List of Courses Focus on Employability/ Entrepreneurship/ Skill Development

Department : *Civil Engineering*

Programme Name : *M.Tech.*

Academic Year : 2021-22

List of Courses Focus on Employability/ Entrepreneurship/Skill Development

Sr. No.	Course Code	Name of the Course
01.	CEPATT1	ADVANCED STRUCTURAL ANALYSIS
02.	CEPATT2	ADVANCED SOLID MECHANICS
03.	CEPATP3	THEORY OF STRUCTURAL STABILITY
04.	CEPATP7	ADVANCE CONCRETE TECHNOLOGY
05.	CEPATP8	ADVANCED STEEL DESIGN
06.	CEPALT1	ADVANCED CONCRETE LAB
07.	IPPATC1	RESEARCH METHODOLOGY AND IPR
08.	CEPBTT1	FEM IN STRUCTURAL ENGINEERING
09.	CEPBTT2	STRUCTURAL DYNAMICS
10.	CEPBTP3	SOIL STRUCTURE INTERACTION
11.	CEPBTP7	FRACTURE MECHANICS OF CONCRETE STRUCTURES
12.	MEPBTO5	COMPOSITE MATERIALS
13.	CEPBLT1	COMPUTER APPLICATIONS LAB
14.	CEPBPT1	MINI PROJECT
15.	PEPBTX2	DISASTER MANAGEMENT

Scheme and Syllabus

DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY, GGV, BILASPUR, C.G.
(INDIA)

SCHEME OF EXAMINATION

M. TECH. STRUCTURAL ENGINEERING

M. Tech. I-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CEPATT1	Advanced Structural Analysis	3	0	0	40	60	100	3
2.	CEPATT2	Advanced Solid Mechanics	3	0	0	40	60	100	3
3.		Elective – I	3	0	0	40	60	100	3
	CEPATP1	1. Theory of Thin Plates and Shells							
	CEPATP2	2. Theory and Applications of Cement Composites							
	CEPATP3	3. Theory of Structural Stability							
4.		Elective – II	3	0	0	40	60	100	3
	CEPATP4	1. Analytical and Numerical Methods for Structural Engg.							
	CEPATP5	2. Structural Health Monitoring, Repairs and Rehabilitation of Structures							
	CEPATP6	3. Structural Optimization							
	CEPATP7	4. Advance Concrete Technology							
5		Elective – III	3	0	0	40	60	100	3
	CEPATP8	1. Advanced Steel Design							
	CEPATP9	2. Design of Formwork							
	CEPATP10	3. Design of High-Rise Structures							
	CEPATP11	4. Bridge Engineering							
6.	CEPALT1	Advanced Concrete Lab	0	0	3	30	20	50	2
7.	IPPATC1	Research Methodology and IPR	2	0	0	-	50	50	2
	Total		17	0	3	230	370	600	19

M. Tech. II Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CEPBTT1	FEM in Structural Engineering	3	0	0	40	60	100	3
2.	CEPBTT2	Structural Dynamics	3	0	0	40	60	100	3
3.		Elective – IV	3	0	0	40	60	100	3
	CEPBTP1	1. Design of Advanced Concrete Structures							
	CEPBTP2	2. Advanced Design of Foundations							
	CEPBTP3	3. Soil Structure Interaction							
	CEPBTP4	4. Design of Industrial Structure							
4.		Elective – V	3	0	0	40	60	100	3
	CEPBTP5	1. Advanced Prestressed Concrete							
	CEPBTP6	2. Laminated Composite Plates							
	CEPBTP7	3. Fracture Mechanics of Concrete Structures							
	CEPBTP8	4. Design of Plates and Shells							
5		Open Elective	3	0	0	40	60	100	3
	MSPBTO1	1. Business Analytics							
	IPPBTO2	2. Industrial Safety							
	IPPBTO3	3. Operations Research							
	CEPBTO4	4. Cost Management of Engineering Projects (Other than Civil Engg.)							
	MEPBTO5								
	CHPBTO6	5. Composite Materials							
	ECPBTO7	6. Waste to Energy							
	MCPBTO8	7. IoT							
		8. MOOCs							
6.	CEPBLT1	Computer Applications Lab	0	0	3	30	20	50	2
7.	CEPBPT1	Mini Project	0	0	4	30	20	50	2
8.		Audit Course/Value Added Course	2	0	0	40	60	100	2
	ELPBTX1	1. English for Research Paper Writing							
	PEPBTX2	2. Disaster Management							
	CEPBTX3	3. Constitution of India							
	LAPBTX4	4. Stress Management by Yoga							
Total			17	0	08	300	400	700	21

Note: Under MOOCs the students have to opt any subject other than Civil Engineering from NPTEL/UGC SWAYAM

M. Tech. Structural Engineering

Semester-I

		Credits			
		L	T	P	Total
Subject:	Advanced Structural Analysis	3	0	0	3
Type:	Core-I				
Teaching Scheme:	Lectures: 3 hours/week				

Course Objectives: The course is aimed

1. To impart knowledge on the analysis of structures by stiffness analysis.
2. To introduce the limitations of direct stiffness method.

