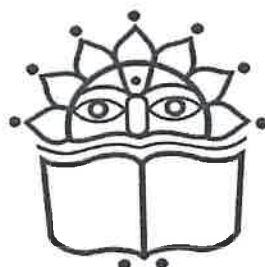


Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering and Technology,
Baramati

(An Autonomous Institute)



Vidya Pratishthan's
Kamalnayan Bajaj Institute of Engineering & Technology

Syllabus Structure

M. Tech

(Structural Engineering)

Department of Civil Engineering

(With effect from June 2023)
[2023 pattern]

VP's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

(An Autonomous Institute)

Department of Civil Engineering

M. Tech- (Structural Engineering) [2023 pattern]

(with effect from A.Y. 2023-24)

Semester I

Semester I												
Course Code	Course	Teaching Scheme (Hrs./Week)		Activity	Examination Scheme and Marks						Credit Scheme	
		TH	PR		In-Sem	End-Sem	TW	PR	OR	Total	TH	PR
MSE23101	Numerical Methods in Civil Engineering	4		20	30	60				110	4	
MSE23102	Advanced Design of Steel Structures	4		20	30	60				110	4	
MSE23103	Structural Dynamics	3		20	30	60				110	3	
MSE23104	MDS-1	2		10	20	40				70	2	
MSE23105	Research Methodology	3		10	30	60				100	3	
MSE23106	Laboratory Proficiency - I		08				50		50	100		04
MHS23101	Indian Knowledge System	2		20					30	50	2	
	Total	18	08	100	140	280	50	00	80	650	18	04
Total Credit											22	
MDS-1												
MSE23104-A	Green Building					MSE23104-B			Optimization Technique			
MSE23104-C	Building Information Modelling					MSE23104-D			Innovation Design and Thinking			

VP's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

(An Autonomous Institute)

Department of Civil Engineering

M. Tech- (Structural Engineering) [2023 pattern]

(with effect from A.Y. 2023-24)

Semester II

Semester II												
Course Code	Course	Teaching Scheme (Hrs./Week)		Activity	Examination Scheme and Marks						Credit Scheme	
		TH	PR		In-Sem	End-Sem	TW	PR	OR	Total	TH	PR
MSE23111	Finite Element Method	4		20	30	60				110	4	
MSE23112	Theory of Plates & Shells	4		20	30	60				110	4	
MSE23113	Advanced Design of Concrete Structures	4		20	30	60				110	4	
MSE23114	Program Elective - I	4		20	30	60				110	4	
MSE23115	Laboratory Proficiency -II	0	08				50		50	100		04
MSE23116	Environmental studies	2		30					30	60	2	
	Total	18	08	110	120	180	50		80	600	18	04
Total Credit											22	
Program Elective I												
MSE23114-A	Design of Pre-Engineered Buildings				MSE23114-B			Structural Stability				
MSE23114-C	Design of Foundations				MSE23114-D			Retrofitting and Strengthening of R C Structure				

BOS, Civil Engineering

Dean Academics

Dean Autonomy

Principal

**Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133**



MSE23101- Numerical Methods in Civil Engineering

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 4 hrs/week	TH:4	Activity- 20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Basic concept of differentiation and integration, differential equations, system of linear equations

Course Objective:

To make the students familiarize with various Numerical methods which will be useful in finding approximate solution of complex Civil Engineering Problems where analytical methods failed. Also identify the difference between analytical and Numerical methods.

Course Outcome: On completion of the course, student will be able to–

1. Apply finite difference method to indeterminate beams, columns and plates.
2. Understand the applications of flexibility method to beams and plane trusses.
3. Understand the applications of Stiffness method to plane and space frame.
4. Learn solution of simultaneous linear equation and Eigen value problem using numerical methods.
5. Apply Numerical methods to find approximate solution ordinary differential equation occurring in Indeterminate Beams, Columns.
6. Apply Numerical methods to find approximate solution numerical integration occurring in Indeterminate Beams, Columns.

Course Contents

Unit I: Finite difference method

[8 Hours]

Forward, backward and centered finite difference approximations to the derivatives. Applications to indeterminate beams, columns and plates.

Unit II: Matrix operations (Flexibility method)

[8 Hours]

Flexibility matrices, numerical examples of application of flexibility method to beams and plane trusses.

Unit III: Matrix operations (Stiffness method)

[9 Hours]

Stiffness matrices, numerical examples of application of stiffness method to beams and plane trusses, concept of transformation matrix, stiffness matrix for plane frame and space frame.



Unit IV: Solution of linear equations**[9 Hours]**

Gauss elimination method, Gauss – Jordan method, Jacobi's method, and Gauss – Seidel method, Numerical computation of Eigen values and Eigen vector by Power method, Householder method and Given's method.

Unit V: Solution of differential equations**[9 Hours]**

Review of Taylor's series and Euler's method. Runge – Kutta fourth order method, predictor – corrector method. Solution of Eigen value problems by Power method.

Unit VI: Numerical integration**[9 Hours]**

Trapezoidal and Simpson's methods, Gauss quadrature method, Newton's – Cotes method.

Books & Other Resources:**Reference Books:**

1. E. Ward Cheney, David R. Kincaid, Numerical Methods and Applications, Brooks Cole / Cengage Learning India.
2. S. C. Chapra & R. P. Canale, Numerical Methods for Engineering, TMH Publications
3. E. Balgurusamy, Numerical Methods, TMH Publications.
4. Krishna Raju, Numerical Methods in Civil Engineering, CBS Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition).

Activity:

1. Using Numerical methods find approximate solution ordinary differential equation occurring in Indeterminate Beams or Columns.
2. Using Numerical methods find approximate solution partial differential equation occurring in problems of Plate.

Dr C. B. Nayak



MSE23102- Advanced Design of Steel Structures

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Prerequisite:

1. Fundamentals of steel design.

Course Objectives:

1. This course is designed to provide understanding of various IS code provisions, fundamentals and advanced structural steel design and its applications for design of various steel structures
2. Students should be able to understand design of various advanced steel structures and its arrangements.

Course Outcomes:

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

1. Analyzed and design of hoarding structures and castellated beams.
2. Design of microwave towers and tubular structures
3. Design of transmission towers
4. Demonstrate knowledge about the cold form light gauge steel section, steel code provisions and design of the light gauge section.
5. Design of steel chimney.
6. Design of base plate and foundation for steel chimney.

Course Contents

Unit I: Hoarding Structures and Castellated beams

[9 Hours]

- a) Hoarding Structures: Analysis and design of hoarding structures under dead, live and wind load as per the latest IS:875 by limit state method.
- b) Castellated beams: Concept, fabrication of the castellated beam from rolled steel section, design of castellated beam for bending and shear as per latest code by limit state method.

Unit II: Microwave Towers and Tubular Structures

[9 Hours]

- a) Microwave Towers: Introduction, structural configuration, function, analysis and design.
- b) Tubular Structures: Design of tubular Trusses and scaffoldings using circular hollow, rectangular hollow sections as per code, detailing of joints.

Unit III: Transmission Towers

[9 Hours]

Transmission Towers: Introduction, structural configuration, bracing systems, analysis and design as per code. Use the working stress method.

Unit IV: Cold form light gauge section

[9 Hours]

Cold form light gauge section: Advantage, type of cross-section, stiffened, multiple stiffened and un-stiffened element, flat-width ratio, effective design width, design of light gauge compression, tension and flexural members as per code.



Unit V: Design of chimneys

[8 Hours]

Design of chimneys: Introduction, type, joints, lining, ladder, forces acting on the chimney, design of thickness of steel plates for the self-supporting chimney.

Unit VI: Design of base for chimney

[8 Hours]


Design of base plate of chimney, design of anchor bolt, design of foundation and stability of steel chimneys.

Books and Other Resources:

1. Ram Chandra, Design of steel Structures, Volume II, Standard Book House, New Delhi.
2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, New Delhi.
3. M Raghupathi, Design of steel structures, Tata McGraw Hill, New Delhi.
4. S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
5. N Subramanian, Design of steel structures, Oxford University Press.
6. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.

Activity:

1. Design of Hoarding structure using commercial software.
2. Design of Castellated beams using commercial software.


Dr. S. G. Moshkhade



MSE23103- Structural Dynamics

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:3	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites:

Basics structural analysis, basics of mathematics, matrix method of analysis.

Course Objective:

The Objective of this course is to realize the seismic hazards and identify structural dynamic methods for safety and stability of civil engineering structures.

Course Outcome:

On completion of the course, student will be able to–

1. Analyze degrees of freedom and analyse forced & free vibrations.
2. Assess the harmonic excitations and apply Duhamel's integral.
3. Apply forced vibration & free vibration to multistorey building.
4. Identify the clauses from I.S. 1893, and distinguish between E.S.L. method & R.S. method.
5. Utilize the T.H. method apply capacity-based design method w.r.to 13920.
6. Execute nonlinear analysis & interpret the results.

Course Contents

UNIT I: Basics of structural dynamics

[7 Hours]

Fundamental concepts of vibrations, Degrees of freedom & mathematical modelling of dynamic systems. SDOF An undamped & damped free vibration, viscosity & coulomb's damping.

UNIT II: Single degree of freedom system (SDOF System)

[7 Hours]

SDOF System: Undamped & damped forced vibrations to harmonic excitations. Response to until impulse and arbitrary loading by Duhamel's integral and analyses for Nonlinear analysis.

UNIT III: Multi degree of freedom system (MDOF System)

[7 Hours]

MDOF System: Forced vibrations and free vibrations of shear building orthogonally of mode shapes & concept & T.M.D.

UNIT IV: Seismic analysis methods

[6 Hours]

Design of multi-story RC Structure with I.S. 1893, by equivalent static lateral load method & R.S. method.

UNIT V: Shear wall and ductile detailing

[6 Hours]

Introduction to time history method, capacity-based design of soft story RC Buildings, Design of shear wall, Ductile detailing as per I.S. 13920.

UNIT VI: Non-Linear analysis

[6 Hours]

Non-Linear Analysis, free vibration of cantilever beam by Rayleigh Ritz method.



