

**Jabalpur Engineering College, Jabalpur**  
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)  
(AICTE Model Curriculum Based Scheme)  
**Bachelor of Technology (B.Tech.) IV 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			L	T	P	
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignme nt	End Sem.	Lab Work					
1	CE41	PCC	Concrete Technology	70	20	10	-	-	100	3	1	-	4
2	CE42	PCC	Transportation Engineering	70	20	10	30	20	150	3	-	2	4
3	CE43	PCC	Geotechnical Engineering-I	70	20	10	30	20	150	3	-	2	4
4	CE44	PCC	Fluid Mechanics	70	20	10	30	20	150	3	-	2	4
5	CE45	PCC	Advance Surveying	70	20	10	-	-	100	3	1	-	4
6	CE46	ESC	Software Lab - II	-	-	-	30	20	50	-	-	4	2
Total				350	100	50	120	80	700	15	2	10	22
7	CE47	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
8	CE48	MC	NSS/NCC/Swathhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code CE47 for the award of Honours (Minor Specialization).									


**Note:** MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

1 hour lecture (L) = 1 credit

1 hour Tutorial (T) = 1 credit

2 hour Practical (P) = 1 credit

PCC: Professional Core Course, ESC: Engineering Science Course, DLC: Distance Learning Course, MC: Mandatory Course

  
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**COURSE CONTENTS**

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
CE-41	Concrete Technology	Theory			Practical			100	L 3	T 1	
		End Sem 70	Mid-sem Exam 20	Quiz/ Assignment 10	End sem -	Lab work -					
		4									

**MODULE-I**

Introduction: Concrete as construction materials, Concrete making materials: Cement- Types and testing, Aggregates- various properties and testing, Water- quality for mixing and curing and use of sea water, Admixtures- functions and classification.

**MODULE-II**

Properties of fresh concrete, workability, factors affecting and measurement of workability, segregation, bleeding, setting time. process of manufacturing of concrete, curing of concrete, strength of concrete, elasticity, creep, durability, corrosion and shrinkage.

**MODULE-III**

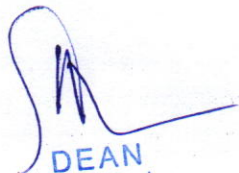
Concrete mix design factors influencing mix proportion, mix design by ACI method and I.S. code method, design of high strength concrete.

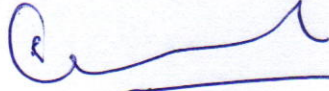
**MODULE-IV**

Testing of hardened concrete, compression flexure strength, tensile strength of concrete, comparison between cube and cylinder strength. non-destructive testing methods, test on composition of hardened concrete.

**MODULE V**

Special concrete, lightweight concrete, fiber reinforced concrete, polymer-modified concrete, fibrocement, mass concrete, ready mix concrete, self compacting concrete.

  
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Books References:


1. Shetty, MS, Concrete Technology, Theory & Practice, S. Chand and Co, 2004.
2. Gambhir, ML., Concrete Technology, Tata McGraw Hil, 2004.
3. Revile, Properties of Concrete, Longman Publishers, 2004.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007

After the completion of this course students will able to –

CO1	Outline the importance of ingredients of concrete and its properties.
CO2	Summarise the concept of workability and testing of green concrete
CO3	Compute the design mix proportion for special work for required strength and workability with available material at workplace.
CO4	Illustrate the physical properties of hardened concrete
CO5	Ability to analyze various special concrete and their applications.



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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
CE-42	Transportation Engineering	Theory			Practical		150	L	T	P	4
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		3	-	2	
		70	20	10	30	20					

**MODULE-I**

**Highways :** Classification of Roads, Road Patterns, Brief History of Road Development around the World, Road Development Plans of the India, Typical Cross Sections in Urban and Rural roads, Various Cross Sections Elements, Width of Carriage-way, Shoulders, Medians, Width of Roadways, Right of Way, Camber, Design Speed, Sight Distance, Stopping Sight Distance, Passing Sight Distance, Sight Distance at Inter-Section, Passing Zones, Super Elevations, Set Back, Extra Widening on Horizontal Curve, Transition Curve, Design of Horizontal and Vertical Alignment, Combinations of Horizontal and Vertical Alignment

**MODULE-II**

**Traffic Engineering :** Definition, Road User and Vehicle, Traffic Studies - Speed, Volume, Origin & Destination, Capacity, Parking and Accidents, Traffic Signs, Traffic Markings, Traffic Signals - Types, Signal systems, Warrants and Design, Traffic Management, Intersection Types - At Grade & Grade Separation, Rotary Design, Street Lighting.

