineers, 1978.
5. ACI 336. (1988), Suggested Analysis and Design Procedures for combined footings and Mats, American Concrete Institute, 1988.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR21002– Soil Structure Interaction

Program: M. Tech. (CE) **Time: 03 Hrs.**
Semester: Odd 2020 – 21 **Max. Marks: 40**

Instructions:
Attempt **All Questions** from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	Section A (Answer **All the Questions)**		
1.	**Write** about the sub grade modulus.	**U**	**CO1**
2.	**Define** stiffness of soil.	**R**	**CO1**
3.	**Show** the typical diagram of Elastic half space of soil.	**U**	**CO2**
4.	**What** is Stiffness?	**R**	**CO2**
5.	**Give** the dimension of Thin plates for the analysis.	**R**	**CO3**
	SECTION B (Attempt any **Three Questions)**		
6.	**Explain** the concept of Sub-grade reaction.	**Analyze**	**CO4**
7.	**Discuss** the Numerical analysis of finite plates.	**U**	**CO3**
8.	**Write** the advantages and disadvantages of a Antisiphonage pipes.	**R**	**CO4**
9.	**Discuss** about the Contact pressures of shallow foundation.	**U**	**CO1**
	SECTION C (Attempt any **Two Questions)**		
10.	**Describe** the different layers of Lithosphere of the earth, briefly with diagram.	**R**	**CO1**
11.	An anchored sheet pile was constructed to protect a river front. The top of sheet pile was at El. 0. The anchor was located at El. -1.3m. The water table on the landside and the river water El. are at -2.4m. The dredge line is located at El.- 9.lm. The soil above the dredge line is a sand with moist unit weight of 16.5 kN/m3 , saturated unit weight of20.2 kN/m3 and~= 30 degrees. The soil beneath the dredge line is a clay with saturated unit weight of 19.2 kN/m3 , ϕ = 0, c = 72 kPa. **Find** the depth of embedment of the sheet pile assuming a factor of safety of 1.5 for cohesion.	**App**	**CO4**
12.	**Estimate** the modulus of sul5grade reaction· (a) at the center, and (b) at the corner, of a foundation with length, L = 1.829m, breadth, B = 1.219m, depth, D = 0.61m. Assume allowable bearing pressure of foundation soil, qa = 191.521 kPa, Elastic modulus of soil, Es = 1.149E+04 kPa and Poisson's ratio, Us= 0.3	**R**	**CO2**

Elective – I

STR 21003	**Bridge Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Design of RC Structure, Structural Mechanics II (B. Tech.)				
Co-requisites	----------				

Course Objectives

1. To be acquainted with different types of bridges and their history of development
2. To develop concept about reinforced concrete bridges and box culvert
3. To gain idea about the design of beam-slab bridges and balanced cantilever bridges.
4. To calculate and analyze steel bridges
5. To perceive design philosophies of cable stayed bridge and composite bridge

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	**Details/Statement**	**Knowledge Level**
CO1	Recognize basic forms and identify loads on bridges as per IRC	Remember (L1)
CO2	Define general features of RC solid slab bridge and design of Box Culvert	Understand (L2)
CO3	Design internal components of slab panels, various methods and general features of balanced Cantilever bridges	Applying (L3)
CO4	Explain different types of stresses and plate girder bridges	Analyzing (L4)
CO5	Understand the design concept of composite bridges and design philosophy of cable Stayed Bridges.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

Bridge Engineering is an interdisciplinary course of Civil Engineering which is introduced to equip students with the knowledge of history of development of bridges and behaviour of different types of bridges. Through this course students will be exposed to the design philosophies of different types of bridges. With the fundamental knowledge about code provisions and state-of-art practices, students will be able to choose appropriate type of bridges for a particular project and analyze and design various

components of bridges. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Unit I: 12 Lecture Hours

Introduction: Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. I.R.C Loads. Analysis of IRC Loads, Impact factors, Other loads to be considered, Importance of Hydraulic factors in Bridge Design

Unit II: 12 Lecture Hours

Reinforced concrete solid slab bridge: Introduction, General design features, Effective width method. Simply supported and cantilever Slab Bridge, analysis and design

Box Culvert: Introduction, Design method and Design example.

Unit III: 12 Lecture Hours

Beam and Slab Bridges: Introduction, Design of interior panel of slab, Pigeauds method, Design of longitudinal girder, Calculation of longitudinal moment, design example.

Balanced Cantilever Bridges: General Features, Arrangement of supports, design features Articulation, Design example.

Unit IV: 12 Lecture Hours

Steel Bridges: General features, types of stress, Design example.

Plate Girder Bridge: Elements, design, lateral bracing, Box- girder.

Unit V: 12 Lecture Hours

Composite Bridges: General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.

Cable Stayed Bridge: General features, Philosophy of design.

Reference Books

1. D.J. Victor, Essentials of Bridge Engineering, Oxford and IBH Publishing Company
2. S.P. Bindra, Principle & Practice of Bridge Engineering, Dhanpat Rai Pub
3. N. Krishna Raju, Bridge Engineering, Oxford and IBH Publishing Co. Pvt. Ltd.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	1	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: STR 21003– Bridge Engineering

Program: M. Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 mark); any **Three Questions** from **Section B** (each carrying 5 marks); any **Two Questions** from **Section C** (carrying 10 marks)**.**

	Section A (attempt **All Questions)**		
1.	**What** is scour depth?	**R**	**CO1**
2.	**How** to determine the economical depth of steel plate girder beam?	**U**	**CO5**
3.	At **what** condition balanced cantilever bridge is suitable over other type of bridges?	**U**	**CO3**
4.	**Why** shear connector is provided in composite bridges?	**U**	**CO5**
5.	**Which** IRC code is followed to find out shear stresses in deck slab?	**R**	**CO2**
	SECTION B (Attempt any **Three Questions)**		
6.	**Enumerate** the various loads to be considered for the design of bridges	**R**	**CO1**
7.	**Write** a short note on bridge bearings.	**R**	**CO2**
8.	**Briefly** explain Pigeaud's method.	**U**	**CO3**
9.	**List** major components of cable stayed bridge and state their requirements.	**R**	**CO5**
	SECTION C (Attempt any **Two Questions)**		
10.	**Design** a reinforced concrete slab culvert for a National Highway crossing to suit the following: Carriage way- Two lane (7.5m wide), foot paths- 1m on either side, Clear span=6m, wearing coat=80mm, width of bearing=400mm, Materials: M-25 Grade Concrete and Fe415 grade HYSD bars, loading-IRC class AA tracked vehicle.	**Analyze**	**CO2**
11.	**Design** a plate girder bridge using following data: Broad Gauge Span-20m Top level of railway embankment:116m Beal level of the steam 101m Ground level of the stream for Foundation Stability-99m Stream Bund top level-102.5m, Assume any data if required.	**Analyze**	**CO4**
12.	Briefly **explain**- a) Liner waterway ii) Afflux iii) Economic Span	**U**	**CO5**

STR21004	Structural Optimization	L	T	P	C
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	Differential Calculus and Matrix Algebra (B. Tech.)				
Co-requisites	Probability and Statistics (B. Tech.)				

Course Objectives

1. To develop the concept of formulation of linear programing problem (LPP) and solution procedure of LPP by using simplex method and duality concept
2. To acquire the knowledge of optimization techniques for univariate and multivariate optimization problems
3. To help the students to build the concept of solution procedures of numerical optimization and nonlinear optimization.

Course Outcomes

Upon successful completion of this course, it is expected that students will be able to:

Course Outcomes	Details/Statement	Knowledge Level
CO1	Construct linear programming model for real-life problems and make use of available solution procedures for solving LPP.	Remember (L1)
CO2	Build the knowledge of integer programming and duality theory, and related solution procedures for solving LPP.	Understand (L2)
CO3	Choose appropriate techniques for solving univariate and multivariate optimization problems.	Applying (L3)
CO4	Explain the theoretical aspects and solution techniques of nonlinear optimization.	Analyzing (L4)
CO5	Apply optimization techniques to real-world problems in engineering and management, ensuring effective decision-making and resource utilization.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

Optimization is a subject that is widely and increasingly used in science, engineering, economics, management, industry, and other areas. It deals with selecting the best of many possible decisions in real-life environment, constructing computational methods to find optimal solutions, exploring the theoretical properties, and studying the computational performance of numerical algorithms implemented based on computational methods. This course focuses on algorithms for solving optimization problems and also

study applications involving such problems. Some of the topics covered include nonlinear optimization (convex and non-convex), discrete optimization, approximation techniques and heuristic approaches.

Course Content

Module 1 **Lecture Hrs. 12**

Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers. Linear Programming Problem, Simplex method, Concept of Duality.

Module 2 **Lecture Hrs. 10**

Single Variable Optimization Problems Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method. Application to Root finding.

Module 3 **Lecture Hrs. 10**

Multivariable Optimization Algorithms Optimality Criteria, Unidirectional Search. Direct Search Methods: Hooke-Jeeves pattern search method, Powell's Conjugate Direction Method. Gradient Based Methods: Cauchy's Steepest Descent Method, Newton's method, Marquardt's Method.

Module 4 **Lecture Hrs. 13**

Further Topics in Optimization Techniques Quadratics Programming, sequential programming, quadratic programming, Integer Programming, Penalty Function Method, Branch and Bound Method, Geometric Programming, Dynamic programming; Genetic algorithm.

Text Books:

1. S. S. Rao: Engineering Optimization, New Age International.
2. E. J. Haug and J.S. Arora, Applied Optimal Design, Wiley, New York.

Reference books:

1. Kalyanmoy Deb, Optimization for Engineering Design, Prentice Hall of India.
2. A. Ravindran and K.M. Rogsdeth, Optimization G.V. Reklaites, Wiley, New York.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:

Enrolment No:

Course: STR21004– Structural Optimization

Program: M.Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt All Questions from **Section A** (Each Carrying 1Marks); any **Three Questions** from **Section B** (Each Carrying 5Marks)**.** Any **Two Questions from Section C** (Each Carrying 10 Marks)**.**

	SECTION A (Answer **All Questions)**		
1.a	**State** Kuhn Tucker conditions for constraint optimization.	**R**	**CO3**
b	**Define** Basic Feasible Solution of a Linear programming problem.	**R**	**CO1**
c	**Explain** Saddle point.	**U**	**CO3**
d	**State** strong Duality theorem.	**R**	**CO2**
e	**Explain** Complementary Slackness.	**U**	**CO2**
	SECTION B (Attempt any **Three Questions)**		
2.	A publisher of textbooks is in the process of presenting a new book to the market. The book may be bound by either cloth or hard paper. Each cloth bound book sold contributes Rs. 24, and each paper-bound book contributes Rs. 23. It takes 10 minutes to bind a cloth cover, and 9 minutes to bind a paper- back. The total available time for binding is 800 hours. After considerable market survey, it is predicted that the cloth-cover sales will exceed at least 10,000 copies, but the paperback sales will be not more than 6,000 copies. **Construct** the mathematical form of the given problem in terms of profit.	**Ap.**	**CO1**
3.	**Solve** the following LPP by dual method $Min \quad z = 2x_1 + 2x_2$ subject to, $2x_1 + 4x_2 \geq 1$ $x_1 + 2x_2 \geq 1$ $2x_1 + x_2 \geq 1$ $x_1, x_2 \geq 0.$ (5)	**Ap.**	**CO2**
4.	When $n > m + 1$, **illustrate** the solution of the following NLP problem by using geometric programming method. $Minimize\ f(x) = 7x_1x_2^{-1} + 3x_2x_3^{-1} + 5x_1^{-3}x_2x_3 + x_1x_2x_3\ ;\ x_1, x_2, x_3 \geq 0$ (5)	**U**	**CO4**
5.	Consider the minimization of the function $f(x, y) = 6x^2 + 2y^2 - 6xy - x - 2y$. If $S_1 =$	**U**	**CO3**