Books & Other Resources:

Reference Books:

- 1: S.N. Paultre "Dynamics of structures", Wiley India
- 2: M. Paz, "Structural Dynamics Theory and Computation", CBS Publications
- 3: A. K. Chopra, "Dynamics of Structures Theory and Applications to Earthquake Engineering", Prentice-Hall Publications
- 4: R.W. Clough and J. Penzin, "Dynamics of Structures", McGraw Hill Publications
- 5: R.C. Roy, "Structural Dynamics an Introduction to Computer Methods", John Wiley & Sons Publications.
- 6: P. Agarwal and M. Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall Publications.
- 7: Hosure, "Earthquake resistant design of building structures building", Wiley India.
- 8: IS 13920, "Indian Standard Criteria for Ductile Detailing of RC Structure", Bureau of Indian Standards, New Delhi.
- 9: IS: 1893, "Indian Standard Criteria for Earthquake Resistant Design of Structures", Bureau of Indian Standards, New Delhi.
- 10: IS: 13935, "Repair and Seismic Strengthening of Buildings", Guidelines, 1993. R11: IS: 4326, "Earthquake Resistant Design and Construction of Buildings" Code of practices.

Activity:

1. Design of shear wall using commercial software.
2. Design of multi-story RC Structure using commercial software.

Dr. S. B. Wadga



MDS-I
MSE24104-A- Green Building

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs/week	TH: 2	Activity Marks-10 Marks
		In-sem-20 Marks
		End-sem-40 Marks

Course Objective:

The objective of this course is to realize the use of green building to reduce global warming.

Course Outcome:

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

1. Select different building materials for construction.
2. Analyze global warming due to different materials in construction.
3. Analyse buildings for green rating
4. Use an alternate source of energy.

Course Contents

Unit I: Introduction to the concept of cost-effective construction

[6 Hours]

Uses of different types of materials and their availability -Stone and Laterite Blocks-Burned Bricks-Concrete Blocks-Stabilized Mud Blocks-Lime Pozzolana Cement-Gypsum Board-Light Weight Beams-Fiber Reinforced Cement Components-Fiber Reinforced Polymer Composite-Bamboo-Availability of different Materials-Recycling of building materials –Brick-Concrete-Steel-Plastics - Environmental issues related to quarrying of building materials.

Unit II: Global Warming

[6 Hours]

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

Unit III: Green Building Rating Systems

[7 Hours]

BREEAM –LEED -GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings –Purpose -Key highlights -Point System with Differential weight age. Green Design – Definition -Principles of sustainable development in Building Design -Characteristics of Sustainable Buildings –Sustainably managed Materials -Integrated Lifecycle design of Materials and Structures (Concepts only).

Unit IV: Utility of Solar Energy in Buildings

[7 Hours]

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings.




Books & Other Resources:

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
8. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

Activity:

- 1- Students have to visit a building which is a green rated and prepare a report.


Jagadele U.T.



MDS-I
MSE24104-B- Optimization Technique

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs/week	TH: 2	Activity-10 Marks
		Insem-20 Marks
		Endsem-40 Marks

Course Objectives: To know optimization techniques to be used for Civil Engineering applications.

Course Outcomes:

1. Able to explain optimization problems and constraints
2. Able to use classical optimization methods
3. Able to apply optimization methods to solve LP problems
4. Able to give the solution to transportation and assignment-related problems

Course Contents

Unit I: Introduction to Optimization Techniques **[6 Hours]**

Introduction to optimization techniques, Applications to various civil engineering problems, Statement of the optimization problem, Constraints of LP, NLP problems.

Unit II: Optimization methods **[6 Hours]**

Single and multiple problems with equality and inequality constraints, Hessian matrix and its use, Lagrangian method, convex and concave functions.

Unit III: Linear programming **[7 Hours]**

Standard LP problem, Assumptions in LP, Geometry and graphical solutions of LP problem, Canonical form of linear simultaneous equations, Simplex method to solve LP problems, Use of big M and two-phase methods.

Unit IV: Additional topics in LP **[7 Hours]**

Additional topics in LP: Duality in LP, Transportation problem, Assignment problem, Mathematical methods of transportation and assignment problem, Methods of solution,



Variation in transportation, and assignment problems such as unbalanced problems, and degeneracy.

Books & Other Resources:

1. Engineering Optimization: Theory & Practice, S. S. Rao., Wiley.
2. Engineering Optimization: Methods and Applications, Ravindran, Wiely
3. Operation Research, Taha Hamdey A.
4. Principles of Operation Research, Wagner, Prentice Hall.
5. Operation Research, Hira and Gupta, S. Chand
6. Operation Research-Ravindran, Wiely.

Activity:

Solve transportation and assignment-related problems using optimization techniques in Civil Engineering (Activity to be done individually).

~~SHY~~
Jagadale U.T.



MDS-I
MSE23104-C- ARTIFICIAL NEURAL NETWORKS

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs/week	TH: 2	Activity-10 Marks
		In-sem- 20 Marks
		End-sem- 40 Marks

Course Objectives: To know applications of ANN in Structural Engineering.

Course Outcomes:

1. Able to know various terms used in ANN
2. Able to learn types of networks used in ANN
3. Able to analyse optimization problems solving using neural networks.
4. Able to apply applications of ANN to identify various patterns.

Course Contents

Unit 1: Introduction

[6 Hours]

Introduction to Neural Networks, Biological Neurons and Neural Networks, Networks of Artificial Neurons. Single Layer Perceptron, Learning and Generalization in Single Layer Perceptron.

Unit II: Applications

[6 Hours]

Applications of Multi-layer Perceptrons. Basic learning models Associative Learning, Competitive Networks, Winner-take-all networks, Adaptive Resonance Theory (ART).

Unit III: Neural networks

[7 Hours]

Neural networks as associative memories, Hopfield network, BAM, Self-Organizing Maps: Fundamentals, Algorithms and Applications. Learning Vector Quantization, Optimization problems solving using neural networks.

Unit IV: Applications of Artificial Neural Networks

[7 Hours]

Applications of Artificial Neural Networks: Application areas like system identification and control, decision-making, pattern recognition, and sequence recognition.



Books and Other Resources

Text Book(s)

1. B. Yegnanarayana - Artificial neural network PHI Publication.2005
2. S. Raj sekaran, Vijayalakshmi Pari - Neural networks, Fuzzy logic and Genetic Algorithms

Reference Books

1. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005.
2. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press, 1995

e- Resources and other Digital Material

1. <https://ocw.mit.edu/courses/9-641j-introduction-to-neural-networks-spring-2005/>
2. <https://nptel.ac.in/courses/117105084>

Activity:

1. Solve Civil engineering problem using ANN.

~~5/4/24~~
Sagadale U.T.



MDS-I
MSE24104-D- Introduction to Smart Material

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs/week	TH: 2	Activity- 10 Marks
		In-sem-20 Marks
		End-sem-40 Marks

Course Objectives

1. To study various types of smart materials used in engineering application
2. To study the processing of smart materials
3. To study the basics of sensors and their engineering application
4. To study the basics of actuators and their engineering application

Course Outcomes

By the end of the course, students will be able to

1. Understand various smart materials and their importance in engineering application
2. Know various processing techniques of smart materials
3. Get knowledge of the use of smart materials as sensors and actuators.

UNIT I: Introduction

[6 Hours]

Introduction Characteristics of metals, polymers, and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of smart material.

UNIT II: Smart Materials

[6 Hours]

Electro-strictive Materials, Magnetoelectric materials, Magnetorheological fluids, Electrorheological fluids, and Shape Memory materials.

UNIT III: Processing of Smart Materials

[7 Hours]

Processing of Smart Materials, Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers

UNIT IV: Types of Sensors

[7 Hours]

Sensors Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magnetostrictive sensors, Piezoresistive sensors, Optical sensors, Resonant sensors, semiconductor-based sensors, Acoustic sensors, polymerize sensors, Carbon nanotube sensors.

Books and Other Resources

Text Books:

1. Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan,




- K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006.
2. Smart Structures and Materials, Brain Culshaw, Artech House, London, 1996.
 3. Smart Materials and Structures, Mukesh V. Gandhi, Brian S. Thompson, , Springer, May 1992

Reference Books:

1. Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.
2. Smart Structures, P. Gauenzi, Wiley, 2009
3. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, Berlin, New York, 2002.
4. Analysis and Performance of Fiber Composites, B. D. Agarwal and L. J. Broutman, John Wiley & Sons.

Activity:

1. Case study on application of smart materials.


Jagadele U.T.



MSE23105-Research Methodology

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:3	Activity-10 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Objective:

The objective of the course is to explain the basics of research, the process involved; identify appropriate research topics, sampling techniques, and data interpretation.

Course Outcome: On completion of the course, students will be able to—

- 1: Know the meaning of research, research proposal format, and funding agencies.
- 2: Perform literature reviews using print and online databases and follow research ethics.
- 3: Demonstrate knowledge of research processes; describe sampling methods, measurement scales, and instruments and appropriate uses of each.
- 4: Able to validate and test the research data with qualitative and quantitative analysis.
- 5: Know the various advanced data analysis techniques.
- 6: Prepare an effective research report and paper.

Unit 1: Introduction to Research**[6 Hours]**

Meaning of research, types of research, process of research, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, formulation of research hypotheses. Search for causation. Developing a Research Proposal Format of an individual research proposal, Significance, objectives, methodology, Funding for the proposal, and Different funding agencies. Framework for the planning.

Unit 2: Literature survey**[6 Hours]**

Definition of literature and literature survey, need of literature survey, sources of literature, elements and objectives of literature survey, styles of literature survey, and strategies of literature survey.

Unit 3: Data collection, Measuring, Sampling and Scaling**[6 Hours]**

Classification of data, benefits and drawbacks of data, evaluation of data, qualitative methods of data collection, methods of qualitative research, Sampling, sample size, sampling strategy, attitude measurement, and scaling, types of measurements, criteria of good measurements, classification of scales.



Unit 4: Preliminary data analysis

[7 Hours]

Testing of hypothesis- concepts and testing, analysis of variance techniques, introduction to non-parametric tests. Validity and reliability, Approaches to qualitative and quantitative data analysis.

Unit 5: Advanced data analysis techniques

[7 Hours]

Correlation and regression analysis, Introduction to factor analysis, discriminant analysis, cluster analysis, multidimensional scaling, Descriptive statistics, Inferential statistics, Multi-dimensional measurement and factor analysis.

