

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 | Blooms Level |
|---|-------|----|--------------|
| 1. a) Explain the electrical resistivity method with reference to the sub-soil investigation. | 5M | 1 | 2 |
| b) Explain the number and disposition of trial pits and borings with reference to sub-soil investigations | 5M | 1 | 2 |

(OR)

- | | | | |
|---|----|---|---|
| 2. a) Explain the procedure for preparing a soil investigation report | 5M | 1 | 2 |
| b) What is 'N-value' of Standard Penetration Test? How do you find the relative density from 'N-value'? | 5M | 1 | 2 |

UNIT-II

- | | | | |
|--|----|---|---|
| 3. a) Why do earth slope fails, types of failures with a neat Sketch and Discuss how slope failures can be minimized? | 5M | 2 | 2 |
| b) An infinite slope is made of clay with the following properties: Bulk unit weight = 18 kN/m ³ , Sub.unit weight = 9 kN/m ³ , cohesion = 25 kN/m ² , angle of internal friction = 28°. If the slope has an inclination of 35° and height equal to 12m, determine factor of safety of the slope, when (i) the slope is submerged, and (ii) there is seepage parallel to the slope. | 5M | 2 | 4 |

(OR)

- | | | | |
|--|----|---|---|
| 4. a) Explain the Taylor's Stability Number | 5M | 2 | 2 |
| b) A slope is to be constructed at an inclination of 30° with the horizontal. Determine the safe height of the slope at a factor of safety of 1.5. The properties of soil are cohesion = 15 kN/m ² , angle of internal friction = 22.5° and bulk unit weight = 19 kN/m ³ . Table shows stability no. values. | 5M | 2 | 4 |

Angle of internal friction (degrees)	Angle of slope (degrees)	Stability no
22.5	30	0.020
15	30	0.046

UNIT-III

- | | | | |
|--|----|---|---|
| 5. a) Explain Coulomb's Earth Pressure theory and compare it with Rankine's theory. | 5M | 3 | 2 |
| b) A retaining wall 6 m high, vertical back, supports a saturated clay soil with a horizontal surface. The properties of the backfill are $\phi_u=0$, $c_u = 35$ kN/m ² , $\gamma = 17$ kN/m ³ . Assuming the back of wall to be smooth, determine the total active thrust against the wall and its point of application, if cracks are formed in the tension zone. | 5M | 3 | 4 |

(OR)

- | | | | | | |
|----|----|--|----|---|---|
| 6. | a) | Explain Rankine's theory of earth pressure and derive the expression for active earth pressure. | 5M | 3 | 2 |
| | b) | Excavation was being carried out for a foundation in plastic clay with a unit weight of 22.5 kN/m^3 . Failure occurred when a depth of 8.10 m was reached. What is the value of cohesion if $\phi = 0^\circ$? | 5M | 3 | 4 |

UNIT-IV

- | | | | | | |
|----|----|---|----|---|---|
| 7. | a) | What are the different types of shallow foundations | 5M | 4 | 2 |
| | b) | A square footing 1.2 m wide is located at a depth of 1.5 m in non-cohesive soil deposit for which the corrected N-value of SPT is 20. Water table is located at 2 m below the ground surface. Find the allowable bearing pressure for the soil. | 5M | 4 | 4 |

(OR)

- | | | | | | |
|----|----|--|----|---|---|
| 8. | a) | State the assumptions and derive an expression for Bearing capacity equation by Terzaghi's theory for shallow foundations. | 5M | 4 | 2 |
| | b) | A strip footing 1.4 m wide is laid at a depth of 4.5 m in purely cohesive soil having cohesion = 144 kPa and unit weight of soil is 17.7 kN/m^3 . Calculate ultimate bearing capacity by Terzaghi's Analysis | 5M | 4 | 4 |

UNIT-V

- | | | | | | |
|----|----|--|----|---|---|
| 9. | a) | Explain the different types of piles used in foundation construction | 5M | 5 | 2 |
| | b) | A square group of 25 piles extends between depths of 2 m and 12 m in a deposit of 20 m thick stiff clay overlying rock. The piles are 0.5 m in diameter and are spaced at 1 m centre-to-centre in the group. The undrained shear strength of clay at the base level is 180 kPa and average value of undrained shear strength over the depth of the pile is 110 kPa. The adhesion factor is 0.45. Estimate the capacity of pile group considering the overall factor of safety equal to 3 against shear failure, Consider $N_c=9$. | 5M | 5 | 4 |

(OR)

- | | | | | | |
|-----|----|--|----|---|---|
| 10. | a) | Explain briefly how can you determine capacity of pile from static formula in the case of cohesionless soils. | 5M | 5 | 2 |
| | b) | A drop hammer weighing 30 kN and falling through a height of 0.8 m drives a pile to an average penetration of 8.2 mm under the last few blows. Determine the allowable load (kN) for the pile according to Engineering News Formula. | 5M | 5 | 4 |

UNIT-VI

- | | | | | | |
|-----|----|--|----|---|---|
| 11. | a) | Distinguish clearly between open and box caissons. | 5M | 6 | 2 |
| | b) | Draw the sketches of shapes of wells commonly used and discuss their advantages and disadvantages. | 5M | 6 | 2 |

(OR)

- | | | | | | |
|-----|----|--|----|---|---|
| 12. | a) | Draw a neat sketch of components of well foundation and explain functions of each component. | 5M | 6 | 2 |
| | b) | Explain any two methods with neat sketches to control tilts and shifts during sinking of caissons. | 5M | 6 | 2 |

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

		<u>UNIT-I</u>	Marks	CO	Blooms Level
1.		Explain the architecture of the 8086 microprocessor with a neat diagram. Discuss the role of different functional units.	10M	1	understand
		(OR)			
2.	a	Describe the concept of an Interrupt Service Routine (ISR). How does the microprocessor handle an interrupt?	5M	1	understand
	b	Explain the memory segmentation in the 8086 microprocessor. Why is it divided into segments, and how does it impact program execution?	5M	1	understand
		<u>UNIT-II</u>			
3.		Discuss the different addressing modes used in 8086 assembly language. How do they impact instruction execution and memory access?	10M	2	understand
		(OR)			
4.	a	Compare and contrast procedures and macros in 8086 assembly language. When should each be used?	5M	2	Analyze
	b	Explain the machine control instructions in the 8086 microprocessor. How do they help in controlling processor operations?	5M	2	understand
		<u>UNIT-III</u>			
5.	a	Discuss the modes of operation of 8255 in detail. How do these modes affect data transfer in a microprocessor-based system?	5M	3	understand
	b	Discuss the interrupt handling mechanism of 8259A. How does it prioritize multiple interrupts?	5M	3	Analyze

(OR)

- | | | | | | |
|----|---|--|----|---|---------|
| 6. | a | Explain the functional block diagram of USART (8251). How does it facilitate serial communication in microprocessor-based systems? | 5M | 3 | Analyze |
| | b | How would you configure 8257 for block data transfer using DMA? Explain with an example. | 5M | 3 | Apply |

UNIT-IV

- | | | | | | |
|----|--|---|-----|---|------------|
| 7. | | Describe the segmentation and paging mechanism in 80386 and how they improve memory management. | 10M | 4 | understand |
|----|--|---|-----|---|------------|

(OR)

- | | | | | | |
|----|---|---|----|---|------------|
| 8. | a | Explain the different modes of operation in 80386 and their applications. | 5M | 4 | understand |
| | b | Compare 80486 and Pentium processors | 5M | 4 | Analyze |

UNIT-V

- | | | | | | |
|----|---|---|----|---|------------|
| 9. | a | Explain ARM architecture and how it improves performance. | 5M | 5 | understand |
| | b | Discuss CPSR. | 5M | 5 | understand |

