Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) (FT/WP/S4 PT) Examination December 2025 (2019 Scheme)

Course Code: MET304

Course Name: DYNAMICS AND DESIGN OF MACHINERY

Max. Marks: 100 **Duration: 3 Hours**

***Recommended Machine Design Data book is allowed for use in examination hall**

PART A

Answer all questions, each carries 3 marks. Marks

1		Explain the equation for inertia force of a reciprocating part in an engine?	(3)
2		Explain the purpose of flywheel in an engine? How do you differentiate the function of a governor in engine with flywheel?	(3)
3		Explain the formula for Dunkerley's method?	(3)
4		Define viscous damping with example	(3)
5		Describe the following properties of a material (a) resilience (b) toughness (c) hardness	(3)
6		Draw stress strain diagram of ductile material	(3)
7		Explain different modes of failure in riveted joints	(3)
8		Differentiate endurance limit with endurance strength for a material.	(3)
9		Give example with purpose of materials used to make spring?	(3)
10		Explain types of welded joints.	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	The turning moment diagram for a multicylinder engine has been drawn to a scale of 1 mm=4500 N.m vertically and 1 mm=2.4° horizontally. The intercepts between output and mean resistance line taken in order from one end are 342, 230, 245, 303, 115, 232, 227 and 164 mm² and the engine is running at 150 rpm. If the mass of the flywheel is 1000 kg and the total fluctuation of speed does not exceed 3% of mean speed, find the radius of gyration.	(7)
	b)	The connecting rod of steam engine is 350 mm long. It has a mass of 20 kg and mass moment of inertia of 8000 kg mm. The centre of gravity is 225 mm from its small end. Determine the dynamical equivalent two mass system of the connecting rod if one of the masses is located at the small end.	(7)

OR

12 A vertical cylinder engine has a cylinder diameter of 250mm and stroke length of 450mm. The reciprocating parts have a mass of 180kg. The connecting rod is four times the crank radius and the speed is 360r.p.m. When the crank has turned though an angle of 45° from TDC, the net pressure on the piston is 1.05 MN/m^2. Calculate the a) effective turning moment on the crankshaft for this position. b) thrust on the bearings c) thrust on side walls of the cylinder. (14)

Module II

13 a) A 40 mm diameter and 250 mm long cantilever shaft has a disc of mass 75 kg at its free end. Young's modulus for the shaft material = 200 GN/m^2. Determine the frequency of Transverse Vibrations of shaft. (7)

b) An engine rests on an elastic foundation which deflects 0.85 mm under the dead load. Find the frequency of free vertical vibration. If the engine has a mass of 1250 kg and when running at 450 rpm, there is an out of balanced force at this frequency and magnitude 2400 N. Find the amplitude (7)

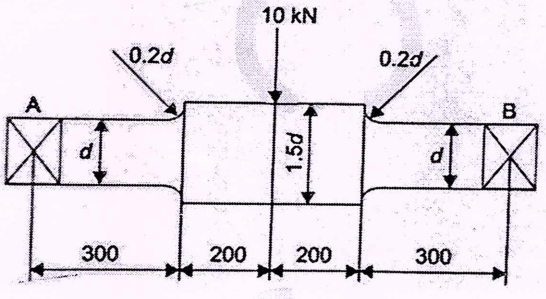
OR

14 a) Explain different types of free vibrations (7)

b) Explain external excitation and its types? (7)

Module III

15 A stepped shaft is subjected to a transverse load of 10kN as shown in figure. The shaft is made of steel with ultimate tensile strength of 300 MPa. Determine the diameter of the shaft based on factor of safety of 2. (14)



OR

16 a) Explain the factors to be considered for selection of materials for design? (7)

b) Calculate the dimension of a stepped cylinder with D/d = 1.5 and the ratio of fillet radius to the dia.'d' as 0.25, when the cylinder is subjected to a BM of ± 1500 N-mm; Material for the cylinder is C 15 steel. (7)

Module IV

17 a) A steel shaft is subjected to a torque that varies over a range of +/- 40%. Determine the diameter of the shaft if it transmits 14 kW at 225 rpm. The material has an ultimate tensile strength of 600 MPa and yield strength of 400 MPa. FOS =3. (7)

b) Explain how endurance limit is determined for a material. Explain S-N curve. (7)

OR

18 A cold drawn steel rod of circular cross section is subjected to a variable bending moment of 565 N.m to 1130 N.m as the axial load varies from 4500 N to 13500 N. The maximum bending moment occurs at the same instant that the axial load is maximum. Determine the required diameter of the rod for a factor of safety of 2. Neglect stress concentration and column effect. Take σ_u = 550 MPa, σ_y = 470 MPa, endurance limit as 50% of the ultimate strength and size, load and surface correction coefficients as 0.85, 1, and 0.85 respectively. (14)

Module V

19 a) Find the maximum shear stress and deflection induced in a helical spring for the following specification, if it has to absorb 1200 Nm of energy. Mean diameter of spring = 120 mm, diameter of steel wire used = 25 mm and number of coils = 35, take G=84 kN/mm². (7)

b) Explain different types of riveted joints (7)

OR

20 Design a close coiled helical compression spring for a service load ranging from 2000 N to 2500 N. The axial deflection of the spring for the load range is 5 mm. Assume a spring index of 6. The permissible shear stress intensity is 420 MPa and modulus of rigidity, G = 84 kN/mm². Neglect the effect of stress concentration. Draw a fully dimensional sketch of the spring, showing details of the finish of the end coils. (14)

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