Unit 6: Report writing

[7 Hours]

Need of effective documentation, importance of report writing, types of reports, report structure, report formulation, Plagiarism. Research briefing, presentation styles, impact of presentation, elements of effective presentation, writing of research paper, presenting and publishing paper, patent procedure.

Reference Books:

1. Research Methodology: concepts and cases, Deepak Chawla and Neena Sondhi, Vikas Publishing House Pvt. Ltd.
2. Research Methods for Business, Sekaran Uma and Rogure Boudie, Wiley, India.
3. Research Methodology: Methods and Trends, by Dr. C. R. Kothari, New Age International Publishers.
4. Research Methods in Education, Louis Cohen, Manion, Morrison, Routledge (Taylor & Francis Group)/ Cambridge University Press India Pvt. Ltd.
5. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville.
6. Research Methodology: A Step by Step Guide for Beginners, by Ranjit Kumar
7. Research in Education, John Best and James Kahn, Prentice Hall of India Pvt. Ltd.

Activity:

1. Literature survey on any 2 research paper.


R. R. Khartode



MSE24106-Laboratory Proficiency I

Teaching Scheme	Credit Scheme	Examination Scheme
Practical: 8 hrs/week	PR:4	TW-50 Marks
		OR- 50 Marks

Course Contents

1 a) Completion of assignments

b) Review of technical documentaries/review of case studies /failure case studies/observation on case studies.

2. Technical review and critique of a research article/paper on any topic from the refereed journal paper related to the program content.

3. Design of earthquake-resistant structures using any civil engineering software.

4. Site visits: Report based on three site visits.

The Oral/TW exam for LP -I should be based on the completion of assignments /review of technical documentaries/review of case studies/research paper review/failure of case studies/Design of structure




(Dr. G.N. Narule)

MHS23101-Indian Knowledge System

Teaching Scheme	Credit Scheme	Examination Scheme
Theory: 2 hrs/week	TH:2	Activity-20 Marks
		Oral -30 Marks

Course Objectives:

1. To create awareness about the history and rich culture of the Country.
2. To introduce Vedic mathematics principles for faster calculations.
3. To know the science and Astronomy contributions of the traditional knowledge of Bhārata.
4. To learn engineering and technology contributions of the traditional knowledge of Bhārata.

Course Outcomes:

Students will be able to

CO1: Explain the historicity of the Indian Knowledge System and the broad classification of Indian philosophical systems.

CO2: Apply Vedic Mathematics for faster calculations.

CO3: Understand the importance of science and astronomy concepts developed by Bhārata.

CO4: To understand the contributions in the engineering, technology, and architectural heritage of ancient Bharata.

UNIT I: Bharatiya Civilization and Development of Knowledge System [6 Hours]

Genesis of the land, Antiquity of civilization, the Saraswati-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy, Ancient Education System, the Takṣaśīla University, the Nalanda University, Ethnic Studies, Life Science studies, Agriculture, Ecology and Environment, Ayurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Surgery, and Yoga. Life and works of Agastya, Patanjali, Lopamudra, Ghosha, Gargi Maitreyi, Adishankaracharya, Panini, Aryabhatta, Kanada, Kautilya, Vishwakarma, Sushruta, Charaka, Bhaskar Acharya, Madhav Acharya.

UNIT II: Vedic Mathematics

[6 Hours]

Indian Mathematicians: Varahmihir, Brahmagupta, Srinivasa Ramanujan, Neelkanth Somayya, Bharti Krishna Tirtha, Introduction to sutras, and sub sutras, Methods for Addition, Multiplication,



division, squaring and square roots, cube and cube roots, Factorization. Differentiation and Integration methods. Easy Solution of linear equations, Quadratic equations, High-Speed Matrix Algebra.

Vedic Geometry: Different forms of straight lines, The Triangle, The Cyclic Quadrilateral, Squares, and the Circle, Geometrical constructions (such as Altars), Transformation of simple shapes, Kalpa Sutras-Srautha Sutras and Sulbha Sutras.

UNIT III: Science, Astronomy

[7 Hours]

Concepts of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bharatiya Kala-gaṇana, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archeoastronomy.

UNIT IV: Engineering, Technology, and Architecture

[7 Hours]

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet-Dwārka.

Textbooks:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2. Engineering and Technology in Ancient India by Ravi Prakash Arya
3. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramakrishna Mission Institute of Culture, Kolkata (2014).
4. Science and Technology in Ancient Indian Texts by Bal Ram Singh, Nath Girish, Umesh Kumar Singh
5. Vedic Mathematics, Swami Bharati Krishna Trithaji, Motilal Banarsidass, New Delhi.

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).
4. Modern Introduction to Ancient Indian Mathematics, T S Bhanumurthy, Wiley Eastern Limited, New Delhi

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5. Advanced Vedic Mathematics, Rajkumar Thakur, Rupa Publications India Pvt. Ltd 2019
6. Vedic Geometry Course, S. K. Kapoor, Lotus Press
7. NPTEL Course: Indian Knowledge System (IKS): Concepts and Applications in Engineering
https://onlinecourses.swayam2.ac.in/imb23_mg53/preview
8. RigvedadiBhashyaBhumika: Swami Dayananda Saraswati publisher Arya samaj, Vedic Mission West Midlands.
9. PatanjaliYogsutra a commentary by Shri ShriRavishankar, Arktos media.
10. NPTEL Course: SohoniPushkar, Introduction to the History of Architecture in India, IISER Pune, 2020. https://onlinecourses.nptel.ac.in/noc22_ar03/preview

Examination Scheme:

Activity

20 Marks

Activity includes survey/ research, models, charts, and implementations on topics mentioned or relevant to the syllabus. Students need to present their work at the end of the term.


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Program Elective-1
MSE23114-C- Design of Foundations

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures:4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites:

Geotechnical Engineering, Foundation Engineering

Course Objective:

The Objective of this course is to able to perform geotechnical design of different foundation systems, and choose the most appropriate one.

Course Outcome:

On completion of the course, student will be able to–

- 1: Identify type of soil and foundation.
- 2: Identify types of raft and able to design raft foundation.
- 3: Able to design foundations for rotary machines / impact machine.
- 4: Identify the types of piles and design of pile foundation.
- 5: Utilize and apply ASD/LRFD method for design of drilled shafts.
- 6: Able to analysis and interpret the results.

Unit I: Introduction and Soil-Structure Interaction

[9 Hours]

- A. Foundation Objectives and Their Importance, Classification of Foundations, Soil Classification, Geotechnical Design Parameters, Bearing Capacity, And Foundation Settlements.
- B. Loads for Design, Depth of Foundation, Depth of Soil Exploration, Parameters for The Design of Foundation on Various Types of Soil, Introduction to Soil Structure Interaction.
- C. Review of IS Code Provisions: IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II).

Unit II: Design of Raft Foundations

[9 Hours]

- A. Types of Rafts, Relative Stiffness Considering: Superstructure-Foundation-Soil System, Soil-Structure Interaction Approach, Raft on Clayey and Sandy Soils.
- B. Review of IS Code Provisions: Is 2950 (Part-I).
- C. Design of Flat Slab Raft Foundation (Rigid Method/Elastic Line Method).

Unit III: Machine Foundation

[9 Hours]

- A. Introduction, Machine Vibrations, Vibration Characteristics, Design Consideration for Machine Foundations.
- B. Review of Is Code Provisions: Is 2974 (Part-II, III & IV).



MSE24111- Finite Element Method

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 4 hrs/week	TH:4	Activity- 20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Prerequisite: Engineering Mathematics, Structural Analysis, Numerical Methods.

Course Objectives:

1. To understand and apply variational methods for structural analysis using different approximation techniques.
2. To analyze two-dimensional finite element problems using standard element types and modeling techniques.
3. To understand and apply shape functions for various finite element types and dimensions.
4. To understand and apply isoparametric mapping concepts for two- and three-dimensional finite elements.
5. To analyze thin plate bending elements using different triangular and rectangular finite element types.
6. To understand and apply finite element methods for axisymmetric and shell structures.

Course Outcomes:

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

1. Formulate stiffness matrices and solve structural problems using variational methods.
2. Solve plane stress/strain problems and formulate stiffness matrices for two-dimensional elements.
3. Formulate stiffness matrices using shape functions for one, two, and three-dimensional elements.
4. Formulate isoparametric elements and use the Jacobian matrix in finite element analysis.
5. Evaluate bending behavior of plates using ACM, BFS, and node elements.
6. Analyze stress-strain relations in axisymmetric and shell elements using appropriate finite element techniques.

UNIT-I Variational Methods in Structural Analysis

[9 Hours]

Background on variational calculus, Galerkin method, collocation method, least squares methods, Variational methods of approximation, Rayleigh-Ritz method, Variational theorem, principle of minimum potential energy, use of polynomial displacement function, variational approach for formulation of element stiffness matrix for truss and beam elements, Strong and Weak formulation.



UNIT-II Two-Dimensional Finite Element Analysis

[9 Hours]

Two dimensional elements in plane stress / plane strain problems. CST, LST and rectangular elements, modelling considerations, aspect ratio, use of polynomial displacement functions, Pascal's triangle. Requirements for convergence, geometric invariance, grid refinement. Standard stiffness and load vector formulation procedures using variational principle. Condensation of internal degrees of freedom-Summary of analysis procedure.

Unit III Shape Functions and Elements

[9 Hours]

Shape functions in Cartesian and natural coordinate systems, shape functions for one, two and three dimensional elements. Higher order elements- Lagrange –Serendipity – Interpolation-formulation of element stiffness.

Unit IV Isoparametric Elements and Mapping

[9 Hours]

Concept of isoperimetric elements and isoparametric mapping, Jacobian matrix, formulation of two dimensional quadrilateral isoparametric element in plane elasticity problem, 3-D isoperimetric elements.

Unit V Thin Plate Bending Elements

[8 Hours]

Thin Plate bending elements, various triangular and rectangular elements, ACM (Adini, Clough, Melosh) and BFS (Bogner, Fox, Schimdt) elements. Conforming and nonconforming elements, the concept of four noded and eight noded.

Unit VI Axisymmetric and Shell Elements

[8 Hours]

Axisymmetric elements in axisymmetric problems, stress strain relations, triangular and Quadrilateral elements. Flat and curved shell element, elements for cylindered shells, curved solid elements.

