AR23

CODE: 23MET206 **SET-2**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April-2026

HEAT AND MASS TRANSFER

(MECHANICAL ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

			Marks	CO	BTL
		UNIT-I			
1.		Derive the expression for general heat conduction in Cartesian coordinate system.	14	1	
		(OR)			
2.	a)	Explain the terms thermal conductance and thermal resistance.	4	1	
	b)	A hot gas at 325°C flowing through a metal pipe of 10 cm OD and 3 mm thick. It is insulated with mineral wool for reducing heat loss in such a way that the insulation surface temperature should not exceed 50°C. Determine thickness of insulation required taking the following data. hi = 25 W/m^2K; ho = 10 W/m^2K and Ta(surrounding air temperature) = 25°C; K (metal of pipe) = 40 W/mK; K(Mineral wool) = 0.045 W/mK. Also calculate the loss of heat transfer per meter length of the pipe after putting insulation.	10	1	
		UNIT-II			
3.	a)	Derive the expression for temperature T as a function of time in lumped capacity approach method.	8	2	
	b)	An apple of 100 mm diameter is subject to a cold environment. The thermal conductivity of apple, k = 0.6 W/(m K) and the convective heat transfer coefficient of the surrounding environment, h = 10 W/(m^2 °C). Comment whether the lumped parameter analysis is suitable for predicting the temperature–time history of the apple.	6	2	
		(OR)			
4.	a)	A steel rod (k=30 W/m K), 12 mm in diameter and 60 mm long, with an insulated end is to be used as spine. It is exposed to surrounding with a temperature of 60°C and heat transfer coefficient of 55 W/m2 K. The temperature at the base is 100°C. Determine: (i) The fin effectiveness (ii) The fin efficiency (iii) The temperature at the end of the spine and (iv) the heat dissipation.	6	2	
	b)	Derive the formula of temperature distribution and heat transfer from a rectangular straight infinitely long fin of uniform cross sectional area considering steady state one dimensional heat transfer.	8	2	
		UNIT-III			
5.	a)	Explain the significance of Reynolds, Prandtl and Nusselt numbers.	8	3	
	b)	Calculate the local and average heat transfer coefficient for natural convection for a vertical plate 25 cm high at 55°C. The surrounding air is at 25°C. Also calculate the boundary layer thickness at the trailing edge of the plate.	6	3	
		(OR)			
6.	a)	Discuss internal forced convection in pipes and explain the difference between laminar and turbulent flow.	8	3	
	b)	A person extends its uncovered arms into the windy air outside at $10^{O}C$ and 50 km/h in order to feel nature closely. Initially, the skin temperature of the arm is $30^{O}C$. The arm as a 0.6 m long and 7.5 cm diameter cylinder, determine the rate of heat loss from the arm.	6	3	

UNIT-IV

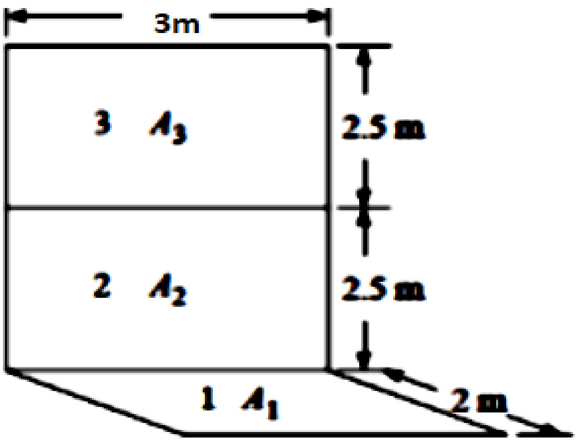
7.	a)	Draw the boiling curve and identify the different boiling regimes. Also explain the characteristics of each regime.	8	4
	b)	In a food processing plant, a brine solution is heated from 8°C to 14°C in a double-pipe heat exchanger by water entering at 55°C and leaving at 40°C at the rate of 0.18 kg/s. If the overall heat transfer coefficient is 800 W/(m2 K), determine the area of heat exchanger required (a) for a parallel flow arrangement, and (b) for a counter flow arrangement. Take cp for water = 4.18 kJ/(kg K).	6	4

(OR)

8.	a)	Derive an expression for parallel flow heat exchanger using LMTD method.	7	4
	b)	In a counter flow heat exchanger water is heated from 25^0C to 65^0C by oil with specific heat of 1.45 kj/kg k and mass flow rate of 0.9 kg/s. The oil is cooled from 230^0C to 160^0C. If overall heat transfer coefficient is 420w/m^2 ^{0}c. Calculate following i) Mass flow rate of water ii) Effective ness of Hex. Iii) Surface area required.	7	4

UNIT-V

9.	a)	Define the properties absorptivity (α), transmissivity (τ), and reflectivity (ρ). Show that τ+ρ+α=1.	8	5
	b)	Determine the view factors F13 and F31 between the surfaces 1 and 3 as shown in Figure	6	5



(OR)

10.	a)	Derive the expression for radiation heat exchange between two infinitely small black bodies	8	5
	b)	What are different modes of mass transfer used in industry? Explain briefly.	6	5

AR23

CODE: 23ITT203 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April-2026

Computer Organization & Architecture

(INFORMATION TECHNOLOGY)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	BTL
		UNIT-I			
1.	a)	Explain functional units of a computer with diagram.	7	1	2
	b)	Illustrate floating point representation with example.	7	1	3
		(OR)			
2.	a)	Describe Von-Neumann architecture and its features.	7	1	2
	b)	Explain multiplication algorithm in computer arithmetic.	7	1	3
		UNIT-II			
3.	a)	Explain basic logic gates with truth tables.	7	2	2
	b)	Design a full adder using logic gates.	7	2	3
		(OR)			
4.	a)	Describe Boolean theorems with examples.	7	2	2
	b)	Explain carry look-ahead adder with diagram.	7	2	3
		UNIT-III			
5.	a)	Explain components of CPU.	7	3	2
	b)	Illustrate different addressing modes with examples.	7	3	3
		(OR)			
6.	a)	Describe instruction execution cycle.	7	3	2
	b)	Explain instruction set architecture of CPU.	7	3	3
		UNIT-IV			
7.	a)	Explain memory hierarchy with diagram.	7	4	2
	b)	Explain cache memory and its performance.	7	4	3
		(OR)			
8.	a)	Describe types of ROM.	7	4	2
	b)	Illustrate paging in virtual memory.	7	4	3
		UNIT-V			
9.	a)	Explain programmed I/O with diagram.	7	5	2
	b)	Explain DMA with working.	7	5	3
		(OR)			
10.	a)	Describe interrupt driven I/O.	7	5	2
	b)	Illustrate cache coherence in multiprocessor.	7	5	3

