PVP 20

Code: 20ME3601

III B.Tech - II Semester – Regular Examinations – JUNE 2023

DYNAMICS OF MACHINERY
(MECHANICAL ENGINEERING)

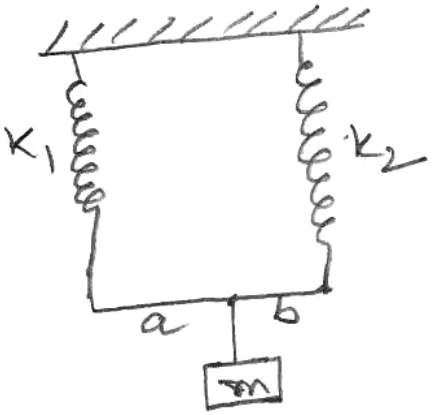
Duration: 3 hours Max. Marks: 70

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)	Three masses P, Q and R with masses 12 kg, 11 kg and 18 kg respectively revolve in the same plane at radii 120 mm, 144 mm and 70 mm respectively. The angular position of Q and R are 60^0 and 135^0 from P. Determine the position and magnitude of mass S at radius 152 mm to balance the system.	L3	CO1	7 M
	b)	Discuss the balancing of several masses in different planes.	L2	CO1	7 M
OR					
2		The firing order in a 6-cylinder vertical 2-stroke in-line engine is 1-4-5-2-3-6. The piston stroke is 100 mm and length of each connecting rod is 200 mm. The cylinder center lines are spaced at 300 mm. In the end view, the cranks are 60^o apart. The mass of reciprocating parts is 100 kg per cylinder and that of rotating parts 50 kg per	L3	CO1	14 M

		crank. The engine rotates at 200 rpm. Examine the engine for the balance of primary and secondary forces and couples. Find the maximum unbalanced force and couples.			
		UNIT-II			
3	a)	The rotor of the turbine of a ship makes 1500 rpm clockwise when viewed from the stern. The rotor has a mass of 800 kg and its radius of gyration is 300 mm. Find the maximum gyro-couple transmitted to the hull when the ship pitches with maximum angular velocity of 1 rad/s.	L3	CO2	7 M
	b)	Derive the expression for gyroscopic couple.	L3	CO2	7 M
		OR			
4		The crank and connecting rod of a vertical petrol engine running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During the expansion stroke when the crank has turned 20^{o} from the top dead center, the gas pressure is 650 kN/m^2. Determine: (i) The net force on the piston (ii) The net load on the connecting rod (iii) Thrust on the cylinder walls (iv) The speed at which the gudgeon pin load is reversed in direction.	L3	CO2	14 M
		UNIT-III			
5	a)	Differentiate Governor and Flywheel of an automotive.	L2	CO3	2 M
	b)	The equation of the turning moment	L3	CO3	10 M

		diagram for a three-crank engine is given by T (N-m) = 25000 - 7500 sin 3θ, where θ radians is the crank angle from the inner dead centre. The moment of inertia of the flywheel is 400 kg-m^2, and the mean engine speed is 300 rpm. Calculate the power of the engine and the total percentage fluctuation of speed of the flywheel, if the resisting torque is constant.			
OR					
6	a)	Explain the terms hunting, isochronism and stability relating to governors.	L2	CO3	7 M
	b)	Explain the working of Porter Governor with a neat sketch.	L2	CO3	7 M
UNIT-IV					
7	a)	Determine the equivalent spring stiffness and natural frequency of the following vibrating system. 	L3	CO4	7 M
	b)	Explain the basic features of a vibrating system. Also list the causes of vibrations.	L2	CO4	7 M
OR					
8	a)	Explain various types of vibrations.	L2	CO4	7 M
	b)	A shaft of 10 cm diameter and 100 cm long is fixed at one end and other end carries a	L3	CO4	7 M

		flywheel of mass 80 kg. Taking Young's modulus for the shaft material as 2×10^6 kg/cm^2, find the natural frequency of longitudinal and transverse vibrations.			
		UNIT-V			
9	a)	The following data relate to a machine supported on 4 springs: mass of the machine =120 kg, stroke = 90mm, mass of the reciprocating parts = 2.5 kg and speed = 750 rpm. Springs are symmetrically placed with respect to the center of the mass of the machine. Find the combined stiffness of the springs so that the force transmitted to the foundation is 1/22 of the impressed force.	L3	CO5	7 M
	b)	Derive the response of a spring-mass system subjected to support motion.	L2	CO5	7 M
		OR			
10	a)	Derive the equation of motion for a harmonically excited undamped vibration system.	L3	CO5	7 M
	b)	A spring-mass system consists of a mass weighing 100 N and a spring with a stiffness of 2000 N/m. The mass is subjected to resonance by a harmonic force of 25 N. Find the amplitude of the forced motion at the end of (i) 0.25 cycle, (ii) 2.5 cycles.	L3	CO5	7 M