

Code No: R22A0305

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025**Materials Engineering**

(ME)

Roll No									
----------------	--	--	--	--	--	--	--	--	--

Time: 3 hours**Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

PART-A (10 Marks)**(Write all answers of this part at one place)**

			BCLL	CO(s)	Marks
1	A	What is a crystal lattice?	L1	CO-I	[1M]
	B	What is a solid solution?	L1	CO-I	[1M]
	C	What is an equilibrium diagram?	L1	CO-II	[1M]
	D	What is allotropy?	L1	CO-II	[1M]
	E	What are common uses of malleable cast iron?	L1	CO-III	[1M]
	F	Name two application of grey cast iron.	L2	CO-III	[1M]
	G	What is the purpose of annealing?	L1	CO-IV	[1M]
	H	What is the main purpose of hardening?	L1	CO-IV	[1M]
	I	What are the three main classifications of composite materials?	L1	CO-V	[1M]
	J	What is meant by a laminar composite?	L1	CO-V	[1M]

PART-B (50 Marks)**SECTION-I**

2	A	Describe the process of crystallization in metals. How does solidification lead to the formation of grains?	L2	CO-I	[5M]
	B	Differentiate between point, line, and surface imperfections in metals, giving one example of each.	L4	CO-I	[5M]

OR

3	A	State Hume-Rothery rules and explain how they govern the formation of solid solutions.	L2	CO-I	[5M]
	B	What are intermediate alloy phases? Give examples and explain their characteristics.	L1	CO-I	[5M]

SECTION-II

4	A	Draw and label the Fe-Fe ₃ C phase diagram and explain its important points.	L2	CO-II	[5M]
	B	State Gibbs phase rule and explain its significance in phase diagram construction.	L2	CO-II	[5M]

OR

5	A	Explain the eutectoid reaction with an example and	L2	CO-II	[5M]
---	---	--	----	-------	------

		equation.			
	B	What are solid-state transformations? Explain with examples.	L1	CO-II	[5M]
<u>SECTION-III</u>					
6	A	Explain the structure and properties of white cast iron with a neat sketch.	L2	CO-III	[5M]
	B	Explain the classification of steels as plain carbon, low alloy, and high alloy steels.	L2	CO-III	[5M]
OR					
7	A	What are alpha and beta titanium alloys? Explain their differences.	L1	CO-III	[5M]
	B	Explain how alloying affects the properties of copper.	L2	CO-III	[5M]
<u>SECTION-IV</u>					
8	A	Differentiate between full annealing, process annealing, and spheroidizing.	L4	CO-IV	[5M]
	B	Why is normalizing performed before hardening in some steels?	L1	CO-IV	[5M]
OR					
9	A	Describe the different transformation products shown on the TTT diagram — pearlite, bainite, and martensite.	L4	CO-IV	[5M]
	B	Explain the structure–property relationship in crystalline ceramics.	L2	CO-IV	[5M]
<u>SECTION-V</u>					
10	A	Define composite materials. Explain their basic characteristics and advantages over conventional materials.	L1	CO-V	[5M]
	B	Explain the hand lay-up method for composite fabrication with a neat sketch.	L2	CO-V	[5M]
OR					
11	A	Describe the mechanical and thermal properties of metal–ceramic mixtures.	L2	CO-V	[5M]
	B	Compare <i>MMCs</i> with polymer matrix composites (<i>PMCs</i>) in terms of strength, temperature resistance, and cost.	L4	CO-V	[5M]

Code No: R22A0302

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025**Engineering Mechanics**

(ME)

Roll No									
---------	--	--	--	--	--	--	--	--	--

Time: 3 hours**Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

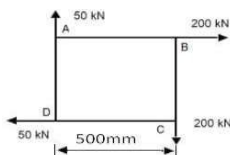
Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

PART-A (10 Marks)**(Write all answers of this part at one place)**

		BCLL	CO(s)	Marks
1	A Define the term Force	L2	CO-I	[1M]
	B Discuss the use of free body diagram	L2	CO-I	[1M]
	C Define friction?	L2	CO-II	[1M]
	D What is Perfect Frame?	L1	CO-II	[1M]
	E How does the centroid differ from the center of gravity	L2	CO-III	[1M]
	F What is the Second Theorem of Pappus?	L2	CO-III	[1M]
	G Define polar moment of inertia.	L2	CO-IV	[1M]
	H State perpendicular axis theorem.	L2	CO-IV	[1M]
	I Define D'Alembert's principle	L2	CO-V	[1M]
	J Discuss the equations of motion of a particle under gravitation.	L2	CO-V	[1M]