AR23

CODE: 23EET207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April-2026

ELECTRICAL POWER GENERATION & DISTRIBUTION

(ELECTRICAL AND ELECTRONICS ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	BTL
		UNIT-I			
1.	a)	Explain the functions of Cooling tower and condenser with respect to a Thermal power station.	7	1	Understand
	b)	Explain briefly about ash handling mechanism in a thermal plant.	7	1	Analyse
		(OR)			
2.	a)	With a neat schematic diagram explain briefly about Hydel power plant	14	1	Understand
		UNIT-II			
3.	a)	Explain types of wind turbines	7	2	Understand
	b)	Discuss about Radiation hazards and shielding in Nuclear Power Plants	7	2	Understand
		(OR)			
4.	a)	With a neat block diagram explain different parts of Nuclear Power Plant	14	2	Understand
		UNIT-III			
5.	a)	Calculate the voltage at a distance of 250m of a 350m long distributor uniformly loaded at the rate of 0.8A/m. The distributor is fed at one end at 250V. The resistance of the distributor (go and return) per meter is 0.00017Ω. Also find the power loss in the distributor.	7	3	Apply
	b)	Compare AC and DC distribution system	7	3	Remember
		(OR)			
6.	a)	Discuss about the classification and design features of distribution systems.	14	3	Analyse
		UNIT-IV			
7.	a)	Explain briefly about an Air Insulated Substation.	7	4	Understand
	b)	Explain the general maintenance requirements of a Gas – Insulated Substation.	7	4	Analyse
		(OR)			
8.	a)	With a neat line diagram explain about components of a 33/11kV substation	14	4	Analyse
		UNIT-V			
9.	a)	A Power station is to fed four regions of load whose peak loads are 12, 7, 10 and 8 MW. The diversity factor at the station is 1.4 and the average annual load factor is 65%. Determine the following: i) Maximum demand on the station ii) Annual energy supplied by the station and iii) Suggest the installed capacity	9	5	Apply
	b)	Explain about power factor tariff methods.	5	5	Remember
		(OR)			
10.	a)	Explain the following with respect to the economic aspects power generation: (i) Load duration curve, (ii) Diversity factor , (iii) Maximum demand (iv) Plant Capacity factor and (v) Utilization factor	7	5	Understand
	b)	Discuss in detail about Simple rate, Flat Rate, and Block-Rate Tariff methods.	7	5	Understand

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CODE: 23ECT208 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April-2026

ELECTRO MAGNETIC WAVES & TRANSMISSION LINES

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	Blooms Level
		UNIT-I			
1.	a)	State and formulate Coulomb's law for a point charge.	7	CO1	L2
	b)	Establish the relationship between Electric potential and Electric field intensity.	7	CO1	L3
		(OR)			
2.	a)	Identify and illustrate Electric flux density and Gauss law with an example.	7	CO1	L1
	b)	Develop Poisson's and Laplace equations and interpret their significance.	7	CO1	L3
		UNIT-II			
3.	a)	Apply Biot–Savart law to determine Magnetic field due to a current element.	7	CO2	L2
	b)	Relate Magnetic flux density with Magnetic field intensity.	7	CO2	L2
		(OR)			
4.	a)	Demonstrate Ampere's circuital law.	7	CO2	L3
	b)	Evaluate the force on a current carrying conductor in Magnetic field.	7	CO2	L2
		UNIT-III			
5.	a)	Examine the concept of displacement current and its role.	7	CO3	L3
	b)	Summarize Maxwell's equations in point form with meanings.	7	CO3	L2
		(OR)			
6.	a)	Formulate boundary conditions at Dielectric interface.	7	CO3	L3
	b)	Illustrate Faraday's law with a suitable case.	7	CO3	L2
		UNIT-IV			
7.	a)	Construct the wave equation for uniform plane wave in free space.	7	CO4	L2
	b)	Classify different types of polarization in EM waves.	7	CO4	L3
		(OR)			
8.	a)	Analyze Poynting theorem and its implications.	7	CO4	L3
	b)	Characterize EM wave propagation in conducting medium.	7	CO4	L2
		UNIT-V			
9.	a)	Obtain expressions for characteristic impedance and propagation constant.	7	CO5	L2
	b)	Distinguish between reflection coefficient and VSWR.	7	CO5	L3
		(OR)			
10.	a)	Apply Quarter-wave transformer concept for impedance matching.	7	CO5	L2
	b)	Compare open and short circuit transmission lines.	7	CO5	L3

AR23

CODE: 23CST206 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)
II B. Tech II Semester Regular & Supplementary Examinations, April - 2026

Software Engineering

(COMPUTER SCIENCE AND ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	Blooms Level
		UNIT-I			
1.	a)	Define Software Engineering and explain the changing nature of software with examples.	7M	CO1	K2
	b)	Design a requirement elicitation and validation strategy for a healthcare system involving multiple stakeholders.	7M	CO1	K2
		(OR)			
2.	a)	Evaluate Scrum and XP in terms of scalability and customer involvement.	7M	CO1	K3
	b)	Describe the requirements engineering process with a neat diagram.	7M	CO1	K2
		UNIT-II			
3.	a)	Explain the Waterfall model and discuss its advantages and limitations.	7M	CO2	K2
	b)	Explain the Incremental and RAD models with suitable examples.	7M	CO2	K2
		(OR)			
4.	a)	Explain the Agile process model and its principles.	7M	CO2	K2
	b)	Describe the Scrum methodology, roles, and artifacts.	7M	CO2	K2
		UNIT-III			
5.	a)	Evaluate the importance of design patterns in software engineering. Analyze the relationship between cohesion and coupling with suitable examples	7M	CO3	K2
	b)	Discuss the design process and design quality attributes.	7M	CO3	K2
		(OR)			
6.	a)	Develop a modular design (structure chart) for a library management system.	7M	CO3	K2
	b)	Explain the user interface design process and golden rules.	7M	CO3	K2
		UNIT-IV			
7.	a)	Differentiate between verification and validation with examples.	7M	CO4	K2
	b)	Explain the debugging process and strategies.	7M	CO4	K2
		(OR)			
8.	a)	Explain boundary value analysis with a suitable example.	7M	CO4	K3
	b)	Explain control structure testing techniques.	7M	CO4	K2
		UNIT-V			
9.	a)	Analyze the effectiveness of COCOMO in modern Agile environments. Suppose that a project was estimated to be 400 KLOC. Calculate the effort and development time for each of the three modes i.e., organic, semidetached and embedded.	7M	CO5	K2
	b)	Discuss software quality assurance (SQA) activities.	7M	CO5	K2
		(OR)			
10.	a)	Explain Statistical Software Quality Assurance (SSQA).	7M	CO5	K2
	b)	Explain software reliability and quality metrics.	7M	CO5	K4

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CODE: 23CET207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April - 2026

Structural Analysis

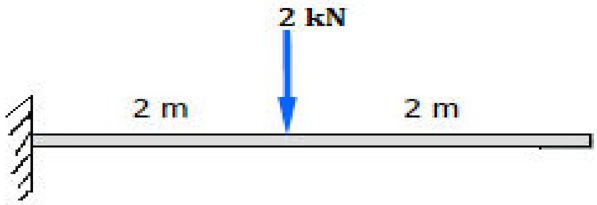
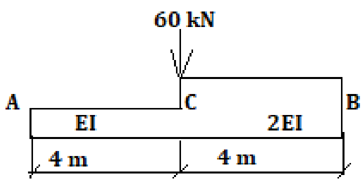
(CIVIL ENGINEERING)