	$(1, 2)$denotes a search direction, **find** a direction S_2 which is conjugate to the direction S_1.		
	SECTION C (Attempt any **Two Questions)**		
6.	**Solve** the following all integer problem using the branch and bound method. *Maximize* $z = 2x_1 + 3x_2$, *subject to*, $6x_1 + 5x_2 \le 25$, $x_1 + 3x_2 \le 10$, $x_1, x_2 \ge 0$ and integers. (10)	**Ap.**	**CO1**
7	Consider the problem minimize $5x^2 + 5y^2 - xy - 11x + 11y + 11$ a) **Illustrate**the rate of convergence of steepest descent for this problem. b) Starting at x = y = 0, how many steepest descent iterations would it take (at most) to reduce the function value to 10^{-11}? (3+7)	**U**	**CO3**
8.	The following table provides the data for a 3-period inventory situation: Period i | Demand D_i $(units)$ | Setup Cost K_i (\$) | Holding Cost h_i (\$) 1 | 3 | 3 | 1 2 | 4 | 7 | 3 3 | 3 | 6 | 2 The demand occurs in discrete units, and the starting inventory is $x_1 = 0$ unit. The unit production cost,$c_i(z_i)$, is \$10 for the first 3 units and \$20 for each additional unit, that is, $c_i(z_i) = \begin{cases} 10z_i, & 0 \le z_i \le 3 \\ 30 + 20(z_i - 3), & z_i \ge 4 \end{cases}$ Find the optimal inventory policy using dynamic programming approach. (10)	**Ap.**	**CO4**

STR21005	Repair and Rehabilitation of Structures	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concrete Technology, Design of RC Structure (B.Tech)				
Co-requisites	----------				

Course Objectives

1. To study about different ways of deterioration with mechanism and controls.
2. To understand about various non-destructive tests, mapping or analysis of data obtained from tests.
3. To identify the causes of building failure under different factors and get idea about various materials with their composition and properties used for repair and rehabilitation of structures.
4. To acquire knowledge about testing methods available for investigation of structures and repair techniques.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Identify the causes of deterioration in structures.	Remember (L1)
CO2	Judge the distress and structural damages by non-destructive testing techniques.	Understand (L2)
CO3	Infer the corrosion mechanism, causes, prevention and predict the damage due to fire.	Applying (L3)
CO4	List all advanced materials for repair and rehabilitation of structure.	Analyzing (L4)
CO5	Predict health of structures and recommend best techniques for repairing.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

This is a course covers the idea of various deterioration process of structures, several non-destructive tests which includes rebound hammer test, ultrasonic pulse velocity test, pull out test, rebar location test etc., various causes responsible for failure of building. This course also provide idea of different materials that can be used for repair and rehabilitation, repair techniques, different testing methods for investigation of structures. Finally some case studies related to rehabilitation of special structures like bridge piers, canals, dams, heritage structures etc will be done and few pictorial representation will be provided to the students for complete understanding about this subject. Classes will be conducted by lectures as well as power point presentation as per the requirements. Discussions related to development of various practical approaches of repair techniques in modern construction advancement on existing structures will be done as well. Students will be subjected to class tests, assignments and field visit for a short period to obtain on site application of different tools/equipments/devices on existing structures for the assessment of current

condition of structural bodies by course coordinator. Through these teaching methods students will have a strong understand regarding the fundamental concepts of this course and will be able apply these concepts in the working field in future.

Course Content

Unit I: 9 Lecture Hours

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: 9Lecture Hours

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

Unit III: 9 Lecture Hours

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 equipments-repair of cracks in concrete.

Unit IV: 9 Lecture Hours

Materials for repair and rehabilitation: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- 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: 9 Lecture Hours

Materials for repair and rehabilitation: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- 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.

Reference 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
4. 'Concrete Structures- protection Repair and Rehabilitation' by R. Doodge Woodson, BH Publishers
5. "Deterioration, Maintenance and Repair of Structures" by Johnson, McGraw Hill

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	1	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR21005– Repair and Rehabilitation of Structures

Program: M. Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt All Questions from **Section A** (Each Carrying 1 Marks); any **Three Questions** from **Section B** (Each Carrying 5 Marks)**.** Any **Two Questions from Section C** (Each Carrying 10 Marks)**.**

	Section A (Answer **all Questions) (5 x 1 = 5)**		
1.a	What is the identification of sulphate attack in structure?	**R**	**CO1**
b	What is function of rebar locator?	**R**	**CO2**
c	Give outline of different building failure.	**U**	**CO3**
d	Define carbonation depth.	**R**	**CO4**
e	What is the utilization of nailing?	**R**	**CO5**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
2.	Discuss the physical process of freezing and thawing that develops deterioration of structures.	**Create**	**CO1**
3.	How Pull out test is applied for diagnose of structure?	**R**	**CO2**
4.	Explain about structural damages developed due to fire.	**U**	**CO3**
5.	Explain and demonstrate about Underpinning with neat sketches.	**Evaluate**	**CO5**
	SECTION C (Answer answer any **Two Questions) (2 x 10 = 20)**		
6.	**Explain** about application of Half cell potential test for the diagnose of concrete structures.	**Evaluate**	**CO2**
7.	**Explain** about **how** concrete behave under corrosion attack.	**Evaluate & R**	**CO4**
8.	**Elaborate** and **compare** Grouting, Jacketing and Shotcreting.	**Create & U**	**CO5**

STR22006	Structural Laboratory-I	L	T	P	C
Version 1.0		0	0	3	2
Pre-requisites/Exposure	Concrete Technology (B.Tech)				
Co-requisites	----------				

Course Objectives

1. To provide a familiarity in the execution of new technology concepts which are applied in field of Concrete Technology.
2. To practice concepts related Concrete Technology which involves types and property of concrete, their ingredients and different adhesive materials.
3. To present the foundations of many basic Engineering tools and concepts related to Concrete Technology and resolve them effectively with hands on practice.
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in Concrete Technology and resolve them effectively with best-practices.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Determination of properties of cement.	Remember (L1)
CO2	Determination of properties of fine aggregate.	Understand (L2)
CO3	Determination of properties of coarse aggregate.	Applying (L3)
CO4	Determination of workability of concrete.	Analyzing (L4)
CO5	Determination of compressive strength and flexural strength of concrete.	Evaluating (L5)
CO6	Determination of workability by compaction factor test	Creating (L6)

Catalog Description

Concrete is a construction material composed of cement, fine aggregates and coarse aggregates mixed with water which hardens with time. This course includes specific concepts related Concrete Technology which involves determination of properties of cement, fine aggregate, coarse aggregate; workability of concrete; compressive strength and flexural strength of concrete. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session

as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

EXP. NO.01: Determination of specific gravity of cement.
EXP. NO.02: Determination of fineness of cement.
EXP. NO.03: Determination of normal consistency of cement.
EXP. NO.04: Determination of initial and final setting time of cement.
EXP. NO.05: Determination of soundness of cement.
EXP. NO.06: Determination of compressive strength of cement.
EXP. NO.07: Determination of FM of fine aggregate
EXP. NO.08: Determination of FM of coarse aggregate.
EXP. NO.09: Determination of specific gravity of coarse aggregate.
EXP. NO.10: Determination of specific gravity of fine aggregate.
EXP. NO.11: Determination of bulking factor of fine aggregate.
EXP. NO.12: Determination of workability by slump cone test.
EXP. NO.13: Determination of workability by Vee Bee test.
EXP. NO.14: Determination of workability by compaction factor test
EXP. NO.15: Mix Design of concrete.
EXP. NO.16: Determination of compressive strength of concrete by cube test.
EXP. NO.17: Determination of Flexure Strength of concrete.

Reference Books

1. A .M. Naville, Concrete Technology, Brooks, J.J., ELBS.
2. M. S. Shetty, Concrete Technology, S. Chand & Co.
3. John Newman & Ban Sang Choo, ADVANCED CONCRETE TECHNOLOGY-Constituent Materials, Elsevier publication.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	1	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:

Enrolment No:

Course: STR22006– Structural Laboratory-I

Program: M. Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt any two questions from **Section A** (each carrying 20 marks).

Section A (attempt any two)

1.	Evaluate the specific gravity of Cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
2.	Perform fineness test of cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
3.	Determine normal Consistency of cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
4.	Evaluate setting time of cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
5.	Perform soundness test of cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
6.	Evaluate the compressive strength of cement. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
7.	Determine FM for Sieve analysis of fine aggregate. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO2**
8.	Determine FM for Sieve analysis of coarse aggregate. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO3**
9.	Evaluate the specific gravity of coarse aggregate. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO3**
10.	Evaluate the specific gravity of fine aggregate. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO2**

11.	Calculate bulking factor of fine aggregate. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO2**
12.	Determine the workability of Concrete by slump test. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO4**
13.	Evaluate the workability of Concrete by vee bee test. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO4**
14.	Determine the workability of Concrete by compaction factor test. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO4**
15.	Calculate amount of each ingredient of concrete by Mix design method.	**Analyzing**	**CO5**
16.	Evaluate the compressive strength of concrete by cube test. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO5**
17.	Determine the flexural strength of concrete. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO5**

STR22007	CAD Lab	L	T	P	C
Version 1.0		0	0	3	2
Pre-requisites/Exposure	B. Tech. CAD Lab				
Co-requisites	----------				

Course Objectives

1. To understand the details of STAAD pro software package.
2. To enable the students to prepare input data for RCC & Steel structures.
3. To enable the students to design different components of structures.
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in structural engineering and resolve them effectively with best-practices.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Introduce of STAAD pro for building structures.	Remember (L1)
CO2	Model of structural systems for symmetric and unsymmetric building structures.	Understand (L2)
CO3	Specify and assign of various types of loads on structural systems as per codal provisions.	Applying (L3)
CO4	Specify analysis and perform analysis	Analyzing (L4)
CO5	Design of the structural elements as per codal provisions.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

STAAD pro is a structural analysis and design software which is widely used to analyze and design structures for bridges, towers, buildings, transportation, industrial and utility structures. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Exp. No.01	Introduction of STAAD pro for building structures.
Exp. No.02	Model structural systems for symmetric and unsymmetric building structures.
Exp. No. 03	Specifying and assigning of various types of loads on structural systems as per codal provisions.
Exp. No.04	Specifying analysis and performing analysis.
Exp. No.05	Design of the structural elements as per codal provisions.

Text Books

1. IS: 456 – 2000, "Indian Standard for Plain and Reinforced Cocrete – Code of Practice", Bureau of Indian Standard.
2. IS: 875 (Part -1, 2, 3, 4) – 1987, "Indian Standard Code of Practice for Design Loads (other than Earthquake) for Building and Structures", Bureau of Indian Standard.
3. IS: 1893 (Part 1) – 2002, "Indian Standard Criteria for Earthquake Resistant Design of Structures", Bureau of Indian Standard.
4. STAAD's tutorial help.