Course outcomes: At the end of the course, students will be able to

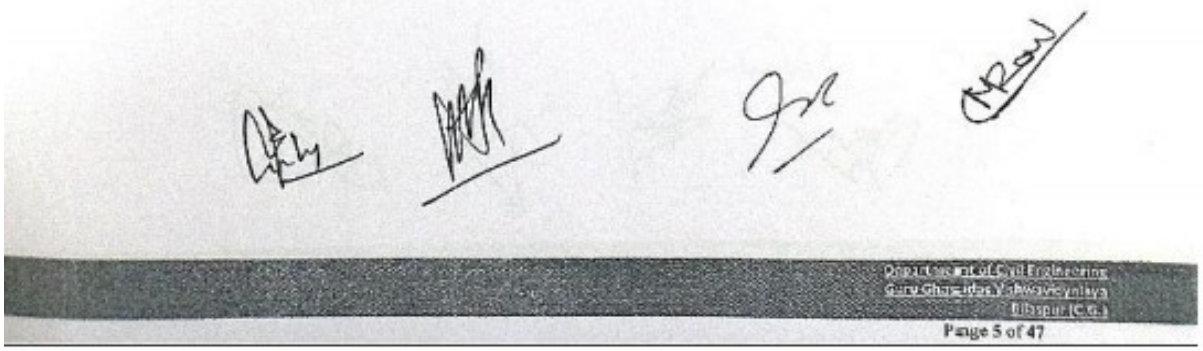
1. Analyze the skeleton structures using stiffness analysis code.
2. Use direct stiffness method understanding its limitations

Syllabus Contents:

- Influence Coefficients: Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.
- Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates
- Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates, Boundary Conditions. Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.
- Applications to Simple Problems: Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.
- Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation ofthe Modified Galerkin Method.
- Linear Element: Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

References:

- Matrix Analysis of Framed Structures, Weaver and Gere.
- The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co.
- Computer Methods in Structural Analysis, MeckJ. L., E and FN, Span Publication.
- The Finite Element Method, Desai and Able, CBS Publication.



Subject: Advanced Solid Mechanics

Type: Core-II

Teaching Scheme: Lectures: 3 hours/week

Credits			
L	T	P	Total
3	0	0	3

Course Objectives: The course is aimed

1. To introduce the basic concepts and problems of elasticity and plasticity.
2. To Emphasize on numerical methods to solve continuum problems

Course outcomes: At the end of the course, students will be able to

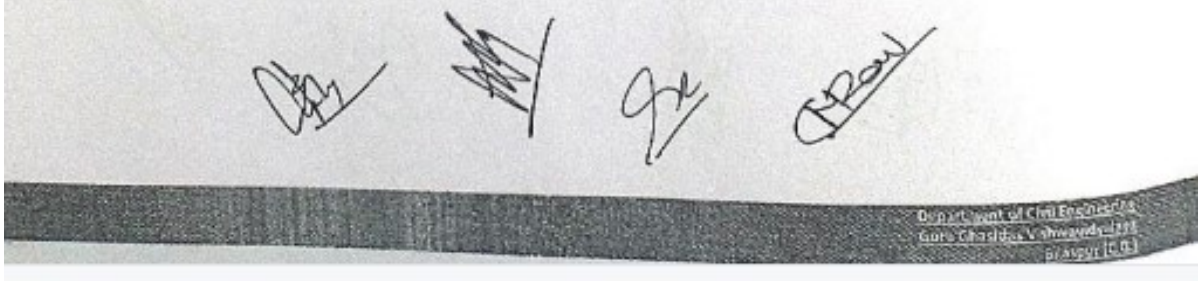
1. Solve simple problems of elasticity and plasticity understanding the basic concepts.
2. Apply numerical methods to solve continuum problems

Syllabus Contents:

- Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.
- Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.
- Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.
- Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.
- Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.
- Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

References:

- Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
- Elasticity, Sadd M. H. Elsevier, 2005.
- Engineering Solid Mechanics, Ragab A. R., Bayoumi S.E., CRC Press, 1999.
- Computational Elasticity, Ameen M., Narosa, 2005.
- Solid Mechanics, Kuzimi S. M. A., Tata McGraw Hill, 1994.
- Advanced Mechanics of Solids, Srinath L.S., Tata McGraw Hill, 2000.



		Credits			
Subject:	Theory of Structural Stability	L	T	P	Total
Type:	Program Elective (I)	3	0	0	3
Teaching Scheme:	Lectures: 3 hours/week				

Course Objectives: The course is aimed

1. To learn the concepts to evaluate stability of columns, frames, beams and plates
2. To emphasize the stability criteria for discrete and continuous systems