Time: 3 Hours **Max Marks: 70**

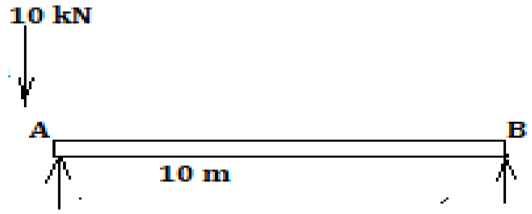
Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		UNIT-I	Marks	CO	BTL
1.	a)	Determine the maximum deflection in cantilever beam of span '4 m' loaded as shown. 	7 M	1	L3
	b)	Determine the deflections in simply supported beam of span 'L' having a central point load 'W'. Use Moment area method.	7 M	1	L3
		(OR)			
2.		A simply supported beam of span 6 m carries a point load 10 kN at a distance 4 m from the left support. The beam has a flexural rigidity $EI=2\times10^7$ $N{\cdot}m^2$. Find the deflection at the point of load application using the Macaulay method.	14 M	1	L3
		UNIT-II			
3.	a)	State Castigliano's first theorem and find the strain energy stored in a simply supported beam of span 'L' subjected to a central point load 'W'.	7 M	2	L3
	b)	State Castigliano's second theorem and derive expression for strain energy due to shear force in a simple beam of span 'L'.	7 M	2	L2
		(OR)			
4.	a)	Derive an expression for strain energy for a beam AB of length 'L' due to bending moment.	7 M	2	L3
	b)	Using strain energy method determine the deflection under 60 kN load in the beam shown in Figure. 	7 M	2	L3

UNIT-III

5.	A system of concentrated load, role beam left to right, simple beam span of 10 m and 10 kN load leading. Find a) absolute maximum positive S.F b). Absolute maximum negative S.F c) Absolute maximum BM. 	14 M	3	L3
	(OR)			
6.	In a simply supported girder AB of span 20m, determine the maximum bending moment and maximum shear force at a section 5m from A, due to the passage of a uniformly distributed load of intensity 20 kN/m, longer than the span.	14 M	3	L3
	UNIT-IV			
7.	A propped cantilever beam of span 8 m due to a point load of 12 kN at the mid span. Determine the support reactions. and also sketch SFD and BMD.	14 M	4	L3
	(OR)			
8.	A fixed beam of span 6 m is loaded with two-point loads of 4 kN and 9 kN from 2 m from left and right supports respectively. Calculate the reactions at both ends and also sketch SFD and BMD.	14 M	4	L3
	UNIT-V			
9.	A three hinged parabolic arch of span 15 m and a rise of 5 m carries a point load of 20 kN at a distance of 4 m from left support. Find the bending moment, radial shear and normal thrust at 3 m from left support.	14 M	5	L3
	(OR)			
10.	A two hinged parabolic arch of constant cross section has a span of 40 m and a rise of 8 m. It is subjected to two concentrated loads of 20 kN at 8 m from left and 10 m from right support. Find the Horizontal thrust in the arch. Also find, bending moment, radial shear and normal thrust at 6 m from left hand side.	14 M	5	L3

AR23

CODE: 23CAT203 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Regular & Supplementary Examinations, April- 2026

OBJECT ORIENTED PROGRAMMING

(Common TO CSE(AIML) & CSE(DS) Branches)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	Blooms Level
		UNIT-I			
1.	a)	Explain the following given below. i) Operators in JAVA. ii) Scope and Lifetime of Variables in JAYA	7	CO1	2
	b)	List the control statements in java and describe any two with syntax.	7	CO1	1
		(OR)			
2.	a)	Describe the benefits and applications of object-oriented programming.	7	CO1	1
	b)	Explain operator precedence rules with a relevant example.	7	CO1	2
		UNIT-II			
3.	a)	Define recursion? Develop a java program for printing Fibonacci series using recursion.	7	CO2	3
	b)	List the various types of constructors and explain each with example.	7	CO2	1
		(OR)			
4.	a)	Discuss the following terms i) final ii) this iii) garbage collection	7	CO2	3
	b)	Compare and contrast the terms java methods and java constructors	7	CO2	2
		UNIT-III			
5.	a)	Define the term Inheritance? Explain various types of Inheritance with example.	7	CO3	2
	b)	Define the term Polymorphism? Develop a code snippet for compile time and run time polymorphism.	7	CO3	3
		(OR)			
6.	a)	What is interface? Explain about Multiple Inheritance using Interface with an example.	7	CO3	2
	b)	Define Abstract class? Differentiate Abstract class and interface with an example.	7	CO3	3
		UNIT-IV			
7.	a)	What is CLASSPATH? Explain CLASSPATH setting procedure.	7	CO4	2
	b)	List the some of the most common types of exceptions that might occur in java. Give example.	7	CO4	1
		(OR)			
8.	a)	Define Exception handling? Develop a small java program using try, catch and finally in exception handling.	7	CO4	3
	b)	Define Package? Explain the procedure for creating and importing the packages in java.	7	CO4	1
		UNIT-V			
9.	a)	Define thread in java? Explain about thread priorities.	7	CO5	2
	b)	Explain about java Applet life cycle.	7	CO5	2
		(OR)			
10.	a)	What is Applet? Write a java applet program to display circle fill with any color and rectangle fill with any color.	7	CO5	1
	b)	Explain about thread life cycle.	7	CO5	2

AR20

CODE: 20MET207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech II Semester Supplementary Examinations, April- 2026

STRENGTH OF MATAERIALS

(MECHANICAL ENGINEERING)

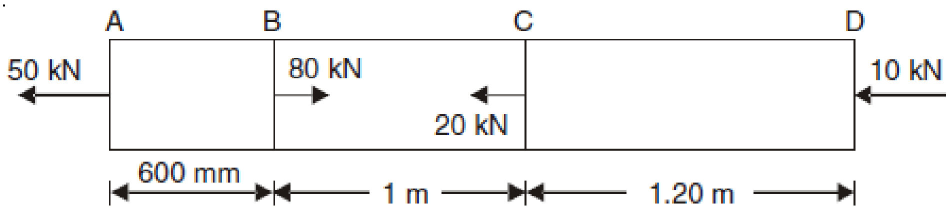
Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

			Marks	CO	BTL
		UNIT-I			
1	a)	Write the types of stresses and strains?	4M	1	K2
	b)	Draw stress – strain diagram for mild steel and explain the salient features.	6M	1	K2
		(OR)			
2	a)	State the following: (i) Hooke's law, (ii) Poisson's ratio, (iii) Factor of safety	4M	1	K2
	b)	A brass bar, having cross-sectional area of 1000 mm^2, is subjected to axial forces as shown in Fig. Find the total elongation of the bar. Take $E = 1.05 \times 10^5$ N/mm^2.	6M	1	K3



