Jabalpur Engineering College, Jabalpur

(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) VIII Semester (Civil Engineering)

w.e.f. July 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	CE81	PEC/DLC	Professional Elective Course-IV	70	20	10	-	-	100	3	1	-	4
2	CE82	OEC/DLC	Open Elective Course-III	70	20	10	-	-	100	3	1	-	4
3	CE83	PI	Major Project / Internship	-	-	-	150	100	250	-	-	16	8
			Total	140	40	20	150	100	450	**6**	**2**	**16**	**16**

Note: 1. Departmental BOS will decide list of three/four optional subjects those are available in MOOC/NPTEL, PEC as well for OEC.

Professional Elective Course-IV		
S.No.	**Subject Code**	**Subject Name**
1	CE81A	Structural Design & Drawing-IV (Steel)
2	CE81B	Pavement Design
3	CE81C	Traffic Engineering

Open Elective Course-III		
S.No.	**Subject Code**	**Subject Name**
1	CE82A	Finite Element Method
2	CE82B	Air Quality Monitoring & Control
3	CE82C	FRP Composites

Note: 2. Students going for internship would have to opt MOOC/NPTEL subjects decided / listed by the HOD / Coordinator.

Professional Elective Course-IV		
S.No.	**Subject Code**	**Subject Name**
1	CE81D	NPTEL-1
2	CE81E	NPTEL-2
3	CE81F	NPTEL-3

Open Elective Course-III		
S.No.	**Subject Code**	**Subject Name**
1	CE82D	NPTEL-4
2	CE82E	NPTEL-5
3	CE82F	NPTEL-6

Note: 3. For Major Project/ Internship, evaluation is based on work done, quality of report, presentation and performance in viva-voce through department project supervisor / Industry Project Coordinator.

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, OEC: Open Elective Course, PI: Project and Internship, DLC: Distance Learning Course

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-81A	Structural Design & Drawing-IV (Steel)	70	20	10	-	-	100	3	1	-	4

MODULE-I:
Plate girder bridges (Riveted and welded)

MODULE - II :
Trussed girder bridges for railways and highways (RC & IRS holding). Bearings for bridges.

MODULE - III :
Water Tanks: Pressed steel tanks, tanks with ordinary plates, square, rectangular, circular with hemispherical bottom and conical bottom.

MODULE-IV:
Chimneys: Guyed and self supporting steel stacks.

MODULE-V:
Bunkers, Silos & Towers.

Reference Books :-

1. Design of Steel Structures - Ramammutham
2. Design of Steel Structures - Punia
3. Steel Str. by Ramchandra Vol II
4. Steel Str. by Arya&Ajmani
5. Design of steel structures - L.S. Negi

Course Outcomes-

After the completion of this course student will be able to-

CO1	Estimate loads on steel structure like girder, bridges, chimneys etc.
CO2	Analyse the steel structure on the basis of estimated loads
CO3	Design plate girder bridge, trussed girder bridge and bearings for bridges, steel water tanks, guyed self supporting steel stacks Bunkers, Silos and Towers.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-81B	Pavement Design	70	20	10	-	-	100	3	1	-	4

MODULE -I :
Equivalent Single Wheel Load (ESWL) : Definition, calculation of ESWL, repetition of loads and their effects on the pavement structures.

MODULE -II :
Flexible Pavements : Component parts of the pavement structures and their firnctions, stresses in flexible pavements, Stress distribution through various layers, Boussinesque's theory, Burmister's two layered theory,methods of design, group index method, CBR method, Burmister's method and North Dakota cone method.

MODULE -III :
Rigid Pavements : Evaluation of subgrade, Modulus-K by plate bearing test and the test details, Westergaard's stress theory stresses in rigid pavements, Temperature stresses, warping stresses, frictional stresses, critical combination of stesses, critical loading positions.

MODULE -IV :
Rigid pavement design : IRC method, Fatigue analysis, PCA chart method, joints, design and construction & types, AASHTO Method, Reliability analysis.

MODULE -V :
Evaluation and Stengthening of Existing Pavements :Benkleman beam method, Serviceability Index Method.Rigid and flexible overlays and their design procedures.

Reference Books :--

1. Principles of pavement design by E.J.Yoder& M.W. Witczak
2. AASHO, "A'r{SHO Interim Guide for Design of Pavement Structures", Washington, D.C.
3. Portland Cement Association, Guidlines for Design of Rigid Pavements, Washington New Delhi.

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Course Outcomes- After the completion of this course student will be able to-

CO1	Calculate ESWL, repetition of load and their effects on pavement structures.
CO2	Determine stresses in Flexible and rigid pavements.
CO3	Design rigid pavements as per IRC methods, PCA Chart methods and AASHTO methods.
CO4	Evaluate and strengthen existing pavement by Benkleman beam method and serviceability Index method.