Course outcomes: At the end of the course, students will be able to

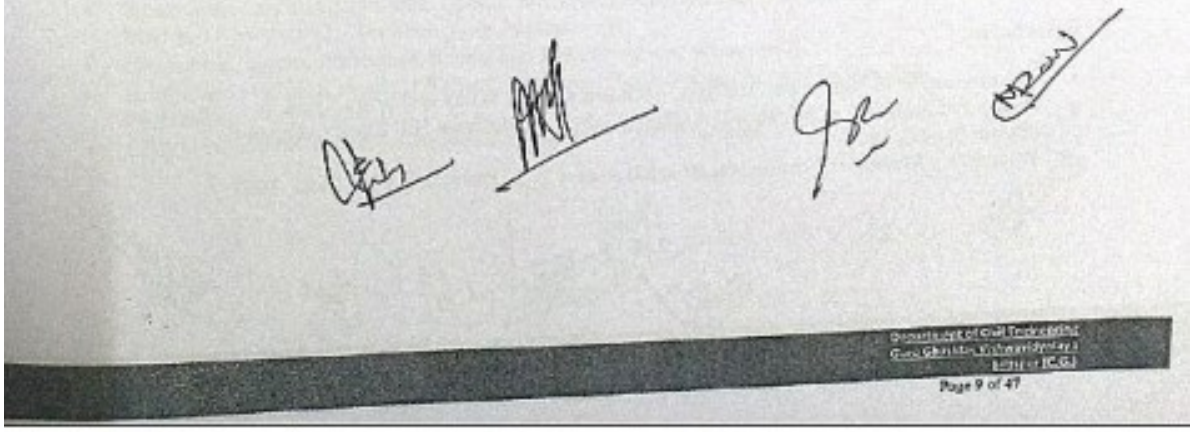
1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analysing discrete and continuous sys tems

Syllabus Contents:

- Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behavio ur.
- Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.
- Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.
- Stability of Beams: lateral torsion buckling.
- Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.
- Introduction to Inelastic Buckling and Dynamic Stability.

References:

- Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981
- Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
- Structural Stability of columns and plates, Iyengar, N. G. R., Eastern west press Pvt. Ltd.
- Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New Yo rk



Subject: Advance Concrete Technology

Type: Program Elective (II)

Teaching Scheme: Lectures: 3 hours/week

Credits			
L	T	P	Total
3	0	0	3

Course Objectives: The course is aimed

1. To make students understand concrete admixtures, non-destructive testing, semi-destructive testing, special concrete.
2. To familiarize students with structure of hydrated cement paste, types of cement, cement production quality control.
3. To make students learn transition zone in concrete, measurement of workability, properties of concrete, concrete mix design
4. To make students understand causes of concrete deterioration, permeability of concrete, durability of concrete, alkali aggregation reaction.

Course outcomes: At the end of the course, students will be able to

1. To understand concrete technology, admixtures, non-destructive testing, semi destructive testing, special concrete.
2. To be familiar with structure of hydrated cement paste, types of cement, cement production quality control.
3. To learn transition zone in concrete, measurement of workability, properties of concrete, rheological behaviour of concrete, economic concrete mix design
4. To be exposed to strength-porosity relationship, failure modes in concrete, elastic behaviour in concrete, ageing properties and long term behaviour
5. To better understand the causes of concrete deterioration, permeability of concrete, durability of concrete, alkali aggregation reaction.

Syllabus Contents:

Introduction to concrete – Mineral and chemical admixtures – Structure of hydrated cement paste – Calcium Aluminate Cement – Cement Production quality control - Transition zone in concrete – measurement of workability by quantitative empirical methods – concrete properties: setting and hardening.
Concrete Design mix for higher grades. Strength-Porosity relationship – Failure modes in concrete – plastic and thermal cracking – maturity concept to estimate curing duration - Elastic behavior in concrete- Creep, shrinkage and thermal properties of concrete.
Classification of causes of concrete deterioration – Permeability of concrete – durability concept: pore structure and transport process - Alkali-aggregate reactivity.
Non-Destructive testing methods - Semi-destructive testing methods. Concreting under special circumstances – Special materials in construction – Concreting machinery and equipment – Sustainability in concrete - Future trends in concrete technology

References:

- P. Kumar Metha and Paulo J. M. Monteiro., Concrete: Microstructure, Properties and Materials, Mc Graw Hill, Fourth Edition, 2014.
- John Newman and Ban Seng Choo, Advanced Concrete Technology Part 1 to 4, utterworth-

Department of Civil Engineering
Guru Ghasidas Vishwavidyalaya
(Bilaspur (C.G.))

Subject:	Advanced Steel Design	Credits			
Type:	Program Elective (III)	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course Objectives: The course is aimed

1. To recognize limit states and failure modes in structural steel members and systems
2. To study the design specification and codes for steel structures, and understand their basis in mechanics, testing, and analysis
3. To learn the design of steel and composite members and connections with an understanding of their limit states / failure modes and current design specifications / codes.

Course outcomes: At the end of the course, students will be able to

1. Design steel structures/ components by different design processes
2. Analyze and design beams and columns for stability and strength, and drift.
3. Design welded and bolted connections

Syllabus Contents:

- Properties of Steel: Mechanical Properties, Hysteresis, Ductility. Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.
- Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.
- Stability of Beams: Local Buckling of Compression Flange & Web, Lateral Torsional Buckling.
- Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.
- Method of Designs: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design.
- Strength Criteria: Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.
- Drift Criteria: P Effect, Deformation Based Design;
- Connections: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

References:

- Design of Steel Structures - Vol. II, Ramchandra, Standard Book House, Delhi.
- Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.
- The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R., Heyman J., ELBS.
- Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.
- IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
- SP – 6 - Handbook of Structural Steel Detailing, BIS,1987

Department of Civil Engineering
Guru Ghasidas Vishwavidyalaya
Bilaspur (C.G.)