			Marks	CO	BTL
		UNIT-II			
3	a)	Explain the terms shear force and bending moment with reference to a loaded beam. Define a beam and classify its types.	4M	2	K2
	b)	A simply supported beam of length 8 m carries point loads of 4 kN, 10 kN and 7 kN at a distance of 1.5 m, 2.5 m and 2 m respectively from left end A. Draw the S.F. and B.M. diagrams for the simply supported beam.	6M	2	K3
		(OR)			
4	a)	What are the different types of beams? Differentiate between a cantilever and a simply supported beam.	4M	2	K2
	b)	A simply supported beam of length 10 m carries point loads of 30 kN and 50 kN at a distance of 3 m and 7 m from the left end. Draw the S.F. and B.M diagrams for the beam.	6M	2	K3

UNIT-III

5		Derive expression for change in volume of a round bar of length L and diameter D subjected to an axial pull P. Take Poisson's ratio = 1/m, young's modulus = E.	10M	3	K3
		(OR)			
6	a)	Derive the governing equation for shear stress in beams and explain the significance of each term in the equation.	5M	3	K2
	b)	Prove that for a rectangular section: $\tau_{max} = 3/2 \times \tau_{avg}$	5M	3	K2

UNIT-IV

7	a)	Explain the torsion of circular shafts and derive the torsion equation. Also discuss the concept of pure shear in torsion.	6M	4	K2
	b)	A solid circular shaft transmits 75 kW at 120 rpm. If the maximum shear stress is 60 N/mm^2, find the required shaft diameter.	4M	4	K3
		(OR)			
8	a)	Derive equations for hoop stress and longitudinal stress of a thin cylinder.	4M	4	K2
	b)	A thin cylinder 1 m diameter and 8 mm thick is under 2 N/mm^2 pressure. Determine hoop and longitudinal stresses. Take $E = 2\times10^5$ N/mm^2.	6M	4	K3

UNIT-V

9	Describe the effect of end support conditions on the critical buckling load of columns. Compare the effective length for: (a) Pinned–pinned, (b) Fixed–free, (c) Fixed–pinned, (d) Fixed–fixed columns.	10M	5	K2
	(OR)			
10	The external and internal diameters of a hollow cast iron column are 5 cm and 3 cm respectively. If the length of this column is 4 m and both of its ends are fixed, determine the crippling load using Rankine's formula. Take the value of σ_c = 550 N/mm2 and a = 1/1600 in Rankine's formula.	10M	5	K3

UNIT-VI

11	A cantilever beam of length L carries a uniformly distributed load w. Using any appropriate method, derive expressions for: (a) Slope at the free end (b) Deflection at the free end	10M	6	K3
	(OR)			
12	A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire span of 5 m. If the value of E for the beam material is 1×10^4 N/mm^2, find: (i) the slope at the supports and (ii) maximum deflection.	10M	6	K3

AR20

CODE: 20ECT207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech I Semester Supplementary Examinations, April,2026

TRANSMISSION LINES & ELECTRO MAGNETIC WAVES

(ELECTRONICS AND COMMUNIATION ENGINEERING)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

		UNIT-I	Marks	CO	BTL
1.	a)	Derive and explain the fundamental equations governing voltage and current on a transmission line.	5	1	K2
	b)	Explain the characteristics and behaviour of lossless transmission lines.	5	1	K2
		(OR)			
2.	a)	Explain the concept of distortion less transmission lines and the conditions required for distortion less signal propagation.	5	1	K2
	b)	Derive and explain the expressions for the characteristic impedance of transmission lines.	5	1	K2
		UNIT-II			
3.	a)	Define the reflection coefficient and explain its significance in transmission lines and wave propagation.	5	2	K2
	b)	Explain the characteristics and behaviour of low-loss radio frequency transmission lines.	5	2	K2
		(OR)			
4.	a)	How UHF transmission lines can be represented and analyzed as equivalent circuit elements	5	2	K2
	b)	Explain the construction of the Smith Chart and its applications in analyzing transmission lines and matching circuits.	5	2	K2
		UNIT-III			
5.	a)	Explain the cylindrical coordinate system and its applications in electromagnetic.	5	3	K2
	b)	Explain the Laplacian operator and its significance in electromagnetic and vector calculus.	5	3	K2
		(OR)			
6.	a)	Explain the concept of electric field intensity	5	3	K2
	b)	State and explain Gauss's Law and its applications in electro magnetics.	5	3	K2
		UNIT-IV			
7.	a)	State Ampère's Circuital Law and discuss its applications in electromagnetic theory.	5	4	K2
	b)	Derive the boundary conditions for electromagnetic fields at the interface between two different media.	5	4	K2
		(OR)			
8.	a)	Explain the forces experienced by charges and current-carrying conductors due to magnetic fields.	5	4	K2
	b)	State and explain Maxwell's two equations applicable to magneto static fields.	5	4	K2
		UNIT-V			
9.	a)	State and explain Faraday's Law of electromagnetic induction and its relation to electromotive force.	5	5	K2
	b)	Explain the concept of displacement current density and its role in electromagnetic theory	5	5	K2
		(OR)			
10.	a)	State and explain the boundary conditions for electromagnetic fields at a surface separating two media.	5	5	K2
	b)	Explain the behaviour of electromagnetic fields at the boundary between two dielectric media.	5	5	K2
		UNIT-VI			
11.	a)	Explain the behaviour and properties of time-varying electromagnetic waves propagating through a perfect dielectric medium.	5	6	K2
	b)	Explain the concept of polarization in electromagnetic waves.	5	6	K2
		(OR)			
12.	a)	Explain the relationship between the electric field (E) and the magnetic field (H) in electromagnetic waves	5	6	K2
	b)	State and explain the Poynting Theorem and its significance in electromagnetic theory.	5	6	K2

AR20

CODE: 20CST207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech.II Semester Supplementary Examinations, April,2026

OPERATING SYSTEMS

(COMMON TO CSE & IT)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

			Marks	CO	BTL
		UNIT-I			
1.	a)	List the services provided by an Operating System?	5	1	L2
	b)	Define System Calls. Explain different types of system calls with examples.	5	1	L2
		(OR)			
2.	a)	Define scheduling and list their types.	5	1	L2
	b)	For the processes given below, calculate average waiting time using FCFS: P1=5, P2=3, P3=8, P4=6 (arrival time = 0)	5	1	L4
		UNIT-II			
3.	a)	What is critical section problem? State its requirements.	5	2	L2
	b)	Explain how Semaphores can be used to solve synchronization problems.	5	2	L3
		(OR)			
4.	a)	Explain how Peterson's solution ensures mutual exclusion with example.	5	2	L3
	b)	Write pseudo code for producer-consumer problem using semaphore and explain working.	5	2	L4
		UNIT-III			
5.	a)	List and explain the necessary conditions for deadlock.	5	3	L2
	b)	Explain deadlock prevention strategies.	5	3	L2
		(OR)			
6.	a)	Explain the resource allocation graph. How is it used for deadlock detection in systems with single instance of resource types?	5	3	L3
	b)	Illustrate the Banker's Algorithm for Deadlock Avoidance.	5	3	L4
		UNIT-IV			
7.	a)	Define paging and explain address translation.	5	4	L2
	b)	Calculate the number of page faults using FIFO page replacement algorithm for the reference string: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2 with 3 frames.	5	4	L4
		(OR)			
8.	a)	What is thrashing? What are its causes and how can the system detect and prevent it?	5	4	L2
	b)	Explain the OPT and LRU page replacement algorithms.	5	4	L2
		UNIT-V			
9.		Explain file allocation methods and analyse which method is best in different scenarios.	10	5	L3
		(OR)			
10.	a)	Design a directory structure for a university system and justify your choice.	5	5	L2
	b)	Explain the Linked Allocation method and its advantages.	5	5	L3
		UNIT-VI			
11.		Explain SCAN disk scheduling and calculate head movement for: Queue: 98, 183, 37, 122, 14, 124, 65, 67, Initial head = 53	10	6	L4
		(OR)			
12.	a)	Explain the disk structure and different disk attachments	5	6	L2
	b)	Explain FCFS and SSTF disk scheduling algorithms.	5	6	L3