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-81C	Traffic Engineering	70	20	10	-	-	100	3	1	-	4

MODULE -I.

Traffic Characteristics: (i) Road user's characteristics - general human characteristics, physical,mental and emotional factors, factors affecting reaction time, PIEV theory. (ii) Vehicularcharacteristics: Characteristics affecting road design-width, height, length and other dimensions. weight, power, speed and braking capacity of a vehicle.

MODULE -II.

Traffic Studies: (i) Spot Speed Studies and Volume Studies.(ii) Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies. (iii) Origin and destination Studies (O & D): Various methods, collection and interpretation of data, planning and sampling. (iv)Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service. (v) Parking Studies: Methods of parking studies cordon counts, space inventories, parking practices.

MODULE -III.

Traffic Operations and Control: (i) Traffic regulations and various means of control.(ii) One way streets- advantages and limitations. (iii) Traffic signals- isolated signals, coordinated signals, simultaneous, alternate, flexible and progressive signal systems. Types of traffic signals, fixed time signals, traffic actuated signals, speed control signals, pedestrian signals, flashing signals, clearance interval and problems on single isolated traffic signal.

MODULE -IV.

Street Lighting: (i) Methods of light distribution. (ii) Design of street lighting system. (iii) Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors. (iv) Differenttypes of light sources used for street lighting. (v) Fundamental factors of night vision.

MODULE -V.

Accident Studies & Mass Transportation: (i) Accident Studies: Causes of accidents, accident studies and records, condition and collision diagram, preventive measures. (ii) Expressways and freeways, problems on mass transportation and remedial measures, brief study of mass transportation available in the country.

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Reference Books :-

1. Traffic Engineering and Transport Planning by L.R. Kadiyali, Khanna Publishers, Delhi
2. Traffic Engineering by Matson, W.S.Smith& F.W. Hurd
3. G.J. Pingnataro, Principles of Traffic Engineering
4. D.R.Drew, Traffic Flaw Theory
5. W.R. Mchsne and R.P. Roess "Traffic Engg"
6. Wohl& Martin, Traffic System Analysis for Engineering & Planners

Course Outcomes-

After the completion of this course student will be able to-

CO1	Illustrate traffic characteristics, its impact on road traffic, various problems on mass transportation and road accidents
CO2	Practice different traffic studies and give its practical significance
CO3	Design different traffic signal system, traffic islands and street lighting

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-82A	Finite Element Method	70	20	10	-	-	100	3	1	-	4

MODULE-I
Introduction- Introduction to Finite Element Method, Comparison with other methods. Basic concepts of finite element method, Introduction to boundary value and initial value problems, Introduction to stiffness matrix and boundary conditions.

MODULE-II
Shape Functions & Discretization of Structures Introduction of shape functions, polynomials, convergence requirements of shape functions, derivation of shape functions, Hermite and Lagrange polynomials. Introduction to discretization of structure, Nodes as discontinuities, Refining mesh, Use of symmetry, Element aspect ratio, Higher order element, Elements numbering.

MODULE-III
Spring, Bar & Beam Element- One dimensional second order equations, Derivation of stiffness matrix for a spring element, Direct stiffness method, Potential energy approach to derive spring element equations, Derivation of stiffness matrix for a bar element in local coordinates, Selection of approximation function, Beam stiffness, assemblage of beam stiffness matrix, potential energy approach to derive beam element equations, Analysis of beam using two noded elements, Galerkin's Residual method.

MODULE-IV
Plane stress and plane strain problems- Introduction, CST (Constant Strain Triangle) element, finite element solution of plane strain problem, Explicit expression for CST stiffness matrix.

MODULE-V
Isoparametric formulation- Coordinate transformation, Bar element, Rectangular plane stress element, Numerical integration, Gauss Quadrature

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Reference Books:

1. Chandrupatla. T.R., and Belegundu, A.D., "Introduction to Finite Element in Engineering". Third Edition, Prentice Hall, India, 2003.
2. Bhavikati, S. S., "Finite Element Analysis", New Age International Publishers, 2005.
3. Daryl L.. Logan, "A First Course in the Finite Element Method", Cengage Learning, 2011.
4. J. N. Reddy, "An Introduction to Finite Element Method", McGraw-Hill. Intl. Student Edition, 1985.
5. Zienkiewics, "The finite element method, Basic formulation and linear problems", Vol.1. 4/e, McGraw-Hill, Book Co.
6. S. S. Rao, "The Finite Element Method in Engineering". Pergaman Press, 2003.
7. C. S. Desai and J. F. Abel, "Introduction to the Finite Element Method". Affiliated East West Press, 1972.

Course Outcomes-

After the completion of this course student will be able to-

CO1	Explain concepts of FEM, plane stress, strain and discretization of structures
CO2	Derive shape functions for various type of elements
CO3	Determine stiffness matrix for spring, bar and beam elements
CO4	Perform numerical integration using Gauss Quadrature.