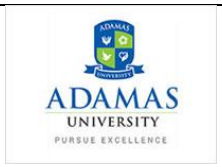
Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Name: **Enrolment No:**	

Course: STR22007– CAD Lab

Program: M.Tech. (CE) **Semester: Odd 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt any **Two Questions** (Each Carrying 20 Marks)**.**

1.	**Introduce** the STAAD pro for building structures.	**R**	**CO1**
2.	**Model** the structural systems for symmetric and unsymmetric building structures.	**Apply**	**CO2**
3.	**Apply** various types of loads on structural systems as per codal provisions.	**Apply**	**CO3**
4.	**Justify** analysis and perform analysis for a particular problem.	**Analyze**	**CO4**
5.	**Design** the structural elements as per codal provisions.	**Create**	**CO5**

STR25008	Seminar-I	L	T	P	C
Version 1.0		0	2	0	1
Pre-requisites/Exposure	Technical Seminar (B.Tech)				
Co-requisites					

Course Objectives

1. To aware of the technical seminar process and apply them in workplace.
2. To improve the communication ability noticeably and precisely.
3. To create the idea of complex thinking about any fact.
4. To implement own ideas in the future area of research.

Course Outcomes

Upon successful completion of this course, it is expected that students will be able to:

Course Outcomes	Details/Statement	Knowledge Level
CO1	Identify the advanced technologies and globalization.	Remember (L1)
CO2	Develop communication and representation skills towards becoming a good team leader and manager.	Understand (L2)
CO3	Appreciate importance of lifelong learning towards industry readiness.	Applying (L3)
CO4	Demonstrate problem-solving and decision-making abilities in dynamic and multicultural environments.	Analyzing (L4)
CO5	Integrate ethical and sustainable practices into professional and organizational contexts.	Evaluating (L5)
CO6	Cultivate adaptability and innovative thinking to address emerging challenges in a globalized industry.	Creating (L6)

Catalog Description:

Each student will present a seminar on an assigned problem in the First Semester. The problem will be given to the student at the beginning of the Semester and the work will be continued throughout the Semester. The student will be required to give a write up and present a seminar in the First Semester.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Semester-II

STR21009	Advanced Structural Design	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Design of RC Structure – I, Advanced R C Design				
Co-requisites					

Course Objectives

1. To enhance competence in design of advanced reinforced concrete structures.
2. To familiarize students with the concepts of designing concrete mixes using different methods of proportioning and to understand the effects of various parameters.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Understand the concept of designing Flat slab, Grid slab, Deep beams as per IS Code.	Remember (L1)
CO2	Analyse and design of RCC Water Tank and Liquid retaining structures.	Understand (L2)
CO3	Interpret and design the cylindrical shell, Structures for handing materials like silo and bunkers.	Applying (L3)
CO4	Illustrate the design of RCC Pile and Pile caps.	Analyzing (L4)
CO5	Evaluate and apply advanced design techniques for prestressed concrete structures as per IS Code specifications.	Evaluating (L5)
CO6	Integrate practical considerations and durability aspects in the design of special RCC structures to meet functional and safety requirements.	Creating (L6)

Catalog Description

Advanced Structural Design generally deals with the Reinforced concrete (RC), which is a versatile composite and one of the most widely used materials in modern construction. Concrete is a relatively brittle material that is strong under compression but less so in tension. Plain, unreinforced concrete is unsuitable for many structures as it is relatively poor at withstanding stresses induced by vibrations, wind loading, and so on.

To increase its overall strength, steel rods, wires, mesh or cables can be embedded in concrete before it sets. This reinforcement, often known as rebar, resists tensile forces. By forming a strong bond together, the two materials are able to resist a variety of applied forces, effectively acting as a single structural element. For designing complex structures, Advanced Structural Design is adopted.

Course Content

Module I: **11 Lecture Hours**

Design of Flat, Grid slab: Introduction, classification, behaviour of flat slabs, Grid slab, I.S codal provisions.

Module II: **12 Lecture Hours**

Deep Beams: General features, Parameter influence design, Flexural bending and shear stresses in Deep beams, I.S codal provisions. Checking for local failures, Detailing of Reinforcement in Deep beams.

Module III: **15 Lecture Hours**

Shells and Folded plates: Forms of shells and folded plates, structural behaviour of cylindrical shell and folded plate, method of analysis, Design of Cylindrical shell, Structures for handing materials like silo and bunkers.

Module IV: **10 Lecture Hours**

Liquid retaining structures: Load analysis on Liquid retaining structures; Design of Dam.

Module V: **12 Lecture Hours**

RCC Pile and Pile cap: Design of RCC Pile and Pile cap.

REFERENCE BOOK:

1. Design of Reinforce Concrete Structures A. K. Gupta
2. Limit State Design of RCC A.K. Jain
3. Limit State Design of RCC Structure by Pillai & Menon

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: STR21009– Advanced Structural Design

Program: M. Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	SECTION A (Answer **All the Questions) (5 x 1 = 5)**		
1.	Identify the critical section for Shear in case of Flat slab.	**App**	**CO1**
2.	What is the L/D ratio criterion for Deep beam?	**R**	**CO1**
3.	What are the types of elevated water tank?	**R**	**CO2**
4.	Distinguish Silo from Bunkers.	**An**	**CO3**
5.	What is the function of the Pile cap?	**R**	**CO4**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
6.	Write the advantages and disadvantages of 'Grid Slab'.	**U**	**CO1**
7.	Design a section to resist a direct tensile force of 120 kN/m width. Use M35 concrete and Fe-415 grade steel	**Apply**	**CO2**
8.	What are the advantages of using shell structure	**U**	**CO4**
9.	State the classifications of Retaining wall.	**R**	**CO3**
10.	A silo with internal diameter of 6 m & height of cylindrical portion 22 m with central opening of 0.5 m is to be built to store wheat. Use the following data: Unit wt. of wheat = 9 kN/m^3. Angle of internal friction between wall surface and wheat = 0.75ϕ while filling = 0.6 ϕ while emptying Pressure ratio = Ph/Pv = u = 0.5 while filling. Use Jansen's Theory for pressure calculation. Use M20 concrete and Fe-415 steel	**Apply**	**CO4**
	SECTION C (Answer Any **Two Questions) (2 x 10 = 20)**		
11.	Design the top dome and top ring beam of an Intze type water tank. Adopt grade of concrete is M30 and Fe-415 grade of steel. Inside diameter of the tank is 12m. The design of the top dome and top ring beam of the water tank should conform to the stress specified in IS:3370 and IS :456	**Apply**	**CO2** **CO4**
12.	Design a square tank having inner dimension of 7.5×7.5×2.5 m with walls fixed at the base and sides but free at top. The tank is directly supported on the earth. Free board is 15cm. Use M30 grade concrete and Fe-415 grade steel. Use IS:3370 & IS:456.	**Apply**	**CO2**
13.	A ribbed slab is continuous over a number of spans of 7.5 m each. Assuming the dead load to be 5kN/m^2 including self weight & superimposed load. D.L.+L.L.=3kN/m^2, Design the ribbed slab spanning in one direction. Consider spacing of ribs as 600 mm. Use M25 concrete and Fe-500 grade steel	**Apply**	**CO1**

STR21010	Structural Dynamics & Earthquake Engineering	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Earthquake Engineering (ECE43107)				
Co-requisites					

Course Objectives

1. To independently carry out research /investigation and development work to solve practical problems
2. To demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
3. To understand the state of art need, professional, ethical practices, services to the society and socio-economic relevance while executing the civil engineering project.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Derive differential equations for single degree of freedom (SDOF) systems and for multi-degree of freedom systems (MDOF) and evaluate their free vibration characteristics.	Remember (L1)
CO2	Identify the possible causes of failure in a poorly designed structures subjected to earthquake loading.	Understand (L2)
CO3	Describe basic concepts of engineering seismology and design of construction.	Applying (L3)
CO4	Describe the construction of response/design against the Liquefaction.	Analyzing (L4)
CO5	Analyze the dynamic response of structures using response spectrum and time history methods for earthquake-resistant design.	Evaluating (L5)
CO6	Develop seismic retrofitting strategies and evaluate their effectiveness in enhancing the performance of existing structures under earthquake loading.	Creating (L6)

Catalog Description

Structures are often subjected to dynamic forces of one form or the other during their lifetime. This course introduces the theory of dynamic response of structures with emphasis on physical insight into the analytical procedures and with particular application to earthquake engineering. The structural dynamics

component of the course includes free and forced vibration response of single and multi-degree of freedom systems. The earthquake engineering component considers seismic analysis methods, earthquake resistant design philosophy and includes elements of engineering seismology.

Course Content

Module I: **25 Lecture Hours**

Introduction: Single and multi-degree freedom systems, undamped and damped systems, numerical integration scheme, modal analysis for undamped and damped systems. Vibration of continuous elastic media – Beam, Plates.

Unit II: **22 Lecture Hours**

Characteristics of earthquake, Earthquake response of structures, Concept of earthquake resistant design. Codal provision for design of buildings.

Unit III: **13 Lecture Hours**

Design of liquid storage tanks, Liquefaction, non-engineered construction, special topics.

Reference Books

1. Structural dynamics theory and computation by Paz Mario
2. Seismic analysis of the Structure b y T.K.Dutta
3. Introduction to Structural Dynamics by John M. Biggs (McGraw Hill)
4. Dynamics of Structures by Jagmohan L. Humar (A. A. Balkema Publisher)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:

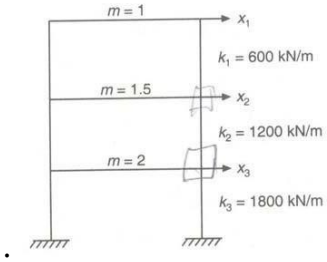
Enrolment No:

ADAMAS UNIVERSITY
PURSUE EXCELLENCE

Course: STR21010– Structural Dynamics & Earthquake Engineering

Program: M. Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	SECTION A (Answer **All the Questions) (5 x 1 = 5)**		
1.	Define damping.	**R**	**CO1**
2.	What is meant by damping ratio?	**R**	**CO1**
3.	Write the equation of motion for an undamped two degree of freedom system	**U**	**CO2**
4.	What are the types of Body waves and surface waves?	**R**	**CO3**
5.	What is the cause of Liquifaction of soil?	**R**	**CO4**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
6.	Write a short note on simple Harmonic motion	**R**	**CO1**
7.	Briefly explain plate tectonics and lithospheric plates.	**U**	**CO3**
8.	Explain degrees of freedom. Classify it according to their mechanism.	**U**	**CO2**
9.	Discuss the design criteria of a building against Liquifaction of soil.	**App**	**CO3**
10.	A mass of 10kg is supported by a steel wire 1m in diameter and 3m long. The system is made to move upwards with a uniform velocity of 10 cm/sec when the upper end is suddenly stopped. Determine the frequency and the amplitude of the resulting vibrations of the mass and the maximum stress on the wire.	**Evaluate**	**CO1**
	SECTION C (Answer Any **Two Questions) (2 x 10 = 20)**		
11.	A single degree of freedom system having a mass of 2.5m is set into motion with a viscous damping and allowed to oscillate freely. The frequency of oscillation is found to be 20 Hz, and measure of the amplitude of vibration shows two successive amplitude to be 6mm and 5.5 mm. determine he viscous damping co-efficient.	**Evaluate**	**CO1 CO2**
12.	Develop natural frequency and draw the mode shape for the shear building. 	**Evaluate**	**CO2**
13.	Explain about some recent earthquakes and give information on some disastrous earthquakes.	**An**	**CO3**

STR21011	Theory of Elasticity and Plasticity	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	----------				
Co-requisites	----------				

Course Objectives

1. To introduce principles of Elasticity and Plasticity, need of analysis of it and different techniques of analysis of it.
2. To apply principles of science and engineering in analysis and operation of civil engineering structures.
3. To expose students to the challenges involved in analysis of Theory of Elasticity and Plasticity through examples, numerical problems and practical problems.
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in structural engineering and resolve them effectively with best-practices.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Analyse the three-dimensional stresses.	Remember (L1)
CO2	Determine the three-dimensional strains.	Understand (L2)
CO3	Analyse of thick cylinder under pressure.	Applying (L3)
CO4	Estimate the elasto-plastic analysis of bending problems.	Analyzing (L4)
CO5	Estimate the elasto-plastic analysis of torsion problems.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

Theory of Elasticity and Plasticity covers elasto-plastic analysis for obtaining several engineering properties of materials. This course also includes the study of three dimensional stress and strain and application of this technology as well as the concept to thick cylinder under pressure, elasto-plastic analysis of bending and torsion problems. All the lectures will be devoted on discussions of basic theories

and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content **45 Lecture Hours**

Elasticity: Introduction to tensor analysis; three dimensional stress and strain analysis. Two dimensional problems in Cartesian, polar and curvilinear co-ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions. Torsion of rectangular bars including hollow sections, bending problems. Energy principles, variational methods and numerical methods.