AR20

CODE: 20CET207 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B.Tech.II Semester Supplementary Examinations, April,2026

GEOTECHNICAL ENGINEERING

(CIVIL ENGINEERING)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

		UNIT-I	Marks	CO	BTL
1	a)	A soil sample has G = 2.70, water content = 18%, and degree of saturation = 60%. Determine the void ratio and comment on the state of the soil.	5M	1	K3
		Sol $e = 0.18 \times 2.70 / 0.60 = 0.81$	4M		
		Formula	1M		
	b)	Compare fine-grained and coarse-grained soils in terms of engineering behaviour and justify their suitability for foundation applications.	5M	1	K4

Ans **1. Basic Difference**

Property	**Coarse-grained soils (Sand, Gravel)**	**Fine-grained Clay)**
Particle size	Large	Very small
Example s	Sand, gravel	Silt, clay
Plasticity	Non-plastic	Plastic (especi

1M

---

2. Engineering Behaviour

(a) Permeability 4M

- **Coarse-grained soils**: High permeability → water drains quickly
- **Fine-grained soils**: Very low permeability → slow drainage

☞ This is why sands don't retain water, but clays stay wet for long periods.

(b) Shear Strength

- **Coarse soils**: Strength comes from **friction between particles** → high and reliable
- **Fine soils**: Strength depends on **cohesion + water content** → can reduce drastically when wet

---

(c) Compressibility & Settlement

- **Coarse soils**:

- Low compressibility
- Immediate settlement (occurs quickly and stabilizes fast)

- **Fine soils**:
  - High compressibility (especially clay)
  - **Consolidation settlement** (slow, long-term settlement)

(d) Volume Change

- **Coarse soils**: Negligible volume change
- **Fine soils**:
  - Significant swelling and shrinkage
  - Expansive clays can cause serious structural damage

(e) Bearing Capacity

- **Coarse soils**: Generally **high bearing capacity**
- **Fine soils**: Lower bearing capacity, varies with moisture

---

(f) Drainage Behavior

- **Coarse soils**: Free-draining → no pore pressure buildup
- **Fine soils**: Poor drainage → excess pore water pressure develops

---

3. Suitability for Foundations
Coarse-Grained Soils (Best for Foundations)

✓ Advantages:

- High bearing capacity
- Low settlement
- Good drainage
- Immediate stability

✓ Suitable for:

- Shallow foundations
- Raft foundations
- Pavements and embankments

(OR)

2	a)	Explain origin of soil and state difference between residual and transported soils.	5M	1	K4

Sol oil is formed by the **weathering of rocks**, a process that breaks down parent rock into smaller particles over time. This happens through three main mechanisms:

1. Mechanical (Physical) Weathering 1M

- Breakdown of rock without chemical change
- Caused by temperature changes, wind, water, and frost

- Produces coarse particles like sand and gravel

2. Chemical Weathering

- Decomposition of minerals due to chemical reactions
- Involves water, oxygen, carbon dioxide, etc.
- Forms clay minerals and alters soil composition

3. Biological Weathering

- Caused by plant roots, microorganisms, and burrowing animals
- Contributes to both physical and chemical breakdown

Types of Soil Based on Origin

Soils are broadly classified into: 1M

1. **Residual soils** (formed in place)
2. **Transported soils** (moved from original location)

Difference Between Residual and Transported Soils

3M

Property	Residual Soil	Transported Soil
Formation	Formed at the place of origin	Transported from parent rock
Movement	No movement	Moved by agents like water, wind, ice, gravity
Relation to parent rock	Directly related	May not resemble parent rock
Structure	Non-uniform, irregular	Often stratified (layered)
Depth	Varies with weathering	Depends on deposition process
Examples	Laterite, black cotton soil	Alluvial soil, aeolian soil, glacial soil

b)	Explain the steps involved in IS soil classification system.	5M	1	K2

1. Coarse-Grained Soils

- More than **50% retained on 75 micron sieve**
- Further divided into:
  - **Gravels (G)** → more than 50% retained on 4.75 mm sieve
  - **Sands (S)** → more than 50% passes 4.75 mm sieve

Sub-classification:

Based on grading and fines:

- **Well graded (W)** → good distribution of particle sizes
- **Poorly graded (P)** → uniform or gap graded
- **With fines:**
  - **Silty (M)** → non-plastic fines
  - **Clayey (C)** → plastic fines

📌 Examples:

- GW → Well graded gravel
- GP → Poorly graded gravel
- GM → Silty gravel
- GC → Clayey gravel
- SW, SP, SM, SC similarly for sands

---

2. Fine-Grained Soils

- More than **50% passes 75 micron sieve**

Classified based on **Plasticity Index (PI)** and **Liquid Limit (LL)** using the plasticity chart.

Types:

- **Silts (M)** → low plasticity
- **Clays (C)** → high plasticity
- **Organic soils (O)**

Sub-divisions:

- **Low compressibility (L)** → LL < 35
- **Medium compressibility (I)** → LL = 35–50
- **High compressibility (H)** → LL > 50

📌 Examples:

- ML → Silt of low compressibility
- CI → Clay of medium compressibility
- CH → Clay of high compressibility
- OL, OH → Organic soils

---

3. Highly Organic Soils

- Classified as **Pt (Peat)**
- Very high compressibility and organic content

◆ **2. Plasticity Chart Concept**

Fine soils are further classified using the **A-line equation**:

PI=0.73(LL−20)PI = 0.73(LL - 20)PI=0.73(LL−20)

- Points **above A-line** → **Clay (C)**
- Points **below A-line** → **Silt (M)**

Soil Type	Symbol	Description
Gravel	G	Coarse particles
Sand	S	Medium particles
Silt	M	Fine, non-plastic
Clay	C	Fine, plastic
Organic	O	Organic matter present
Peat	Pt	Highly organic

UNIT-II

3	a)	Analyze how void ratio and grain size distribution influence permeability of soils with examples.	5M	2	K4

Ans **1. Grain Size and Gradation**

- **Larger particles (sand, gravel)** → large voids → **high permeability**
- **Smaller particles (clay)** → tiny pores → **low permeability**
- Well-graded soils (mixed sizes) tend to have **lower permeability** than uniformly graded soils because smaller particles fill the voids.