Books & Other Resources:


1. J. N. Reddy, An Introduction to the finite element method, Tata McGraw Hill Publishing Co. Ltd.
2. C. S. Krishnamoorthy, Finite Element Analysis: Theory & Programming, Tata McGraw Hill Publishing Co. Ltd.
3. Zienkiewicz & Taylor, The Finite Element Method 4th Edition: Vol. I & II – McGraw Hill International Edition
4. G. R. Buchanan, Finite Element Analysis Schaum's outlines, Tata McGraw Hill Publishing Co. Ltd.
5. Daryl L. Logan, A First Course in Finite Element Method, Cengage Learning



6. S. S. Bhavikatti, Finite Element Analysis – New Age International Publishers, Delhi
7. S. S. Rao, The Finite Element Method in Engineering 4th Edition – Elsevier Publication.

Activity:

1. Analyse Thin plate elements using FEM analysis.
2. Solve two dimensional elements in plane stress / plane strain problems using FEM.


Dr. D. D. Ahiwale.



MSE23112- Theory of Plates & Shells

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Prerequisite: Engineering Mathematics, Structural Analysis.

Course Objectives:

Objectives of a "Theory of Plates and Shells" course are to equip students with the knowledge and skills to analyze and design thin-walled structures, including plates and shells, by understanding their structural behavior under various loads and conditions.

Course Outcomes:

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

1. Understand the simple bending of plates and different boundary conditions for plates.
2. Understand the different theories associated with plate analysis.
3. Derive equations for circular plates and different boundary conditions for circular plates.
4. Understand different types of shells and analyse deformation theories of shells.
5. Design various types of shells structures, pipes and pressure vessels.
6. Analyse different methods of analysis and applications of shells.

Unit I Introduction: Theory of plates**[9 Hours]**

Introduction: Thin and thick plates, small and large deflections, small deflection theory of thin plates: assumptions, moment curvature relations, stress resultants, governing differential equation in Cartesian co-ordinates, various boundary conditions, pure bending of plates. Analysis of rectangular plates: Navier solution for plates with all edges simply supported, distributed loads, point loads and rectangular patch load.

Unit II Levy's Method:**[9 Hours]**

Levy's Method: Distributed load and line load, plates under distributed edge moments. Raleigh- Ritz approach for simple cases in rectangular plates. Introduction to shear deformation theories, Reissener - Mindlin theory, moment curvature relationship for First order shear deformation theory.

Unit III Circular Plates:**[9 Hours]**

Circular Plates: Analysis of circular plates under axi-symmetric loading, moment curvature relations, governing differential equation in polar co-ordinates. Simply supported and fixed edges, distributed load, ring load, a plate with a central hole.



Unit IV Introductions: Theory of Shells**[9 Hours]**

Introduction: Classification of shells on geometry, thin shell theory, equations to shell surfaces, stress resultants, stress- displacement relations, compatibility and equilibrium equations. Shells of revolution: Membrane theory, equilibrium equations, strain displacement relations, boundary conditions, cylindrical, conical and spherical shells.

Unit V Circular cylindrical shells**[8 Hours]**

Circular cylindrical shells: Membrane theory: Equilibrium equations, strain displacement relations, boundary conditions. Bending Theory: Equilibrium equation, strain displacement relations, governing differential equation, solution for a simply supported cylindrical shell, various boundary conditions and application to pipes and pressure vessels.

Unit VI Beam theory of cylindrical shells**[8 Hours]**

Beam theory of cylindrical shells: Principles of Lundgren's beam theory, beam analysis, arch analysis, and application to cylindrical roof shells.

Books & Other Resources:

1. S. Timoshenko and W. Krieger, Theory of Plates and Shells, Mc Graw Hill.
2. Ansel C. Ugural, Stresses in Plates and Shells, Mc Graw Hill.
3. G. S Ramaswamy, Design and Construction of Concrete Shell Roofs, CBS Publications.
4. Chandrashekhara K., Analysis of Concrete Shells, New Age International Edition.
5. Chandrashekhara K., Analysis of Plates, New Age International Edition.

Activity:

1. Analyse thick plate using FEM software.
2. Analyse circular cylindrical shells using FEM software.



R. R. Khortode

MSE23113- Advanced Design of Concrete Structures

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Prerequisite:

1. Fundamentals of RC design.

Course Objectives:

1. This course is designed to provide understanding of various IS code provisions, fundamentals and advanced RC design and its applications for design of various RC structures
2. Students should be able to understand design of various advanced RC structures and its arrangements.

Course Outcomes:

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

1. Analyzed and design of various types of slab.
2. Analyzed and design of grid slab.
3. Analyzed and design of flat slab.
4. Analyzed and design of Elevated Service Reservoir.
5. Analyzed and design of Bunkers, and Silos.
6. Analyzed and design raft and pile foundation.

[9 Hours]

Unit I:

Yield line theory for analysis of slabs, various patterns of yield lines, assumptions in yield line theory, characteristics of yield lines, equilibrium and virtual work method of analysis. Design of various slabs such as rectangular, triangular, circular with various edge conditions using yield line theory, Design for limit state of strength and serviceability of ortho-tropically reinforced slabs.

[9 Hours]

Unit II:

Grid and coffered slabs, general features, rigorous and approximate method of analysis, design of grid floor by approximate method.

[9 Hours]

Unit III:

Flat slabs, types, design methods, column and middle strip, proportioning of flat slab element, total design moment, distribution of moments, effect of pattern loading, design for shear, design of intermediate and end panel by direct method only.

[9 Hours]

Unit IV:

Elevated service reservoir: Rectangular and circular type only flat bottom, Design of staging for wind and earthquake forces.



Unit V:**[8 Hours]**

Design of bunkers, and Silos, square and circular bunkers. silos shallow and deep beams.

Unit VI:**[8 Hours]**

Design of raft foundations, pile foundations, single pile, group of piles, Pile cap, design of form work for slabs, girders and, columns.

References

1. Advance R. C. C. Design, S. S. Bhavikatti, New Age International Publishers
2. B.C. Punmia, Ashok K. Jain, Arun K. Jain, Reinforced Concrete Structures Vol. II, Laxmi Publications, New Delhi
3. N. C. Sinha, S.K. Roy, Fundamentals of Reinforced Concrete, S. Chand & Co. Ltd, New Delhi
4. P. C. Varghese, Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., New Delhi
5. Dr .H.J.Shah, Reinforced Concrete design, Charotar publishing house
6. Design of R. C. C, S. Ramaamruthum, Dhanpat Rai publications
7. IS: 456-2000, Indian Standard code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
8. IS: 1893:-2017, Indian Standard Code of practice for criteria for Earthquake resistant design of Structures, Bureau of Indian Standards, New Delhi.
9. IS: 3370, Indian Standard code of practice for concrete structures for storage of liquids, Bureau of Indian Standards, New Delhi

Activity:

1. Analysis and design of any two structures from the syllabus using any finite element software.
2. Design of RC building using any finite element software. Submission and presentation of the design report is desirable.



Dr. S. G. Mohkhade

Program Elective-1
MSE23114-A- Design of Pre-Engineered Buildings

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures:4 hrs/week	TH:4	Activity- 20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Limit State Design of steel structures.

Course Objective: To understand fabrication aspects, inculcate analytical and design aptitude and be able to prepare fabrication drawing and detailing of Pre-Engineered Buildings.

Course Outcome: On completion of the course, student will be able to—

- 1: Understand fabrication aspects of pre-engineered buildings.
- 2: Analyze strategies of pre-engineered steel buildings.
- 3: Understand Code provisions of pre-engineered buildings.
- 4: Design strategies of pre-engineered steel buildings.
- 5: Optimize design to have the optimum cost of material.
- 6: Produce fabrication drawings of pre-engineered building components.

UNIT I: Introduction to pre-engineered buildings

[9 Hours]

History Concept, Difference between Conventional Steel Buildings and Pre-Engineered buildings, components of pre-engineered buildings, material and connections used for manufacturing of PEB, Advantages of PEB, Applications of PEB, Pre-Engineered Building Components.

UNIT II: Analysis of the Pre-Engineered Buildings

[9 Hours]

Plastic analysis, Analysis for wind load, Seismic analysis.

UNIT III: Code stipulations

[9 Hours]

Code Provisions: AISC, AISI, MBMA, ANSI, ASCE, UBC, and IS codes, Designed for stability, flexure, shear and deflections.

UNIT IV: Design of components

[9 Hours]

Design of primary frame, Gable end framing, Secondary framing, and Bracing systems.

UNIT V: Design optimization

[8 Hours]

Iterative design procedure to arrive at optimum section sizes.

UNIT VI: Fabrication drawings and detailing

[8 Hours]

Components of fabrication drawings, Fabrication details of various components of the pre-



engineered buildings.

Books and Other Resources:

1. A Newman, Metal Building Systems Design and Specifications, McGraw-Hill publication, ISBN 978-0-07-177664-6
2. N Subramanian, Design of Steel Structures, OUP India publication, ISBN 978-0-19- 567681
3. K. S. Vivek and P. Vaishnavi, Pre-Engineered Steel Buildings, Lambert Academic Publishing
Supplementary Reading: <http://nptel.ac.in/courses/105106113/3>.

Activity:

1. Design Pre-engineered building using STADD –PRO software.
2. Site visits: Report based on 2 site visits to Pre-engineered buildings.

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Program Elective1
MSE23114-B- Structural Stability

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures:4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Types of conventional material, elastic properties of materials, effect of force systems on structural members.

Course Objective: It is a course based on fundamental mechanics of structural members that is designed to give the theoretical background to the more practical design-based module.

Course Outcome: On completion of the course, student will be able to–

- 1: Identify the stability and instability for structures
- 2: Apply finite element approach for stability analysis
- 3: Apply differential equation to analyze the beam-column joints
- 4: Determine the buckling loads for optimization of stability
- 5: Apply energy methods for thin plate problems and beam-column members
- 6: Analyze the stability of beam-column members

Unit I:

[9 Hours]

Fundamental concepts, elastic structural stability, structural instability, analytical methods for the stability analysis, equilibrium, imperfections and energy methods.