Plasticity: basic concepts and yield criteria. Equations of plasticity, elasto-plastic analysis of torsion and bending problems, torsion of a bar of oval section (Sokoloskey's method), problems of spherical and axial symmetry, slip lines and plastic flow, strain hardening.

Reference Books

1. J. Chakraborty, Theory of Plasticity, Elsevier Science.
2. Timoshenko S.P. and Goodier, Theory of Elasticity and Plasticity, Tata McGraw Hill.
3. Timoshenko S.P. and Woinowsky-Kreiger, Theory of Elasticity and Plasticity, Tata McGraw Hill.
4. Jacob Lubliner, Plasticity Theory, Courier Corporation Publication.
5. Harold Malcolm Westergaard, Theory of Elasticity and Plasticity, Wiley Publishers.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: STR21011– Theory of Elasticity and Plasticity

Program: M.Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt All Questions from **Section A** (Each Carrying 1 Marks); any **Three Questions** from **Section B** (Each Carrying 5 Marks). Any **Two Questions from Section C** (Each Carrying 10 Marks).

	SECTION A (Answer **All Questions)**		
1.a	**Differentiate** between plastic deformation & elastic deformation.	**U**	**CO1**
b	**What** is Bauschinger effect?	**R**	**CO2**
c	**Enumerate** Anelastic deformation.	**R**	**CO3**
d	**How** plastic deformation results from twinning?	**U**	**CO4**
e	**Why** Von Mises and Tresca criteria give different yield stress for pure shear stress?	**U**	**CO5**
	SECTION B (Attempt any **Three Questions)**		
2.	**Derive** the 3-D stress tensor in Matrix form.	**Ap**	**CO1**
3.	**Differentiate** between Octahedral Normal & Shear stress.	**U**	**CO2**
4.	The state of stress at a point is given by: $fx=x^2y+20$; $Sxy=3x^2y$ $fy=x^3z+y^2$; $Syz=yz$ $fz=yz^2$; $Sxz=xz$ **Determine** the body force distribution at the point (1, 2, 3) so that the stresses are in equilibrium. [N.B: Normal stress='f' & Shear stress='S']	**Evaluating**	**CO3**
5.	Given the following displacement field: Ux=2x+y, Uy=z, Uz=z-y **Show** that the displacement vector is physically possible for a continuously deformed body.	**Evaluating**	**CO5**
	SECTION C (Attempt any **Two Questions)**		
6.	The stress components at a point are fx=20, fy=10, fz=5, Sxy=10, Syz=4, Sxz=5 MPa with respect to xyz co-ordinate system. **Determine** the Normal & Shear stresses on the plane whose direction cosines are $1/\sqrt{3}$, $1/\sqrt{3}$, $1/\sqrt{3}$. Also **calculate** the direction of the Shear stress.	**Evaluating**	**CO2**

7	Given the following displacement field: $Ux=3x^2+y$, $Uy=2y^2+z$, $Uz=4z^2+x$ **Compute** the magnification of a line element 'ds' that passes through the point (1, 1, 1) in the direction anx=any=anz=1/√3.	**Evaluating**	**CO4**
8.	Given the following displacement field: $Ux=0.01xy+0.02y^2$, $Uy=0.02x^2+0.01z^3y$, $Uz=0.01xy^2+0.05z^2$ **Determine** the strain matrix, rotation matrix & the angle of rotation at the point P (3, 2, -5).	**Evaluating**	**CO5**

Elective – II

STR21012	Advanced Foundation Engineering	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Soil Mechanics (ECE42104), Foundation Engineering (ECE43103)				
Co-requisites					

Course Objectives

1. To select the suitable foundation according to their functions, requisites and their limitations.
2. To obtain knowledge about different types of foundations for shallow and deep both foundations, to enhance the selection procedure.
3. To execute any excavation in practice safely, along with the knowledge about its stability, even for deep excavations and also about necessary supporting arrangements.
4. To get a brief idea about shallow and deep foundations along their design considerations, based on necessity of project, its soil data from various field tests, the condition of the sub-stratum, the existence of the water table etc.
5. To design different types of Machine foundations according to the feature of the machine and nature of the foundation soil.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Introduce various types of foundations with their salient features and designs.	Remember (L1)
CO2	Determine the bearing capacity of foundation soil satisfying the Shear failure as well as Settlement criteria; Design Raft foundation.	Understand (L2)
CO3	Describe the design and installation procedures of deep foundations, mainly the piles, piers and caissons.	Applying (L3)
CO4	Construct foundation on expansive soils; Design the machine foundation enhancing controls over various modes of vibration generated from machine.	Analyzing (L4)
CO5	Evaluate the stability and safety of foundations under various loading and soil conditions, incorporating advanced geotechnical investigation techniques.	Evaluating (L5)
CO6	Apply modern analytical tools and software for the design and analysis of complex foundation systems, ensuring compliance with industry standards and sustainability principles.	Creating (L6)

Catalog Description

Advanced Design of Foundation is the advanced version of Foundation engineering. In this subject one can get a brief idea about different types of foundations, especially under the major categories of the

shallow and deep foundations along with their limitations. According to these the selection procedure for the suitable foundation according to their functions, requisites also taught to students. For shallow foundations (isolated, combined, raft etc.), the understanding of bearing capacity of soil, type loading, stress distributions, the existence of the water table etc. are too important for the future engineers. And under deep foundations (pile, well etc.), except bearing capacity, the knowledge of skin friction, group functions, earth pressure, water pressure, various components of caisson are very crucial for the engineers. All the designs are executed according to the relevant codes of Indian Standards. Classes will be conducted by lecture, brief calculations with practical examples as well as power point presentation. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Module I: **20 Lecture Hours**

Bearing capacity: Bearing capacity of shallow foundation in layered soils, Footings on slopes, Foundation with uplift or tension forces.

Settlements: Settlement Analysis of shallow foundations in sand, clay, and layered deposits, Reliability of settlement calculations, Structural tolerances

Unit II: **10 Lecture Hours**

Design of various footings: Design of rectangular footings, combined footings and mat foundations.

Unit III: **15 Lecture Hours**

Deep foundations: Pile foundations under vertical and lateral loads, Negative skin friction of piles; Uplift capacity of piles and anchors, Well foundations.

Unit IV: **15 Lecture Hours**

Foundations on expansive soils; Introduction to soil dynamics and machine foundation.

Reference Books

1. Foundation Analysis & Design By J.E. Bowels (Mc Graw Hill)
2. Principles of Foundation Engg. By B.M. Das (PWS Publishing
3. Pile Foundation- Analysis & Design Poulus & Davis
4. Constructional methods in Foundation Engineering Koener
5. Foundation design and construction by Tomlinson .M.J.
6. Raft foundation design and analysis with practical approach by Gupta, s. c.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	1	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR21012– Advanced Foundation Engineering

Program: M. Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt **Five** questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks); any **Two Questions** from **Section C** (carrying 10 marks)**.**

	SECTION A (Attempt **All Questions)**		
1.	If the diameter of a Under reamed pile shaft is 0.35 m, then **what** will be the diameter and c/c distance of the intermediate bulbs?	**R**	**CO3**
2.	**Define** the terms of Degree of disturbance for the sampling process.	**R**	**CO1**
3.	In Plate load test, a 450 mm square steel plate or concrete block decide to be used for **which** types of soils?	**R**	**CO2**
4.	If an anchored sheet pile retain 5 m. high sandy backfill of φ = 30˚, γ = 10 kN/m^3 and embedded about 4 m. depth in a clayey deposit of c = 15 kN/m^2. Then, **find** out the resultant Passive thrust?	**Evaluate**	**CO4**
5.	A wooden pile of 0.3 m diameter is driven with a drop hammer upto 10 m depth in a immediately deposited soil, then **what** will be the safe load carrying capacity of the pile to avoid the Negative skin friction?	**U**	**CO3**
	SECTION B (Attempt any **Three Questions)**		
6.	**Discuss** about the Degree of freedom and its application in design of machine foundation.	**U**	**CO5**
7.	**Explain** the equations regarding Water table reduction factors (R_w) according to Terzaghi and show the values for various positions of Water table to obtain the Bearing capacity of soil.	**U**	**CO2**
8.	**Select** a friction pile group to carry 2500 KN load, including the weight of pile cap. The group is embedded through the uniform clay of average UCS of 50 KN/m^2. The clay layer is upto 25 m. and underlain by the rock. Consider the factor e safety about 2.75 against shear failure. Use IS code method.	**Evaluate**	**CO3**
9.	**What** is the Standard Penetration Test? List the different types of samplers used in soil investigation.	**R**	**CO1**
10.	**Compare** the General and Local shear failure of soil beneath footing with neat diagram.	**U**	**CO2**

	SECTION C (Attempt any **Two Questions)**		
11.	**What** is the ultimate load bearing capacity of circular pile of 0.5 m diameter and of 12 m long, passing a no. of layers of granular soil of thickness of 2 m, 3.5 m, 4 m and 4.2 m from G.L? The angles of shearing resistances of the corresponding layers are 25˚, 28˚, 32˚, 32˚ and the unit weights are 18 KN/m^3, 20 KN/m^3, 23 KN/m^3 and 24 KN/m^3.	**R**	**CO3**
12.	A building to be supported on a R.C.C. raft foundation of 15 X 10 m^2. The sub soil is clay of average UCS of 30 KN/m^2. The pressure on the soil due to the weight of the building along imposed load is designed about 80 KN/m^2 at base. If the unit weight of excavated soil is 19 KN/m^3, then **estimate** the depth at which the base of raft should be house to maintain the factor of safety 3.	**Evaluate**	**CO2**
13.	**Compute** the embedment length and pull in the anchor for the Anchored sheet pile as, by Free earth support method. The retained backfill soil of 5 m height and the soil below dredge line is same and having following properties: c = 0 kN/m^2, φ = 30˚, γ_{sat} = 24 kN/m^3 and γ = 18 kN/m^3. Consider, the depth of anchor rod and water table from G.L. are 1 m. and 3 m. respectively.	**U**	**CO4**
14.	**Describe** the Geo-physical tests conducting for Soil Exploration with neat diagrams.	**R**	**CO1**
15.	A Square footing located at a depth of 1.3 m. below the G. L. has to carry a safe load of 800 kN. **Design** the size of the footing if the desired factor of safety is 3. The soil has the following properties: c = 8 kN/m^2, φ = 30˚, *Void ratio* = 0.55, *Degree of saturation* = 50%, *Specific Gravity* = 2.67.	**Evaluate**	**CO2**

STR21013	Prestressed Concrete Structures	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	ECE 42107 / Structural Mechanics I				
Co-requisites	ECE43109 & ECE43113				

Career Objectives

1. To administer business and management skills in various positions within the construction industry.
2. To practice informed decision-making in personal and professional endeavors.
3. To apply scientific planning methods to optimize time and cost in construction related problems.
4. To plan resource requirements including men, machine and materials based on resources allocation and budget and budgetary control methods.
5. To understand the labour laws and regulations, safety requirements and its financial aspects in construction industry.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Understand the concept of prestressing and the behaviour of concrete structures.	Remember (L1)
CO2	Determine the losses of prestress in prestressed concrete structures.	Understand (L2)
CO3	Analyse the deflection of prestressed members.	Applying (L3)
CO4	Discuss about the Limit State Design criteria and checking of serviceability according to IS:1343	Analyzing (L4)
CO5	Design of prestressed concrete members.	Evaluating (L5)
CO6	Analyze the foundation of different civil structures with considering soil-structure interaction in static as well as dynamic conditions.	Creating (L6)

Catalog Description

Pre-stressed concrete is a form of concrete where initial compression is given in the concrete before applying the external load so that stress from external loads are counteracted in the desired way during the service period. This initial compression is introduced by high strength steel wire or alloys (called ‘tendon’) located in the concrete section.