(OR)

- | | | | | | |
|-----|---|--|----|---|------------|
| 10. | a | Describe the role of different modes of operation in ARM architecture. | 5M | 5 | understand |
| | b | Demonstrate how an interrupt service routine (ISR) is implemented in ARM processors. | 5M | 5 | Apply |

UNIT-VI

- | | | | | | |
|-----|---|--|----|---|------------|
| 11. | a | Describe the architecture of the 8051 microcontroller. | 5M | 6 | understand |
| | b | Discuss about memory organization of 8051 microcontroller? | 5M | 6 | Apply |

(OR)

- | | | | | | |
|-----|---|--|----|---|------------|
| 12. | a | Discuss the interrupt structure of 8051. Mention the priority. Explain how least priority is made as highest priority. | 5M | 6 | understand |
| | b | Develop an ALP in 8051 to determine the sum of odd numbers in a given N-numbers. | 5M | 6 | understand |

SWITCHGEAR AND PROTECTION
(ELECTRICAL AND ELECTRONICS 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 | Blooms Level |
|-------------|---|-------|-----|--------------|
| 1. | a) Explain the construction and working principle of a minimum oil circuit breaker with a neat sketch. | 5M | CO1 | Understand |
| | b) Discuss the phenomenon of arc extinction in circuit breakers and compare high resistance and low resistance interruption | 5M | CO1 | Understand |
| (OR) | | | | |
| 2. | a) List out the advantages, and disadvantages of vacuum circuit breakers | 5M | CO1 | Remember |
| | b) Define the following terms i) Recovery voltage ii) Restriking voltage. | 5M | CO1 | Remember |

UNIT-II

- | | | | | |
|-------------|--|----|-----|------------|
| 3. | a) Explain the construction and working of an induction cup relay with a neat sketch | 5M | CO2 | Understand |
| | b) Describe the working of an instantaneous overcurrent relay and its applications. | 5M | CO2 | Understand |
| (OR) | | | | |
| 4. | a) Compare the operation and performance of electromagnetic and static relays in power system protection | 5M | CO2 | Evaluate |
| | b) Classify different types of relays based on their principle of operation and application. | 5M | CO2 | Understand |

UNIT-III

- | | | | | |
|----|---|----|-----|------------|
| 5. | a) Describe the working principle of differential protection applied to generator windings. | 5M | CO3 | Understand |
| | b) A 15 kV, 200 MVA alternator is grounded through a resistance of 10Ω . The CT ratio is 800/5, and the relay setting is 0.4 A. Calculate the percentage of the generator winding protected. | 5M | CO3 | Apply |

(OR)

- | | | | | | |
|----|----|---|----|-----|------------|
| 6. | a) | Explain the protection scheme used for a generator against rotor and inter-turn faults. | 5M | CO3 | Understand |
| | b) | Explain the Buchholz relay operation in transformer protection. | 5M | CO3 | Understand |

UNIT-IV

- | | | | | | |
|----|----|---|----|-----|------------|
| 7. | a) | Explain the working principle and application of a translay relay. | 5M | CO4 | Understand |
| | b) | Discuss in detail about three-zone distance relay protection with an impedance relay. | 5M | CO4 | Understand |

(OR)

- | | | | | | |
|----|----|---|----|-----|------------|
| 8. | a) | Explain how differential protection is implemented in bus bars. | 5M | CO4 | Understand |
| | b) | Differentiate between feeder and bus bar differential protection schemes with a neat diagram. | 5M | CO4 | Analyze |

UNIT-V

- | | | | | | |
|----|----|---|----|-----|------------|
| 9. | a) | Describe the different types of surge arresters used for overvoltage protection in power systems. | 5M | CO5 | Understand |
| | b) | What are the causes for over voltages in power system. | 5M | CO5 | Understand |

(OR)

- | | | | | | |
|-----|----|---|----|-----|------------|
| 10. | a) | Explain in detail the working of a zinc-oxide lightning arrester. | 5M | CO5 | Understand |
| | b) | Explain the causes of over voltages in a power system and their impact on electrical equipment. | 5M | CO5 | Understand |

UNIT-VI

- | | | | | | |
|-----|----|---|----|-----|------------|
| 11. | a) | Compare different types of grounding methods with examples. | 5M | CO6 | Understand |
| | b) | Explain the working principle and advantages of resistance grounding. | 5M | CO6 | Understand |

(OR)

- | | | | | | |
|-----|----|---|----|-----|------------|
| 12. | a) | Calculate the reactance of Peterson coil suitable for a 33 kV, 3-phase transmission line having a capacitance to earth of each conductor as 4.5 μ F. Assume supply frequency to be 50 Hz. | 5M | CO6 | Apply |
| | b) | Describe the concept and application of resonant grounding. | 5M | CO6 | Understand |

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

	<u>UNIT-I</u>	Marks	CO	Blooms Level
1. a)	Define Managerial Economics and discuss its importance in decision-making.	5	1	Understand
b)	Explain the factors influencing demand and their significance.	5	1	Understand
	(OR)			
2. a)	Illustrate the different types of demand elasticity with examples.	5	1	Understand
b)	Describe qualitative and quantitative demand forecasting techniques.	5	1	Understand
	<u>UNIT-II</u>			
3. a)	Discuss the concept of Isoquants and Iso-costs with examples.	5	2	Analysis
b)	Explain the significance of economies and diseconomies of scale.	5	2	Understand
	(OR)			
4. a)	Define different types of cost and their managerial relevance.	5	2	Apply
b)	Illustrate the concept of Break-Even Analysis with a practical example.	5	2	Understand
	<u>UNIT-III</u>			
5. a)	Describe the characteristics of different market structures.	5	3	Evaluation
b)	Analyse the pricing strategies used in monopolistic competition.	5	3	Analysis
	(OR)			
6. a)	Explain how price is determined in a monopoly market.	5	3	Understand
b)	Discuss the advantages and disadvantages of different pricing methods.	5	3	Understand
	<u>UNIT-IV</u>			
7. a)	Define Management and explain its objectives and significance.	5	4	Understand
b)	Summarize the contributions of Henry Fayol to management principles.	5	4	Understand
	(OR)			
8. a)	Explain Maslow's Hierarchy of Needs with real-world applications.	5	4	Understand
b)	Discuss the responsibilities of management towards society.	5	4	Understand
	<u>UNIT-V</u>			
9. a)	Discuss the importance of marketing functions in business.	5	5	Evaluating
b)	Analyse the impact of product life cycle on marketing strategies.	5	5	Analysis
	(OR)			
10. a)	Explain the role of distribution channels in modern marketing.	5	5	Understand
b)	Discuss the advantages and challenges of digital marketing.	5	5	Understand
	<u>UNIT-VI</u>			
11. a)	Explain the essential functions of an HR manager in an organization.	5	6	Understand
b)	Compare and contrast Personnel Management and HRM.	5	6	Understand
	(OR)			
12. a)	Describe the process of handling employee grievances in an organization.	5	6	Understand
b)	Discuss the importance and methods of job evaluation.	5	6	Understand

20MET312

III B.Tech II Sem Reg/supple exams - April - 2025 ①
Dynamic Systems & Mechanical Vibrations.
Scheme of Evaluation.

