R20

Code No: R20A0303

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: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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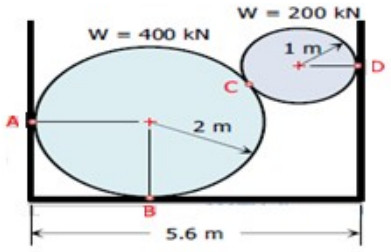
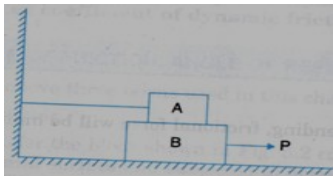
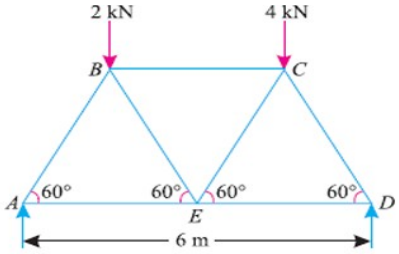
		SECTION-I	BCLL	CO(s)	Marks
1	**A**	Summarize the following terms i) Free body diagram ii) Law of Transmissibility of forces iii) Newton's law of Gravitation iv) Resolution of a force	**L2**	**CO-I**	**[7M]**
	B	The resultant of two forces, one of which is double the other is 260N.If the direction of the larger force is reversed and the others remains unaltered, the resultant reduces to 180N.Determine the magnitude of the forces and the angle between the forces.	**L3**	**CO-I**	**[7M]**
		OR			
2	**A**	State and prove Varignon's theorem with neat diagram.	**L1**	**CO-I**	**[7M]**
	B	By applying the conditions of equilibrium, evaluate the supporting reactions at all contact points of the system as shown in figure. 	**L3**	**CO-I**	**[7M]**
		SECTION-II			
3	**A**	Write Coulomb's laws of friction.	**L1**	**CO-II**	**[7M]**
	B	Block A weighing 1000N rests over block B which weights 2000N as shown in figure**.** Block A is tied to wall with a horizontal string. If the coefficient of friction between blocks A and B is 0.25 and between B and floor is 1/3, what should be the value of P to move the block B, if i) P is horizontal, ii) P acts at 30^0 upwards to horizontal?	**L3**	**CO-II**	**[7M]**



OR

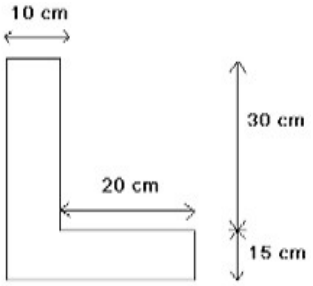
4	A	Fig. shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile.	L3	CO-II	[7M]



	B	Outline the step-by-step procedure of the method of joints.	L1	CO-II	[7M]

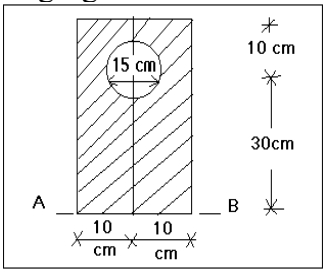
SECTION-III

5	A	Explain the difference between centroid and center of gravity with neat diagrams.	L2	CO-III	[7M]
	B	Indicate the centroid of the L-shape lamina shown in the following figure	L3	CO-III	[7M]



OR

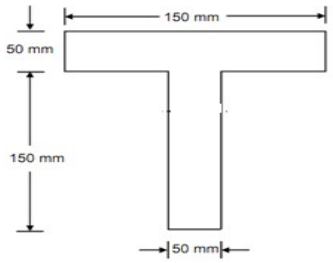
6	A	State and prove Pappus' first theorem for finding the surface area of a solid of revolution.	L1	CO-III	[7M]
	B	Locate the centroid of the shaded portion from base AB as shown in the following figure.	L3	CO-III	[7M]



SECTION-IV

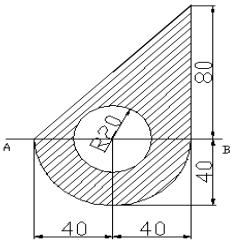
7	A	State and Prove Parallel Axis theorem.	L1	CO-IV	[7M]
	B	Determine the moment of inertia of the following figure with	L3	CO-IV	[7M]

respect to centroidal axis and top layer of top flange.