Unit II:

[9 Hours]

Elastic buckling of columns, assumptions, critical load for various boundary conditions, columns with geometric imperfection, large deflection theory of columns, Southwell plot, Orthogonality of buckling modes, eccentrically loaded columns, numerical techniques – Finite difference and Finite element approach.

Unit III:

[9 Hours]

Elastic buckling of beam-column, differential equations of beam-column, beam-column with concentrated point load, several point loads, continuous lateral load, single couple, uniformly distributed load, end couples.



Unit IV:**[9 Hours]**

Elastic buckling of frames, triangular, partial, multistory portal, and box frames with symmetric & and symmetric buckling, stiffness method approaches, approximate method, buckling of open sections, and torsional buckling.

Unit V:**[8 Hours]**

Elastic buckling of thin plates, equilibrium approach, rectangular plate with axial load in one and two directions, various boundary conditions, Energy methods-Rayleigh-Ritz and Galerkin, large deformation theory of plates and effective width concept, post-buckling the behavior of plates.

Unit VI:**[8 Hours]**

Structural Design for stability of Members, Lateral torsional buckling of beams, lateral torsional buckling of cantilever and S.S. beams, stability design of beam-column member.

References

1. Timoshenko S. P. and Gere J. M., Theory of Elastic Stability, Mc Graw Hill, Singapore.
2. George Gerard, Introduction to Structural Stability Theory, Mc Graw Hill, New York.

Activity:

1. Power point presentation on structural stability and instability for any one of the structural member or structure. (10 Marks)
2. Preparation of model for structural member or any structure to demonstrate the stability and instability. (10 Marks)



A handwritten signature in blue ink, appearing to read 'Mr. G. H. Navale'.

(Mr. G. H. Navale)

C. Design of Foundations for Rotary Machines / Impact Machine.

Unit IV: Pile Foundation

[9 Hours]

A. Function and Classification of Piles, Static Point and Skin Resistance Capacity of a Pile, Negative Skin Friction, Vertically and Laterally Loaded Piles, Pile Settlements.

B. Pile Cap, Pile Group, Efficiency of Piles in a Group.

C. Review of IS Code Provisions: IS 2911 (All Related Parts).

Unit V: Design of Drilled Shaft (Caissons/Well) Foundations -

[8 Hours]

A. Drilled Shafts (Caissons/Well) Foundations: Introduction, Types, and Applications of Drilled Shafts, Construction Procedures – Dry, Wet and Casing Methods of Construction.

B. Soil-Structure Interaction Considerations, Design Considerations Under Axial and Lateral Forces, ASD/LRFD Method of Design-General Principles and Steps.

Unit VI: Case Studies and Failures of Foundations -

[8 Hours]

a. Review of Case Studies of Shallow and Deep Foundations.

b. Review of Failures of Shallow and Deep Foundations.

References:

1. Kurain N.P, Modern Foundations: Introduction to Advance Techniques: Tata McGraw Hill, 1982
2. Kurain N. P, Design of foundation systems Principles and Practice, Narosa Publishing house, New Delhi, 2005.
3. Nayak N. V., Foundation Design Manual, Dhanpat Rai and Sons, Delhi.
4. Shah H. J., Reinforced Concrete, Vol II, Charotar Publishing House.
5. Winterkorn H.F. and Fang H.Y. Ed., Foundation Engineering Hand Book, Van-Nostrand Reynold, 1975
6. Bowles J. E., Foundation Analysis and Design (4th Ed.), Mc. Graw –Hill, NY, 1996
7. Poulos H. G. and Davis E. H., Pile foundation Analysis and Design, John-Wiley Sons, New York, 1980.
8. Leonards G. Ed., Foundation Engineering, Mc. Graw-Hill, NY, 1962
9. Shamsheer Prakash, Soil Dynamics, McGraw Hill
10. Sreenivasulu & Varadarajan, Handbook of Machine Foundations, Tata McGraw Hill
11. O'Neil, M.W. and Reese, L.C. —Drilled Shafts: Construction Procedures and Design Methods, FHWA Publication No. FHWA-IF-99-025, Federal Highway Administration, Washington, D.C., USA, 1999.
12. P. C. Varghese, —Design of Reinforced Concrete Foundations, PHI Learning Pvt. Ltd.,



New Delhi, 2009.

13. IS 1892, IS 1904, IS 6403, IS 8009 (Part-I & II); IS 2950 (Part-I); IS 2974 (Part-II, III & IV); IS 2911 (all related parts).

Activity:

1. Soil Mechanics V Lab- 5 Practical
2. Site Visit and Report Writing

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Program Elective-I

MSE23114-D- Retrofitting and Strengthening of R C Structure

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures:4 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites:

Basics structural analysis, basics of mathematics, matrix method of analysis.

Course Objective:

The Objective of this course is to improve the strength, ductility and stiffness of the structure.

Course Outcome:

On completion of the course, student will be able to–

- 1: Analyze need for repair and rehabilitations.
- 2: Apply NDT methods on the structure.
- 3: Apply various method for repairing of the structure.
- 4: Identify design methods for strengthening of the structure.
- 5: Identify design methods for strengthening of the structure for FRP.
- 6: Execute quality control construction.

Unit I:

[9 Hours]

Introduction: Needs for repair and rehabilitation of R C structure, degradation of reinforced concrete structure, major causes and signs, deterioration of concrete structures, causes of deterioration, cracking type, causes, and characteristics.

Unit II:

[9 Hours]

Evaluation of concrete structures: Conditional evaluation- definition, objectives and stages of conditional assessment, preliminary investigation scope, methodology, and output, detailed investigation-scope and methodology, In situ and laboratory testing such as non-destructive, semi-destructive, corrosion test, chemical test, and NDT for cracks, flaws, and voids in concrete.

Unit III:

[9 Hours]

Repair system, material, and techniques: Repair methodology, compatibility of repair material and concrete, material for the repair-cement base, polymer modified, resin base, micro concrete and composite, repair techniques.



Unit IV:**[9 Hours]**

Retrofitting and strengthening of concrete structures: Design philosophy of strengthening; strengthening technique-section enlargement, composite construction, post-tensioning, stress reduction, strengthening by reinforcement, and strength by FRP.

Unit V:**[8 Hours]**

Strengthening of R C members: Strengthening of beams: flexural and shear, slab, columns, footings, and seismic retrofitting of R C structures using FRP.

Unit VI:**[8 Hours]**

Quality control in concrete construction, maintenance, water leakage detection and mitigation, fire damage detection and reparation, corrosion detection and mitigation, demolition of concrete structures and structural health monitoring.

References:

1. Concrete Repair and Maintenance, P. H. Emmons and G M Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation – Compilation from Indian Concrete Journals.
3. Management of Deteriorating Concrete Structures, George Somerville, Taylor and Francis, Publication.
4. Concrete Building Pathology, Susan Macdonald, Blackwell Publishing
5. Durability of Cement and Cement Composites, C. L. Page, M M Page, Wood Head, Publishing.
6. ACI 440.2R-08, Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures, American Concrete Institute.
7. Xilin lu (2010), Retrofitting design of building structures, Science Press, New York.
8. Strengthening and Rehabilitation of Civil Infrastructures Using Fibre-reinforced Polymer. (FRP) Composites, L. C. Hollaway and J.G. Teng, Woodhead Publishing Series in Civil and Structural Engineering.
9. Maintenance, Repair & Rehabilitation & Minor Works of Building, by P C Varghese, PHI.

Activity:

1. V Lab- 2 Experiments
2. Site Visit for structural audit and preparation of report for the same. (Visualization)

Dr. S. B. B. B. B.



MSE23116-Environmental Studies

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs./week	TH:2	Activity-30 Marks
		Oral -30 Marks

Course objectives: The Objective of this course is to impart knowledge of environment and ecosystems. It also creates awareness among the students about conservations of the resources, pollutions and different environmental acts.

Course Outcomes: After completion of this course, students must able to,

1. Understand importance of environment and natural resources.
2. Study different ecosystems and prepare a detailed report.
3. Identify the causes of pollution and suggest remedial actions.
4. Address social issues and understand the various environmental acts.

Unit I: Introduction

Multidisciplinary nature of environmental studies:

[6 Hours]

Definition, scope, and importance, Need for public awareness.

Natural Resources:

Renewable and non-renewable resources, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.

Unit II: Ecosystems & Biodiversity

[6 Hours]

Concept of an ecosystem, Structure, and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure, and function of the various ecosystems. Biodiversity: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, India as a mega-diversity nation.

Unit III: Environmental Pollution

[7 Hours]

Definition, Cause, effects, and control measures of a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. nuclear hazards, Solid Waste Management, Pollution case studies.



Unit IV: Social Issues and the Environmental acts

[7 Hours]

Urban problems related to energy, Water conservation, rainwater harvesting, watershed management, Environmental ethics: Issues and possible solutions, Environment Protection Act. Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.

References:

1. Suman Gupta , 2024. Environmental studies, S. Chand publication.
2. Gadgil, M., & Guha, R. 1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
4. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
5. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.
6. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.

Activity:

Report writing of any two activities and Poster presentation of any one activity from the list given below,

- i) To record the biodiversity of the any visited area and write a report
- ii) Identify the Natural resources and ecosystems of your area and write a report
- iii) Identify the sources of pollutions in your area and write a report



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MSE23115-Laboratory Proficiency II

Teaching Scheme	Credit Scheme	Examination Scheme
Practical: 8hrs/week	PR:4	TW-50 Marks
		OR-50 Marks

1. A mini-project to be completed individually which shall be based on the analysis and design of a G + 10 stories building. The analysis shall be done using any commercially available software and the design of all structural members shall be done manually. The detailing shall be prepared using any commercially available drafting software.
2. Mini project on analysis of chimney, Water Tank, retaining wall, RCC Dam, and Industrial steel structure using ABAQUS software (Any one).
3. Site visits: Report based on three site visits.