1. 10 Marks

$$\phi_a = 90^\circ$$

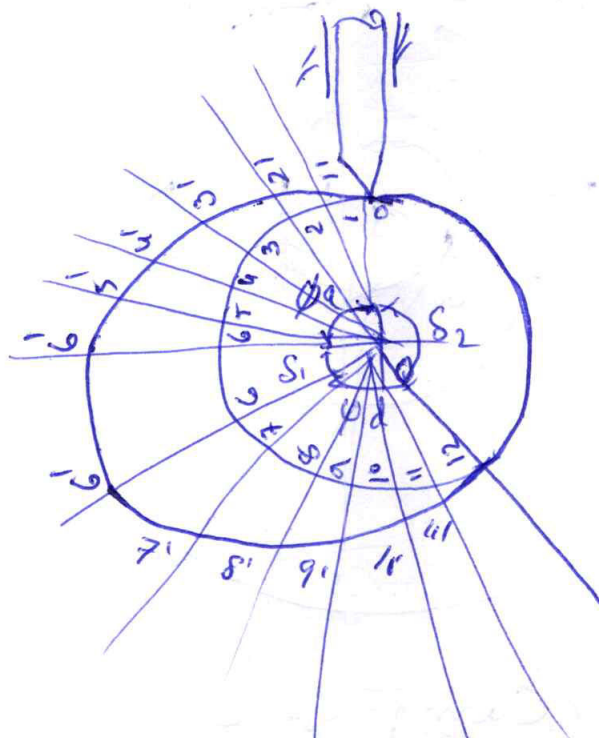
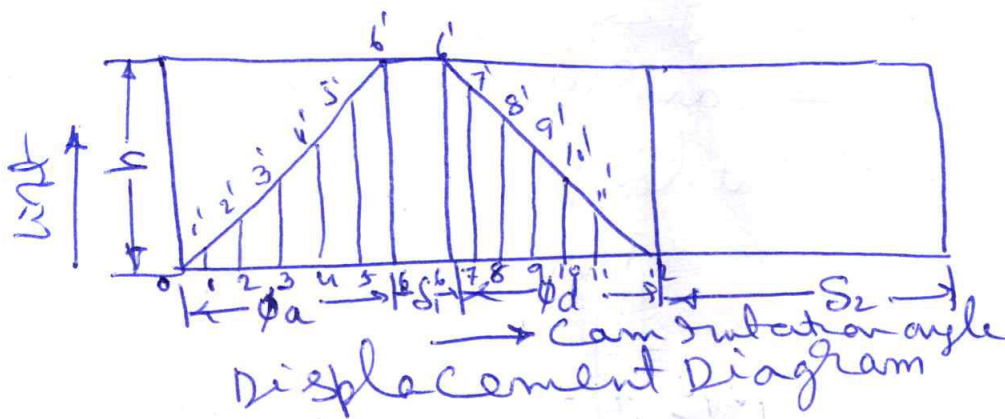
$$\delta_1 = 30^\circ$$

$$\phi_d = 90^\circ$$

$$\delta_2 = 150^\circ$$

$$h = 40 \text{ mm}$$

$$r_c = 40 \text{ mm}$$



10 Marks

2
Page

$$\phi_a = 120^\circ$$

$$\delta_1 = 60^\circ$$

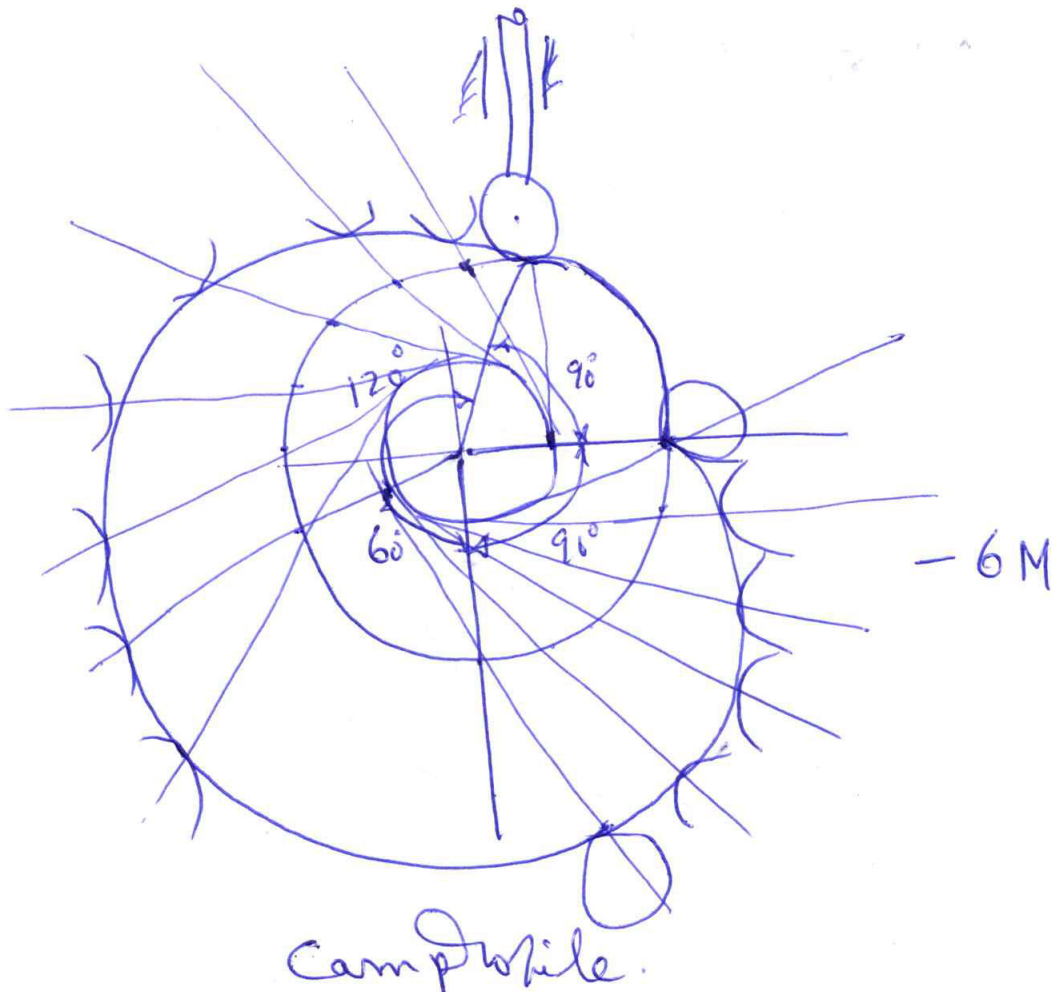
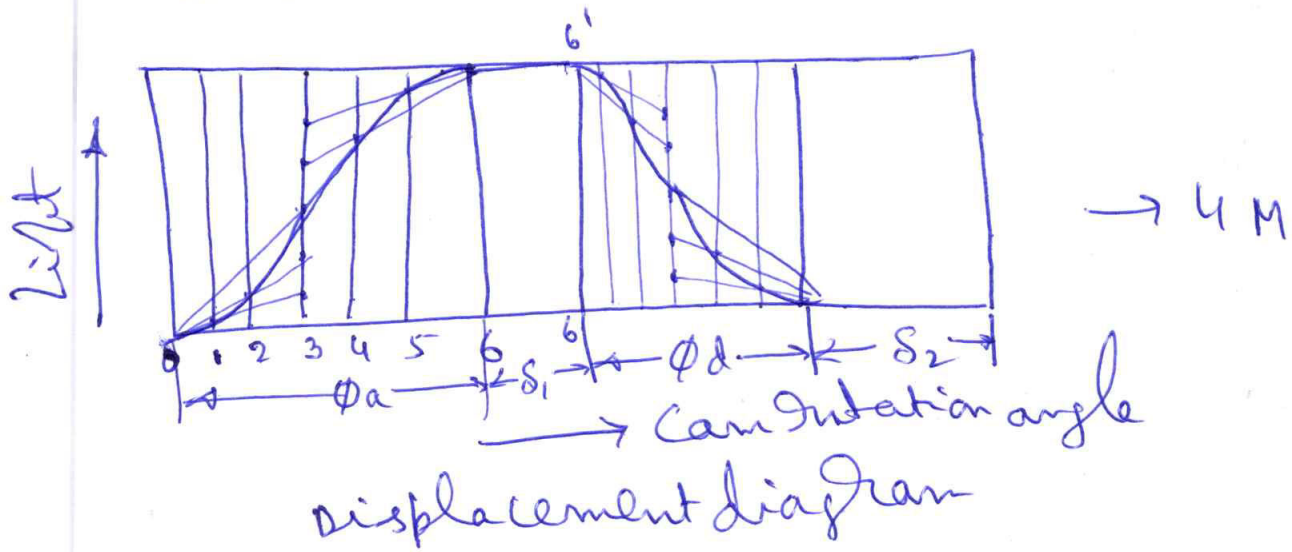
$$\phi_d = 90^\circ$$