Subject:	Advance Concrete Lab	Credits			
Type:	Core Lab (I)	L	T	P	Total
Teaching Scheme:	Lectures: 2 hours/week	0	0	4	2

Course Objectives: The course is aimed

1. To learn the design of high grade concrete and study the parameters affecting its performance.
2. To conduct Non Destructive Tests on existing concrete structures.
3. To understand behavior of structural/ elements.

Course outcomes: At the end of the Lab, students will be able to

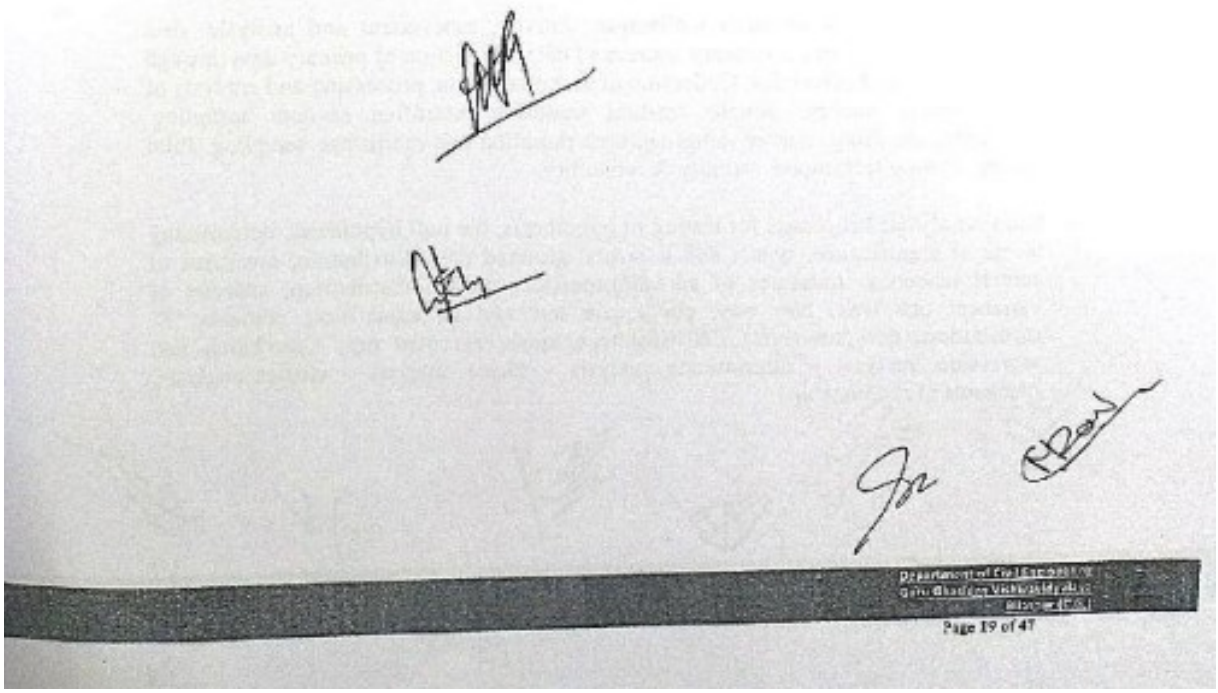
1. Design high grade concrete and study the parameters affecting its performance.
2. Conduct Non Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

- 1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
- 2. Effect of cyclic loading on steel.
- 3. Non-Destructive testing of existing concrete members.
- 4. Behavior of Beams under flexure, Sheer and Torsion.

References:

- Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
- Concrete Technology, Shetty M. S., S. Chand and Co., 2006.



Subject:	Research Methodology and IPR	Credits			
		L	T	P	Total
Type:	MLK	2	0	0	2

Teaching Scheme: Lectures: 2 hours/week

Course Objectives: The course is aimed

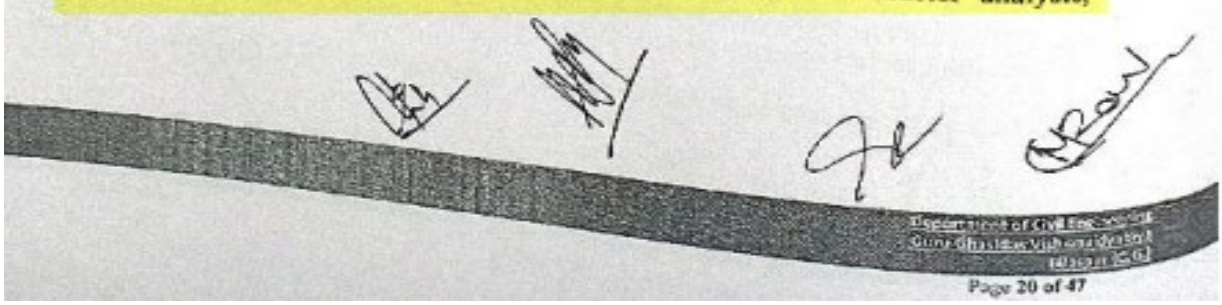
1 To understand the research problem formulation.
2 To study and analyze the research related information
3 To learn the research ethics, implement IR and understanding research problems

Course outcomes: At the end of the course, students will be able to

1 Understand research problem formulation for implemention.
2 Analyze the research related information and summarize the results
3 Learn and Follow the research ethics
4 Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property
5 Right to be promoted among students in general & engineering in particular.
6 Understand research problem formulation.