**MODULE-III**

**Highway Materials:** Soil, Desirable Properties, Classification, CBR, G. I. Modulus of Subgrade Reaction, Aggregates and their Characterisations, Bitumen Types, Tests on Bitumen, Bituminous Mixes-Requirements and Design, Concrete Mixes-Design, I.R.C. - 44 Method, Road Note No. 4 Method, ACI, Guidelines by I.S.


**MODULE-IV**


**Pavement Design:** Pavement Structures, Wheel Load Configuration, Behaviour under Repeated Loading, Function of Various Pavement Components, Factors affecting Pavement Design, Flexible Pavement Design Methods-GI, CBR, California R-Value Method. Triaxial Method, Mcleod Method, Burmister Method, I.R.C. Method Rigid Pavements, Calculation of Wheel Load Stresses and Temperature Stresses, Westergaard Method, Analysis, Joints in Rigid Pavements, I.R.C. Method for Design, Filling and Sealing of Joints, Design of Reinforcement, Dowel Bars and Tie Bars, Pumping of Concrete Pavements.

**MODULE-V**

**Railway Engineering :** Early development in rail transport, Permanent Way, Gauges, Sleepers, Ballast, Rails, Rail Fastenings, Calculation of Materials for Permanent way, Coning of Wheels, Rail Cross Section, Tilting of Rails, Wear & Creep of Rails, Geometrics, Gradients, Transition Curves, Widening of Gauges on Curves, Cant & Cant Deficiency.

Points & Crossing - Design of Turn outs and description of Track Junctions, Signalling and Interlocking, Classification of Signals and Points, Control of Train, Track Circuits, Station Yards.

  
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**References:-**

1. Khanna S.K. & Justo, C.E.G. "Highways Engineering" 10<sup>th</sup> edition. Nem Chand and Brothers, 2015.
2. O. Flaherty C.A., "Highway Vol. I & II", Butterworth Heinemann, 2002
3. IRC-58-2015, "Guideline for Design of Rigid Pavements".
4. IRC-37-2012, "Guideline for the Design of Flexible Pavements".
5. Railway Engineering by S.C. Saxena and S.P. Arora; Dhanpat Rai Publication

**List of Experiments:**

1. Impact Test of Aggregates.
2. Abrasion Test of Aggregates.
3. Shape test – Elongation and Flakiness Index Test of Aggregates.
4. Penetration Test of Bitumen
5. Softening point Test of Bitumen
6. Ductility test of Bitumen
7. Crushing strength of Aggregate
8. Bituminous mix design by marshal method
9. Specific gravity and water absorption of aggregate
10. CBR of soil sub grade.

**Course Outcomes-**

After the completion of this course students will able to –


CO1	Calculate geometrical elements of highways and railways.
CO2	Illustrate traffic engineering aspects highways and railways.
CO3	Design of Flexible and rigid pavements and components of railway track.
CO4	Explain materials used in construction of highways.

After the completion of this lab students will able to –

CO1	Evaluate properties of materials used in construction of highways.
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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
CE-43	Geotechnical Engineering-I	Theory			Practical		150	L	T	P	4
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work					
		70	20	10	30	20					

**MODULE-I**

Basic Definitions & Index Properties : Definition and scope of soil mechanics, Historical development. Formation of soils, Soil composition. Minerals, Three phase system. Index properties and their determination. Consistency limits. Classification systems based on particle size and consistency limits.

**MODULE-II**

Influence of clay minerals on engineering behavior, Soil structure. Effective, Neutral and Total stresses, Permeability, Determination of permeability in laboratory and in field. Seepage and seepage pressure, Flownets, uses of a flownet.

**MODULE-III**

Soil Compaction, Laboratory Tests, Factors Affecting Compaction, Behavior of compacted Soils and Compaction control in the field. Stress distribution beneath loaded areas by Boussinesq and water guard's analysis. Newmark's influence chart.