$$S_2 = 90^\circ$$

$$r_c = 50 \text{ mm}$$

$\eta_n = 10 \text{ mm}$

Offset = 20mm



(3) — 10 Marks.

(3) page

$$r_A = 100 \text{ mm} = 0.1 \text{ m}$$

$$r_B = 125 \text{ mm} = 0.125 \text{ m}$$

$$r_C = 200 \text{ mm} = 0.2 \text{ m}$$

$$r_D = 150 \text{ mm} = 0.15 \text{ m}$$

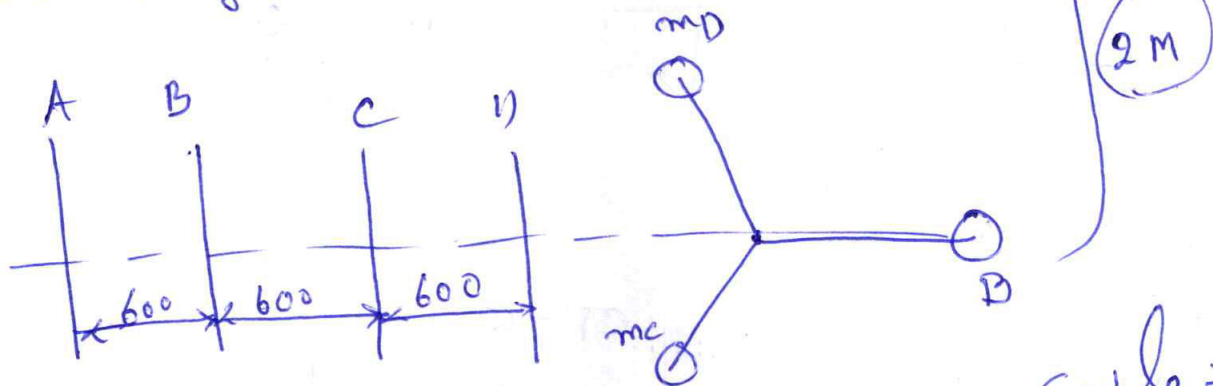
$$m_B = 10 \text{ kg}$$

$$m_C = 5 \text{ kg}$$

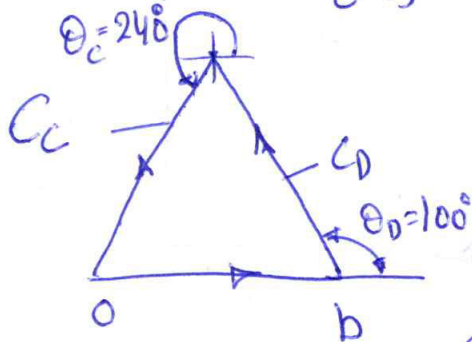
$$m_D = 4 \text{ kg}$$

$$m_A = ?$$

Assuming B to be horizontal.



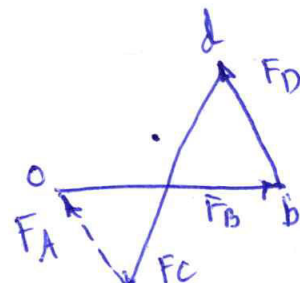
plane	mass m	Radius r	$CF \div W^2$ $\frac{m}{r}$	distance from RP λ	Couple $\div W^2$ mrl
A (RP)	m_A	0.1	$0.1 \times m_A$	0	0
B	10	0.125	1.25	0.6	0.75
C	5	0.2	1.0	1.2	1.2
D	4	0.15	0.6	1.8	1.08



$$0.25 \text{ kg-m}^2 - 1 \text{ cm}$$

Couple polygon

(2M)



Force polygon

Scale: $0.25 \text{ kg-m} - 1 \text{ cm}$

(2M)

Answer (2M)

$$\theta_A = 155^\circ$$

$$0.1 \times m_A = 0.7 \text{ kg-m}$$

$$m_A = 7 \text{ kg}$$

4

Page

$$a = 0.7 \text{ m}$$

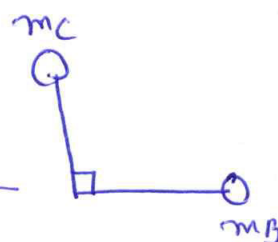
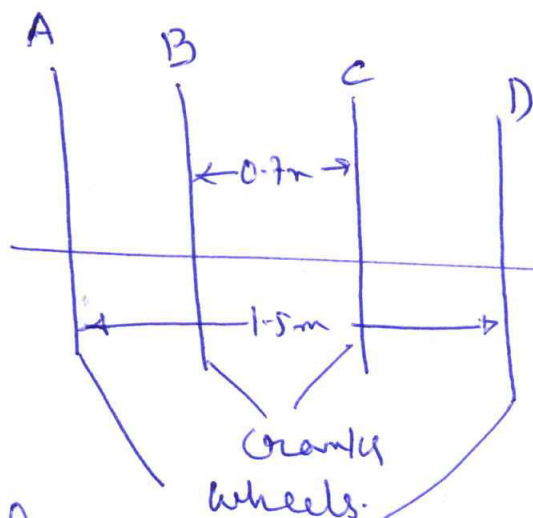
$$L = 0.6 \text{ m} = 2r \Rightarrow r = 0.3 \text{ m} = r_B = r_C$$

$$m_H = 150 \text{ kg}$$

$$m_{rec} = 180 \text{ kg}$$

$$m_B = m_C = 150 + C - m_{rec} =$$

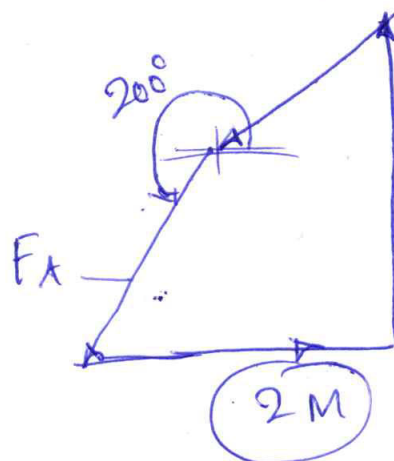
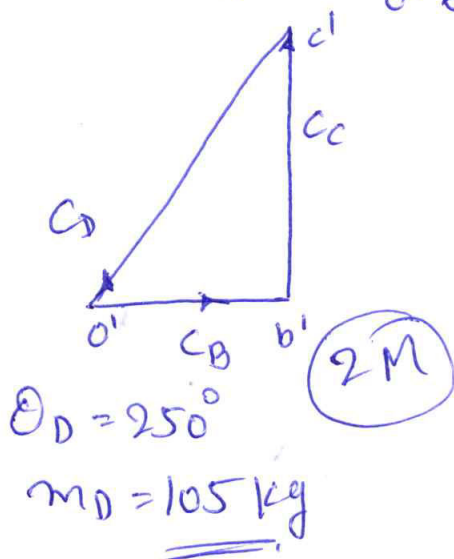
$$r_A = r_D = 0.6 \text{ m}$$



