Code: 20ME3601

III B.Tech - II Semester – Regular / Supplementary Examinations
APRIL 2024

DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level   CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Four masses m_1,m_2,m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45^0,75^0 and 135^0. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	L3	CO3	8 M
	b)	Discuss briefly about radial engines with a neat sketch.	L2	CO1	6 M
OR					
2	a)	A four cylinder crank engine has the two outer cranks set at 120^0 to each other, and their reciprocating masses are each 350 kg. The distances between the planes of rotation of adjacent cranks are 45,75 and 60 cm. If the engine is to be in complete primary balance,	L3	CO3	10 M

		find the reciprocating masses and the relative angular positions for each of the inner cranks. If the length of each crank is 30 cm, the length of each connecting rod is 120 cm, and the speed of rotation is 250 rpm, determine the maximum secondary unbalanced force.			
	b)	Describe the balancing of several masses in a plane.	L2	CO1	4 M
		UNIT-II			
3	a)	A steam engine 200 mm bore and 300 mm stroke has a connecting rod 625 mm long. The mass of the reciprocating parts is 15 kg and the speed is 250 rpm. When the crank is 30^0 to the inner dead centre and moving outwards, the difference in steam pressure is 840 kN/m^2. Determine i) the force on the crankshaft bearing and ii) the torque acting on the frame.	L3	CO3	9 M
	b)	Explain the effect of gyroscopic couple on an aeroplane.	L2	CO1	5 M
		OR			
4	a)	The connecting rod of steam engine is 350 mm long. It has a mass of 20 kg and mass moment of inertia of 8000 $kg\text{-}mm^2$. The centre of gravity is 225 mm from its small end. Determine the dynamic equivalent two mass system of the connecting rod if one of the masses is located at the small end.	L3	CO3	9 M
	b)	Define the term Gyroscope and state its applications.	L2	CO1	5 M

UNIT-III					
5	a)	In a single acting four stroke engine, the workdone by the gases during the expansion stroke is three times the workdone during the compression stoke. The workdone during the suction and exhaust strokes is negligible. The engine develops 14 kW at 280 rpm. The fluctuation of speed is limited to 1.5 % of the mean speed on either side. The turning moment diagram during the compression and expansion strokes may be assume to be triangular in shape. Determine the Moment of inertia of the flywheel.	L3	CO4	10 M
	b)	Explain the working principle of Hartnell governor.	L2	CO4	4 M
OR					
6	a)	Each arm of a porter governor is 200 mm long and is pivoted on the axis of Rotation. The radii of rotation of the balls at the minimum and maximum speeds are 120 mm and 160 mm. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also find the range of speed if the friction at the sleeve is 18 N.	L3	CO4	10 M
	b)	Explain briefly about sensitiveness and isochronous of governors.	L2	CO4	4 M
UNIT-IV					
7	a)	Define the terms i) Free and Forced Vibrations ii) Natural frequency and resonance.	L2	CO1	4 M

	b)	A cantilever shaft of 50 mm dia, 300 mm long has a disc of 100 kg attached to the free end. The Young's modulus is 200 GN/m^2. Determine i) Frequency of longitudinal vibration ii) Frequency of transverse vibration.	L3	CO2	10 M
OR					
8	a)	Derive an expression for the natural frequency of oscillation of simple pendulum by D'Alemberts principle method.	L3	CO2	8 M
	b)	Discuss briefly about equivalent stiffness of springs.	L2	CO1	6 M
UNIT-V					
9	a)	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 maximum amplitude.	L3	CO2	10 M
	b)	Explain briefly about the response of the periodic excitation.	L2	CO2	4 M
OR					
10	a)	Discuss briefly about vibration analysis of harmonic motion.	L2	CO2	6 M
	b)	An SDOF system has a total weight of 5 kN and a spring stiffness of 360 kN/m. The system is excited at resonance by a harmonic force of 3kN. Determine the displacement amplitude of the forced response after (i) 1.25 cycles and (ii) 10.25 cycles.	L3	CO2	8 M