**MODULE-IV**

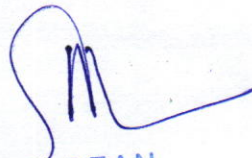
Compressibility and consolidation, Relationship between pressure and void ratio, Theory of one dimensional consolidation. Consolidation test, Fitting Time curves. Normally and over consolidated clays. Determination of preconsolidation pressure, settlement analysis. Calculation of total settlement.


**MODULE-V**

Shear Strength of Soils : Mohr-Coulomb's theory of shear failure of soils, Mohr's stress circle, Measurement of shear strength, Shear box test, Triaxial compression test, unconfined compression test. Value shear test, Measurement of pore pressure, pore pressure parameters, critical void ratio, Liquefaction.

**Reference Books :**

1. Soil Mech. & Found. Engg. By Dr. K.R. Arora - Std Publishers Delhi.
2. Soil Mech. & Found by Dr. B.C. Punmia - Laxmi Publications, Delhi
3. Modern Geotech Engg. By Dr. I Aram Singh - IBT Publishers Delhi
4. Geotech Engg. By C. Venkatramiah New Age International Publishers, Delhi
5. Soil Mech & Found. Engg. By S.K. Garg - Khanna Publishers, Delhi
6. Soil Testing for Engg. By T.W. Lambe - John Wiley & Sons. Inc.

  
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**List of Experiments:**

1. Determination of Hygroscopic water content
2. Determination of field density by Core Cutter method.
3. Determination of field density by Sand Replacement method.
4. Determination of field density by Water Replacement method
5. Particle - size analysis
6. Determination of Specific gravity of soil particles
7. Determination of plastic limit
8. Determination of liquid limit
9. Determination of shrinkage limit
10. Permeability test
11. Light Compaction Test (Std. Compaction Test)
12. Heavy Compaction Test (Modifies Compaction Test)

**Course Outcomes-**

After the completion of this course students will able to –

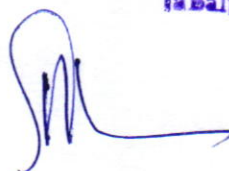
CO1	Determine index properties, compressibility and permeability parameters of soil.
CO2	Calculate shear strength and earth pressure of cohesive and non-cohesive soil.
CO3	Analyze the stability of finite and in-finite slopes

After the completion of this lab students will able to –

CO1	Determine insitu density using various methods.
CO2	Classify soil as per IS classification.



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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
CE-44	Fluid Mechanics	Theory			Practical			150	L	T	
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work					
		70	20	10	30	20					

**MODULE-I**

Review of Fluid Properties: Engineering units of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure.

Fluid Statics: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

**MODULE-II**

Kinematics of Flow : Types of flow-ideal & real, steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, stream lines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets their utility & method of drawing flow nets.

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications.

**MODULE-III**

Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.


Turbulent Flow: Laminar and turbulent boundary layers and laminar sub layer, hydro dynamically smooth and rough boundaries, velocity distribution in turbulent flow, resistance of smooth and artificially roughened pipes commercial pipes, aging of pipes.

**MODULE-IV**

Pipe flow problems : Losses due to sudden expansion and contraction, losses in pipe fittings and valves, concepts of equivalent length, hydraulic and energy gradient lines, siphon, pipes in series, pipes in parallel, branching of pipes.

Pipe Network : Water Hammer (only quick closure case) transmission of power, Hardy Cross Method Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations

  
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## MODULE-V

Turbines: Classifications, definitions, similarity laws, specific speed and unit quantities, Pelton turbine-their construction and settings, speed regulation, dimensions of various elements,

Centrifugal pumps : Various types and their important components, manometric head, total head, net positive suction head specific speed, shut of head, energy losses cavitation, principle of working and characteristic curves.

Reciprocating Pumps: Principle of working, Coefficient of discharge, slip single acting and double acting pump, Manometric head, Acceleration head.

Forces on immersed bodies: Types of drag, drag on a sphere, flat plate, cylinder and an aerofoil development of lift, lifting vanes, magnus effect.

### Reference Books-

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechanics and machinery; TMH
3. Cengel; Fluid Mechanics; TMH
4. White ; Fluid Mechanics ; TMH
5. JN IK DAKE; Essential of EnggHyd; Afrikan Network & ScInstt. (ANSTD)
6. Franiss JRD; A Text Book of fluid Mech. for Engg. Student
7. R Mohanty; Fluid Mechanics; PHI
8. Gupta; Fluid Mechanics, Pearson.