Syllabus Contents:

- **Introduction and Design of research:** Meaning, objectives and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative vs. quantitative research methodology, field studies, field experiments vs. laboratory experiments, research design in social and physical sciences.
- **Data and Methods of Data Collection:** Survey, assessment and analysis: data collection, primary and secondary sources of data, Collection of primary data through questionnaire and schedules. Collection of secondary data, processing and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling and multistage sampling. Pilot survey, scaling techniques, validity & reliability.
- **Data Analysis:** Procedure for testing of hypothesis, the null hypothesis, determining levels of significance, type i and ii errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two way, chi square test and its application, students 'T' distribution, non-parametric statistical techniques, binomial test. Correlation and regression analysis – discriminate analysis – factor analysis – cluster analysis, measures of relationship

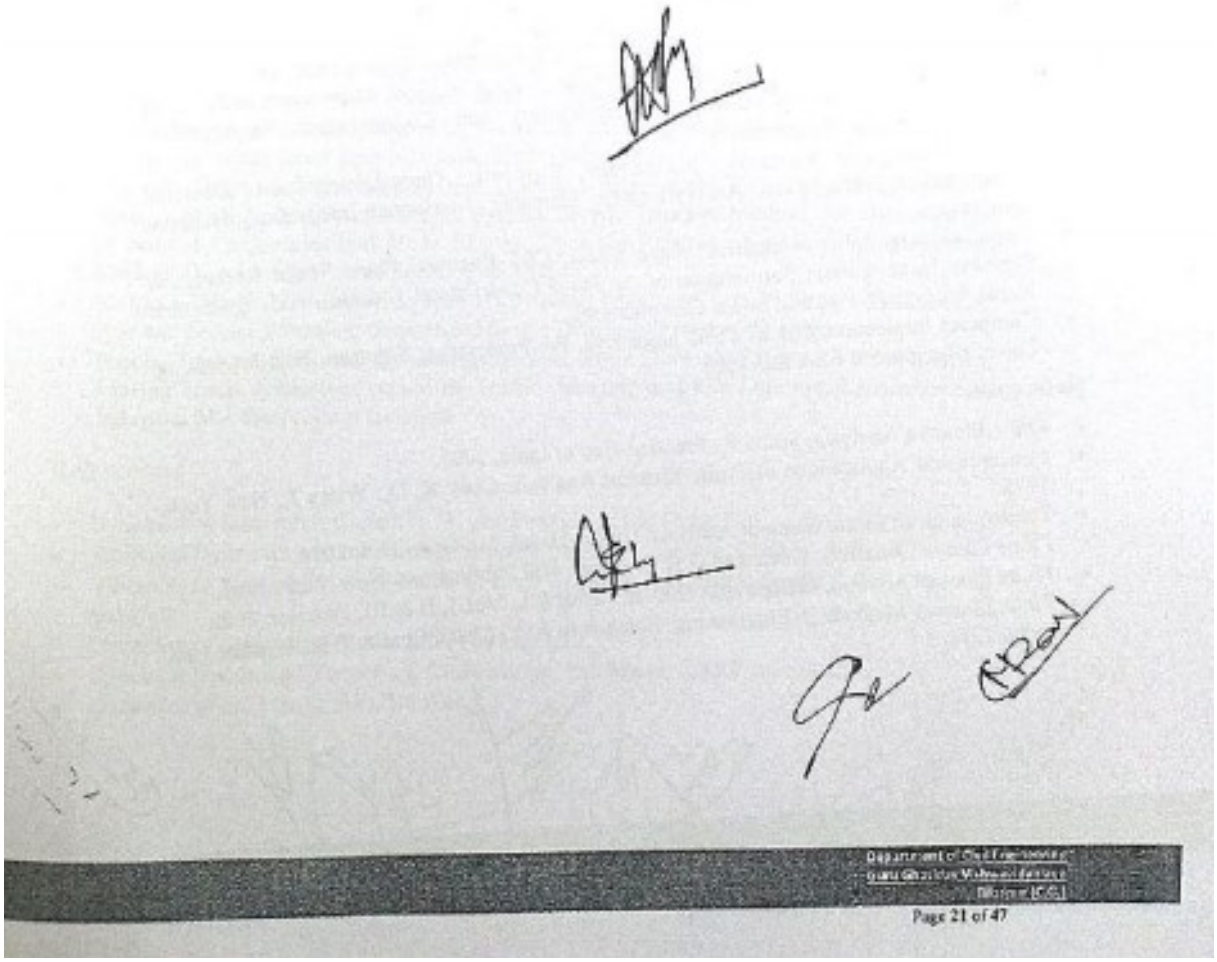


- Research report preparation and presentation: Review of literature: historical survey and its necessity, layout of research plan, meaning, techniques and precautions of interpretation, types of report: technical report, popular report, report writing – layout of research report, mechanics of writing a research report. Writing bibliography and references.

- Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

References:

- Research in education, By J W Best and J V Kahn, Pearson/ Allyn and Bacon.
- Research Methodology – Methods and Techniques, C K Kothari, New Age International.
- Design and Analysis of Experiments, D C Montgomery, Wiley.
- Applied Statistics & Probability for Engineers, D C Montgomery & G C Runger, Wiley.
- Management Research Methodology: Integration of Principles, Methods and Techniques, K N Krishnaswamy, A I Sivakumar and M Mathiranjan, Pearson Education.