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VP's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

(An Autonomous Institute)

Department of Civil Engineering

M. Tech- (Structural Engineering) [2023 pattern]

(with effect from A.Y. 2023-24)

Semester III

Semester III												
Course Code	Course	Teaching Scheme (Hrs./Week)		Activity	Examination Scheme and Marks						Credit Scheme	
		TH	PR		In-Sem	End-Sem	TW	PR	OR	Total	TH	PR
MSE23201	Analysis and Design of Earthquake-Resistant Structures	04		20	30	60				110	04	
MSE23202	Theory of Elasticity	04		20	30	60				110	04	
MSE23203	Program Elective II	04		20	30	60				110	04	
MSE23204	Dissertation Stage I		08				100		50	150		04
MHS23201	Constitution of India	02		10					25	35	02	
MRA23205	Industrial Management	02		10					25	35	02	
	Total	16	08	80	90	180	100		100	550	16	4
Total Credit											20	
Program Elective II												
MSE23203-A	Bridge Engineering				MSE23203-B			Design of Prestressed Concrete Structures				
MSE23203-C	Mechanics of Modern Materials				MSE23203-D			Ferrocete Technology				

VP's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

(An Autonomous Institute)

Department of Civil Engineering

M. Tech- (Structural Engineering) [2023 pattern]

(with effect from A.Y. 2023-24)

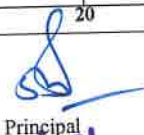
Semester IV

Course Code	Course	Teaching Scheme (Hrs./Week)		Activity	Examination Scheme and Marks						Credit Scheme	
		TH	PR		In-Sem	End-Sem	TW	PR	OR	Total	TH	PR
MSE23211	Seminar		04				50		50	100		02
MSE23212	Industry Internship / Inhouse research project		20				150		100	250		10
MSE23213	Dissertation Stage- II		16				100		100	200		08
	Total		40				350		250	550		20
Total Credit											20	


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**Vidya Pratishthan's
Kamalnayan Bajaj Institute of
Engineering & Technology, Baramati
Vidyanagari, Baramati-413133**



MSE23201- Analysis and Design of Earthquake Resistant Structures

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Prerequisite: Engineering Mechanics, Structural Design, Fundamentals of Structural Dynamics.

Course Objectives:

1. To understand the fundamentals of earthquake-resistant design and relevant IS code provisions.
2. To analyze structural behavior during earthquakes and identify earthquake-resistant features.
3. To understand seismic-resistant building architecture and effective lateral load-resisting systems.
4. To analyze ductility requirements for earthquake-resistant design of RCC buildings.
5. To design and detail a two-story RCC building for earthquake resistance.
6. To understand the principles and design considerations for base isolation in structures.

Course Outcomes:

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

1. Explain earthquake-resistant design principles and apply code requirements effectively.
2. Evaluate structural performance and apply earthquake-resistant design principles.
3. Assess and design structures with optimal seismic-resistant architectural features.
4. Evaluate and apply ductility provisions in RCC structures as per IS 13920.
5. Design and detail RCC building components using seismic analysis methods.
6. Analyze and apply base isolation techniques for improved seismic performance.

UNIT I Design Philosophy:

[9 Hours]

Philosophy of Earthquake Resistant Design, Earthquake Proof v/s Earthquake Resistant Design, Four Virtues of Earthquake Resistant structures (Strength, Stiffness, Ductility, and Configuration), Seismic Structural Configuration, Introduction to IS: 1893 (Part I), IS: 875 (Part V), and IS Code Provisions.



UNIT II Behavior of Structures During Earthquake and Earthquake Resistant Features of Structure: [9 Hours]

Inertia forces in structures, Behavior of Brick and stone Masonry Structures: Behavior of Brick and stone Masonry Walls, Box Action, Different types of Bands, Earthquake Resistant Features of Stone Masonry Structures. Behavior of RC Structures: Load Transfer Path, Strength Hierarchy, Reversal of Stresses, Importance of Beam Column Joints, Importance of Stiffness and Ductility (Capacity Design Concept) in Structures, Effect of Short Column, Effect of Soft Storey, Improper Detailing, Effect of Masonry Infill Walls, Effect of Eccentricity.

UNIT-III Seismic-resistant building architecture [9 Hours]

Introduction; Lateral load resisting systems- moment resisting frame, building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity /redundancy, non-structural elements.

UNIT-IV Ductility considerations in earthquake resistant design of RCC buildings

[9 Hours]

Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920.

UNIT V Earthquake-resistant design of a long two-story, two-bay RCC building: [8 Hours]

Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of an exterior joint as per IS13920.

UNIT VI Base isolation of structures:

[8 Hours]

Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; Seismic isolation design principle; Feasibility of seismic isolation; Seismic-isolation configurations.

List of Reference Books:

1. Earthquake-Resistant Design of Building Structures, by Vinod Hosur.
2. Earthquake Design Practice for Buildings, by Damian Grant.
3. Earthquake Resistant Design of Structures, by Pankaj Agarwal and Manish Shrikhande.



Activity: Perform any two of the following activities

1. Conduct a seismic analysis of a multi-storey building using the equivalent static method with commercial finite element software. Prepare and present an analysis report for submission.
2. Conduct a seismic analysis of a multi-storey building using the response spectrum method with commercial finite element software. Prepare and present an analysis report for submission.
3. Visit an earthquake-resistant designed structure and prepare a report detailing the design of typical flexural members, columns, footings, and exterior joints according to IS 13920.

Amo

Dr. D. D. Ahiwale.



MSE23202- Theory of Elasticity

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Basics of stress and strain, deflection of body under various load, boundary conditions, shear force and bending moment diagram

Course Objective: The Objective of this course is to impart knowledge of theory of elasticity to analyze civil engineering problems with parameters such as geometry, material properties and boundary conditions.

Course Outcome: On completion of the course, student will be able to–

1. Analyze stress strain in Cartesian coordinate system and to apply equilibrium and compatibility conditions.
2. Comprehend the boundary value problems (2D and 3D) in Cartesian Coordinate System.
3. Apply the boundary conditions in Polar Coordinate System.
4. Utilize the concept of failure criteria for effect of stress concentration due to circular hole in a stressed plate.
5. Apply the state of stress and strains for plates.
6. Quantify the practice problems related to rectangular plates.

Course Contents**UNIT-I Analysis of Stresses and Strain****[9 Hours]**

Concept of stress at a point, stress tensor, stress on inclined plane, stress components on a Rectangular parallel piped in Cartesian coordinate system, derivation of stress equilibrium equations, transformation of stresses, stress invariants. The state of strain at a point, strain displacement relations, strain compatibility condition and stress compatibility conditions. Hands on Self-pressure test, Drawing Sketches, Demonstrations.

UNIT-II Analysis of Stresses and Strain**[9 Hours]**

Relations between Elastic Constants, Problems on Navier Lamé's Equilibrium Equations, Problems on Beltrami-Michell compatibility equations, Boundary value problems in Elasticity. Generalized Hook's law for Isotropic, Orthotropic, plane stress, plane strain and axisymmetric problems, Problems in 2D and 3D Cartesian coordinate system, Airy's stress function, bending of beams. Hands on Drawing Sketches, Discussion based on technical video / documentaries, Failure case studies, Mini experiments.



UNIT-III Polar Coordinate System

[9 Hours]

Relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations, Stress-strain relationship, Strain-displacement relationship for plane stress and plane strain conditions. Hands on Drawing Sketches, Demonstrations, Model making.

UNIT-IV Stress Concentration Problems

[9 Hours]

Stress concentration problems such as stress concentration due to circular hole in stressed plate (Kirsch's Problem), failure criterion- von mises. Hands on Discussion based on technical video/documentaries, Drawing Sketches, Failure case studies, Mini experiments.

UNIT-V Plates

[8 Hours]

Introduction: Thin and thick plates, small and large deflections. Small deflection theory of thin plates: Assumptions, Moment Curvature relations. Stress resultants. Governing differential equation in Cartesian co-ordinates, various boundary conditions. Pure bending of Plates. Hands on Discussion based on technical video / documentaries, Drawing Sketches, Application Case studies.

UNIT-VI Analysis of Rectangular Plate

[8 Hours]

Analysis of Rectangular Plates: Navier solution for plates with all edges simply supported. Hands on Discussion based on technical video / documentaries, Application Case studies, Mini experiments

Books & Other Resources:

Reference Books:

1. Timoshenko and Goodier, "Theory of Elasticity", McGraw-Hill Publications.
2. C. Wang, "Applied Elasticity", Dover Publications.
3. Enrico Volterra and J. H. Gaines, "Advanced Strength of Materials", Prentice Hall.
4. S. M. Akazimi, "Solid Mechanics", Tata McGraw-Hill Publications.

Activity:

1. Power point presentation on application of state of stress for any one of the structural member or structure. (10 Marks)
2. Drawing Mohr's circle on quarter sheet to demonstrate for variable stress-strain conditions. (10 Marks)


(Dr. G. N. Narule)



Program Elective-II
MSE23203-A- Bridge Engineering

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: IRC provisions for bridges, loading standards, IS Codes, Different Loadings, Types of foundations.

Course Objective: To design concrete bridge components and provide cost-effective solutions for bridge construction.

Course Outcome: On completion of the course, student will be able to–

- 1: Determine the economic span for bridges as per site condition and IS standards.
- 2: Analysis and design of deck slabs using different methods.
- 3: Design of T-beam deck slab and girders.
- 4: Analysis and design of rigid frame bridges.
- 5: Design of abutments and piers.
- 6: Design of bearings for RC bridges.

Course Contents

UNIT-I Introduction

[9 Hours]

Classification of concrete bridges, components of bridge and related structures, economic spans. Factors affecting the selection of site, hydrological data, waterway, scour depth. IRC provisions, loading standards.

UNIT-II Analysis of deck Slab

[9 Hours]

Load distribution on deck slabs, isotropic plate, grillage analysis, distribution of loads to longitudinal girders, Little-Morrice-Rowe method, Courbon's method, Guy on Massenet method and Hendry Jaegar method, Design of slab and box culverts for highway loadings.

UNIT-III Design of deck slab & girders

[9 Hours]

Design of T-beam deck slab bridge: design of RC deck slab, design of post-tensioned longitudinal girder and cross girders.

UNIT-IV Design of rigid frame bridges

[9 Hours]

Analysis and design of rigid frame bridges.

UNIT-V Design of abutments & piers

[8 Hours]

Types of abutments, piers, loads acting on pier and abutments, design of abutments, piers.

UNIT-VI Design of bearings

[8 Hours]

Functions of bearings, types, design of elastomeric bearings, design of PTFE-pot bearings.