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		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-82B	Air Quality Monitoring & Control	70	20	10	-	-	100	3	1	-	4

MODULE- I
Air-pollution :Definition, Atmosphere and global effects, Pollutants and their sources, classification. Air Pollution Meteorology : Interaction of Meteorology parameters, Transport and Diffusion Models and mechanism, Wind rose diagram, Particulates Visibility. Dynamics of pollutant dispersion and disposal. Effects on environment including living and non-living matter.

MODULE- II
Air Pollutant Chemistry:Properties of Pollutant, MODULEs for expression of concentrations, Effects on Vegetation, Physical Environment and Human Health Mechanisms of Effect, Estimation Methodology. Human Health Hazard: MODULEs of Measurement, Measurement of Concentration on Human Health. Nature of process Emissions: Mobile Combustion. Sources, Stationary Source, Measurement of Monitoring.

MODULE- III
Ambient air quality monitoring techniques: Air pollution indices, standards, norms, rules and regulations. Removal processes. An introduction to air pollution meteorology. Air Laboratory - High Volume
Sampling, Handy Sampling, Bio aerosols sampling, Indoor Air Sampling, Stack Sampling.

MODULE- IV
Prevention and Control of Air Pollution:Regulated Release of Air Pollutant Practicability, Mechanisms of Control, Equipment Mathematical Model of Control Processes, Mechanical Collectors, Wet Collectors, Filtration, Electrostatics Precipitators Of Form Bed Reactors and Ventury Scrubbers, After Burners And Dispersion. Industrial
Application: Wood Working Operation, Open Hearth Neel Making, Manufacture of Sulfuric Acid, Coffee Roasting, Environmental Industrial Location, Theories And Facilities, Impact of Industrial Products.

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MODULE- V

Legislation : Standards of Air Qualities in Various Countries , Evolution of Standards, Standards and Criteria, Emission Standards and Air Qualities Standards, Clean Air Act, Total Environmental Protection, Social Responsibility, Economics and Production..

Reference Books :

1. "Air Pollution : It's Origin and Control" By Kenneth Wark& Cecil F. Warner.
2. "Air Pollution Control Volume (I to VII)" By A.C. Stern.
3. "Air Pollution" By Henery C. Perkins (Mc-Graw Hill Publication)
4. "Air Pollution and It's Control" By M.N. Rao & C.S. Rao.

Course Outcomes-

After the completion of this course student will be able to-

CO1	Identify the sources of air pollution.
CO2	Relate general diseases and toxicity of pollutants.
CO3	Explain the design and operation of various air pollution control equipments.
CO4	Apply air pollution control legislation, public education pollution standards, etc. to practice.

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		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
CE-82C	FRP Composites	70	20	10	-	-	100	3	1	-	4

MODULE-I
Introduction-Composites- Advantages of FRP –Role of resin and reinforcements -Applications of FRP. Designing in FRP – Selection criteria - material and process selection

MODULE-II
Molds for FRP-Polyester resins. Introduction – Plaster mold, wooden Mold - GRP molds-Epoxide moldsSteel molds- Aluminum alloy molds- Nickel shell molds.

MODULE-III
Reinforcements-Introduction - Surfacing tissue –Glass fiber - Continuous filament rovings-Chopped strands- Chopped strand mats- Continuous strand mat Woven glass fabrics- Carbon fiber- Aromatic polyamide (aramid) fibers - Polyester fibers- Polyacrylonitrile fibers - Nylon - PVC and PVDC Cotton – Sisal - Asbestos– Jute- Boron fibers

MODULE-IV
Molding Processes-Introduction - Contact molding -hand lay up - Spray lay-up- Vacuum bag molding - Pressure bag molding – Resin transfer or resin injection molding-pressure injection-Vacuum impregnation and injection - Hot press/matched metal molding - Filament winding-Centrifugul molding - Continuous sheet manufacture – Pultrusion - Sandwich construction.

MODULE-V
Bulk, Dough and Sheet molding Compounds and Prepregs. Introduction- Dough and bulk molding compounds - Sheet mould compounds- manufacture of SMC- Prepregs - Commercial products.

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Reference Books:

1. FRP TECHNOLOGY by Weatherhead.
2. FIBERREINFORCED COMPOSITES- Materials, Manufacturing, and Design by P.K. Mallick
3. COMPOSITES MANUFACTURING- Materials, Product, and Process Engineering by Sanjay K. Mazumdar 4. Hand book of Reinforcement for plastics – Milewski .
5. M O W Richardson "Polymer Engineering Composite" – Applied Science.

Course Outcomes-

After the completion of this course student will be able to-

CO1	Illustrate selection criteria for materials selection.
CO2	Choose different types of fibre for FRP composites
CO3	Explain types of molds and manufacturing processes.

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