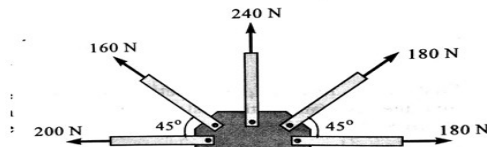
PART-B (50 Marks)**SECTION-I**

- 2 A Distinguish the following system of forces with a suitable sketch. a) Coplanar b) Collinear.
- B A system of forces are acting at the corners of a square block as shown in Fig. Determine the magnitude and direction of the resultant force



OR

- 3 A A gusset plate of roof truss is subjected to forces as shown in Fig. Determine the magnitude of the resultant force and its orientation measured counterclockwise from the positive x-axis.

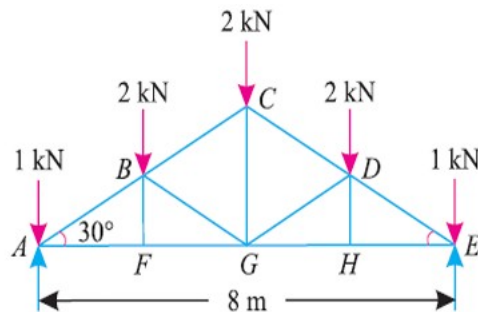


SECTION-II

- 4 A Define the following: (a) Limiting Force of Friction (b) Coefficient of Friction (c) Angle of Friction L2 CO-II [5M]
- B A body, resting on a rough horizontal plane, required a pull of 180 N inclined at 30° to the plane just to move it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. L3 CO-II [5M]

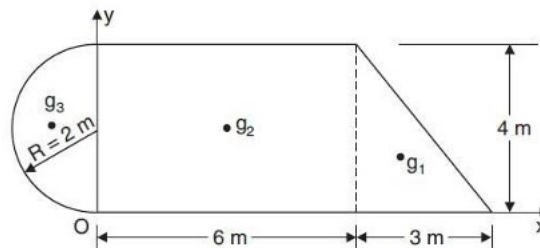
OR

- 5 A Find the forces in each member of the truss L3 CO-II [10M]



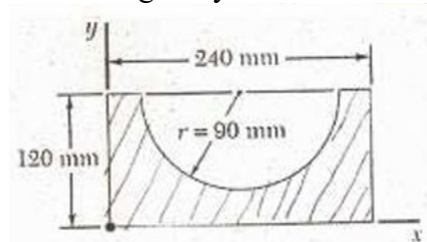
SECTION-III

- 6 A Determine the centroid of the area shown in Fig. with respect to the axis shown L3 CO-III [10M]



OR

- 7 A How can the centroid of a composite figure be found by dividing it into simpler shapes? L2 CO-III [5M]
- B Determine the center of gravity of the lamina. L3 CO-III [5M]



SECTION-IV

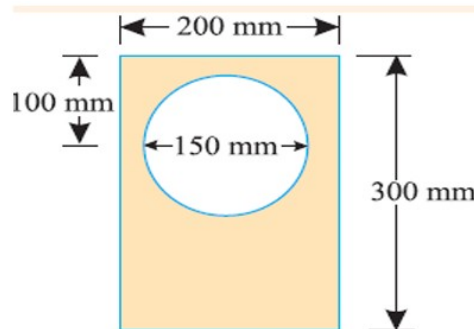
- 8 A Derive an equation for moment of inertia of the following sections about centroidal axis: a) A rectangular section b) A L3 CO-IV [10M]

triangular section from its base

OR

- 9 Find the moment of inertia of a hollow section shown in Fig. about an axis passing through its center of gravity or parallel X-X axis.

L3 CO-IV [10M]



SECTION-V

- 10 A Distinguish between kinetics and kinematics.
B Define range of projectile and Find the range of the projectile of a stone is projected in space at an angle of 45° to horizontal at an initial velocity of 10 m/sec.