OR

8	**A**	Provide a detailed explanation on finding the centroid of a semicircle and a quarter-circle	**L3**	**CO-IV**	**[7M]**
	B	Find the moment of inertia of the shaded area as shown in figure about the axis AB.	**L3**	**CO-IV**	**[7M]**



SECTION-V

9	**A**	Derive the expression for D Alembert's principle	**L3**	**CO-V**	**[7M]**
	B	A man Weighing W entered a lift which moves with an acceleration of a m/s^2.Find a force exerted by man on the floor of the lift when a) Lift is moving downward b) Lift is moving upward	**L3**	**CO-V**	**[7M]**

OR

10	**A**	What is the difference between kinetics and kinematics in particle motion analysis?	**L1**	**CO-V**	**[7M]**
	B	A body of mass 8kg is moving over a smooth surface, whose equation of motion is given by the relation $s = 5t + 2t^2 + 3$ where (s) is in metres and (t) in seconds. Find the velocity and accelaration t=5 sec .	**L3**	**CO-V**	**[7M]**

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R20

Code No: R20A0304

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: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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

		SECTION-I	BCLL	CO(s)	Marks
1	***A***	2kg of gas at a pressure of 1.5 bar, Occupies a volume of 2.5 m^3. If this gas compresses isothermally to 1/3 times the initial volume. Find initial, Final temperature, work done and heat transfer.	**L3**	**CO-I**	**[7M]**
	B	A gas at a pressure of 138 kN/m^2 is having volume of 0.112 m^3. It is com-pressed to 690 kN/m^2 according to the law $pv^{1.4}$=constant. Calculate the final volume of the gas.	**L3**	**CO-I**	**[7M]**
		OR			
2	***A***	A certain water heater operates under steady flow conditions receiving 4.2 kg/s of water at 75°C temperature, enthalpy 313.93 kJ/kg. The water is heated by mixing with steam which is supplied to the heater at temperature and enthalpy 2676kJ/kg. The mixture leaves the heater as liquid water at temperature 100uC and enthalpy 419 kJ/kg. How much steam must be supplied to the heater per hour?	**L3**	**CO-I**	**[7M]**
	B	State the first law of Thermodynamic and which is the property introduced by the First law?	**L2**	**CO-I**	**[7M]**
		SECTION-II			
3	***A***	Explain the working of Carnot cycle with neat sketch? And Derive an expression for Carnot Efficiency ?	**L3**	**CO-II**	**[7M]**
	B	A reversible heat engine operates between two reservoirs at 827ºC and 27ºC. Engine drives a Carnot refrigerator maintaining –13ºC and rejecting heat to reservoir at 27ºC. Heat input to the engine is 2000 kJ and the network available is 300 kJ. How much heat is transferred to refrigerant and total heat rejected to reservoir at 27ºC?	**L3**	**CO-II**	**[7M]**
		OR			
4	***A***	What does the principle of entropy increase specify?	**L3**	**CO-II**	**[6M]**
	B	State the Kelvin-Planck and Clausius statements of the Second Law of Thermodynamics clearly.	**L3**	**CO-II**	**[8M]**
		SECTION-III			
5	***A***	A large insulated vessel is divided into two chambers, one	**L3**	**CO-III**	**[8M]**

		containing 5 kg of dry saturated steam at 0.2 MPa and the other 10 kg of steam, 0.8 quality at 0.5 MPa. If the partition between the chambers is removed and the steam is mixed thoroughly and allowed to settle, find the final pressure, steam quality, and entropy change in the process.			
	B	Explain with a neat diagram p -V-T surface.	**L2**	**CO-III**	**[6M]**
		OR			
6	***A***	What do you understand by triple point? Give the pressure and temperature of water at its triple point.	**L3**	**CO-III**	**[7M]**
	B	A rigid vessel contains 1 kg of a mixture of saturated water and saturated steam at a pressure of 0.15 MPa. When the mixture is heated, the state passes through the critical point. Determine (i) The volume of the vessel (ii) The mass of liquid and of vapour in the vessel initially.	**L3**	**CO-III**	**[7M]**
		SECTION-IV			
7	***A***	Discuss why the enthalpy of air-vapour mixture remains constant does during an adiabatic saturation process.	**L3**	**CO-IV**	**[6M]**
	B	Moist air at 1 atm. pressure has a dry bulb temperature of 32^0C and a wet bulb temperature of 26^0C. Calculate i) the partial pressure of water vapour, ii)humidity ratio, iii) relative humidity, iv) dew point temperature, v) density of dry air in the mixture, vi) density of water vapour in the mixture and vii) enthalpy of moist air using perfect gas law model and psychrometric equations.	**L4**	**CO-IV**	**[8M]**
		OR			
8	***A***	Discuss about Mass fraction Gravimetric and volumetric Analysis.	**L3**	**CO-IV**	**[7M]**
	B	For the atmospheric air at room temperature of 30ºC and relative humidity of 60% determine partial pressure of air, humidity ratio, dew point temperature, density and enthalpy of air.	**L3**	**CO-IV**	**[7M]**
		SECTION-V			
9	***A***	An air standard dual cycle has a compression ratio of 16, and compression begins at 1 bar, 50ºC. The maximum pressure is 70 bar. The heat transferred to air at constant pressure is equal to that at constant volume. Estimate (a) the pressures and temperatures at the cardinal points of the cycle, (b) the cycle efficiency, and (c) the m.e.p. of the cycle, Cv = 0.718 kJ/kg K, Cp= 1.005 kJ/kg K.	**L4**	**CO-V**	**[8M]**
	B	Define mean effective pressure and thermal efficiency of an air standard cycle.	**L3**	**CO-V**	**[6M]**
10	***A***	Explain the air standard Otto cycle with the help P-V and T-S diagrams.	**L3**	**CO-V**	**[7M]**
	B	How is a reversed Brayton cycle used for refrigeration?	**L3**	**CO-V**	**[7M]**