Semester-II

Subject: Finite Element Method in Structural Engg.

Credits			
L	T	P	Total
3	0	0	3

Type: Core (III)

Teaching Scheme: Lectures: 3 hours/week

Course Objectives: The course is aimed

1. To introduce the Finite Element Method for structural analysis.
2. To practice the Finite Element Program/ Software
3. To study the solutions for continuum problems using finite element analysis.

Course outcomes: At the end of the course, students will be able to

1. Use Finite Element Method for structural analysis.
2. Execute the Finite Element Program/ Software
3. Solve continuum problems using finite element analysis.

Syllabus Contents:

- Introduction: History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.
- Beam Elements: Flexure Element, Element Stiffness Matrix, Element Load Vector.
- Method of Weighted Residuals: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.
- Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.
- Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.
- Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

References:

- Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005.
- Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
- Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.
- Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
- Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000.
- Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.

Subject:	Structural Dynamics	Credits			
Type:	Core (IV)	L	T	P	Total
Teaching Scheme:	Lectures: 3 hours/week	3	0	0	3

Course Objectives: The course is aimed

1. To study the analysis of dynamics response of single degree freedom system using fundamental Theory and equation of motion.
2. To analyze and study the dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
3. To study the use of the available software for dynamic analysis.

Course outcomes: At the end of the course, students will be able to

1. Analyze and study dynamics response of single degree freedom system using fundamental Theory and equation of motion.
2. Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
3. Use the available software for dynamic analysis.

Syllabus Contents:

- Introduction: Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.
- Single Degree of Freedom System: Free andF orced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.
- Numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.
- Multiple Degree of Freedom System (Lumped parameter): Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.
- Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.
- Special Topics in Structural Dynamics(Concepts only): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

References:

- Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw Hill.
- Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
- Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
- Dynamics of Structures, Humar J. L., Prentice Hall.
- Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication.
- Dynamics of Structures, Hart and Wong.

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Subject: Soil Structure Interaction

Credits			
L	T	P	Total
3	0	0	3

Type: Program Elective (IV)

Teaching Scheme: Lectures: 3 hours/week

Course Objectives: The course is aimed

1. To study the soil structure interaction and the computer programs for interaction problems
2. To learn the analysis of different types of frame structure and evaluate the action of group piles considering stress-strain characteristics of soils.

Course outcomes: At the end of the course, students will be able to

1. Understand soil structure interaction concept and complexities involved to evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics
2. Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
3. Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
4. Evaluate action of group of piles considering stress-strain characteristics of real soils.

Syllabus Contents:

- Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.
- Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.
- Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.
- Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems,
- Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts, Etc.
- Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.
- Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

References:

- Analytical and Computer Methods in Foundation, Bowels J.E., McGraw Hill Book Co., New York, 1974.
- Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
- Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
- Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
- Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.
- Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.
- Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing

Department of Civil Engineering
Guru Ghasidas Vishwavidyalaya
Bilaspur (C.G.)

Subject: Fracture Mechanics of Concrete Structures

Type: Program Elective : V

Teaching Scheme: Lectures: 3 hours/week

Credits			
L	T	P	Total
3	0	0	3

Course Objectives: The course is aimed

1. To study the identification and the classification of cracking of concrete structures based on fracture mechanics.
2. To study the implementation of stress intensity factor for notched members
3. To introduce the application of fracture mechanics models to high strength concrete and FRC structures.

Course outcomes: At the end of the course, students will be able to

1. Identify and classify cracking of concrete structures based on fracture mechanics.
2. Implement stress intensity factor for notched members
3. Apply fracture mechanics models to high strength concrete and FRC structures.
4. Compute J-integral for various sections understanding the concepts of LEFM.

Syllabus Contents:

Review of theory of elasticity: Body and surface forces, strain and strain tensors, equilibrium equation, compatibility condition, plane stress, plane strain, Airy stress function, polar coordinate system.

Basic modes of fracture, an atomic view of fracture, stress concentration effect of flaws, Griffith theory of brittle fracture, Irwin's modifications for elastic-plastic materials, dimensional analysis of fracture mechanics.

Theories of linear elastic fracture mechanics, stress intensity factors, Fracture toughness, Energy release rate, Critical Energy release rate, Crack mouth opening displacement, R-Curve and J integral.

Tensile Behavior of Concrete, Strain localization effect, Fracture process zone, Nonlinear behavior of concrete, softening function of concrete, Fracture energy.

Definition and brief introduction of fracture parameters of various nonlinear concrete fracture models: cohesive crack model (CCM) or fictitious crack model (FCM), crack band model (CBM), two parameter fracture model (TPFM), size effect model (SEM), effective crack model (ECM), double-K fracture model (DKFM) and double-G fracture model (DGFM).

References:

- David Broek, Elementary Engineering Fracture Mechanics, Sijthoff and Noordhaff, Alphen Aan Den Rijn, The Netherlands, 2001.
- Analysis of Concrete Structure by Fracture Mechanics, Ed L. Elfgren and S.P. Shah, Proc of Rilem Workshop, Chapman and Hall, London, 2001.
- Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009. K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007.
- Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, Wiley, India, 5th Edition, 2014.
- Anderson, : Fracture Mechanics: Fundamentals and Applications, CRC press, 3rd Ed., 2005
- Kumar S, Barai SV (2011) Concrete Fracture Models and Applications. ISBN 9783642167638 (Hard Cover), Springer.