L2 CO-V [5M]

L3 CO-V [5M]

OR

- 11 A A vehicle, of mass 500 kg, is moving with a velocity of 25 m/s. A force of 200 N acts on it for 2 minutes. Find the velocity of the vehicle:
(i) when the force acts in the direction of motion, and
(ii) when the force acts in the opposite direction of the motion

L3 CO-V [10M]

Code No: R22A0303

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025**Engineering Thermodynamics**

(ME)

Roll No									
----------------	--	--	--	--	--	--	--	--	--

Time: 3 hours**Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

Note :Steam Tables, Mollier chart and Psychrometric Charts are Permitted

	PART-A (10 Marks)	BCLL	CO(s)	Marks
	(Write all answers of this part at one place)			
1	A Define system and surroundings.	L1	CO-I	[1M]
	B Differentiate between point and path functions.	L2	CO-I	[1M]
	C State the second law of thermodynamics.	L1	CO-II	[1M]
	D Describe the term “availability.	L2	CO-II	[1M]
	E Define dryness fraction.	L1	CO-III	[1M]
	F Write the equation of state for a perfect gas.	L2	CO-III	[1M]
	G What is Dalton’s law of partial pressure?	L2	CO-IV	[1M]
	H Define relative humidity.	L2	CO-IV	[1M]
	I Define air-standard cycle.	L1	CO-V	[1M]
	J Name the four strokes in an Otto cycle.	L1	CO-V	[1M]
	PART-B (50 Marks)			
	SECTION-I			
2	A Discuss the concept of reversibility and causes of irreversibility.	L2	CO-I	[5M]
	B A gas in a piston–cylinder expands from 0.1 m ³ to 0.25 m ³ under a pressure of 200 kPa. Calculate the work done during the expansion if the process is isobaric.	L3	CO-I	[5M]
	OR			
3	A Apply the first law of thermodynamics to a closed system undergoing various processes.	L2	CO-I	[5M]
	B Explain different types of thermodynamic systems with examples.	L2	CO-I	[5M]
	SECTION-II			
4	A State and explain the Kelvin–Planck and Clausius statements.	L2	CO-II	[5M]
	B A Carnot engine operates between T ₁ = 700 K and T ₂ = 300 K and produces 200 kJ of work. Find (a) Thermal	L3	CO-II	[5M]

efficiency (b) Heat supplied

OR

- | | | | | | |
|---|---|---|----|-------|------|
| 5 | A | Describe the working of a Carnot cycle with T–S and P–V diagrams. | L2 | CO-II | [5M] |
| | B | 2 kg of air at 300 K is heated reversibly to 600 K at constant volume. Find the change in entropy. ($C_v = 0.718$ kJ/kg·K) | L3 | CO-II | [5M] |

SECTION-III

- | | | | | | |
|---|---|--|----|--------|------|
| 6 | A | Explain different phases and phase transformation in pure substances. | L2 | CO-III | [5M] |
| | B | Examine the importance of steam calorimetry for quality determination. | L2 | CO-III | [5M] |

OR

- | | | | | | |
|---|---|---|----|--------|------|
| 7 | A | Illustrate the use of T–S and h–s diagrams. | L3 | CO-III | [5M] |
| | B | Steam at 10 bar has a dryness fraction $x = 0.85$. Using steam tables, find (a) Specific volume (b) Enthalpy (c) Entropy | L3 | CO-III | [5M] |

SECTION-IV

- | | | | | | |
|---|---|---|----|-------|------|
| 8 | A | Define and explain specific humidity, relative humidity, and degree of saturation. | L2 | CO-IV | [5M] |
| | B | A mixture of gases contains 2 kg O ₂ and 6 kg N ₂ . Find (a) Mass fraction (b) Mole fraction (c) Partial pressures (At 1 atm, 27°C) | L3 | CO-IV | [5M] |

OR

- | | | | | | |
|---|---|---|----|-------|------|
| 9 | A | Explain the construction and use of a psychrometric chart. | L2 | CO-IV | [5M] |
| | B | Air at 30°C DBT and 24°C WBT flows at 1 atm. Find (a) Specific humidity (b) Relative humidity (c) Dew point temperature (Use psychrometric chart) | L3 | CO-IV | [5M] |

SECTION-V

- | | | | | | |
|----|---|--|----|------|------|
| 10 | A | Discuss the T–S and P–V representations of Otto cycle | L2 | CO-V | [5M] |
| | B | A Petrol engine has a Compression ratio $r = 7$, $\gamma = 1.4$. Find (a) Thermal efficiency (b) MEAN effective pressure for max cycle temperature = 1800 K. | L3 | CO-V | [5M] |

OR

- | | | | | | |
|----|---|---|----|------|------|
| 11 | A | Analyze the effect of compression ratio on cycle efficiency. | L3 | CO-V | [5M] |
| | B | An air-standard Otto cycle has a compression ratio of 8. The initial pressure and temperature are $P_1 = 100$ kPa and $T_1 = 300$ K. During the constant-volume heat addition, the pressure rises to 6.5 MPa. Take for air: $R = 0.287$ kJ/kgK, $\gamma = 1.4$, $C_v = 0.718$ kJ/kgK. Find a) Temperature at all four states T_2, T_3, T_4 b) Net work output per kg of air. | L3 | CO-V | [5M] |