It is now commonly used for floor beams, piles and railways sleepers, as well as structures such as bridges, water tanks, roofs and runways. Generally, prestressed concrete is not necessary for columns and

walls, however, it can be used economically for tall columns and high retaining walls with high bending stresses.

All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Module 1: **25 Lecture Hours**
Specification of materials, methods of prestressing, losses, analysis and design of members for moment and shear, stresses in anchorage zones of pre-tensioned and post tensioned members.

Module II: **22 Lecture Hours**
Design of end block, prestressed concrete compression members, partial prestressing, composite construction with prestressed concrete and reinforced concrete.

Module III: **13 Lecture Hours**
Two-way prestressing, circular prestressing, indeterminate structures. Review of IS code.

Reference Books

1. Design of prestressed concrete structure by Lin
2. Design of pre stressed Concrete by Krishna Raju
3. Design of Prestressed Concrete by Mallik & Gupta
4. Code of Practice for pre-stressed concrete structures, IS: 1343, BIS, 2009

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:

Enrolment No:

Course: STR21013– Prestressed Concrete Structures

Program: M. Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	SECTION A (Answer **All the Questions) (5 x 1 = 5)**		
1	In axially prestressed members, the concrete will experience which condition?	**R**	**CO1**
2	What types of loads applied on Prestressing wires in electric poles?	**R**	**CO5**
3	Explain the Creep of concrete in a structural member.	**An**	**CO1**
4	Where the Curved cables can be used?	**U**	**CO2**
5	Eccentric tendons in a concrete beam section induce which types of stresses?	**U**	**CO2**
	SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**		
6	What are the advantages of prestressed concrete?	**U**	**CO1**
7	A concrete beam is prestressed by a cable carrying an initial prestressing force of 300 kN. The cross sectional area of the wires in the cable is 300 mm2. Calculate the percentage loss of stress of stress in the cable only due to shrinkage of concrete using IS:1343 recommendations assuming the beam to be (i). Pretensioned, (ii). Post-tensioned. Assume Es = 210 GPa, age age of concrete at transfer = 8 days	**Analyze**	**CO2**
8	A prestressed concrete beam of rectangular cross section of 120 m wide and 300 mm deep, spans over 6m. the beam is stressed by a straight cable of carrying a force of 200 kN at an eccentricity of 50 mm. the modulus of elasticity of concrete is 38 kN/mm2. Compute the deflection at the centre of the span for the following cases: (i). Deflection under (prestress + self weight) (ii). Find magnitude of the UDL live load which will nullify the deflection due to prestress under self weight	**Analyze**	**CO3**
9	A concrete beam is post tensioned by a cable carrying an initial stress of 1000 Mpa. The slip at the jacking end was observed to be 5 mm. the modulus of elasticity of steel is 210 Gpa. Estimate the percentage loss of stress due to anchorage slip if the length of the beam is (i). 30 m, and (ii). 3 m	**Analyze**	**CO2**

10	Design a concrete mix for casting the precast pretensioned girder to suit the following requirements: Characteistics cube strength = M-45, Type of cement – OPC, Type of Fine agg- Zone II, Type of Coarse agg. – granite (crushed, angular) of maximum size- 20 mm according to IS: 383, Specific gravity of cement, sand, and coarse agg. are 3.14, 2.63 and 2.61 respectively. Type of exposure – Mild, Degree of workability – very good	**Analyze**	**CO4**
	SECTION C(Answer Any Two Questions) (2 x 10 = 20)		
11	A post tensiond bonded pre stressed concrete beam of rectangular cross section, 350 mm wide and 500 mm deep, is subjected to a service load bending moment of 150 kN-m, torsional momet of 40 kN-m, and shear force of 60 kN-m. the section has an effective prestressing force, determined from the service load of magnitude 500 kN at an eccentricity of 150 mm, provided by the five numbers of 12.5 mm stress relieved strands of cross sectional area of 506 mm2 with ultimate tensile strength of 1800 N/mm2. If he cube strength of concrete is 40 MPa, design suitable longitudinal and transverse reinforcement in the beam using IS:1343 recommendation based on skew banding approach	**Analyze**	**CO5**
12	A prestressed concrete beam having rectangular cross section 100 mm wide and 200 mm deep spans over 2.76 m. the beam is prestressed by a straight cable containing five wires of 5 mm diameter stressed to 1200 N/mm2 at an eccentricity of 37 mm. Assume the modular ratio α_e "=6.2" . If the modulus of elasticity of concrete is 34 kN/mm2 and modulus of rupture is 4 N/mm2, calculate the maximum deflection of the beam at the following conditions: i. Prestress + Self weight of the beam, ii. Prestress + Self weight of the beam + Imposed load of 8.4 kN/m, iii. Cracking load, iv. 1.46 times the working load, v. 1.8 times the working load	**Apply**	**CO3**
13	Design a pretensioned concrete pole for following data: Total length of pole = 8 m, Depth of pole below ground level = 1.5 m, Projection of poles above the level of wires = 0.6 m, Minimum ultimate transvers load = 4 kN, Load factor = 2.5 fck= 40 MPa; Characteristic strength of concrete at transfer = 30 MPa, fp=1600 MPa; Loss in prestress = 20 % Design wind pressure = 10 N/mm2 as per IS: 875-1987-Part-III Permissible stress in concrete at transfer in compression = 0.5 fci , and in tension = 0 Design PSC pole as a class 2 structure according to IS : 1343:2012	**Analyze**	**CO5**

STR21014	**Composite Material & Structures**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Building Planning and Materials (ECE42103)				
Co-requisites					

Course Objectives

1. To develop a solid understanding of the properties of **composite materials**, micromechanics and lamination theory, together with the analysis and manufacture of lightweight **composite structures**.
2. To plan resource requirements including men, machine and materials based on resources allocation and budget and budgetary control methods.
3. To understand the labour laws and regulations, safety requirements and its financial aspects in construction industry.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.	Remember (L1)
CO2	Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.	Understand (L2)
CO3	Analyse the elastic properties and simulate the mechanical performance of composite materials	Applying (L3)
CO4	Design and evaluate composite structures for specific applications, considering factors such as strength, stiffness, and durability.	Analyzing (L4)
CO5	Investigate the failure mechanisms in composite materials and propose effective solutions for enhancing their performance under various loading conditions.	Evaluating (L5)
CO6	Apply advanced computational tools and analytical methods to model and optimize the behavior of composite materials in real-world engineering applications.	Creating (L6)

Catalog Description

The use of fiber-reinforced polymer (FRP) composite materials has had a dramatic impact on civil engineering techniques over the past three decades. FRPs are an ideal material for structural applications where high strength-to-weight and stiffness-to-weight ratios are required. Most of the civil engineering structures involve some type of structural element with direct contact The course covers properties of fibre-reinforced polymer composites and the mechanical performance of laminated composites, including failure behaviour. Students will be able to model, simulate and optimise the performance of composite structures as well as develop practical skills in one or more common manufacturing techniques. Students will be taught how to use and apply classical laminate theory to intelligently design laminates with tailored mechanical responses in commercial composite analysis software. The course will also include a design exercise for a composite component or structure.

Course Content

Module I: **25 Lecture Hours**
FRP composites, Types, Mechanics, behaviour, properties, application.

Unit II: **35 Lecture Hours**
Steel — Concrete composite structures, design philosophy, shear connectors, beams, girders and slabs, Concrete — Prestressed concrete composite structures.

Reference Books

1. Johnson, Composite structure of steel and concrete.
2. M. Mukhopadhay, Mechanics of composite material and structure, university press.
3. D. Hull, An Introduction to Composite Material, Cambridge University Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

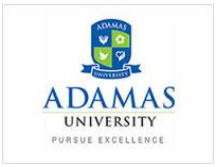
Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	1	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR21014– Composite Material & Structures

Program: M. Tech. (Structural Engg.) **Time: 03 Hrs.**
Semester: Even 2020 – 21 **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	Section A (attempt any two)		
1.	**Write** about the FRP.	**U**	**CO1**
2.	**Define** Prestressed concrete.	**R**	**CO2**
3.	**What** are the advantages of composite material?	**U**	**CO1**
4.	**Define** Reduced stiffness matrix?	**R**	**CO2**
5.	**Describe** stress strain relations for a lamina of arbitrary orientation	**R**	**CO1**
	SECTION B (Attempt any **Two Questions)**		
6.	For a graphite/epoxy unidirectional lamina, find the Compliance matrix and the Minor poisons ratio.	**Analyze**	**CO2**
7.	**Why** are fiber reinforcements of a thin diameter?	**U**	**CO1**
8.	**What** are the aircraft structural components made of composite materials?	**R**	**CO3**
9.	**Write the** difference between isotropic and anisotropic materials.	**U**	**CO1**
	SECTION C (Attempt any **Three Questions)**		
10.	**Explain** how the longitudinal tensile strength of a unidirectional lamina can be estimated.	**Analyze**	**CO1**
11.	**Describe** the experimental procedure by which the elastic constant of a unidirectional composite can be measure.	**U**	**CO3**
12.	**Discuss** briefly about the concrete- environment interaction.	**R**	**CO2**

Elective – III

STR21015	Environmental Impact Assessment	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites					

Course Objectives

1. To aware students about various international and national treaties about environmental awareness and revolution.
2. To give idea to students for estimating the regulations on control and prevention against different types of pollutions, commenced by the Govt. of India.
3. To evaluate the impacts of various projects based on EIA methodologies and identify the components of conflicts an prepare the EIA reports and environmental management plan for these projects.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Understand the various international and national treaties, and convention that laid the foundation for environmental awareness and revolution globally	Remember (L1)
CO2	Assess the Indian regulations on control and prevention of air pollution, water pollution; protection of forest and wildlife, and public liability insurance.	Understand (L2)
CO3	Explain the project clearance process, the authorities and EIA process.	Applying (L3)
CO4	Assess the impacts of various projects based on EIA methodologies and identify the components of conflicts and the need of public participation in EIA.	Analyzing (L4)
CO5	Prepare EIA reports and environmental management plan for developmental projects.	Evaluating (L5)
CO6	Analyze complex civil engineering problems, identify key issues, and develop effective solutions.	Creating (L6)

Catalog Description

Environmental Impact Assessment is the subject deal with the estimation of impact on the environment in the form of pollutions. Now-a-days, various projects are executed related to engineering as well, responsible for create pollution and disturb the environment. Therefore, an engineering student need to aware about these impacts as well as about the regulation provided by the authorities. Then only the student will be able to assess the impacts using prescribed EIA methodologies and by this way only the impact on environment may controlled.