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R20

Code No: R20A0305

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

II B.Tech I Semester Supplementary Examinations, November 2025

Fluid Mechanics & Hydraulic Machinery

(ME)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

			BCLL	CO(s)	Marks
		SECTION-I			
1	***A***	Explain various classifications of fluids with the help of a stress-strain graph. Give suitable examples.	**L1**	**CO-I**	**[7M]**
	B	A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N/m2 to maintain this speed. Determine the fluid viscosity between the plates.	**L4**	**CO-I**	**[7M]**
		OR			
2	***A***	Write briefly about different types of Pressure measuring devices.	**L1**	**CO-I**	**[7M]**
	B	A differential manometer connected at the two points A and B at the same level in a pipe containing an oil of specific gravity 0.8, shows a difference in mercury levels as 100 mm. Find the difference in pressures at the two points.	**L5**	**CO-I**	**[7M]**
		SECTION-II			
3	***A***	Define path line, streak line and the stream line. For what type of flow these lines are identical.	**L1**	**CO-II**	**[7M]**
	B	Check whether the following velocity relations satisfy the requirements for steady irrational flow. (i) $u = x + y$, $v = x - y$ (ii) $u = xt^2 + 2y$, $v = x^2 - yt^2$ (iii) $u = xt^2$, $v = xyt + y^2$	**L3**	**CO-II**	**[7M]**
		OR			
4	***A***	Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm² (gauge) and with a mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross-section, which is 5 m above the datum line.	**L4**	**CO-II**	**[7M]**
	B	Derive Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum.	**L1**	**CO-II**	**[7M]**
		SECTION-III			
5	***A***	Explain how the boundary layer separation takes place when the fluid moves over a curved surface.	**L1**	**CO-III**	**[7M]**
	B	How will you find the drag on a flat plate due to laminar and turbulent boundary layers?	**L2**	**CO-III**	**[7M]**

OR

6	***A***	Explain the losses of energy in flow through pipes.	**L2**	**CO-III**	**[7M]**
	B	Derive friction factor for the flow through the circular pipe by Darcy Weisbach equation?	**L3**	**CO-III**	**[7M]**

SECTION-IV

7	***A***	Derive the expression for force exerted by the jet on Single vertical plate moving in the direction of jet	**L3**	**CO-IV**	**[7M]**
	B	Explain various types of draft tube with neat sketch.	**L4**	**CO-IV**	**[7M]**

OR

8	***A***	Briefly explain the construction details of radial flow reaction turbine with neat sketch.	**L1**	**CO-IV**	**[7M]**
	B	Describe briefly definitions of heads and efficiencies of a turbine	**L2**	**CO-IV**	**[7M]**

SECTION-V

9	***A***	Explain about the working principle of centrifugal pump with neat sketch.	**L1**	**CO-V**	**[7M]**
	B	The internal and external diameters of the impeller of centrifugal pumps are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of flow is constant. Examine the work done by the impeller per unit weight of water. Sketch the velocity triangle.	**L4**	**CO-V**	**[7M]**

OR

10	***A***	Explain the working of a double acting reciprocating pump with a neat sketch. Derive the expression for work done of it.	**L1**	**CO-V**	**[7M]**
	B	What is indicator diagram? Prove that work done by a reciprocating pump is proportional to the area of indicator diagram.	**L2**	**CO-V**	**[7M]**

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