Code No: R22A0304

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025**Fluid Mechanics & Hydraulic Machines**

(ME)

Roll No									
---------	--	--	--	--	--	--	--	--	--

Time: 3 hours**Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.**PART-A (10 Marks)**

			BCLL	CO(s)	Marks
1	A	Define surface tension.?	L1	CO-I	[1M]
	B	Define gauge pressure.?	L2	CO-I	[1M]
	C	Define stream line?	L1	CO-II	[1M]
	D	Define path line	L2	CO-II	[1M]
	E	Write assumptions of Bernoulli's equation.?	L1	CO-III	[1M]
	F	Draw the sketch of orifice meter.?	L2	CO-III	[1M]
	G	Write types of Hydraulic turbines.	L1	CO-IV	[1M]
	H	Define Water hammer??	L2	CO-IV	[1M]
	I	Define Delivery Head.?	L1	CO-V	[1M]
	J	Define Suction Head.?	L2	CO-V	[1M]

PART-B (50 Marks)**SECTION-I**

2	A	A single column vertical manometer is connected to a pipe containing oil of specific gravity 0.9. The area of the reservoir is 80 times the area of the manometer tube. The reservoir contains mercury of sp. gr. 13.6. The level of mercury in the reservoir is at a height of 30 cm below the center of the pipe and difference of mercury levels in the reservoir in the right limb is 50 cm. find the pressure in the pipe.	L2	CO-I	[5M]
	B	Explain inverted U tube differential manometer? Explain how they could be used for measuring the pressure difference.	L6	CO-I	[5M]

OR

3		Explain atmospheric, gauge and vacuum pressure with the help of a neat sketch.	L4	CO-I	[10M]
---	--	--	----	------	-------

SECTION-II

4		Differentiate between a) laminar flow and turbulent flow and b) rotational and	L2	CO-II	[10M]
---	--	--	----	-------	-------

irrotational flows c) Steady and unsteady flow

d) uniform and non uniform flow.

OR

- | | | | | |
|---|---|----|-------|-------|
| 5 | Derive Bernoulli's equation from Euler's equation of motion. What are the assumptions made in deriving Bernoulli's theorem? | L5 | CO-II | [10M] |
|---|---|----|-------|-------|

SECTION-III

- | | | | | |
|---|----------------------------------|----|--------|-------|
| 6 | Derive Darcy Weisbach equation.? | L6 | CO-III | [10M] |
|---|----------------------------------|----|--------|-------|

OR

- | | | | | |
|---|---|----|--------|-------|
| 7 | Explain in detail pitot – tube with neat sketch.? | L4 | CO-III | [10M] |
|---|---|----|--------|-------|

SECTION-IV

- | | | | | |
|---|---|----|-------|------|
| 8 | A Design a Pelton wheel for a head of 80m and speed 300rpm. The Pelton wheel develops 103kW shaft power. Take $C_v = 0.98$, speed ratio=0.45 and overall efficiency as 0.80. | L5 | CO-IV | [5M] |
|---|---|----|-------|------|

- | | | | | |
|--|--|----|-------|------|
| | B Briefly explain Reynolds Experiment with neat sketch.? | L2 | CO-IV | [5M] |
|--|--|----|-------|------|

OR

- | | | | | |
|---|--|----|-------|------|
| 9 | A Explain Pelton wheel Turbine. | L4 | CO-IV | [5M] |
| | B A jet of water diameter 50mm moving with a velocity of 25m/sec impinges on a fixed curved plate tangentially at one end at an angle of 30° to the horizontal. Calculate the resultant force of the jet on the plate, if the jet is deflected through an angle of 50° . Take $g=10\text{m/sec}^2$. | L5 | CO-IV | [5M] |

SECTION-V

- | | | | | |
|----|--|----|------|------|
| 10 | A With the help of a neat sketch discuss the main parts of a reciprocating pump. | L2 | CO-V | [5M] |
| | B A centrifugal pump delivers water to a height of 22 m at a speed of 800 rpm. The velocity of flow is constant at a speed of 2m/s and the outlet vane angle is 45° . If the pump discharges 225 litres of water / second, find the diameter of the impeller and width of the impeller. | L5 | CO-V | [5M] |

OR

- | | | | | |
|----|--|----|------|------|
| 11 | A Explain centrifugal pump with neat sketch | L2 | CO-V | [5M] |
| | B A double acting reciprocating pump, running at 40 r.p.m. is discharging 1.0m^3 of water per minute. The pump has a stroke of 400 mm. the diameter of piston is 200 mm. the delivery and suction head are 20m and 5m respectively. Find the slip of the pump and power required to drive the pump. | L4 | CO-V | [5M] |

Code No: R22A0306

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025**Kinematics of Machinery**

(ME)

Roll No									
---------	--	--	--	--	--	--	--	--	--

Time: 3 hours**Max. Marks: 60****Note:** This question paper contains two parts A and B

Part A is compulsory which carries 10 marks and Answer all questions.