2M

Plane	Mass	Radius	$CF \div \omega^2$	Distance from RP	Couple $\div \omega^2$
A	m_A	0.6	$0.6 m_A$	0	0
B	270	0.3	81	0.4	32.4
C	270	0.3	81	1.1	89.1
D	m_D	0.6	$0.6 m_D$	1.5	$0.9 m_D$

2M



$$\theta_A = 200^\circ$$

$$m_A = 105 \text{ kg}$$

$$B = \frac{105 \times 120}{270} = 46.6 \text{ kg}; \text{ B.M. reqd to balance rec parts.}$$

$$(i) \text{ V.T.F.} - \pm \sqrt{2} (1-c) m_H \omega^2 = \pm 25130 \text{ N}$$

$$(ii) \text{ S.C.} = \pm \frac{a}{\sqrt{2}} (1-c) m_H \omega^2 = \pm 8795.65 \text{ N}$$

2M

5.(a) — 6M

$$m = 8 \text{ kg}$$

$$S = 5.4 \text{ N/mm} = 5.4 \times 10^3 \text{ N/m}$$

$$C = 40 \text{ N/m/s}$$

$$\left. \begin{aligned} W_n &= \sqrt{\frac{S}{m}} \\ &= 25.98 \text{ rad/s} \end{aligned} \right\} 1 \text{ M}$$

$$\textcircled{1} C_c = 2 \cdot m \cdot W_n$$

$$= 2 \times 8 \times W_n = 416 \text{ N/m/s} \quad \left. \right\} 1 \text{ M}$$

$$\textcircled{2} \eta = \frac{C}{C_c} = 0.0962 \quad \left. \right\} 1 \text{ M}$$

$$\textcircled{3} \delta = \frac{2\pi \eta}{\sqrt{1-\eta^2}} = 0.607 \quad \left. \right\} 2 \text{ M}$$

5.(b) 4M
 $m = 200 \text{ kg}$

$$S = 80 \text{ N/mm} = 80 \times 10^3 \text{ N/m} \quad \left| \quad W_n = \sqrt{\frac{S}{m}} = 20 \text{ rad/s} \right.$$

$$C = 800 \text{ N/m/s}$$

$$C_c = 2 m W_n = 8000 \text{ N/m/s} \quad \left. \right\} \textcircled{1 \text{ M}}$$

$$\eta = \frac{C}{C_c} = 0.1 \quad \textcircled{1 \text{ M}}$$

$$W_d = (\sqrt{1-\eta^2}) W_n = 19.899 \text{ rad/s}$$

$$f_d = \frac{W_d}{2\pi} = 3.167 \text{ Hz}$$

$$\left. \right\} \textcircled{2 \text{ M}}$$

6.(a)

$$m = 10 \text{ kg}$$

— 5 Marks

$$S = 10 \text{ N/mm} = 10 \times 10^3 \text{ N/m}$$

$$\alpha_5 = \frac{1}{10} \alpha_1$$

$$P_n = 150 \text{ Gs } 50 \text{ t}$$

$$W = 50 \text{ rad/s}$$

$$F = 150 \text{ N}$$

$$\omega_n = \sqrt{\frac{s}{m}} = 31.62 \text{ rad/s} \quad (1M)$$

6 page

$$\frac{x_1}{x_2} + \frac{x_2}{x_3} + \frac{x_3}{x_4} + \frac{x_4}{x_5} = \frac{x_1}{x_5} = \left(\frac{x_1}{x_2}\right)^4 = \frac{x_1}{0.1x_1} = 10$$

$$\frac{x_1}{x_2} = 10^{1/4} = 1.7782 \quad (1M)$$

$$\frac{x_1}{x_2} = e^{\frac{2\pi\eta}{\sqrt{1-\eta^2}}} \Rightarrow \eta = 0.0912 \quad (1M)$$

$$C = 2\eta m \omega_n = 57.696 \text{ N/m/s} \quad (1M)$$

$$x_{\max} = \frac{F}{\sqrt{c^2\omega^2 + (s - m\omega^2)^2}} = 0.0099 \text{ m} = 9.99 \text{ mm} \quad (1M)$$

$$x_{\max} \text{ at resonance} = \frac{F}{c \cdot \omega_n} = 80.0822 \text{ mm} = 82.2 \text{ mm} \quad (1M)$$

6 (b) — 5 Marks

$$m = 1 \text{ kg}$$

$$s = 9800 \text{ N/m}$$

$$c = 5.9 \text{ N/m/s}$$

(c)

$$\omega_n = \sqrt{\frac{s}{m}} = \sqrt{\frac{9800}{1}} = 98.99 \text{ rad/s}$$

$$f_n = \frac{\omega_n}{2\pi} = 15.75 \text{ Hz} \quad (1M)$$

(ii)

$$c_c = 2 \cdot m \cdot \omega_n = 2 \times 1 \times 98.99 = 197.98 \text{ N/m/s}$$

$$\eta = \frac{c}{c_c} = 0.0298$$

$$\delta = \frac{2\pi\eta}{\sqrt{1-\eta^2}} = 0.1872 \Rightarrow \frac{x_1}{x_2} = 1.206 \quad (2M)$$

(iii)

$$\frac{x_1}{x_2} \times \frac{x_2}{x_3} \times \frac{x_3}{x_4} = \left(\frac{x_1}{x_2}\right)^3 \Rightarrow x_4 = \frac{5}{(1.206)^3} = 2.85 \text{ mm} \quad (1M)$$

7. (a) Explanation of Critical Speed - 1M } 5M
Derivation = 4M

(b) $d = 50 \text{ mm} = 0.05 \text{ m}$
 $l = 3 \text{ m}$

(5M)

$E = 200 \times 10^9 \text{ N/m}^2$

$I = \frac{\pi}{64} d^4 = 0.307 \times 10^{-6} \text{ m}^4 = 3.07 \times 10^{-7} \text{ m}^4$ (1M)

$\Delta_1 = \frac{W_1 a_1^2 b_1^2}{3 E I l} = 7.24 \times 10^{-3} \text{ m} = 0.00724 \text{ m}$ (1M)

$\Delta_2 = \frac{W_2 a_2^2 b_2^2}{3 E I l} = 10.86 \times 10^{-3} \text{ m} = 0.01086 \text{ m}$ (1M)

$\Delta_3 = \frac{W_3 a_3^2 b_3^2}{3 E I l} = 2.12 \times 10^{-3} \text{ m} = 0.00212 \text{ m}$ (1M)

8. (10M) $f_n = \frac{1}{2\pi} \sqrt{\frac{g}{\Delta_1 + \Delta_2 + \Delta_3}} = \frac{0.4985}{\sqrt{\Delta_1 + \Delta_2 + \Delta_3}} = 3.5 \text{ Hz}$ (1M)

$l = 1.5 \text{ m}$

$m_1 = m_2 = 50 \text{ kg}$

$D = 75 \text{ mm}$

$d = 40 \text{ mm}$

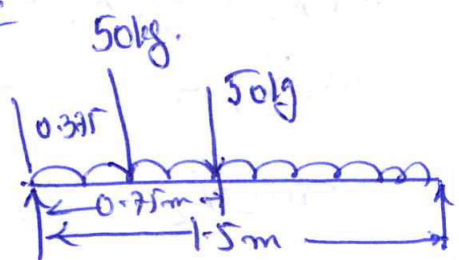
$\rho = 7700 \text{ kg/m}^3$

$G = 200 \text{ GN/m}^2 = 200 \times 10^9 \text{ N/m}^2$

$I = \frac{\pi}{64} (D^4 - d^4) = 1.4275 \times 10^{-6} \text{ m}^4$

$m_s = \rho \times A = 24.34 \text{ kg/m}$

(3M)