Subject: Composite Materials

Type: Open Elective

Teaching Scheme: Lectures: 3 hours/Week

Credits			
L	T	P	Total
3	0	0	3

Course Objectives: The course is aimed

1. To study the implementation of the composite materials for the required performance and adopt the composite materials as reinforcements
2. To study the methods of manufacturing of meta; matrix composites
3. To study the strength of laminates

Course outcomes: At the end of the course, students will be able to

1. Explain and also implement the composite materials for the required performance based on the characteristics.
2. Adopt the composite materials as reinforcements.
3. Implement the methods of manufacturing of metal matrix composites
4. Adopt the methods of manufacturing of polymer matrix composites
5. Evaluate the strength of laminates.

Syllabus Contents:

- INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
- REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.
- Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.
- Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.
- Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations

References:

- Material Science and Technology – Vol 13 – Composites by R. W. Cahn – VCH, West Germany.
- Materials Science and Engineering, An introduction, WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
- Hand Book of Composite Materials-ed-Lubin.
- Composite Materials – K.K.Chawla.
- Composite Materials Science and Applications – Deborah D.L. Chung.
- Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Department of Civil Engineering
Guru Ghasidas Vishwavidyalaya
Bilaspur (C.G.)

Subject: Computer Applications Lab

Credits			
L	T	P	Total
0	0	4	2

Type: Core Lab I(II)

Teaching Scheme: Lectures: 2 hours/week

Course Objectives: The course is aimed

1 To introduce the practical development of computer programs for the analysis of structural elements based on FEM

2 To introduce the use of software for the design of multi-storey building

Course outcomes: At the end of the course, students will be able to

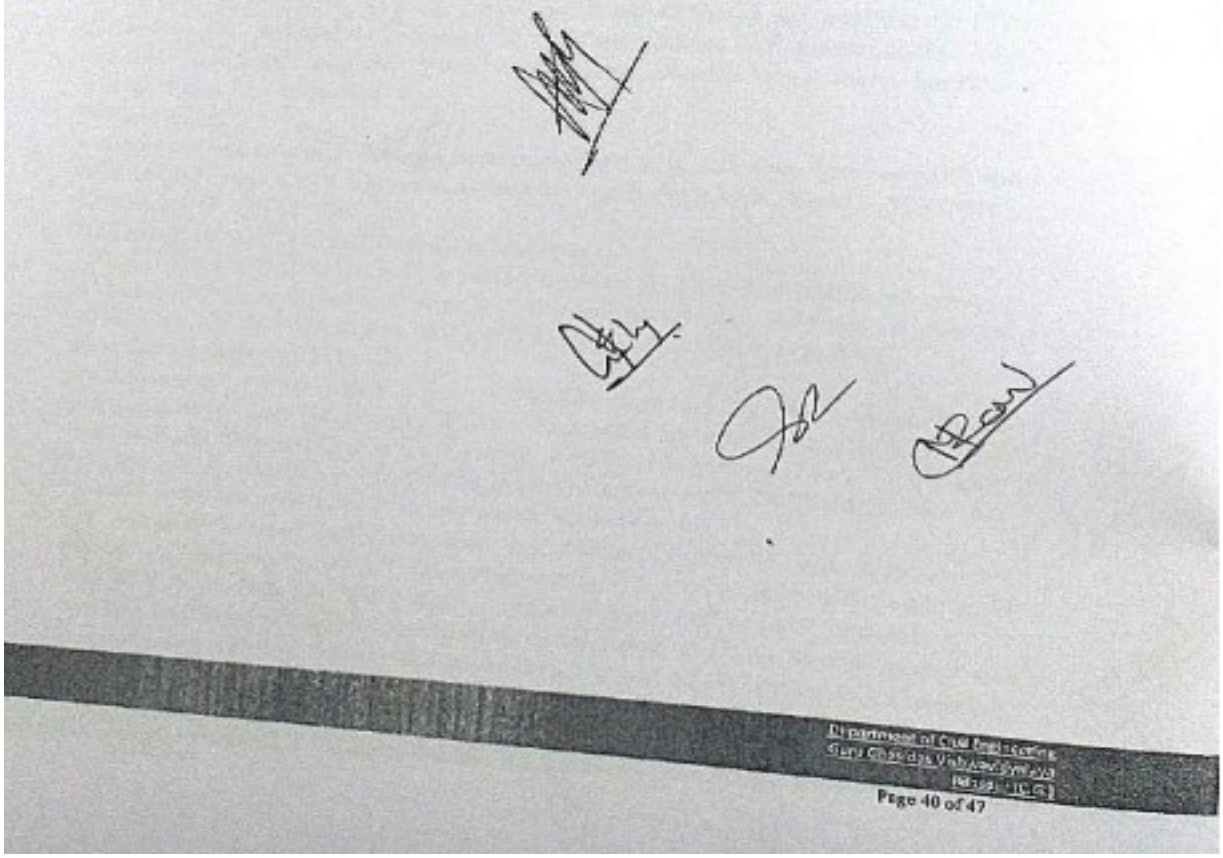
1 Develop the computer programs for analysis of structural elements based on FEM

2 Use the design software for the design of multi-storey buildings

Syllabus Contents:

To develop the MATLAB applications for Finite Element Method on structural analysis

- Static and Dynamic Analysis of Beam, rigid frame and truss, 3-D Analysis of simple building
- Analysis, Design and Detail complete Multi-Storey Framed Buildings using STAAD Pro/ETABs.