Classes will be conducted by lecture, brief calculations with practical examples as well as power point presentation. The tutorials will familiarize the students with practical statistics and problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Unit I: **12 Lecture Hours**

Legal Aspects of EIA: The Need for EIA, EIA Cycle and Procedures, -Screening Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation.

Measure and EIA Report, Public Hearing, Decision Making, Components of EIA, Roles in the EIA Process, Government of India Ministry of Environment and Forest Notification (2000).

Unit II: **12 Lecture Hours**

Objectives of EIA: Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection, Construction, Phase Input Requirements Wastes and Emissions Air Emissions Liquid Effluents.

Unit III: **12 Lecture Hours**

EIA Methodologies: Criteria for the selection of EIA methodology, Impact identification, Impact measurement, Impact interpretation & Evaluation, Impact communication, Methods Adhoc Methods-Checklists Methods Matrices methods, Networks methods Overlays methods.

Base line Studies, Screening, Scoping, Public Consultation, Data Collection.

Environmental Impact Analysis: Predictive or Simulation methods, Rapid assessment of Pollution sources method, predictive models for impact assessment, Applications for RS and GIS.

Unit IV: **12 Lecture Hours**

Reviewing the EIA Report: Scope, Baseline Conditions, Site and Process alternatives, Public hearing. Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts Ecological Impacts Occupational Health Impact Major Hazard/ Risk Assessment, Impact on Transport System.

Unit V: **12 Lecture Hours**

Integrated Impact Assessment. Review of EMP and Monitoring: Environmental Management Plan Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief and Rehabilitation Stipulating the Conditions, Impact Management

Case Studies: Preparation of EIA for developmental Projects-Factors to be considered in making assessment decisions, Water Resources Project, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

Environmental Audit

Reference Books

1. Environmental Impact Assessment by Bartwal R. R. (New Age)
2. Introduction to Environmental Impact Assessment by John Glasson, Riki Therivel, Andrew Chadwick (Taylors & Francis)
3. Environmental Impact Assessment Practice & Participation by Fevin Stuart Hanna (OUP)
4. Methods of Environmental Impact Assessment by Peter Morris (Taylor & Francis)
5. Environmental Impact Assessment by Alan Gilpin (CUP)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name:

Enrolment No:

Course: STR21015– Environmental Impact Assessment

Program: M. Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	SECTION A (Attempt **All Questions)**		
1.	Define EIA.	**R**	**CO1**
2.	Discuss any one of the criterion, consider for adopting the EIA methodology.	**Cr**	**CO3**
3.	List the name of the Players of EIA.	**R**	**CO1**
4.	Explain Long term impacts.	**U**	**CO3**
5.	List any four baseline conditions, generally mentioned in the EIA report.	**An**	**CO4**
	SECTION B (Attempt any **Three Questions)**		
5.	Explain the EIA guidelines for a development project, with an example.	**U**	**CO2**
6.	What are the basic criteria to finalize the locations of an EIA project.	**R**	**CO2**
7.	Develop the outlines of the EIA aspects for a highway construction project.	**App**	**CO5**
8.	Illustrate the term Rapid EIA.	**U**	**CO1**
	SECTION C (Attempt any **Two Questions)**		
9.	Deduct a brief case study of a Sewage treatment plant and step by step describe the procedure.	**Evaluate**	**CO5**
10.	Compare between Reversible and Irreversible impacts. Exalin in detail Biological and Socio-economic environment impacts of an Industrial Project.	**U**	**CO2**
11.	Why it is considered that EIS is the conclusion of EIA. Write short notes on Networks methods Overlays methods	**R**	**CO3**

STR21015	Advanced Concrete Technology	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concrete Technology (ECE43109)				
Co-requisites					

Course Objectives

1. To identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy.
2. To evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure.
3. To design a concrete mix which fulfills the required properties for fresh and hardened concrete.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Discuss the concrete ingredients and its influence at gaining strength.	Remember (L1)
CO2	Design of concrete mix and grade as per IS codes.	Understand (L2)
CO3	Conclude the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.	Applying (L3)
CO4	Describe the application and use of fiber reinforced concrete.	Analyzing (L4)
CO5	Evaluate the durability and sustainability aspects of concrete under various environmental conditions to ensure long-term performance.	Evaluating (L5)
CO6	Apply modern testing methods and quality control techniques for assessing and enhancing the properties of conventional and special concretes.	Creating (L6)

Catalog Description

Over the past two decades concrete has enjoyed a renewed level of research and testing, resulting in the development of many new types of concrete. Through the use of various additives, production techniques and chemical processes, there is now a great degree of control over the properties of specific concretes for a wide range of applications. New theories, models and testing techniques have also been developed to push the envelope of concrete as a building material. There is no current textbook which brings all of these advancements together in a single volume. This book aims to bridge the gap between the traditional concrete technologies and the emerging state-of-the-art technologies which are gaining wider use.

Course Content

Module I: 60 Lecture Hours

Microstructural aspects of cement paste; Models of hydrated Portland cement gel; Mechanism, application and specification of chemical admixtures, mineral admixtures and other cement replacement materials; Special cementitious systems, viz., phosphate cement, magnesium oxychloride cement, regulated set cement, high alumina cement etc.; concrete- environment interaction; Marine concrete; Resistance of concrete to Fire and influence of temperature; Extreme weather concreting; Properties and mix proportioning of flyash concrete, silica fume concrete, fibre reinforced concrete, sprayed concrete, high performance concrete, self compacting concrete and geopolymer concrete.

Reference Books

1. M.S. Shetty, Concrete Technology, S. Chand Publications, 2008.
2. Neville, A.M., "Properties of Concrete", 3rd Edition, Longman Scientific and General, 1992.
3. P.kumar Mehta &Paulo J. M. Monteiro, Concrete Microstructure, Properties and Material.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR21015 – Advanced Concrete Technology

Program: M.Tech. (Structural Engg.) **Time: 03 Hrs.**
Semester: Even 2020 – 21 **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any **Two Questions** from **Section C** (carrying 10 marks each)**.**

	SECTION A (Attempt **All Questions)**		
1.	**Write** the various test for determining the properties of cement.	**U**	**CO1**
2.	**Define** Prestressed concrete.	**R**	**CO2**
3.	What are the admixtures?	**U**	**CO1**
4.	**Write** a note on blended .cement	**R**	**CO2**
5.	**Describe** stress strain relations for a lamina of arbitrary orientation.	**R**	**CO1**
	SECTION B (Attempt any **Three Questions)**		
6.	**Explain** the term shrinkage in concrete. What are the different forms of shrinkage in concrete	**U**	**CO2**
7.	**Explain** the term workability and enumerate the various factors affecting workability?	**U**	**CO1**
8.	**Explain** the production of artificial aggregate and write a note on blended cement.	**R**	**CO3**
9.	**Compare** compressive strength results of cube with cylinder test on concrete.	**U**	**CO1**
	SECTION C (Attempt any **Two Questions)**		
10.	**Discuss** briefly about the concrete- environment interaction.	**R**	**CO1**
11.	What is non-destructive testing of concrete? **Discuss** any four methods.	**U**	**CO3**
12.	**Describe** sprayed-concrete and mass-concrete.	**R**	**CO2**

STR21017	Construction Technology & Management	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	ECE 44103 / Construction Planning and Management				
Co-requisites					

Course Objectives

1. To administer business and management skills in various positions within the construction industry.
2. To practice informed decision-making in personal and professional endeavours.
3. To apply scientific planning methods to optimize time and cost in construction related problems.
4. To plan resource requirements including men, machine and materials based on resources allocation and budget and budgetary control methods.
5. To understand the labour laws and regulations, safety requirements and its financial aspects in construction industry.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Discuss the Elements, Tools & Methods of Construction Management.	Remember (L1)
CO2	Recognize the Fundamentals of Network Analysis to Schedule a Project.	Understand (L2)
CO3	Prepare Schedule for Time and Cost of a Construction Project.	Applying (L3)
CO4	Choose the Type and Capacity of Construction Equipment Required for the Project Site.	Analyzing (L4)
CO5	Illustrate Organizational Structure and Safety Procedures to the Project Site.	Evaluating (L5)
CO6	Analyze complex civil engineering problems, identify key issues, and develop effective solutions.	Creating (L6)

Catalog Description

Construction Management is the overall planning, coordination and control of a project from inception to completion aimed at meeting a client's requirements in order to produce a functionally and financially viable project. This course includes specific activities like defining the responsibilities and management structure of the project management team, planning methods and implementing it in project controls (time

and cost), defining roles and responsibilities of personnel in the organization, equipment's and safety measures in construction. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

Unit I: 13 Lecture Hours

Project Management: Different Construction techniques — equipments used — new technologies

Unit II: 22 Lecture Hours

PERT and CPM Analysis: Network scheduling CPM, PERT, Planning & Scheduling of activity Networks.

PERT Calculations: Expected time Event time, Slack Critical path, Probability of completion of project.

CPM Analysis: Time estimate of an analysis, Floats, Critical path.

Unit III: 25 Lecture Hours

Scheduling with limited resource, Resource Planning, Resource Allocation, Project Schedule Compression, Project Scheduling, Estimation of Project Cost, Monitoring Project Progress, Project Appraisal & Selection, Recent Trends in Project Management

Reference Books

1) Construction and project management for Engineer—Krishnamurthy
2) Urban Construction Project Management (McGraw-Hill Construction Series) by Richard Lambeck, John Eschemuller
3) Construction Management Fundamentals By: Kraig Knutson, Clifford J. Schexnayder, Christine M. Fiori, Richard Mayo
4) Construction Method and Management by Stephens W. Nunnally (Prentice Hall)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	1	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

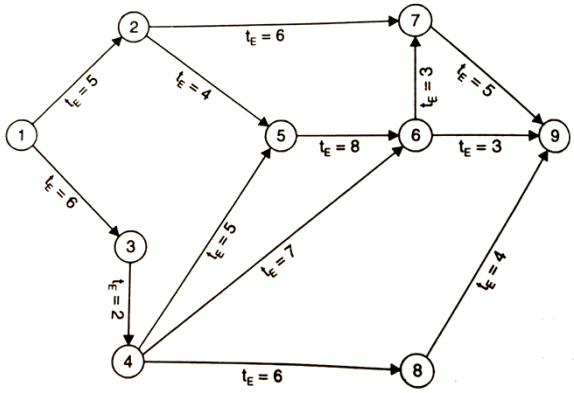
Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

Course: STR21017– Construction Technology & Management

Program: B.Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt all questions from **Section A** (each carrying 1 marks); any **Three Questions** from **Section B** (each carrying 5 marks) and any two questions from **Section C** (carrying 10 marks each)**.**

Section A (Answer **All the Questions) (5 x 1 = 5)**			
1	How the concrete mixers are specified?	**U**	**CO1**
2	Name some suitable equipment for excavating solid rocks	**R**	**CO1**
3	What is the expected life of a wheel tractor?	**R**	**CO1**
4	Write full name of PERT.	**R**	**CO2**
5	What is organization chart?	**R**	**CO5**
SECTION B (Attempt any **Three Questions) (3 x 5 = 15)**			
6	Discuss role of decision in project management.	**U**	**CO1**
7	Compare PERT and CPM.	**U**	**CO2**
8	What are the different types of handling equipments?	**R**	**CO4**
9	If for an activity optimistic time is 1day, pessimistic time is 8 days and most likely time is 3 days, then what is the expected time?	**Apply**	**CO3**
10	How employee benefit can be maintained with safety and health aspect?	**R**	**CO5**
SECTION C (Answer any **Two Questions) (2 x 10 = 20)**			
11	What is WBS? How is this helpful in planning, monitoring and controlling the programme of projects?	**U**	**CO2**
12	a) What are the factors affecting Earth Moving Equipment? b) A network is shown in the following fig. with the	**Apply**	**CO4** **CO2** **CO3**

	expected time of completion of each activity. Determine the earliest expected time and latest allowable occurrence time for each event.  		