Books & Other Resources:**Reference Books:**

1. Timoshenko and Goodier, Theory of Elasticity, McGraw-Hill Publications.
2. C. Wang, Applied Elasticity, Dover Publications.
3. Enrico Volterra and J. H. Gaines, Advanced Strength of Materials, Prentice Hall.
4. S. M. Akazimi, Solid Mechanics, Tata McGraw-Hill Publications.

Activity:

1. Power point presentation on working of the bearings/ calculation of economic span of any one of the type of bridges as per site data. (10 Marks)
2. Preparation of model of any RC bridge to demonstrate the various components of bridge. (10 Marks)




(G. N. Nandale)

Program Elective-II
MSE23203-B- Design of Prestressed Concrete structures

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity: 20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Behavior of prestressed concrete, methods of prestressing, loss and stress calculation in prestressed members

Course Objective: To analyse the behaviour of different prestressed concrete element, enable to detail different prestressed concrete elements and composite sections

Course Outcome: On completion of the course, student will be able to—

1. Analyze and design of pre tensioned flexural members.
2. Analyze and design of post tensioned flexural member.
3. Analyze and design of post tensioned slab.
4. Design composite sections.
5. Analyze and design of statically indeterminate prestressed members like continuous beam and frame.
6. Analyze and design of prestressed pipes and circular tanks.

Course Contents

UNIT-I Pre-tensioned Flexural members

[09 Hours]

Design of Pre-tensioned Flexural members: Design of pole, sleepers, pipes, cylinders and lintels.

UNIT-II Post tensioned Flexural members

[09 Hours]

Design of Post tensioned Flexural members: Design Tee, I and box section girders

UNIT-III Post tensioned Prestressed Concrete Slabs

[09 Hours]

Design of Post tensioned Prestressed Concrete Slabs: Introduction, Design of one way, two way and flat slabs.

UNIT-IV Composite Beams

[09 Hours]

Composite Beams: Composite sections of Prestressed concrete beam and cast in-situ RC slab
 Analysis of stress, Differential shrinkage, Deflections, Flexural and Shear strength of composite sections, Design of composite sections.



UNIT-V Statically Indeterminate Structures

[08 Hours]

Statically Indeterminate Structures: Analysis and Design of continuous beams and Frames including choice of cable profile, linear transformations, concordance of cable and shift calculations.

UNIT-VI Prestressed Concrete Pipes and Tanks

[08 Hours]

Prestressed Concrete Pipes and Tanks: Circular prestressing, types of Prestressed concrete pipes. Prestressed Concrete tanks: General features, Analysis and design of circular tanks.


Books & Other Resources:

Reference Books:

1. N. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill Publication Co.
2. B. C. Punmia, A. K. Jain and Arun K. Jain, "Reinforced Concrete Structures Vol. II", Laxmi Publications, New Delhi.
3. T. Y. Lin & N. H. Burns, "Design of Prestressed Concrete Structures", John Wiley.
4. E. G. Nawy, "Prestressed Concrete- A Fundamental Approach", Practice Hall International

Activity:

1. Visit to prestressed concrete pipes industry and prepare a report.
2. Design and analyse prestressed concrete slab using software.


Dr C. B. Nayak



Program Elective-II
MSE23203-C- Mechanics of Modern Materials

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Types of conventional material, elastic properties of materials

Course Objective: To have an overview of Material Science and Engineering as a basis for understanding how structure/property/processing relationships are developed and used for different types of materials. Illustrates the role of materials in modern society of advances in new materials and processes to apply them for advanced manufacturing processing for various structural engineering applications.

Course Outcome: Course Outcome: On completion of the course, student will be able to–

- 1.Explain classification and applications of modern materials.
- 2.Understand the engineering properties of modern materials
- 3.Determine the failure theories.
- 4.Identify the behavior of Composite Laminates.
- 5.Analyze and design of Composite Structures.
- 6.Experimental analysis of various modern materials.

Course Contents

UNIT-I Introduction to Modern Materials

[9 Hours]

Fiber-Reinforced Polymer Composite (FRPC) Materials: definition, historical development, applications. Fibers and Matrix: types and their properties, manufacturing process and methods for composites. Types and classification of composite materials, properties, and advantages over conventional materials. Piezoelectric Materials: History, crystal structure, applications. Shape Memory Alloys (SMA), Functionally Graded Materials (FGM): definition and applications.

UNIT-II Engineering Properties of Modern Materials

[9 Hours]

FRPC Composite Lamina: Micromechanics approach, methods. Longitudinal and transverse elastic properties of composite lamina, in- plane shear modulus for continuous fibres. Stress-strain relationship, compliance and stiffness matrices for generally anisotropic, especially orthotropic material, transversely isotropic material, orthotropic, isotropic materials, Plane stress condition for thin lamina, transformation of stress and elastic properties. Three dimensional



transformations. Stiffness matrix for Functionally Graded Materials.

UNIT-III Strength of Composite Lamina

[9 Hours]

Introduction. Failure theories, Maximum stress theory, Maximum strain theory, Energy based interaction theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu), Failure mode-based theory (Hasin-Rotem). Computation of lamina strength by Tsai-Wu theory for plane stress condition. Comparison of various failure theories.

UNIT-IV Elastic behaviour of Composite Laminate

[9 Hours]

Basic assumptions, Laminate configurations, Strain-displacement relationship, Stress-strain relationship, Force and moment resultants, Laminate Compliances and stiffness matrices, Transformation of matrices. Load deformation relationship for symmetric laminates, symmetric crossply, symmetric angle-ply, balanced, anti-symmetric cross-ply and angle ply, orthotropic, quasiisotropic laminates.

UNIT-V Design of Composite Structures

[8 Hours]

Coefficients of thermal and moisture expansion of various unidirectional lamina, load deformation relationship, residual stresses for cross ply symmetric laminates. Design methodology, design of pressure vessel for various laminate configurations

UNIT-VI Experimental Methods of Testing of Composite Materials

[8 Hours]

Characterization of constituent materials, fibre, matrix, thermal fibre, interface/interphase characterization, Fibre volume ratio, void volume ratio. Determination of hydrothermal expansion coefficients, tensile, compressive and shear properties of unidirectional laminates. Testing of inter laminar fracture toughness, Biaxial testing, Introduction to stress concentration in laminates.

Books & Other Resources:

- 1: I. M. Daniel and O. Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press, Second Edition, New Delhi.
- 2: M. W. Hyer, "Stress Analysis of Fiber-Reinforced Composite Materials", WCB/McGrawHill, Singapore.
- 3: R. M. Jones, "Mechanics of Composite Materials", McGraw-Hill, New York.
- 4: R. F. Gibbson, "Mechanics of Fiber Reinforced composites". McGraw-Hill



Activity:

1. Analyse and design of composite structures using software.
2. Site visit to composite structure and write a report.




(Dr. G. N. Nandhe)

Program Elective-II
MSE23203-D- Ferrocure Technology

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 3 hrs/week	TH:4	Activity-20 Marks
		In-sem-30 Marks
		End-sem-60 Marks

Course Prerequisites: Basic properties of concrete ingredients, Analysis methods for structural members

Course Objective: To have an overview of Ferrocure material as a structural smart material for innovative constructions and infrastructural developments.

Course Outcome: On completion of the course, students will be able to—

1. Comprehend different types of Ferrocement concrete, its typical properties, and the proportion of mortar
2. Recognize the mechanical properties and different construction methods using ferrocement.
3. Design of structure based on form, shape, various structural forms and their behavior.
4. Design the houses with cavity walls, hollow floors, and hollow beams.
5. Apply the concept of ferrocement to various structural members.
6. Apply ferrocement in different space structures and precast products like shells, pyramids, domes etc.

Course Contents

UNIT-I Introduction of concrete in structure

[9 Hours]

Definition. Basic concept like bond increase. Comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement. Special types of ferrocement. Ferrocement as substitute for conventional building materials. Typical characteristics and their applications. Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants

UNIT-II Ferro cementing Method

[9 Hours]

Mechanical properties and typical features affecting design. Properties under static and dynamic loading. Shrinkage and creep. Testing of ferrocement. Experimenting the methods of constructing ferrocement structures. Standardizing method of construction. Planning the work. Fabricating skeleton, tying meshes and mortaring. Curing. Maintenance. Protective surface



treatments. Damage to ferrocement structures

UNIT-III Design methods for various Structure

[9 Hours]

Strength through shape. Design of structure based on form and shape. Forms in nature. Various structural forms and their behaviour. Typical strengths of different materials. Comparative study of various forms. Design of ferrocement structures. Design, analysis and optimization. Special design considerations for ferrocement. Typical features of ferrocement affecting design. Conventional design methods like working stress, load factor, applied to ferrocement. Design based on equivalent area method for compression, tension and flexural members. Specific surface method and crack control method, Design of structures subjected to membrane stresses. Design of shaped structures in ferrocement like stiffened plates, arch faced walls, stiffened cavity walls and hollow floors and beams.

UNIT-IV Cost Analysis

[9 Hours]

Cost analysis: Factors governing cost analysis. Special considerations for ferrocement structures. Cost comparison with conventional construction. Specifications for ferrocement structures. Quantity analysis of material and labour for ferrocement items. Cost and value of ferrocement construction. Ferrocement in building construction. Ferrocement in foundations, walls, floors roofs. Ferrocement single wall construction. Design and construction of houses with cavity walls, hollow floors and hollow beams. Staircases and other building accessories. Earthquake resisting structures. Special characteristics of ferrocement to resist shock loading. Design and construction of quake proof structures

UNIT-V Water and Soil retaining structure

[8 Hours]

Hydraulic structures. Why ferrocement? Water retaining structures. Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating. Soil retaining structures. Types of retaining walls and their comparison with ferrocement arch faced wall. Design and method of fabrication and casting. ferrocement counter fort retaining wall. Ferrocement containers for storing granular materials.

UNIT-VI Precast Ferrocement products

[8 Hours]

Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries. Precast ferrocement products: Why ferrocement for precasting? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.