Part B Consists of 5 SECTIONS (One SECTION for each UNIT). Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 10 marks.

PART-A (10 Marks)**(Write all answers of this part at one place)**

			BCLL	CO(s)	Marks
1	A	Define Grubler's criteria for a mechanism.	L1	CO-I	[1M]
	B	Define kinematic link and kinematic pair	L1	CO-I	[1M]
	C	Enumerate applications of Peaucellier mechanism.	L1	CO-II	[1M]
	D	Draw Ackerman's steering mechanism.	L1	CO-II	[1M]
	E	Define linear velocity and angular velocity.	L1	CO-III	[1M]
	F	What are the applications of Universal coupling?	L1	CO-III	[1M]
	G	Why a roller follower is preferred to that of a knife-edged follower?	L1	CO-IV	[1M]
	H	State the reasons for providing offset in a cam follower mechanism.	L1	CO-IV	[1M]
	I	What is meant by interference and undercutting of gears?	L1	CO-V	[1M]
	J	What are the advantages of epicyclic gear trains?	L1	CO-V	[1M]

PART-B (50 Marks)**SECTION-I**

- | | | | | | |
|----------|---|--|-----------|-------------|-------------|
| 2 | A | Give the classification of kinematics pairs (lower pairs) according to type of relative motion between links. Also indicate the degree-of-freedom associated with each pair. | L2 | CO-I | [5M] |
| | B | Explain the working of Whitworth quick return motion mechanism with neat diagram. | L2 | CO-I | [5M] |

OR

- | | | | | | |
|----------|---|---|-----------|-------------|-------------|
| 3 | A | Define Grashof's law. State how it is helpful in classify various types of four link mechanisms. | L2 | CO-I | [5M] |
| | B | What are the inversions of mechanism? Sketch the inversions of slider crank chain and name the mechanisms obtained. | L2 | CO-I | [5M] |

SECTION-II

- | | | | | | |
|----------|---|--|-----------|--------------|-------------|
| 4 | A | Prove that the Peaucellier mechanism generates a straight-line motion. | L2 | CO-II | [5M] |
| | B | Derive the conditions for correct steering gear of an automobile. | L2 | CO-II | [5M] |

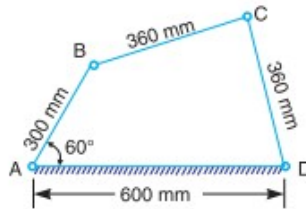
OR

- | | | | | | |
|----------|---|--|-----------|--------------|-------------|
| 5 | A | How can you show that a Chebicheff mechanism traces an approximate straight line motion? | L2 | CO-II | [5M] |
|----------|---|--|-----------|--------------|-------------|

- B In a Davis steering gear, the distance between the pivots of the front axle is 1.2 metres and the wheel base is 2.7 metres. Find the inclination of the track arm to the longitudinal axis of the car, when it is moving along a straight path. L3 CO-II [5M]

SECTION-III

- 6 In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when the angle BAD = 60° . L3 CO-III [10M]



OR

- 7 Two shafts with an included angle of 160° are connected by a Hooke's joint. The driving shaft runs at a uniform speed of 1500 r.p.m. The driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required. L3 CO-III [10M]

SECTION-IV

- 8 A cam is to be designed for a knife edge follower with the following data: 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30° . 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4. Dwell during the remaining 180° . Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m. L3 CO-IV [10M]

OR

- 9 A cam is to be designed for a knife edge follower with the following data : 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30° . 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4. Dwell during the remaining 180° . Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m. L4 CO-IV [10M]

SECTION-V

- | | | | | | |
|-----------|---|---|-----------|-------------|-------------|
| 10 | A | Two 20° involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and the pinion has 13 teeth. Does interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? | L3 | CO-V | [5M] |
| | B | What is a differential gear of an automobile? How does it function? Explain. | L2 | CO-V | [5M] |
| | | OR | | | |
| 11 | A | State and prove the law of gearing. | L2 | CO-V | [5M] |
| | B | Describe the comparison between simple and compound gear train with help of neat sketches. | L3 | CO-V | [5M] |