STR21018	Theory of Elastic Stability and Behaviour of Metal Structure	L	T	P	C
Version 1.0		3	0	0	4
Pre-requisites/Exposure	----------				
Co-requisites	----------				

Course Objectives

1. To introduce principles of Elastic stability and behaviour of metal structures, need of analysis and different techniques of analysis of metal structures.
2. To apply principles of science and engineering in analysis, design and operation of civil engineering metal structures.
3. To expose students to the challenges involved in analysis of metal structures through examples, numerical problems and practical problems.
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in structural engineering and resolve them effectively with best-practices.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Demonstrate principles of buckling of thin elements.	Remember (L1)
CO2	Analyse principles of combined bending and axial force.	Understand (L2)
CO3	Analyse the torsional buckling of thin walled structures.	Applying (L3)
CO4	Demonstrate the buckling principle for frame elements.	Analyzing (L4)
CO5	Discuss buckling strength of column elements.	Evaluating (L5)
CO6	Analyze complex civil engineering problems, identify key issues, and develop effective solutions.	Creating (L6)

Catalog Description

Elastic Stability and Behaviour of Metal Structure covers the idea of buckling of thin elements, column elements, frame elements. This course also includes combined bending and axial force, torsional buckling of thin walled structures, buckling and post-buckling strength of plate elements. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content **60 Lecture Hours**

Introduction; Fundamental principles and models for elastic stability, stability of column; classification of dynamical systems, linear and nonlinear eigen value problems. Stability of plates, frames, beams and arches Lateral buckling of beams, combined bending and axial force, combined bending and torsion. Buckling of thin elements, Torsional buckling of thin walled structures and open sections, Column-strength curves. Buckling and post-buckling strength of plate elements with special references to the codal provisions. Behaviour of light gauge steel structures.

Reference Books

1. Simitses & Hodges, Fundamental of Structural Stability, S. S. S. Enterprises.
2. Gambhir M.L, Stability Analysis and Design of Structures, New Delhi Publisher.
3. Banzant, Stability of structure, Oxford University Press.
4. Lothers, Advanced Design in Structural Steel, Prentice Hall Publication.
5. S. K. Duggal, Design of Steel Structure, McGraw Hill Publisher.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

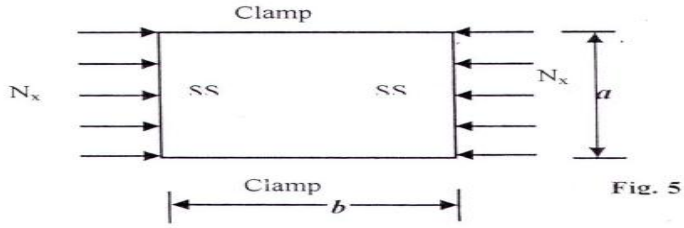
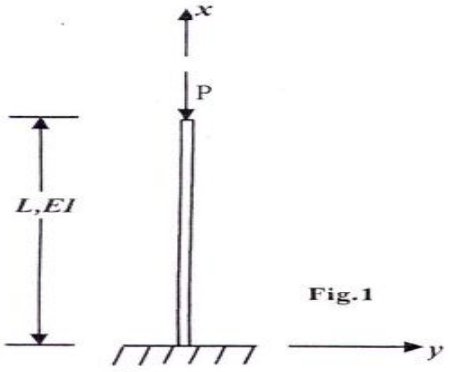
Model Question Paper

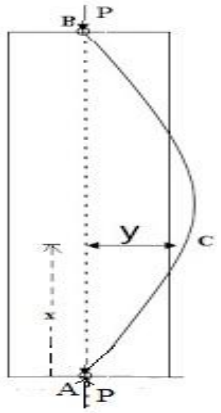
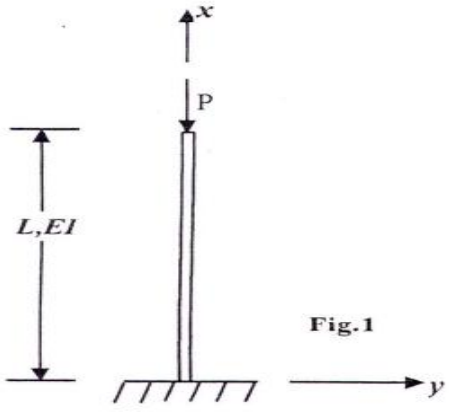
Name: **Enrolment No:**	ADAMAS UNIVERSITY PURSUE EXCELLENCE

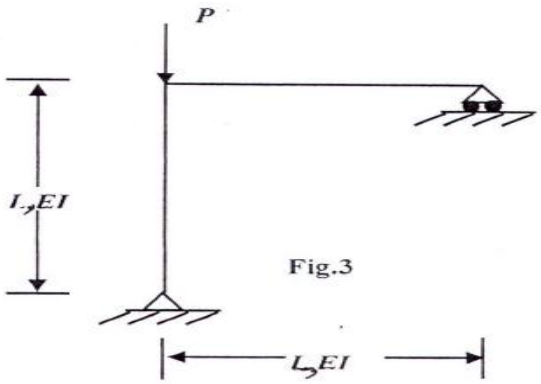
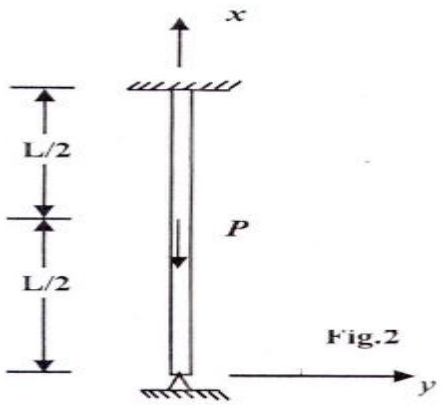
Course: STR21018– Theory of Elastic Stability and Behaviour of Metal Structure

Program: M.Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt All Questions from **Section A** (Each Carrying 1 Marks); any **Three Questions** from **Section B** (Each Carrying 5 Marks). Any **Two Questions from Section C** (Each Carrying 10 Marks).

	SECTION A (Answer All Questions)		
1.a	**Enumerate** basic equation of buckling load for thin elements.	**R**	**CO1**
b	**Write down** the equation for maximum stress under bending and axial loading.	**R**	**CO2**
c	**What** is lateral torsional buckling?	**U**	**CO3**
d	**Enumerate** basic equation of buckling load for frame elements.	**R**	**CO4**
e	**Write down** the equation for buckling load of column with both ends fixed.	**R**	**CO5**
	SECTION B (Attempt any **Three Questions)**		
2.	**Calculate** the buckling load of an isotropic plate shown in Fig. 5. The sides on which axial in-plane loads are applied are simply supported and other two sides are clamped.  Fig. 5	**Evaluating**	**CO1**
3.	A fixed-free prismatic column is compressed by compressive axial force *P* as shown in the fig. 1. **Write down** the expression for total potential energy of the system.  Fig.1	**R**	**CO2**

4.	A simply supported column having I-cross section is subjected to central concentrated load *P* as shown in the Fig. 4. Calculate the critical buckling load of the column from lateral-torsional buckling considerations. Assume following geometric properties. L= 3.0 m; depth, h=250 mm; sectional area, A= 35.53 cm^2; width of flange, b= 125 mm; thickness of flange, t_t=8.2 mm; thickness of web, t_w=6.1 mm; $I_{,,}$=3717.8 cm^4; I_{yy}=193.4 cm^4; torsional constant, J=6.4 cm^4. The z-axis coincides with the longitudinal centroidal axis of the member, while the x and y coordinates are taken along the principal axes of cross section. The flexural and torsional boundary conditions corresponding to simple supports are $u = v = \frac{d^2u}{dz^2} = \frac{d^2v}{dz^2} = 0$ at $z = 0, L$ and $\phi = \frac{d^2\phi}{dz^2} = 0$ at $z = 0, L$ $C_w = I_f h^2 / 2$	**Evaluating**	**CO3**
5.	The hinged-hinged column is subjected to axial load at its one end as shown in the figure. **Evaluate** its buckling load. 	**Evaluating**	**CO5**
	SECTION C (Attempt any **Two Questions)**		
6.	A fixed-free prismatic column is compressed by compressive axial force *P* as shown in the fig. 1. **Derive** the governing differential equations of the problem along with the associated boundary conditions.  Fig.1	**R**	**CO2**

7	Find the buckling load of the frame shown in fig. 3, assuming inextensibility of columns and beams.  Fig.3	**Evaluating**	**CO4**
8.	The fixed-hinged column is subjected to axial load at its centre as shown in the fig. 2. **Evaluate** its buckling load.  Fig.2	**Evaluating**	**CO5**

STR22019	Structural Laboratory-II	L	T	P	C
Version 1.0		0	0	3	2
Pre-requisites/Exposure	----------				
Co-requisites	----------				

Course Objectives

1. To provide a familiarity in the execution of new technology concepts which are applied in field of Advanced Concrete Technology.
2. To practice concepts related Advanced Concrete Technology which involves types and property of concrete, their ingredients and different adhesive materials.
3. To present the foundations of many basic Engineering tools and concepts related to Advanced Concrete Technology and resolve them effectively with hands on practice.
4. To enrich the knowledge and skills of engineers to proactively anticipate problems faced in Advanced Concrete Technology and resolve them effectively with best-practices.
5. To engage in lifelong learning and adapt to changing professional and societal needs.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Determination of filling ability of Self compacting concrete.	Remember (L1)
CO2	Determination of passing ability of Self compacting concrete.	Understand (L2)
CO3	Estimate the segregation resistance of Self compacting concrete.	Applying (L3)
CO4	Analyse of compressive strength by non-destructive method.	Analyzing (L4)
CO5	Determination of quality of concrete by Ultrasonic pulse velocity test.	Evaluating (L5)
CO6	Determination of concrete strength by Rebound hammer test.	Creating (L6)

Catalog Description

Special concrete is a construction material composed of cement/cementious material, aggregates or other substitutes, super-plasticizers or other chemicals hardens with time. This course includes specific

concepts related Concrete Technology which involves determination of properties of special concrete i.e., all type of mechanical properties associated with and all type of durability properties associated with the special concrete. All the lectures will be devoted on discussions of basic theories and advanced topics, focusing on practical implementation of knowledge. Classes will be conducted by lecture as well as power point presentation, audio visual virtual lab session as per requirement. The tutorials will familiarize the students with practical problem-solving techniques led by the course coordinator. Students will strongly grab the basic concepts of the subject via exercise and discussions with the coordinator.

Course Content

EXP. NO.01: Determination of filling ability of Self compacting concrete by Slump flow test.

EXP. NO.02: Determination of filling ability of Self compacting concrete by V-funnel test.

EXP. NO.03: Determination of filling ability of Self compacting concrete by Orimet test.

EXP. NO.04: Determination of passing ability of Self compacting concrete by L-box test.

EXP. NO.05: Determination of passing ability of Self compacting concrete by J-ring test.

EXP. NO.06: Determination of passing ability of Self compacting concrete by U-box test.

