SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Design of Prestressed Concrete Structures				
Subject Code		MCESE20S301				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Be able to perform analysis and design of prestressed concrete members and connections.
2. Students will be able to analyze and design prestressed concrete flexural members.
3. Students will be able to analyze and design for vertical and horizontal shear in prestressed concrete.

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

CO1: Find out losses in the prestressed concrete.
CO2: Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
CO3: Analyse prestressed concrete deck slab and beam/girders.
CO4: Design prestressed concrete deck slab and beam/girders.
CO5: Design of end blocks for prestressed members.

Unit	Syllabus	Periods
UNIT-I	**Introduction to prestressed concrete**: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.	8
UNIT-II	**Statically determinate PSC beams**: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.	9
UNIT-III	**Transmission of prestress** in pre tensioned members; Anchorage zone stresses for post tensioned members. **Analysis and design** of prestressed concrete pipes, columns with moments.	11
UNIT-IV	**Statically indeterminate structures** - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.	13

UNIT-V	**Composite construction** with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack- width calculations.	**14**

Text Books:

1. Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955.

2. Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.

Reference Books:

1. Limited State Design of Prestressed Concrete, GuyanY, Applied Science Publishers, 1972.

2. IS: 1343- Code of Practice for Prestressed Concrete.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Analytical and Finite Element Analysis of Laminated Composite Plates				
Subject Code		MCESE20S302				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Laminated composite plates are extensively used in various industries due to their high stiffness-to-weight ratio.
2. Directional properties that allow optimization of the stiffness characteristics for specific applications.
3. In multi-objective optimization problems, optimal designs for individual performance metrics may be conflicting, necessitating knowledge on the design requirements for different metrics and potential trade-offs.

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

CO1: Analyse the rectangular composite plates using the analytical methods.

CO2: Analyse the composite plates using advanced finite element method.

CO3: Develop the computer programs for the analysis of composite plates.

CO4: Find out losses in the prestressed concrete.

CO5: Understand the basic aspects of prestressed concrete fundamentals.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.	8
UNIT-II	**Governing Equations:** Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply- Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.	9
UNIT-III	**Finite Element Solutions**: Bending of Rectangular Laminated Plates using CLPT. Analysis of Rectangular Composite Plates using Analytical Methods.	11
UNIT-IV	**Introduction**: Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post	13

	Computation of Stresses.	
UNIT-V	**Finite Element Solutions**: Bending of Rectangular Laminated Plates using FSDT. Finite Element Model, C^0 Element Formulation, Post Computation of Stresses.	**14**

Text Books:

1. Mechanics of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.

Reference Books:

1. Mechanics of Composite Materials, 2nd edition, Robert M. Jones, Taylor and Francis Publication.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Fracture Mechanics of Concrete Structures				
Subject Code		MCESE20S303				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Uses energy criteria, possibly in conjunction with strength criteria.
2. Failure propagation through the structure.
3. Fracture mechanics, in a broad sense, is a failure theory.

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

CO1: Identify and classify cracking of concrete structures based on fracture mechanics.
CO2: Implement stress intensity factor for notched members.
CO3: Apply fracture mechanics models to high strength concrete and FRC structures.
CO4: Compute J-integral for various sections understanding the concepts of LEFM.
CO5: Uses energy criteria, possibly in conjunction with strength criteria, and which takes into account failure propagation through the structure.

Unit	Syllabus	Periods
UNIT-I	**Introduction:** Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.	8
UNIT-II	**Stress at Crack Tip:** Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.	9
UNIT-III	**Material Models**: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modelling.	11
UNIT-IV	**Concrete Fracture Properties :** Test Protocols-Direct tension tests , Flexural tests on notched beams, Fracture energy using three-point bend test, Fracture parameters using three-point bend test .	13

UNIT-V	**LEFM-The Basic Concepts:** Introduction, Linear Elastic Fracture Mechanics (LEFM) , The energy criterion , Modes of fracture, Energy balance and the Griffith criterion , Energy release rate under fixed grip/load conditions , Stability of crack growth and the R-Curve ,Crack tip stress analysis , Plastic zone characterization.	**14**

Text Books:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEM Report, Chapman and Hall, 1989.

Reference Books:

1. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989.
2. Elementary Engineering Fracture Mechanics, Broek David, 3rd Revised Edition, Springer, 1982.

SYLLABUS

STRUCTURAL ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**III/II**	**3**	**0**	**0**	**3**
Subject Name		**BUSINESS ANALYTICS**				
Subject Code		**MCESE20S304**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**100**				

Course Objectives:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques.
3. Understand relationships between the underlying business processes of an organization.

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

CO1. Demonstrate knowledge of data analytics.
CO2. Understand the ability of think critically in making decisions based on data and deep analytics.
CO3. Demonstrate the ability to use technical skills in predicative.
CO4. Prescriptive modeling to support business decision-making.
CO5. Demonstrate the ability to translate data into clear, actionable insights.

Unit	Syllabus	Periods
UNIT-I	Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	**8**
UNIT-II	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	**9**
UNIT-III	Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process,	**11**

	Prescriptive Modelling, nonlinear Optimization.	
UNIT-IV	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	**13**
UNIT-V	Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	**14**

Text Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G., Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, Pearson Education.