$\Delta_1 = \frac{m_1 g a_1^2 b_1^2}{3 E I l} = 67.95 \times 10^{-6} \text{ m}$

$\Delta_2 = \frac{m_2 g a_2^2 b_2^2}{3 E I l} = 120.8 \times 10^{-6} \text{ m}$

$\Delta_s = \frac{5 m g l^4}{384 E I} = 55.13 \times 10^{-6} \text{ m}$

$2 \times 3 = 6 \text{ M}$

$$N_c = f_n = \frac{0.4985}{\sqrt{\Delta_1 + \Delta_2 + \frac{\Delta_s}{1.27}}} = 38.89 \text{ Hz}$$

1M

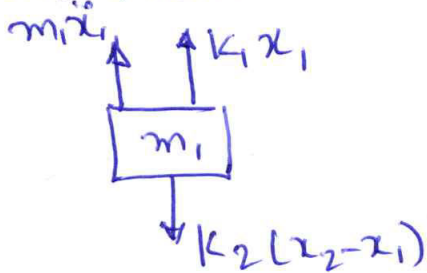
$$N_c = 38.89 \text{ rps} = \underline{2333.4 \text{ rpm}}$$

9. 10M

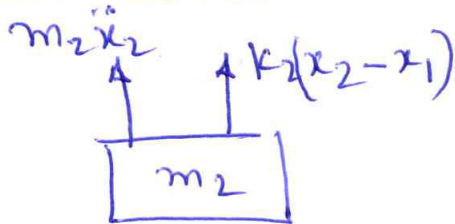
$$m_1 = 1.5 \text{ kg} \quad m_2 = 0.8 \text{ kg}$$

$$K_1 = K_2 = 40 \text{ N/m}$$

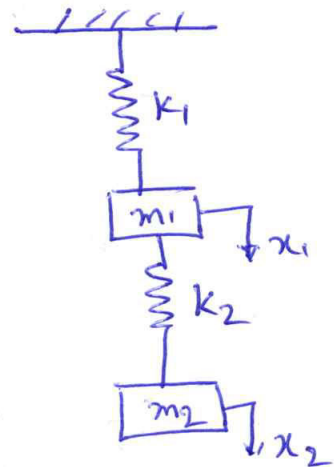
FBD of Mass 1



FBD of Mass 2



2M



Equations of Motion are

$$m_1 \ddot{x}_1 + K_1 x_1 = K_2 (x_2 - x_1)$$

$$m_1 \ddot{x}_1 + K_1 x_1 - K_2 x_2 + K_2 x_1 = 0$$

$$m_1 \ddot{x}_1 + (K_1 + K_2) x_1 - K_2 x_2 = 0 \quad \text{--- (i)}$$

$$m_2 \ddot{x}_2 + K_2 (x_2 - x_1) = 0$$

$$m_2 \ddot{x}_2 + K_2 x_2 - K_2 x_1 = 0$$

$$-K_2 x_1 + K_2 x_2 + m_2 \ddot{x}_2 = 0 \quad \text{--- (ii)}$$

2M

9 contd. --

Assuming the motion to be periodic and the displacement is of the form

$$\begin{cases} x_1 = A_1 \sin \omega t \\ x_2 = A_2 \sin \omega t \end{cases} \quad \begin{cases} \ddot{x}_1 = -A_1 \omega^2 \sin \omega t \\ \ddot{x}_2 = -A_2 \omega^2 \sin \omega t \end{cases}$$

substituting the values $x_1, x_2, \ddot{x}_1, \ddot{x}_2$ in the eqn of motion

$$m_1 (-A_1 \omega^2 \sin \omega t) + (K_1 + K_2) A_1 \sin \omega t - K_2 A_2 \sin \omega t = 0$$

$$(K_1 + K_2 - m_1 \omega^2) A_1 \sin \omega t - K_2 A_2 \sin \omega t = 0 \quad \text{(iii)}$$

$$-K_2 A_1 \sin \omega t + K_2 A_2 \sin \omega t + m_2 (-A_2 \omega^2 \sin \omega t) = 0$$

$$-K_2 A_1 \sin \omega t + (K_2 - m_2 \omega^2) A_2 \sin \omega t = 0 \quad \text{(iv)}$$

$$\begin{bmatrix} K_1 + K_2 - m_1 \omega^2 & -K_2 \\ -K_2 & K_2 - m_2 \omega^2 \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} \sin \omega t = 0$$

$$\begin{vmatrix} K_1 + K_2 - m_1 \omega^2 & -K_2 \\ -K_2 & K_2 - m_2 \omega^2 \end{vmatrix} = 0$$

$$(K_1 + K_2 - m_1 \omega^2) (K_2 - m_2 \omega^2) - K_2^2 = 0$$

$$K_1 K_2 - K_1 m_2 \omega^2 + K_2^2 - K_2 m_2 \omega^2 - K_2 m_1 \omega^2 + m_1 m_2 \omega^4 - K_2^2 = 0$$

$$m_1 m_2 \omega^4 - K_1 m_2 \omega^2 - K_2 m_2 \omega^2 - K_2 m_1 \omega^2 + K_1 K_2 = 0$$

$$\omega^4 - \frac{K_1}{m_1} \omega^2 - \frac{K_2}{m_1} \omega^2 - \frac{K_2}{m_2} \omega^2 + \frac{K_1 K_2}{m_1 m_2} = 0$$

$$\omega^4 - \left(\frac{K_1 + K_2}{m_1} + \frac{K_2}{m_2} \right) \omega^2 + \frac{K_1 K_2}{m_1 m_2} = 0$$

$$\omega^4 - 103.33\omega^2 + 1333.33 = 0$$

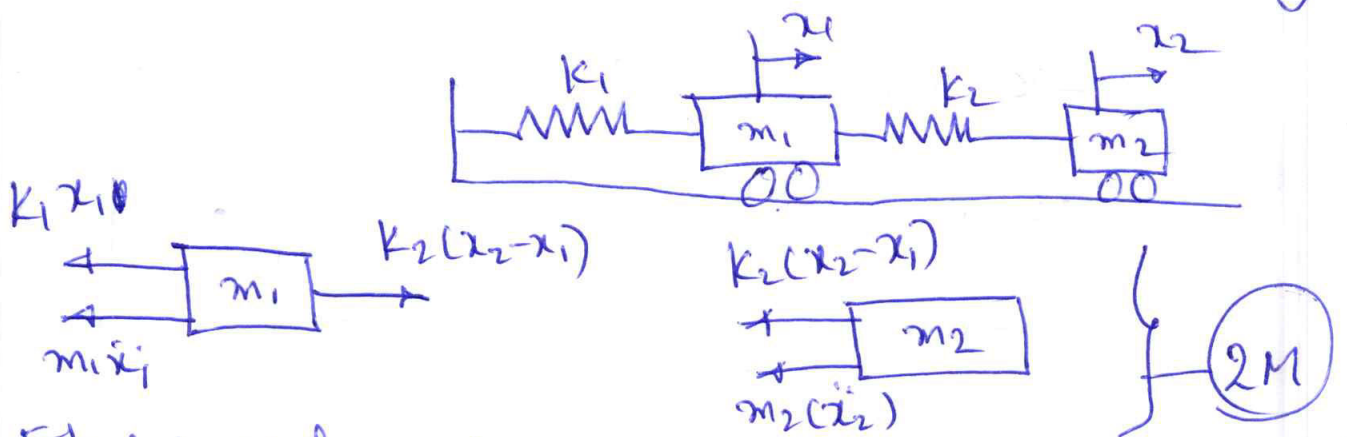
$$\omega_1 = 3.8877 \text{ rad/s} \Rightarrow f_1 = 0.6187 \text{ Hz}$$

$$\omega_2 = 9.392 \text{ rad/s} \Rightarrow f_2 = \frac{\omega_2}{2\pi} = 1.495 \text{ Hz}$$

$$\left(\frac{A_1}{A_2}\right)_I = 0.6976$$

$$\left(\frac{A_1}{A_2}\right)_{II} = -0.7646$$

10. $K_1 = 100 \text{ N/m}$; $K_2 = 200 \text{ N/m}$ $m_1 = 100 \text{ kg}$; $m_2 = 200 \text{ kg}$.