Subject: Mini Project

Type: Core

Credits			
L	T	P	Total
0	0	4	2

Teaching Scheme: Practice 4 hours/week (Contact: 2 hours/week)

Course Objectives: The Mini Project is aimed

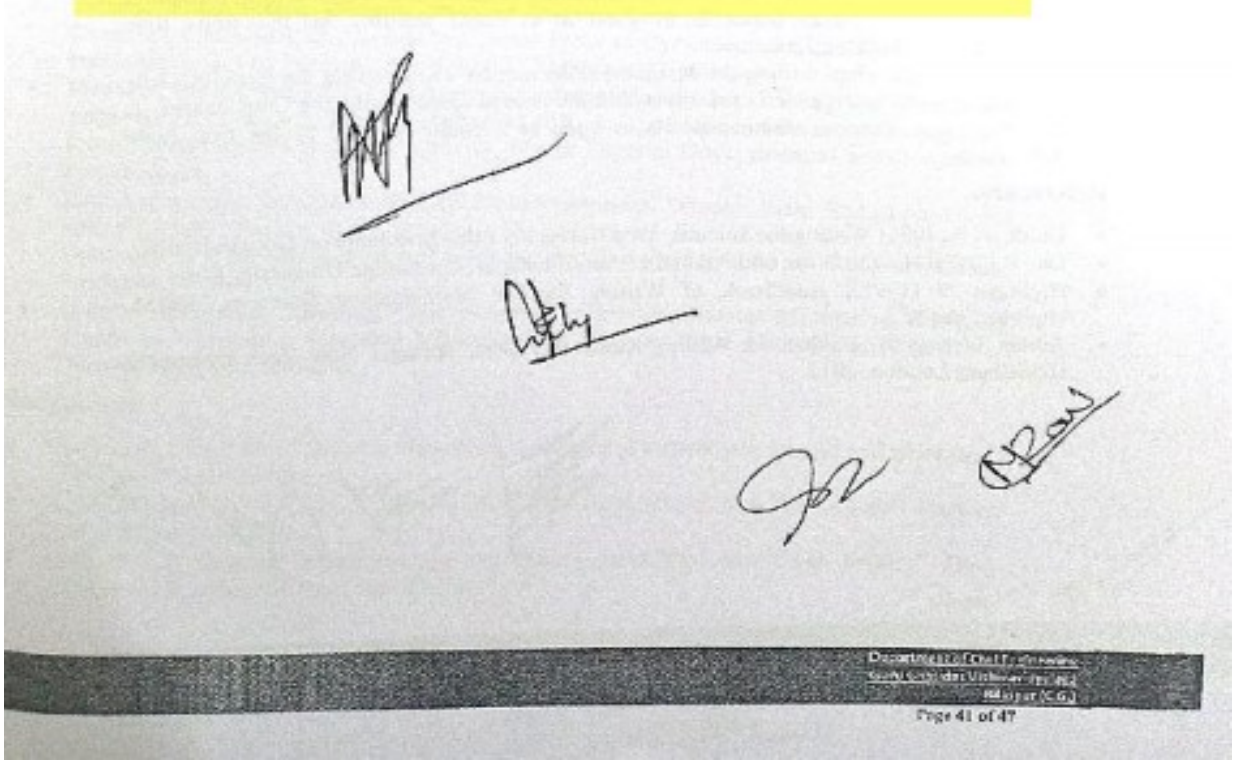
1. To Identify structural engineering problems reviewing available literature.
2. To Study different techniques used to analyze complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying Engineering principles.

Course outcomes: At the end of the course, students will be able to

1. Identify methods for structural engineering problems reviewing available literature.
2. Adopt different techniques used to analyze complex structural systems.
3. Propose solutions, or give solutions or present a solution by using his/her technique applying Engineering principles.

Syllabus Content:

- Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
- End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.
- Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.



Subject: Disaster Management

Type: Audit/Value Added Course

Teaching Scheme: Lectures: 2 hours/week

Credits			
L	T	P	Total
2	0	0	2

Course Objectives: The course is aimed

1. To attempt the understanding of key concepts in disaster risk reduction and humanitarian response
2. To study the disaster risk reduction and humanitarian response policy and practice from multiple perspectives
3. To study the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations

Course outcomes: At the end of the course, students will be able to

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations and understand the strengths and weaknesses of disaster management approaches

Syllabus Contents:

- Introduction Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
- Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
- Disaster Prone Areas in India, Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with special reference to Tsunami; Post-Disaster Diseases and Epidemics.
- Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other agencies, Media Reports: Governmental and Community Preparedness.
- Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.
- Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

References:

- R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.
- Sahni, Pardeep Et. al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi.
- Goel S. L. , Disaster Administration and Management Text and Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

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