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PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

UE21ME131A

MARCH 2022: END SEMESTER ASSESSMENT (ESA) B. TECH I SEMESTER

UE21ME131A – MECHANICAL ENGINEERING SCIENCE

Time: 3 Hrs	Answer All Questions	Max Marks: 100

1	a)	The following particulars were obtained in a trial on a 4 stroke gas engine. Duration of trial = 1 hour No. of revolutions = 14000 Net brake load = 1470 N Mean effective pressure = 7.5 bar Gas consumption = 20000 litres Calorific value of gas = 21 kJ/litre Cylinder diameter = 250 mm Stroke = 400 mm Sum of diameters of brake drum and rope = 1.27 m Calculate (i) Indicated Power (ii) Brake Power (iii) Indicated thermal efficiency (iv) Mechanical efficiency	8
	b)	Explain the working principle of a single stage De – Laval steam turbine with a neat sketch. Show the variation of pressure and velocity across the nozzle and turbine.	6
	c)	Describe the way in which series hybrid electric vehicle and parallel hybrid electric vehicle are propelled, with corresponding block diagram representations.	6
2	a)	A flat belt runs on a pulley of 1m diameter and transmits 7.5 kW at a speed of 200 rpm. Taking angle of lap as 170° and coefficient of friction as 0.2, determine the necessary width of the belt if the ratio of maximum tension to width of the belt is not to exceed 196 N/cm.	6
	b)	i) Define inversion of a mechanism. ii) Describe with neat sketches, the inversions obtained when the cylinder and connecting rod respectively are fixed in a single slider crank chain mechanism.	7 (1+6)

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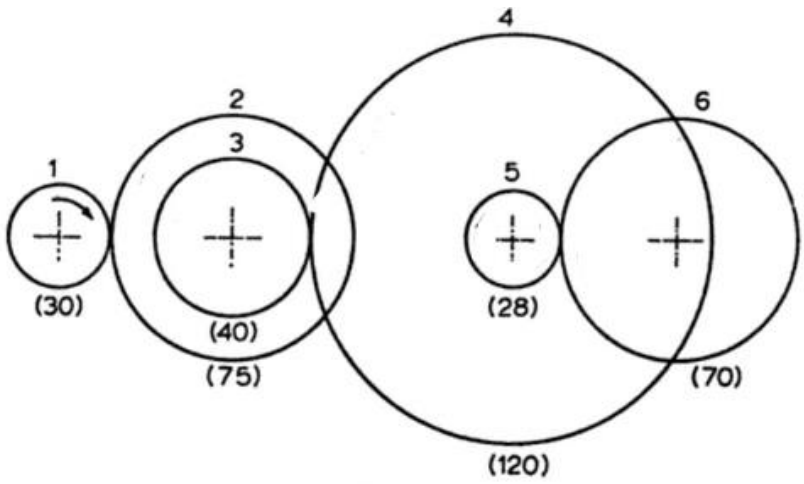
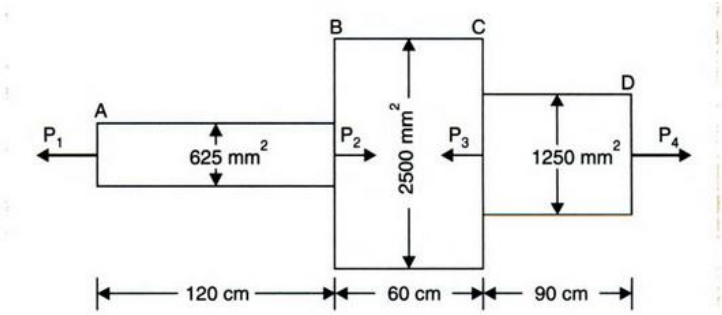
	c)	i) A certain gear box in an automobile initially contains a pair of spur gears for transmitting power between two shafts. Suggest a suitable alternative type of gears for the following scenarios encountered by the gear box, with suitable justifications. a) Spur gears are generating heavy noise as there is involvement of high speed. b) Due to a layout change, the shafts which were initially parallel, are now made intersecting at right angles. (ii) In a compound gear train, shown in the following figure, the power is transmitted from a motor shaft to output shaft. The motor shaft is connected to gear 1 whereas the output shaft is connected to gear 6. The motor shaft is rotating at 1125 rpm in the clockwise direction. Determine the direction and speed of output shaft. The number of teeth on each gear are given below.	7 (2+5)

Gear	1	2	3	4	5	6
No. of teeth	30	75	40	120	28	70



3	a)	Explain one way and two way shape memory effects with neat diagrammatic representations.	6
	b)	Explain stress – strain diagram of a mild steel specimen subjected to tensile test, with a proper description of all salient points and regions of the diagram.	8
	c)	A member ABCD is subjected to point loads P_1 = 45 kN, P_2 = 365 kN, P_3 = 450 kN and P_4 = 130 kN as shown in the following figure. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1×10^5 N/mm^2.	6



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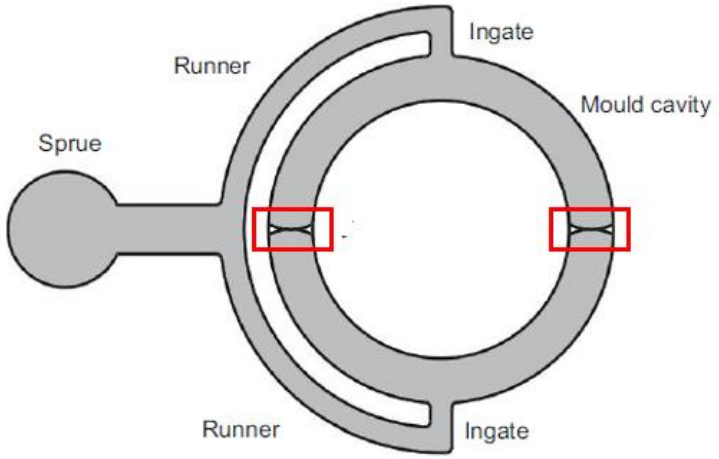
4	a)	i) What do you mean by a loose piece pattern? Explain with a simple sketch. ii) The following figure highlights a particular type of casting defect. Identify and describe the defect with atleast one cause and one remedy for the same.  	6 (3+3)
	b)	Explain the working principle of oxy – acytelene gas welding with a neat sketch. Describe the three types of flames used in this welding.	8
	c)	Explain the working principles of extrusion and riveting with simple sketches.	6 (3+3)
5)	a)	Explain with neat sketches, the working principles of i) Taper turning by swiveling the compound rest ii) Slab milling	8 (5+3)
	b)	A hole of 181.5 mm has to be drilled on a flat plate. The available twist drill is only of 181 mm size. i) Suggest a suitable operation for the machinist to enlarge the hole to required size, after drilling the hole of 181 mm diameter. Explain the same with a neat sketch. ii) Further, the hole prepared in (i) has to be modified to accommodate a cylindrical headed cap screw in it. Suggest the operation to be carried out by the machinist for the aforementioned purpose. Explain the same with a neat sketch. Note: Reamer of 181.5 mm is not available.	8 (4+4)
	c)	Differentiate between fixed and programmable automation.	4