Equl d Motion are

$$\begin{cases} m_1 \ddot{x}_1 + (K_1 + K_2)x_1 - K_2x_2 = 0 & \text{(i)} \\ -K_2x_1 + K_2x_2 + m_2 \ddot{x}_2 = 0 & \text{(ii)} \end{cases} \quad (2M)$$

$$\begin{vmatrix} K_1 + K_2 - m_1 \omega^2 & -K_2 \\ -K_2 & K_2 - m_2 \omega^2 \end{vmatrix} = 0$$

$$\omega^4 - \left(\frac{K_1 + K_2}{m_1} + \frac{K_2}{m_2} \right) \omega^2 + \frac{K_1 K_2}{m_1 m_2} = 0$$

$$\omega^4 - 4\omega^2 + 1 = 0$$

$$\omega^2 = \frac{4 \pm \sqrt{16 - 4}}{2} = \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 3.464}{2}$$

10. Contd. ---

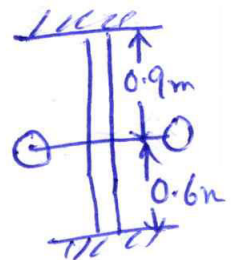
11 page

$$\left. \begin{aligned} \omega_1^2 &= 0.2679 \Rightarrow \omega_1 = 0.5176 \text{ rad/s} \Rightarrow f_1 = 0.0824 \text{ Hz} \\ \omega_2^2 &= 3.732 \Rightarrow \omega_2 = 1.93 \text{ rad/s} \Rightarrow f_2 = 0.3072 \text{ Hz} \end{aligned} \right\} (2M)$$

11. (A). Derivation of $f_n = \frac{1}{2\pi} \sqrt{\frac{g}{I}} = \frac{1}{2\pi} \sqrt{\frac{65}{I \cdot 1}} \quad (5M)$

11. (b) - (5M)

$$\left. \begin{aligned} \Delta &= \frac{mg a^3 b^3}{3EI l^3} = 1.24 \times 10^{-3} \text{ m} \\ f_n &= \frac{0.4985}{\sqrt{\Delta}} = 14.24 \text{ Hz} \end{aligned} \right\} (5M)$$



12. $I_A = 0.15 \text{ kg-m}^2$

$I_B = 0.3 \text{ kg-m}^2$

$I_C = 0.09 \text{ kg-m}^2$

$G = 84 \text{ kN/m}^2 = 84 \times 10^3 \text{ N/m}^2$

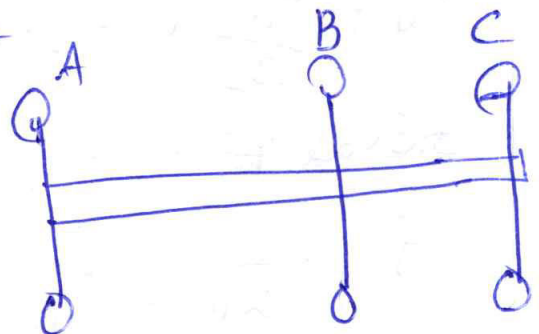
$d = 70 \text{ mm} = 0.07 \text{ m}$

$f_{nA} = f_{nC}$

$$\frac{1}{2\pi} \sqrt{\frac{GJ}{I_A l_A}} = \frac{1}{2\pi} \sqrt{\frac{GJ}{I_C l_C}}$$

$I_A l_A = I_C l_C$

$$l_A = \frac{I_C}{I_A} \times l_C = 0.6 l_C$$



(3M)

$f_{nB} = f_{nC}$

$$\frac{1}{2\pi} \sqrt{\frac{GJ}{I_B} \left[\frac{1}{l_1 - l_A} + \frac{1}{l_2 - l_C} \right]} = \frac{1}{2\pi} \sqrt{\frac{GJ}{I_C l_C}}$$

$$\frac{1}{I_C l_C} = \frac{1}{I_B} \left[\frac{1}{l_1 - l_A} + \frac{1}{l_2 - l_C} \right]$$

$$\frac{I_B}{I_C - l_C} = \frac{l_1 - l_A + l_2 - l_C}{(l_1 - l_A)(l_2 - l_C)}$$

$$\frac{10}{3l_C} = \frac{2.5 - 1.6l_C}{(1.5 - 0.6l_C - 1.5l_C + 0.6l_C^2)} \quad \left. \vphantom{\frac{10}{3l_C}} \right\} (3M)$$

$$10.8l_C^2 - 28.5l_C + 15 = 0$$

$$l_C = \frac{28.5 \pm 12.816}{2} = 1.912 \text{ m} \text{ or } 0.726 \text{ m}$$

$$l_A = 0.6l_C = 1.1472 \text{ m} \text{ or } 0.4356 \text{ m} \quad \left. \vphantom{l_A} \right\} (2M)$$

$l_C = 1.912 \text{ m}$, $l_A = 1.1472 \text{ m}$ give position of single node

$l_C = 0.726 \text{ m}$ and $l_A = 0.4356 \text{ m}$ give two node points.

$$J = \frac{\pi}{32} d^4 = 2.3572 \times 10^{-6} \text{ m}^4$$

Natural frequency for single node system

$$f_{n1} = \frac{1}{2\pi} \sqrt{\frac{GJ}{I_A l_A}} = 170.72 \text{ Hz}$$

Natural frequency for two node system:

$$f_{n2} = \underline{277.05 \text{ Hz}} \quad \left. \vphantom{f_{n2}} \right\} (2M)$$

AR18

CODE: 18CET316

SET-2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

III B. Tech II Semester Supplementary Examinations, April, 2025

**Geotechnical Engineering-II
(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

1. a) Discuss with neat sketches any two boring methods used in soil exploration. 6 M
- b) Describe the procedure of conducting plate load test in the field. State limitations of the test. 6 M

(OR)

2. a) Explain methods of soil exploration? 6 M
- b) Write a brief note on wash borings. 6 M

UNIT-II

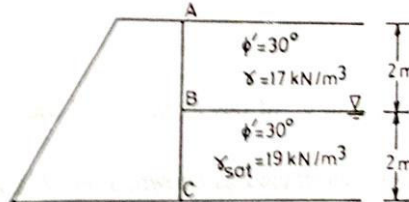
3. Why do earth slope fails, types of failures with a neat Sketch and Discuss how slope failures can be minimized? 12M

(OR)

4. a) Discuss the uses of stability charts. 6 M
- b) Swedish Circle Method For Analyzing The Slope Stability 6 M

UNIT-III

5. a) Explain Culmann's graphical method and also its advantage. 6 M
- b) Determine earth pressure at rest per unit length of the wall as shown in figure. Also determine the location of the resultant earth pressure. Take $K_0 = 1 - \sin\phi$ and $\gamma_w = 10 \text{ kN/m}^3$. 6 M