EXP. NO.07: Determination of passing ability of Self compacting concrete by Fill-box test.

EXP. NO.08: Determination of segregation resistance of Self compacting concrete by V-funnel test at T5 minutes.

EXP. NO.09: Determination of concrete strength by Rebound hammer test.

EXP. NO.10: Determination of concrete strength and quality by Ultrasonic pulse velocity test.

Reference Books

1. A .M. Naville, Concrete Technology, Brooks, J.J., ELBS.
2. M. S. Shetty, Concrete Technology, S. Chand & Co.
3. John Newman & Ban Sang Choo, ADVANCED CONCRETE TECHNOLOGY-Constituent Materials, Elsevier publication.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

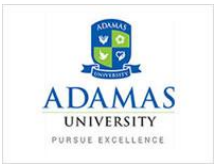
Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	1	3	-	-	-	-	3
CO3	3	-	3	-	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	-	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Model Question Paper

Name: **Enrolment No:**	

Course: STR22019 – Structural Laboratory-II

Program: M.Tech. (CE) **Semester: Even 2020-21**
Time: 03 Hrs. **Max. Marks: 40**

Instructions:
Attempt any **Two Questions** from **Section A** (each carrying 20 marks).

Section A (attempt **any Two)**

1.	**Evaluate** the passing ability of Self compacting concrete. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO1**
2.	**Compute** the filling ability of Self compacting concrete. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO2**
3.	**Evaluate** the segregation resistance of Self compacting concrete. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO3**
4.	**Determine** the compressive strength of Concrete by Rebound hammer test. The write up should contain the objective/aim of the test, basic theory, observation & results, and conclusion.	**Analyzing**	**CO4**
5.	**Evaluate** the quality of concrete by Ultrasonic pulse velocity test.	**Analyzing**	**CO5**

STR25020	Seminar-II	L	T	P	C
Version 1.0		0	2	0	1
Pre-requisites/Exposure	Seminar I				
Co-requisites					

Course Objectives

1. To provide information regarding recent developments in the field of structural engineering.
2. To impart techniques to review recent research work/ literature.
3. To develop interactive and presentation skill of students.

Course Outcomes

Upon successful completion of this course, it is expected that students will be able to:

Course Outcomes	Details/Statement	Knowledge Level
CO1	Summarize literature survey and demonstrate the selection of topic.	Remember (L1)
CO2	Organize the latest information regarding the structural engineering.	Understand (L2)
CO3	Conclude seminar work effectively.	Applying (L3)
CO4	Develop effective presentation skills to communicate technical concepts and findings in structural engineering.	Analyzing (L4)
CO5	Critically evaluate and synthesize research findings to propose innovative solutions for engineering challenges.	Evaluating (L5)
CO6	Foster collaborative and independent learning abilities to enhance research competency in structural engineering topics.	Creating (L6)

Catalog Description:

Seminar II shall be delivered on one of the advanced topics chosen in consultation with the guide after compiling the information from the latest literature and also internet. The concepts must be clearly understood and presented by the student. All modern methods of presentation should be used by the student. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing both side printed, preferably in IEEE format) should be submitted to the Department.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Semester-III

STR25022	**SE-Pre-Dissertation**	**L**	**T**	**P**	**C**
Version 1.0		**0**	**0**	**0**	**4**
Pre-requisites/Exposure	Relevant Courses Studied in M. Tech. (SE) Program				
Co-requisites					

Course Objectives

1. To plan a suitable dissertation proposal.
2. To display evidence of understanding the requirements of focusing research ideas.
3. To exhibit facts of understanding the requirements of dissertation writing.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Identify the scope of further improvement before final submission of dissertation report.	Remember (L1)
CO2	Develop communication and representation skills towards becoming a good presentation skill person.	Understand (L2)
CO3	Assess the learning towards industry readiness.	Applying (L3)
CO4	Demonstrate proficiency in defending research findings through effective oral and visual presentations.	Analyzing (L4)
CO5	Integrate critical feedback to refine research methodologies and conclusions for improved dissertation quality.	Evaluating (L5)
CO6	Cultivate professional ethics and a proactive approach to adapt research insights to practical applications in industry.	Creating (L6)

Catalog Description

This module will be provided with guidance and support throughout the preparation of report. From discussing initial ideas of dissertation through the process of actually writing the document, this module will be provided with the information and support required from both the teaching staff and allocated dissertation supervisor.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

STR25021	SE-Pre-submission Defense of Dissertation	L	T	P	C
Version 1.0		**0**	**0**	**0**	**4**
Pre-requisites/Exposure	Relevant Courses Studied in M.Tech (SE) Program				
Co-requisites					

Course Objectives

1. To demonstrate a knowledge of sources, concepts and methodologies in their field of study.
2. To lucid critically and clearly in the area of specialization, demonstrates both breadth and depth of knowledge in chosen area of specialization.
3. To exhibit facts of understanding the requirements of dissertation writing.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Apply curriculum and assessment based on big ideas and essential questions.	Remember (L1)
CO2	Develop communication and representation skills towards becoming a good presentation skill person.	Understand (L2)
CO3	Comprehend a discussion in a coherent and convincing way by summarizing the key arguments and providing suitable and coherent findings.	Applying (L3)
CO4	Design and implement instructional strategies that foster critical thinking and engagement through meaningful curriculum connections.	Analyzing (L4)
CO5	Enhance collaborative skills to facilitate effective group discussions and interdisciplinary learning experiences.	Evaluating (L5)
CO6	Evaluate and integrate feedback to improve curriculum delivery and assessment practices, ensuring alignment with educational objectives.	Creating (L6)

Catalog Description

To satisfy the requirements of the M.Tech in Structural Engineering, every candidate must submit a pre-dissertation copy and pass an oral examination of their progress in dissertation (pre-dissertation defense) by a Dissertation Defense Committee, one of whom is the designated Committee Chair, and one of whom can be from outside the institution who has expertise in the area of the student's research.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

Semester-IV

STR25023	SE- Dissertation	L	T	P	C
Version 1.0		0	0	0	18
Pre-requisites/Exposure	SE-Pre-Dissertation				
Co-requisites					

Course Objectives

1. To understand that how to improve your writing skills and level of readability,
2. To learn about what to write in each section,
3. To understand the skills needed when writing a Title, and
4. To ensure the good quality of paper at very first-time submission

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Identify and choose key research questions in the related field through analysis, will be helpful to motivate future research independently.	Remember (L1)
CO2	Show knowledge and potential degree of report writing and communicate easily to the viewer and readers.	Understand (L2)
CO3	Understand and utilize the knowledge of theoretical knowledge/framework into the area of study.	Applying (L3)
CO4	Study, identify and summarize literature in connection with related research work and select specific area of investigation by means of problem analysis.	Analyzing (L4)
CO5	Analyse, investigate and come with various important research findings that may be applied in real life construction activities for the betterment of society, environment in an ethical manner.	Evaluating (L5)
CO6	Understand about the benefits of knowledge exchange through collaborative research activities.	Creating (L6)

Catalog Description

The dissertation shall be the extension of Pre - dissertation carried out in the 3rd semester. Every student will be required to present three seminar talks, first at the beginning of the dissertation to present the progress made during the winter break, second in the middle of the semester involving partial results obtained and comparative analysis and third towards the end of the semester, presenting the dissertation report of the work carried out by him/her. The students will

be required to submit two copies of dissertation report to M.Tech. coordinator for record and processing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

STR25024	SE - Defense of Dissertation	L	T	P	C
Version 1.0		0	0	0	6
Pre-requisites/Exposure	Pre-submission Defense of Dissertation				
Co-requisites	SE - Dissertation				

Course Objectives

1. To present the evidence of dissertation work.
2. To discuss his/her research work directly with experts

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Utilize the opportunity to show and defend thesis work in front of experts, reply and communicate to criticism and challenges to their arguments which provide experts clear view about thesis work will be helpful for guiding students to improve their presentation skills.	Remember (L1)
CO2	Demonstrate the knowledge using which thesis work done and discuss work in detail with the experts and interact directly in the field of study related to problem analysis, investigation, solution of problems, societal, environmental benefits will be useful in future research.	Understand (L2)
CO3	Show the oral presentation skills and make it easy understand for examiners about the whole thesis by mentioning utilization of tools and cost benefits useful in future work.	Applying (L3)
CO4	Showcase critical thinking and effective communication skills when presenting thesis work, addressing feedback, and defending research arguments before experts.	Analyzing (L4)
CO5	Demonstrate a comprehensive understanding of research methodologies and their application to real-world problems, highlighting the societal and environmental benefits of the work.	Evaluating (L5)
CO6	Analyze complex civil engineering problems, identify key issues, and develop effective solutions.	Creating (L6)

Catalog Description

In this course each student will present a summary of entire thesis work done by means of presenting a PPT. Each student will get suitable time slot for presentation in front of external and internal examiners. PPT should be prepared in a prescribe format provided by institute. After presentation completed experts will ask related questions that need to be answered by student. This presentation method facilitate examiners to reach agreement on an examination result. Also facilitate the examiners offering the student an agreed, single, set of corrections required to be made before the award of the degree can be made.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**

STR25025	SE - Comprehensive Viva	L	T	P	C
Version 1.0		0	0	0	4
Pre-requisites/Exposure	Structural Analysis, Design of RC Structures I, Prestressed Concrete				
Co-requisites	Advanced Structural Analysis, Soil Structure Interaction, Industrial Management, Structural Laboratory I, Advanced Structural Design, Structural Dynamics & Earthquake Engineering				

Course Objectives

1. To assess the overall knowledge of students in the related field of engineering and management obtained over the entire program.
2. To provide an overview of virtual technical interview to students.

Course Outcomes

On completion of this course, the students will be able to

Course Outcomes	Details/Statement	Knowledge Level
CO1	Evaluate and analyze their overall technical knowledge and industry readiness.	Remember (L1)
CO2	Analyze various application-based activities in construction field and real-life problem solving.	Understand (L2)
CO3	Exposed to virtual technical interview and understand about the necessary procedures need to be followed in future.	Applying (L3)
CO4	Assess and enhance problem-solving abilities by applying technical knowledge to real-life construction challenges, ensuring readiness for industry demands.	Analyzing (L4)
CO5	Develop professional skills and industry-specific knowledge through virtual technical interviews and understand the procedures for career advancement in the construction field.	Evaluating (L5)
CO6	Analyze complex civil engineering problems, identify key issues, and develop effective solutions.	Creating (L6)

Catalog Description

T course will be conducted in the 4th semester covering complete syllabus. Each student will have to appear for this comprehensive viva in final semester of M. Tech program. The duration of viva for each student will range from 15-30 minutes. Viva shall cover all subjects taught in all the semesters. Examination will be conducted by a committee formed by institution. The examination committee constituted by HOD and other faculties. This course will test the students learning and understanding throughout this course. This course is arranged to prepare students to give an outlook about how to face interview both in academic and industrial sector.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Class Assessment	End Term
Weightage (%)	50	50

Co-Relationship Matrix

Indicate the relationships by 1- Slight (Low) 2- Moderate (Medium) 3-Substantial (High)

Program Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	3	-	3	-	-	-	-	3
CO2	3	-	3	-	3	-	-	-	-	3
CO3	3	-	3	1	3	-	-	-	-	3
CO4	3	-	3	-	3	-	-	-	-	3
CO5	3	-	3	-	3	-	-	-	-	3
CO6	3	-	3	1	3	-	-	-	-	3
Average	**3**	**-**	**3**	**1**	**3**	**-**	**-**	**-**	**-**	**3**