---

2. Void Ratio / Porosity

- Higher void ratio → more space for water flow → **higher permeability**
- Lower void ratio → compact soil → **lower permeability**

Even a small change in void ratio can significantly affect permeability

b) A soil deposit consists of two horizontal layers of equal thickness with permeabilities $k_1=1\times10^{-4}$ cm/s and $k_2=5\times10^{-4}$ cm/s. Determine equivalent permeability for vertical flow and interpret the result. 5M 2 K3

Given data – 1 M

Relevant Formulas – 1 M

kv1=1/3*(1/k1+1/k21+1/k3) = $4.33*10^{-5}$ cm/s

Step by Step process – 3 M

(OR)

4 a) Explain briefly constant head permeability test. 5M 2 K2

Constant Head Permeability Test

The **constant head permeability test** is used to determine the **coefficient of permeability (k)** of **coarse-grained soils** like sand and gravel, where water can flow easily.

Principle

Water is allowed to flow through a soil sample under a **constant hydraulic head**, and the quantity of water flowing per unit time is measured.

It is based on **Darcy's Law**, which states that flow rate is proportional to hydraulic gradient.

Apparatus

- Permeameter (cylindrical mould)
- Constant head water supply tank
- Measuring jar
- Stop watch
- Manometer tubes
- Soil sample (undisturbed or remoulded)

Test Procedure

1. Place the soil sample in the permeameter.
2. Saturate the sample completely (remove air voids).
3. Maintain a **constant water head (h)** across the sample.
4. Allow water to flow through the soil.
5. Collect the discharge (Q) over a time (t).
6. Measure:
   - Length of sample (L)
   - Cross-sectional area (A)
   - Head difference (h)

Formula

k=QL/Aht

Where:

- k = coefficient of permeability
- Q = quantity of water collected
- L = length of soil sample
- A = cross-sectional area
- h= head difference
- t = time

b)	A soil sample experiences a head difference of 40 cm over a length of 20 cm. If k = 3×10^{-4} cm/s, compute discharge through a cross-sectional area of 60 cm² and analyze the flow condition.	5M	2	K3

V =ki i= h/L =2

=$2*3\times10^{-4}$ Q =60 *6*10^{-4} = 36*10^{-2} cm3/sec

UNIT-III

5	a)	A capillary rise of 0.8 m occurs in a soil. Determine capillary pressure and discuss its effect on soil behavior. (Take γ_w = 9.81 kN/m³).	5M	3	K3

Ans

uc=9.81×0.8=7.848kN/m2

negative pore pressure

Effect on Soil Behaviour

1. Increase in Shear Strength

- Capillary pressure creates **negative pore pressure (suction)**
- This increases **effective stress**
- Soil becomes **stronger**, especially in partially saturated soils

---

2. Apparent Cohesion

- Even cohesionless soils (like sand) show **temporary cohesion**
- This is why moist sand can stand in slopes or be molded

---

3. Reduction in Permeability

- Water held in pores reduces flow paths
- Soil becomes less permeable in partially saturated condition

---

4. Volume Change Behavior

- Changes in moisture reduce capillary effects
- Leads to **shrinkage or collapse** when soil becomes saturated

b) Analyze the effect of upward seepage on effective stress and discuss its implications on soil stability. 5M 3 K4

The **quick condition** (or **boiling condition**) occurs in **cohesionless soils (like sand)** when **upward seepage pressure** becomes equal to the **submerged weight of soil particles**.

At this stage:

- The **effective stress becomes zero**
- Soil particles lose contact with each other
- The soil behaves like a **liquid (suspension)**
- This condition is called **quicksand**, though it is not actually sand behaving mysteriously—it's a seepage phenomenon

Quick condition occurs when:

$i = i_c$

Where:

- i = hydraulic gradient
- i_c = critical hydraulic gradient

At this point:

- **Seepage force = submerged weight**
- **Effective stress = 0**

Conditions Favorable for Formation of Quicksand

1. Upward Seepage Flow

- Water must flow **upward**, opposing gravity
- Common near the **downstream side of dams, sheet piles, or excavations**

---

2. High Hydraulic Gradient

- When the hydraulic gradient approaches the **critical gradient**, quick condition develops

---

3. Loose Sand Deposit

- **Loosely packed soils** are more prone because:
  - Lower weight per unit volume
  - Easier particle separation

---

4. Fine Sand or Silt

- Occurs mostly in:
  - **Fine sand**
  - **Silty sand**
- Very coarse sand or gravel is less susceptible

---

5. High Water Table

- Presence of groundwater close to surface supports upward seepage

---

6. Poor Drainage Conditions

- If water cannot escape easily → pressure builds up → increases seepage force

---

7. Absence of Cohesion

- Cohesionless soils (sand) are vulnerable
- Clay soils are less affected due to **cohesive forces**

(OR)

6	a)	Define total stress and neutral effective stress in geotechnical engineering applications with suitable examples.	5M	3	K4

Sol 1. Total Stress (σ\sigmaσ)

Definition:
Total stress is the **total force per unit area** acting at a point in soil due to the **weight of soil and any external loads** (water, structures, etc.).

$\sigma = \gamma z$

- γ= unit weight of soil
- z = depth

☞ It represents the **entire stress carried by soil + water together**.

---

2. Neutral Stress / Pore Water Pressure (u)

Definition:
Neutral stress is the **pressure exerted by water present in the voids of soil**. It is also called **pore water pressure**.

$u = \gamma w z$

- γw = unit weight of water

☞ It does **not contribute to shear strength**, because water cannot resist shear.

---

3. Effective Stress (σ′)

Definition:
Effective stress is the **stress carried by soil particles (soil skeleton)** and is responsible for **strength and deformation**.

This follows the **Effective Stress Principle**:

	b)	A 6 m thick saturated soil layer has a unit weight of 20 kN/m³. Determine total stress, pore water pressure, and effective stress at 4 m depth and interpret the results	5M	3	K3

Given data – 1 M
Relevant Formulas – 1 M
Step by Step process – 3 M

UNIT-IV

7	a)	Analyze how moisture content influences compaction characteristics of soil with reference to dry density curve.	5M	4	K4

Sol Moisture Content vs Compaction (Dry Density Curve)

When soil is compacted at different moisture contents (e.g., in a Proctor test), the relationship between **water content (w)** and **dry density (γd)** forms a characteristic curve:

$\gamma d = \gamma / 1 + w$

(This relation is used to compute dry density from measured bulk density.)