(OR)

6. a) Explain different types of lateral earth pressure. 6 M
- b) Explain in detail earth pressure at rest. 6 M

UNIT-IV

7. a) Explain IS code method for determining soil bearing capacity. 6 M
- b) Design a reinforced cement concrete footing for a 1m wide concrete wall carrying a load of 800 kN/m. The allowable soil pressure is 200 kN/m². 6 M

(OR)

8. a) State the assumptions and derive an expression for Bearing capacity equation by Terzaghi's theory for shallow foundations. 6 M
- b) Explain types of shallow foundations. 6 M

UNIT-V

9. Explain different classifications of piles with neat sketches. 12M

(OR)

10. a) A square concrete pile (35cm x 35 cm) is driven into a homogeneous sand layer ($\phi = 30^\circ$, $\gamma = 17 \text{ kN/m}^3$) for depth of 10 m. Calculate ultimate load. Use Meyerhof's method. Take $k = 1.3$ and $\delta = 18^\circ$. 6 M
- b) Explain the concept of negative skin friction. 6 M

AR18

CODE: 18CST315

SET-2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

III B. Tech II Semester Supplementary Examinations, April, 2025

**UNIX Internals
(COMPUTER SCIENCE AND 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) Explain process utility (6m)
b) What are text processing utilities (6m)
(OR)
2. Explain following commands with syntax (12m)
(i) wc (ii) ls (iii) tar (iv) head (v) tail (vi) join

UNIT-II

3. Define a shell? discuss shell key words and variables. (12m)
(OR)
4. Explain any three conditional structures with an example. (12m)

UNIT-III

5. a) Differentiate between system calls and library functions. (6m)
b) Explain usage of stat(), fstat(), umask() with syntax. (6m)
(OR)
6. a) Differentiate fgets(), gets() system calls. (6m)
b) Explain link, unlink system calls with syntax. (6m)

UNIT-IV

7. a) How to create a new process and what are the system calls involve in to create a new process. (6m)
b) Explain zombie process. (6m)
(OR)
8. a) Differentiate reliable and unreliable signals. (6m)
b) What are interrupted system calls. (6m)

UNIT-V

9. a) Explain IPC mechanism using pipes. (6m)
b) What is parent child process. (6m)
(OR)
10. Explain message queues and shared memory. (12m)

AR18

CODE: 18EET314

SET-2

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
(AUTONOMOUS)**

III B.Tech II Semester Supplementary Examinations, April, 2025

**SWITCHGEAR AND PROTECTION
(ELECTRICAL AND ELECTRONICS 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) Explain restriking voltage and recovery voltages phenomenon. 6M
b) In a 132kV system, the inductance and capacitance up to the location of circuit breaker are 0.3H and 0.017 μ F, respectively. Determine 6M
(i) The maximum value of the restriking voltage across the contacts of circuit breaker,
(ii) Frequency of transient oscillation and the maximum value of RRRV.

(OR)

2. a) Explain the current chopping phenomena in circuit breakers. 6M
b) What are the advantages and disadvantages of vacuum circuit breaker. 6M

UNIT-II

3. a) Explain the operation of electromagnetic attraction type relay in detail. 6M
b) Explain characteristic of different types of distance relays. 6M

(OR)

4. a) With the help of neat diagram, explain the principle of definite and inverse time static over current relay 6M
b) Compare static relays with electromagnetic relays in detail. 6M

UNIT-III

5. a) Develop the protection scheme of generator against stator fault and inter turn. 6M
b) A 3-phase, 33/11 kV star delta connected transformer is protected by Merz-price system. The CTs on low voltage side have a ratio of 520/5 A. Find the ratio of CTs on the high voltage side. 6M

(OR)

6. Explain how the transformer is protected with Buchholz relay. 12M

UNIT-IV

7. a) Classify differential protection scheme to the feeder and bus bar with neat diagram. 6M
b) Explain principle of translay relay protection scheme. 6M

(OR)

8. a) Explain principle of three zone protection scheme. 6M
b) Explain the carrier current protection scheme with neat diagram? 6M

UNIT-V

9. a) Explain what are the causes of over voltages in power system. 6M
b) Explain the protection scheme of rod gap arrester against lightning. 6M

(OR)

10. a) Write the advantages and disadvantages of ungrounded system. 6M
b) Explain resonant grounding with neat diagram. 6M

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 cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 12M
1. To move outwards through 40 mm during 100° rotation of the cam; 2. To dwell for next 80° ; 3. To return to its starting position during next 90° , and 4. To dwell for the rest period of a revolution i.e. 90° . The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam.

(OR)

2. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 12M
1. To move outwards through 40 mm during 100° rotation of the cam; 2. To dwell for next 80° ; 3. To return to its starting position during next 90° , and 4. To dwell for the rest period of a revolution i.e. 90° . Draw the profile of the cam when the line of stroke of the follower passes through the centre of the cam shaft. The displacement of the follower is to take place with uniform acceleration and uniform retardation.

UNIT-II

3. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. 12M

(OR)

4. A single cylinder reciprocating engine has speed of 240 rpm and stroke 300mm, mass of reciprocating parts 50kg, mass of revolving parts at 150mm radius is 37kg. If two third of the reciprocating parts and all the revolving parts are to be balanced, find 12M
- the balance mass required at a radius of 400mm, and
 - the residual unbalanced force when the crank has rotated 60° from top dead centre

UNIT-III

5. A single cylinder vertical petrol engine of total mass 300 kg is mounted upon a steel chasis frame and causes a vertical static deflection of 2mm. The reciprocating parts of the engine has a mass of 20 kg and move through a vertical stroke of 150 mm with Simple Harmonic Motion. A dashpot is provided whose damping resistance is directly proportional to the velocity and amounts to 15kN per metre per second. Determine 12M
- The amplitude of forced vibrations when the driving shaft of the engine rotates at 480 rpm and
 - The speed of the driving shaft at which resonance will occur.

(OR)

6. The following data given for a vibratory system with viscous damping. Mass = 2.5 kg; spring constant 3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system. 12M

UNIT-IV

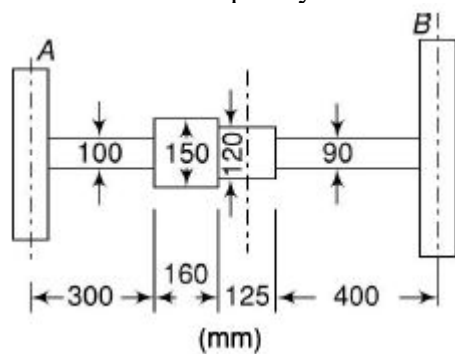
7. A shaft of length 0.75 m, supported freely at the ends, is carrying a body of mass 90 kg at 0.25 m from one end. Find the natural frequency of transverse vibration. Assume $E = 200 \text{ GN/m}^2$ and shaft diameter = 50 mm. 12M

(OR)

8. A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2 . Find the lowest whirling speed of the shaft, taking into account the mass of the shaft. 12M

UNIT-V

9. The shaft shown in Figure carries two masses. The mass A is 300 kg with a radius of gyration of 0.75 m and the mass B is 500 kg with a radius of gyration of 0.9 m. Determine the frequency of the torsional vibrations. 12M



(OR)

10. A flywheel is mounted on a vertical shaft as shown in Fig. The both ends of a shaft are fixed and its diameter is 50 mm. The flywheel has a mass of 500 kg and its radius of gyration is 0.5 m. Find the natural frequency of torsional vibrations, if the modulus of rigidity for the shaft material is 80 GN/m^2 . 12M