Reference Books:

1. H. G. Stoll, "Least cost Electricity Utility Planning", Wiley Interscience Publication, USA, 1989.
2. I. J. Nagarath and D. P. Kothari, Modern Power System Engineering., Tata McGraw Hill publishers, New Delhi, 1995.
3. IEEE Bronze Book- "Recommended Practice for Energy Conservation and cost-effective planning in Industrial facilities", IEEE Inc, USA.

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Industrial Safety				
Subject Code		MCESE20S305				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course Objectives:

1. Industrial safety is needed to check all the possible chances of accidents for preventing loss of life and permanent disability of any industrial employee, any damage to machine and material.
2. It is needed to eliminate accidents causing work stoppage and production loss.
3. It is needed to reduce workman's compensation, insurance rate, and all the cost of accidents.

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

CO1: The safety and productivity of people, machines, and processes is a key element of any sustainable business.

CO2: Industrial safety systems have been used for many years to perform safety functions in the manufacturing industries.

CO3: Safety is best achieved by inherently safe process design, Protection layer systems such as sensors, alarms, and personal protection equipment.

CO4: Apply standard safety procedures in an industrial environment.

CO5: Address any residual identified and counter risk.

Unit	Syllabus	Periods
UNIT-I	**Industrial safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.	8
UNIT-II	**Fundamentals of maintenance engineering:** Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	9
UNIT-III	**Wear and Corrosion and their prevention:** Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication	11

	methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	
UNIT-IV	**Fault tracing:** Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, Electrical motors, Types of faults in machine tools and their general causes.	**13**
UNIT-V	**Periodic and preventive maintenance:** Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.	**14**

Text Books:

1. Maintenance Engineering, H. P. Garg, S. Chand and Company.
2. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.

Reference Books:

1. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

EKLAVYA UNIVERSITY
ज्ञान प्राप्तये लक्ष्य संधानम्
Estd. by Madhya Pradesh Niji Vishvavidyalaya (Sthapna Evam Sanchalana) Adhyadesh, 2020

SCHOOL OF ENGINEERING

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	3	0	0	3
Subject Name		Operation Research				
Subject Code		MCESE20S306				
Paper	English	English				
	Hindi					
Max. Marks		100				

Course objective:

1. Understand the role and application of PERT/CPM for project scheduling.
2. Know how to compute the critical path and the project completion time. Know how to convert optimistic.
3. Most probable and pessimistic time estimates into expected activity time estimates.

Course outcomes:

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

CO1: Apply the dynamic programming to solve problems of discreet and continuous variables.
CO2: Apply the concept of non-linear programming.
CO3: Carry out sensitivity analysis and to model the real-world problem and simulate it.
CO4: Understand the importance of ground improvement techniques in civil engineering construction activities.
CO5: Reinforced wall design using steel strip or geo-reinforcement.

Unit	Syllabus	Periods
UNIT-I	Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.	8
UNIT-II	Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.	9
UNIT-III	Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.	11
UNIT-IV	Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.	13

UNIT-V	Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.	**14**

Text books:

1. H.A. Taha, Operations Research, An Introduction, PHI Learning, 2008

2. H.M. Wagner, Principles of Operations Research, PHI Learning, Delhi, 1982.

References books:

1. J.C. Pant, Introduction to Optimization, Operations Research, Jain Brothers, Delhi, 2008.

2. Hitler Libermann Operations Research, McGraw Hill Publication, 2009.

3. Pannerselvam, Operations Research, Prentice Hall of India, 2010.

4. Harvey M Wagner, Principles of Operations Research, Prentice Hall of India, 2010.

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SCHOOL OF ENGINEERING

SYLLABUS

STRUCTURAL ENGINEERING

Class		M.TECH.	L	T	P	C
Semester/Year		III/II	0	0	20	10
Subject Name		Dissertation I				
Subject Code		MCESE20S307				
Paper	English	English				
	Hindi					
Max. Marks		250				

Course Objectives:
At the end of the course the students should demonstrate skills related to performing a group project activity. The students should be able to undertake and execute a major project.

Course outcomes:
At the end of the Subject, students will be able to:
CO1: Identify structural engineering problems reviewing available literature.
CO2: Identify appropriate techniques to analyze complex structural systems.
CO3: Apply engineering and management principles through efficient and ling of project.

Contents	Periods
Dissertation-I 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 and must bring out individuals 'contribution. Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.	**20**

SYLLABUS

STRUCTURAL ENGINEERING

Class		**M.TECH.**	**L**	**T**	**P**	**C**
Semester/Year		**IV/II**	**0**	**0**	**32**	**16**
Subject Name		**Dissertation II**				
Subject Code		**MCESE20S401**				
Paper	**English**	**English**				
	Hindi					
Max. Marks		**500**				

Course Objectives:
At the end of the course the students should demonstrate skills related to performing a group project activity. The students should be able to undertake and execute a major project.

Course outcomes:
At the end of the Subject, students will be able to:
CO1 Solve complex structural problems by applying appropriate techniques and tools.
CO2: Exhibit good communication skill to the engineering community and society.
CO3: Demonstrate professional ethics and work culture.

Contents	Periods
Dissertation-I 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 and must bring out individuals ‘contribution. Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.	**32**