Shape of the Dry Density Curve

- The curve is **bell-shaped (parabolic)**.
- It shows:
  - A peak → **Maximum Dry Density (MDD)**
  - Corresponding water content → **Optimum Moisture Content (OMC)**

Effect of Moisture Content

1. Dry Side of OMC (Low Water Content)

- Soil is relatively dry
- Water acts as a **lubricant**, reducing friction between particles
- Compaction becomes easier as water increases
- **Dry density increases**

☞ Reason: Soil particles rearrange into a **denser configuration**

---

2. At Optimum Moisture Content (OMC)

- Ideal amount of water for compaction
- Maximum particle rearrangement occurs
- Air voids are minimized

☞ Result:

- **Maximum Dry Density (MDD)** is achieved
- Best engineering properties for construction

---

3. Wet Side of OMC (High Water Content)

- Excess water starts occupying voids
- Water resists compression (incompressible)
- Pore water pressure develops

☞ Result:

- **Dry density decreases** despite compaction effort

Engineering Interpretation of the Curve

Dry Side Characteristics

- Higher strength (in clays)
- More resistance to deformation
- Lower compressibility

Wet Side Characteristics

- Lower strength
- Higher compressibility
- More prone to settlement

b) Explain factors affecting compaction. 5M 4 K2

Sol 1. Moisture Content

- Most important factor
- At low water content → high friction between particles → poor compaction
- As water increases → lubrication improves → better compaction
- At **Optimum Moisture Content (OMC)** → maximum dry density achieved
- Beyond OMC → excess water reduces density

---

2. Compactive Effort (Energy)

- Higher energy (more blows, heavier rollers) → higher density
- Increases **Maximum Dry Density (MDD)**
- Slightly reduces OMC

☞ Example:

- Standard Proctor vs Modified Proctor test

---

3. Type of Soil

- **Coarse-grained soils (sand, gravel)**:
  - Compact easily
  - Less sensitive to water content
- **Fine-grained soils (clay)**:

- Require more water
- Show clear OMC and MDD

- Well-graded soils → better compaction than poorly graded soils

---

4. Method of Compaction

Different methods suit different soils:

- **Static compaction** → smooth wheel rollers
- **Kneading compaction** → sheep foot rollers (best for clays)
- **Vibratory compaction** → effective for sands and gravels
- **Impact compaction** → tamping

(OR)

8 a) Analyze the differences in mechanism between compaction and consolidation using engineering perspective. 5M 4 K4

Aspect	Compaction	Consolidation
Definition	Densification of soil by **mechanical means**	Volume reduction due to **expulsion of (pore water)** under load
Soil type	Mainly **cohesionless & partially saturated soils**	Mainly **cohesive (clayey) saturated soils**
Cause	External energy (rolling, tamping, vibration)	Sustained **static load** over time
Mechanism	Reduction of **air voids**	Expulsion of **water from voids**
Time factor	**Immediate process**	**Time-dependent (slow process)**
Drainage condition	No drainage required	Requires **drainage of pore water**
Water content role	Important (optimum moisture content)	Soil is usually **fully saturated**
Volume change	Due to removal of air	Due to removal of water
Field application	Road construction, embankments, earth fills	Settlement of foundations, clay layers under buildings
Testing	Proctor compaction test	Oedometer (consolidation) test

b) Define coefficient of compressibility, compression index and volume compressibility with sketches . 5M 4 K1

Sol 1. Coefficient of Compressibility (av)

Definition:
It is the **rate of decrease in void ratio with increase in effective stress**.

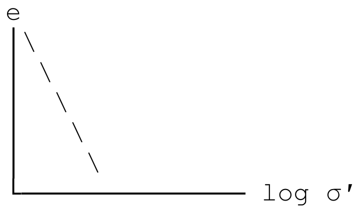
$av=\Delta e/\Delta \sigma'$

- Δe = change in void ratio

- Δσ′ = change in effective stress

☞ It indicates how much the soil **compresses for a given increase in stress**.

Sketch (e vs log σ′ curve)



- Slope of the curve segment = coefficient of compressibility

---

2. Compression Index (Cc)

Definition:
It is the **slope of the virgin compression line** in the **e – log σ′ curve**.

$$Cc=e1-e2/\log(\sigma2'/\sigma1')$$

3. Coefficient of Volume Compressibility (mv)

Definition:
It is the **volume change per unit volume per unit increase in effective stress**.

$mv=\Delta e/(1+e0)\ \Delta\sigma'$

- e0 = initial void ratio

☞ It represents **actual volumetric strain in soil**

☞ Represents compressibility of **normally consolidated soils**

UNIT-V

9 a) A point load of 200 kN acts on the ground surface. Calculate vertical stress at 3 m depth using influence factor = 0.15 and interpret the stress distribution. 5M 5 K4

Given data – 1 M
Relevant Formulas – 1 M
Step by Step process – 3 M

b) Analyze the limitations of Boussinesq’s theory in real field conditions. 5M 5 K3

- Soil is **homogeneous, isotropic, and elastic**
- Soil mass is **semi-infinite**
- Load is applied at a **point (or idealized area)**
- No consideration of **time-dependent behavior**

Limitations in Real Field Conditions

1. **Soil is Not Homogeneous**
    - Natural soils occur in **layers with varying properties**
    - Example: clay over sand, filled ground, weathered strata
      ☞ Boussinesq cannot capture **layered soil behavior**

---

2. **Soil is Not Isotropic**
    - Properties differ in vertical and horizontal directions
      ☞ Leads to **inaccurate stress predictions**

---

3. **Elastic Behavior Assumption**
    - Real soils show:
        - Plastic deformation
        - Irreversible strains
          ☞ Theory ignores **yielding and failure behavior**

---

4. **Semi-Infinite Soil Mass Assumption**
    - In reality:
        - Bedrock may exist at shallow depth
        - Finite thickness soil layers
          ☞ Stress distribution changes significantly near rigid boundaries

---

5. **Point Load Idealization**
    - Actual loads are:
        - Footings
        - Rafts
        - Distributed loads
          ☞ Point load assumption introduces **approximation errors**

---

6. **No Consideration of Time Effects**
    - Does not account for:
        - **Consolidation**
        - Creep
          ☞ Cannot predict **settlement over time**

---

7. **Groundwater Effects Ignored**
    - Pore water pressure not considered
      ☞ Effective stress changes are not captured accurately

---

8. **Unsuitable for Large Deformations**

- Works only for **small strains**

  ☞ Not valid for:
    - Soft clays
    - Highly compressible soils

(OR)

10	a)	Explain Newmark's influence chart.	5M	5	K2

Newmark's Influence Chart

Definition:

Newmark's Influence Chart is a **graphical method** used to determine the **vertical stress at a point in soil due to surface loading of any shape and size**.

Basic Principle

- It is based on **Boussinesq's theory**
- The chart consists of:
  - **Concentric circles**
  - **Radial lines**
- These divide the chart into equal **influence areas (elements)**

☞ Each small area contributes **equal stress influence** at the point considered.

Key Concept

- The chart is drawn such that:

Total influence=1

- Each division (block) has equal **influence factor**

Example:

- If chart has 200 divisions → each division = 0.005 influence factor

---

Procedure for Use

1. **Select the Point**
   - Choose the point where stress is to be calculated
   - Depth z is fixed
2. **Draw Plan of Loaded Area**
   - Draw footing or loaded area to scale
   - Scale = 1/z
3. **Superimpose on Chart**
   - Place the plan over Newmark's chart
   - Center the chart at the point of interest
4. **Count the Number of Blocks (N)**
   - Count how many chart divisions fall within the loaded area
5. **Calculate Stress**

$\sigma z = q \times N \times I$

Where:

- q = intensity of load
- N = number of divisions covered
- I = influence value per division

b)	Define pressure bulb and its significance.	5M	5	K2

Ans A **pressure bulb** is the **zone within the soil mass where the increase in vertical stress due to an applied load is significant**. It is usually represented by **contours (isobars)** showing equal stress increase below a loaded area.