### List of Experiment:

1. To determine the local point velocity with the help of Pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter
4. Determination of  $C_c$ ,  $C_r$ ,  $C_o$  of Orifices
5. Calibration of Nozzle meter and Mouth Piece
6. Reynolds experiment for demonstration of stream lines & turbulent flow
7. Determination of meta-centric height
8. Determination of Friction Factor of a pipe
9. To study the characteristics of a centrifugal pump.
10. Verification of impulse momentum principle

### Course Outcomes-

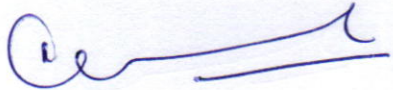
After the completion of this course students will able to –

CO1	Explain fluid properties, flow nets, flow measurements, laminar and turbulent flow, similarity laws
CO2	Solve problems on dynamics, kinematics of fluid flow, fluid statics, laminar & turbulent flow through pipes
CO3	Calculate pressure, dimension-less numbers, forces on plane & curved surface and fixed & moving vanes

After the completion of this lab students will able to –

CO1	Determine local point velocity, terminal velocity, meta-centric height
CO2	Calibration of Orifice-meter, Venturi-meter, Nozzle- meter and Mouth-piece

  
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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/ Week			Total Credits
CE-45	Advance Surveying	Theory			Practical		100	L	T	P	4
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work					
		70	20	10	-	-					

**MODULE-I**

Reciprocal leveling, profile leveling, cross sectioning, contouring, methods of contouring, trigonometrical leveling.

**MODULE-II**

Traversing by theodolite, field work checks, traverse computations, latitude and departures, adjustments, computations of co-ordinates, plotting and adjusting of traverse, omitted measurements.

**MODULE-III**

**Tacheometry** : Tachometric systems and principles, stadia system, uses of analytic lens, tangential system, subtense system, instrument constant field work, reduction, direct reading tacheometers, use of tacheometry for traversing and contouring.

**MODULE-IV**

**Curves** : Classification and use; element of circular curves, calculations, setting out curves by offsets and by theodolites, compound curves, reverse curves, transition curves, cubic spiral and lemniscates, setting out vertical curves.

**MODULE-V**

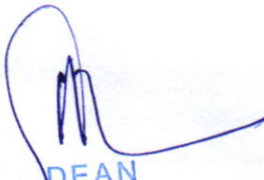
**Control Surveys**: Providing frame work of control points, triangulation principle, reconnaissance selection and marking of stations.


**Hydrographic Surveying**: Sounding, methods of observations, computations and plotting.

**Field Astronomy**: Spherical trigonometry, Astronomical terms, co-ordinate systems circumpolar stars, astronomical triangle determination of Azimuth & time.

**References:**

1. Surveying & Levelling Vol.I& Vol II T.P. Kanetkar.
2. Duggal, Surveying Theory & Practice, Vol .I&II, Tata McGraw Hell Pub co.ltd.
3. Surveying Vol I, II & III B.C. Punamia.
4. Surveying Vol I, II, KR.Arora.

  
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**Course Outcomes-**

After the completion of this course students will able to –

CO1	Explain various method of leveling and contouring.
CO2	Analyse traversing data obtained using theodolite.
CO3	Determine horizontal and vertical distances using tacheometry.
CO4	Set out curves and control point for carrying out any civil engineering work.



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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
CE-46	Software Lab	Theory			Practical		50	L	T	P	2
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work					
		-	-	-	30	20					


**Experiments**

- 1 Analysis & Design determinate structures using software.
- 2 Analysis & Design determinate fixed & continuous beam using software.
- 3 Analysis & Design determinate plane frame using software.
- 4 Analysis & Design of space frames subjected to DL & LL
- 5 Analysis & Design of residential building subjected to all loads
- 6 Analysis & Design of Roof Trusses
- 7 Design and detailing of built up steel beam
- 8 Developing a design Programme for foundation using EXCEL Spread Sheet
- 9 Detailing of RCC beam and RCC slab
- 10 Detailing of Steel built up compression member

**Course Outcomes-**

After the completion of this course students will able to –

CO1	Analysis and design of civil engineering structures and its components
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