Books & Other Resources:

- 1: B. N. Divekar, "Ferrocete Technology- A Construction Manual".
- 2: S. P. Shah and P. N. Balaguru "Concrete Technology and Design Vol. II".
- 3: Proceedings of International Symposiums on 'Ferrocement and thin reinforced composites. - Ferro 1 to Ferro 10. International Ferrocement Information Centre, A I T Bangkok, Thailand.
- 4: "Construction and Repairs of Ferrocement", ACI committee Report. No ACI549R- 88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA
- 5: B. R. Paul and R. P. Pama, "Ferrocement Authors", International Ferrocement Information Centre. A. I. T. Bangkok, Thailand.
- 6: A. E. Naaman, "Ferrocement and Laminated Cementitious Composite", Techno-press, Ann Arbor, Michigan, U S A. R7: "Ferrocement- Materials and applications", SP 61, A C I Detroit. U S A.

Activity:

1. Site visit to precast factory and write a report.
2. Write a report on cost analysis of Ferrocement product.


(Dr. N. Tsunawarshi)




MSE23205-Dissertation Stage I

Teaching Scheme	Credit Scheme	Examination Scheme
Practical: 8 hrs./week	PR:4	TW-100 Marks
		OR-100 Marks

Dissertation Stage-I is the integral part of the dissertation work. The dissertation work should be based on the knowledge acquired by the students during the coursework and should contribute to the needs of the society. The dissertation work aims to provide an opportunity of designing and building complete system or subsystems in an area where the students like to acquire specialized skills. The student shall submit the report (printed on both sides) of dissertation work completed partly in standard format approved by the department as per the following.

1. Introduction including aim and objective of the dissertation topic
2. Review of literature
3. Problem statement and methodology
4. Theoretical contents associated with the dissertation topic
5. Data collection from field or organization / experimental set-up developed if any / part analysis
6. Limitations of study / difficulties encountered if any
7. Progress achieved
8. Future plan of action
9. References

The candidate shall deliver a presentation as a part of the progress report of Dissertation Stage-I in front of panel of examine.


Jagade U.T.



MHS23201- Constitution of India

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs./week	TH:2	Activity-10 Marks
		Oral-25 Marks

Course Objectives:

- To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights as well as fundamental duties.
- To understand the functioning of Union, State and Local Governments in Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

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

1. Understand and explain the significance of Indian Constitution as the fundamental law of the land.
2. Utilize his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
3. Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail
4. Understand Electoral Process, Emergency provisions and Amendment procedure

Course Contents

UNIT-I Introduction to Constitution:

[6 Hours]

Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights. Directive principles of state policy and Fundamental duties.

UNIT-II Union Government:

[6 Hours]

Union Executive, Union Legislature and Union Judiciary-Supreme Court of India – composition and powers and functions.



UNIT-III State and Local Governments:

[7 Hours]

State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-PanchayatRaj system with special reference to 73rd and Urban Local Self Govt. with special reference to 74th Amendment.

UNIT-IV Election provisions

[7 Hours]

Election Commission of India- composition, powers, functions and electoral process. Types of emergency-grounds, procedure, duration, and effects. Amendment of the constitution- meaning, procedure, and limitations.

Textbooks:


1. M. V. Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication, 2005.
2. Durga Das Basu(DD Basu) , "Introduction to the constitution of India", (Student Edition), 19th edition, Prentice-Hall EEE, 2008.

Reference Book:

1. Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007.

Activity:

1. Poster presentation on election provisions in India.


Jagadale U.T.



MRA23205- Industrial Management

Teaching Scheme	Credit Scheme	Examination Scheme
Lectures: 2 hrs/week	TH:2	Activity-10 Marks
		Oral-25 Marks

Course Objectives:

- Engineering disciplines are expected to work during most of their career at middle level. They are also expected to deal with workforce and management problems.
- In the present era of competition, optimum utilization of the resources with achieving higher productivity is essential for any industry to survive. Quality and cost controls are also other important factors which contribute to the day to day supervision issues.

Course Outcome-On completion of the course students will be able

1. To interpret and acquire major management skills, familiarize with different leadership styles
2. To acquire knowledge of different types of plant layouts, Production modes, and PPC functions
3. To understand the need of Total Quality Management and appreciate the usage of TQM tools in quality control
4. To acquire the knowledge of different types of Plant maintenance and measures and procedures observed in industry toward safety

Course Contents

Unit I: Basics of Management

[6 Hours]

Management - Definition – Administration- Definition – Henry-Fayol's principles of management- Business Organization-Types- Proprietorship-Partnership- Joint stock- Cooperative Society-Advantages and disadvantages -Functions of Management.

Organization-Definition- types of organization –Line-Functional-Line &staff-advantages and disadvantages- Leadership -Types –Quality of good leader.



Motivation - Maslow's Theory of Motivation -Hierarchy of needs- Communication - Process of Communication – Barriers for effective communication.

Unit II: Production Management

[6 Hours]

Concept of project work - Project planning -Market survey- Project capacity-selection of site for project Plant layout-Types of Plant layout.

Product design-Stages in product design drawing-Specifications-Material requirement-operation-Planning-Production-definition-Job, Batch & Mass production with their advantages and disadvantages.

Productivity-definition factors to improve productivity- Production planning and Control (PPC)- definition-Functions of PPC- planning, routing, scheduling, dispatching and Inspection.

Unit III: Total quality management

[7 Hours]

Quality–Concept-Quality control- Definition - Factors affecting quality- Advantages of quality control –Inspection-Different types of inspection.

Total Quality Management-Meaning- Principles of total quality management-PDCA cycles Quality Circles-definition-Function.

TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S- Kaizen, and Six-sigma

Quality Certification Systems- ISO 9000 series quality standards.

Unit IV: Plant maintenance and industrial safety

[7 Hours]

Plant maintenance-Definition -Types of maintenance-Preventive maintenance- Break down maintenance-Advantages and disadvantages.

Total Productive Maintenance-Meaning benefits of TPM -Tools of TPM- planned maintenance and predictive maintenance.

Industrial safety –Meaning - Accident- causes for accident- Direct and indirect losses due to an accident-Personal protective device for prevention of accidents.

Safety department- role of safety officer – safety supervisor -safety committee – Fire prevention and Protection- Fire principles of fire extinguishing- various classes of fire- A, B, C, D types of fire extinguishers.



Text books and references

1. Industrial Organization and Engineering Economics T.R.Banga & S C Sharma Khanna.Publishers.
2. Industrial management and organizational behavior K.K.Ahuja.
3. Industrial management and engineering economics O.P.khanna Khanna publishers.
4. Production and operations management -Dr .K.Aswathappa and Dr.Sreedhar Bhatt Himalaya publishers.
5. Safety Management in Industry Krishnan.N V Jaico Publishing House, Bombay, 1997
6. Total Quality Management S Raja Ram, Shivashankar.

Activity:

1. Prepare a site visit report on industrial management tools.

~~Shr~~
Jagadale U.T.



MSE23211- Seminar

Teaching Scheme	Credit Scheme	Examination Scheme
Practical : 4 hrs/week	PR: 2	TW-50 Marks
		OR-50 Marks

Conduction guidelines:

1. This is a 2-credit course aimed at teaching 2nd year MTech students to make research presentations.
2. Each student has to choose a paper / topic related to Structural Engineering. It need not be related to the M. Tech project. Some suggestions are
 - a. A detailed literature review of a specific research problem. This can include: background related to the problem, categorization of approaches, specific approaches, etc.
 - b. One selected journal/TOP-tier conference paper published by others.
3. Each student is allotted EXACTLY 15 minutes for presentation; and 5 minutes for Q&A. Marks will be given based on content, organization, clarity of delivery and ability to answer questions.
4. A report must be submitted based on the content of the seminar duly signed by the guide and Head of Department.


Shruti
Jagdale U.T.



MSE23212-Industry Internship/ In-house Research Project

Teaching Scheme	Credit Scheme	Examination Scheme
Practical: 20 hrs/week	PR:10	TW-150 Marks
		OR-100 Marks

Conduction guidelines: Industry or research internship should include partial/ complete project implementation. Student should be allocated to the research guide in first semester itself and same guide should be continued for the: Industry Internship-/ In house Research Project. Otherwise the preferences/ choices of the domain should be taken from the students. The guide needs to be allocated based on the preference/ choices. The research project should be assigned to students. In case of Industry Internship, the assigned guide from college has to monitor and evaluate the progress of the student. The student has to exhibit the continuous progress through regular reporting and presentations and proper documentation. The continuous assessment of the progress needs to be documented unambiguously.


Jogadale U.T.



MSE23213-Dissertation Stage II

Teaching Scheme	Credit Scheme	Examination Scheme
Practical: 16 hrs/week	PR:08	TW-100 Marks
		OR-100 Marks

Guidelines:

In Dissertation Stage-II work, the student shall consolidate and complete the remaining part of the dissertation which will consist of the Selection of Technology, Installations, implementations, testing, results, measuring performance, discussions using data tables per parameter considered for the improvement with existing/ known algorithms/ systems, comparative analysis, validation of results and conclusions. The student shall prepare the duly certified final report of the Dissertation in standard format for satisfactory completion of the work by the concerned guide and head of the Department/ Institute. The students are expected to validate their study undertaken by publishing it at standard platforms. The investigations and findings need to be validated appropriately at standard platforms – conferences and/or scopus-indexed journal. The student has to exhibit continuous progress through regular reporting and presentations and proper documentation of the frequency of the activities in the sole discretion of the PG coordination. The continuous assessment of the progress needs to be documented unambiguously.

In Dissertation stage II work, the student shall complete the dissertation. The student shall prepare the final report of dissertation work in standard format duly certified for satisfactory completion of the work by the concerned guide and Head of the Department/Institute. The report shall consist of the following as applicable:

1. Introduction including the aim and objective of the dissertation topic
2. Review of literature
3. Problem statement
4. Theoretical contents associated with the dissertation topic
5. Methodology adopted
6. Data collection from field or organization / experimental setup preparation if any/analysis
7. Results and discussion
8. Validation of results if applicable
9. Conclusions and future scope of work
10. References



The final dissertation shall be submitted in hard bound copy as well as a soft copy on CD. The Term Work of Dissertation of semester IV shall be assessed jointly by the pair of internal and external examiners, along with oral examination of the same. The candidate shall deliver a presentation on the report of Dissertation Work Stage-II in front of the external and internal examiner. It is recommended that at least one paper on the dissertation topic be presented at a conference or published in a referred journal.



Head

Department of Civil Engineering
VPKBIET, Baramati-413133