Visualization

- Imagine a loaded footing
- Stress spreads downward and outward
- The region of influence forms a **bulb-shaped zone** → called pressure bulb

---

Characteristics

- Maximum stress occurs **just below the load**
- Stress decreases with:
  - Depth
  - Lateral distance
- Shape depends on:
  - Type of loading (point, line, area)
  - Soil properties

Significance in Geotechnical Engineering

1. Foundation Design

- Helps determine the **depth of significant stress influence**
- Used to assess whether underlying layers will be affected

---

2. Settlement Analysis

- Settlement depends on stress increase within soil layers
- Pressure bulb helps identify **compressible strata contributing to settlement**

---

3. Overlapping of Foundations

- If two structures are close, their pressure bulbs may overlap

  ☞ Leads to **increased settlement or interaction effects**

---

4. Bearing Capacity

- Indicates how stress is distributed in soil

- Helps evaluate **failure zones**

UNIT-VI

11 a) A soil has cohesion of 25 kN/m² and angle of internal friction of 30°. Determine shear strength under a normal stress of 100 kN/m² and interpret the result. 5M 6 K3

Ans $\tau = c + \sigma' \tan \phi$

$\tau = 25 + 100 \tan 30 = 82.73 KN/m2$

b) Define direct shear test with neat a sketch. 5M 6 K4

Direct Shear Test (Shear Box Test)

The **direct shear test** is used to determine the **shear strength parameters of soil**, namely:

- **Cohesion (c)**
- **Angle of internal friction (φ)**

It is commonly used for **cohesionless soils (sand)**.

A soil sample is placed in a **split shear box** and subjected to:

- A **normal load** (vertical pressure)
- A **horizontal shear force** until failure occurs along a **predetermined plane**

Test Procedure

1. Soil sample is placed in the shear box (usually square: 60 mm × 60 mm)
2. Apply **normal load** (vertical stress)
3. Apply **horizontal shear force** gradually
4. Measure:
   - Shear force
   - Horizontal displacement
5. Record **shear stress at failure**
6. Repeat test for different normal stresses

Advantages

1. **Simple and easy to perform**
2. **Low cost and quick results**
3. Suitable for **coarse-grained soils (sand, gravel)**
4. Large samples can be tested
5. Drainage conditions can be controlled

Disadvantages

1. **Failure plane is predetermined**
   - May not represent actual failure plane in soil
2. **Non-uniform stress distribution**
   - Shear stress is not uniform over the plane
3. **Not suitable for cohesive soils**
   - Especially for accurate undrained conditions
4. **Side friction effects**
   - May affect results
5. **Pore water pressure cannot be measured**

Unlike triaxial test

(OR)

12 a) A soil has cohesion = 20 kN/m² and normal stress = 80 kN/m² with φ = 0°. Calculate shear strength. 5M 6 K3

Shear strength = c+ sigma *tan phi

S= 20 kN/m²

b) Design an experimental approach to determine shear strength parameters of a clay sample and justify your selection of test method. 5M 6 K4

- Ans Clay has **low permeability** → drainage conditions control strength.

- Triaxial testing allows **controlled drainage**:
  - **UU (Unconsolidated Undrained) →** short-term/rapid loading
  - **CU (Consolidated Undrained)** → with pore-pressure measurement
  - **CD (Consolidated Drained)** → long-term condition
- Provides **both total and effective stress parameters**.
- Produces a **realistic stress state** (all-around confinement), unlike direct shear.

☞ Hence, triaxial testing is preferred over alternatives like direct shear or vane shear when accurate parameters are required.

Experimental Approach

1. Sample Collection

- Obtain **undisturbed clay sample** (Shelby tube/block sample)
- Preserve natural moisture and structure

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2. Sample Preparation

- Trim specimen (typically **38 mm dia × 76 mm height**)
- Place in rubber membrane
- Mount in triaxial cell

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3. Saturation

- Apply back pressure until **B-value ≈ 1**
  ☞ Ensures full saturation (critical for clays)

---

4. Consolidation Stage

- Apply **confining pressure (σ3\sigma_3σ3)**
- Allow drainage (for CU/CD tests)
- Wait until **volume change stabilizes**

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5. Shearing Stage

- Increase axial stress to cause failure
- Measure:
  - Deviator stress ($\sigma_1 - \sigma_3$)
  - Pore water pressure (for CU)
  - Strain

---

6. Repeat Tests

- Perform tests at **different confining pressures**
  ☞ Minimum 3 tests to define failure envelope

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7. Determination of Shear Parameters

- Plot **Mohr circles**
- Draw failure envelope using **Mohr–Coulomb failure criterion**

$\tau = c + \sigma' \tan \phi$

- Obtain:
  - c → intercept
  - ϕ → slope

AR18

CODE: 18ECT209 **SET-1**

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI

(AUTONOMOUS)

II B. Tech II Semester Supplementary Examinations, April,2026

DIGITAL ELECTRONICS

(Electronics and Communication Engineering)

Time: 3 Hours **Max Marks: 60**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the Question must be answered at one place

UNIT-I

1\. a) Solve for X. 6M

i) $(1256)_8 = (X)_2$ ii) $(19.125)_{10} = (X)_8$ iii) $(10011.11)_2 = (X)_{16}$

b) Explain different Hamming codes with examples. 6M

(OR)

2\. a) Explain the procedure involved in subtraction of binary numbers using 1's and 2's complements with an example. 6M

b) Explain alphanumeric and self- complement codes with examples. 6M

UNIT-II

3\. a) Obtain the minimal expression for f = Σ m (1, 2, 3, 6, 7, 8) using tabular method and verify the result with K-map. 6M

b) Express the following functions in sum of minterms and product of maxterms form. 6M

i. (A,B,C,D)=AB+BC+AD ii. F(x,y,z)=(xy+z)(xz+y)

(OR)

4\. a) Implement all logic gates using NOR gates only. 6M

b) Find the complement of the following Boolean expressions. 6M

i) $x\bar{y} + \bar{x}y$ ii) $(A\bar{B} + C)\bar{D} + E$

UNIT-III

5\. a) Realize full adder using two half adders and logic gates. 6M

b) Design a 4-bit carry look ahead adder. 6M

(OR)

6\. a) Explain the operation of an excess-3 adder. 6M

b) Design a 4-bit binary parallel subtractor. 6M

UNIT-IV

7\. a) Implement the logic function F (A,B,C) = Σ m(1,2,4,7) using 4x1 multiplexer. 6M

b) Design a 2-bit magnitude comparator using logic gates. 6M

(OR)

8\. a) Explain the operation of a 3X8 decoder with truth table and design a 4X16 decoder using 3X8 decoders. 6M

b) Explain the principle involved in priority encoder. 6M

UNIT-V

9\. a) Explain the operation of universal shift register. 6M

b) Convert JK flip flop into D flip flop. 6M

(OR)

10\. a) Design a asynchronous counter using T flip flops. 6M

b) Draw and explain operation of SR flip flop. 6M