Model Question Paper (CBCS) with effect from 2015-16

15ME52

USN | | | | | | | | | | |

Fifth Semester B.E. Degree (CBCS) Examination

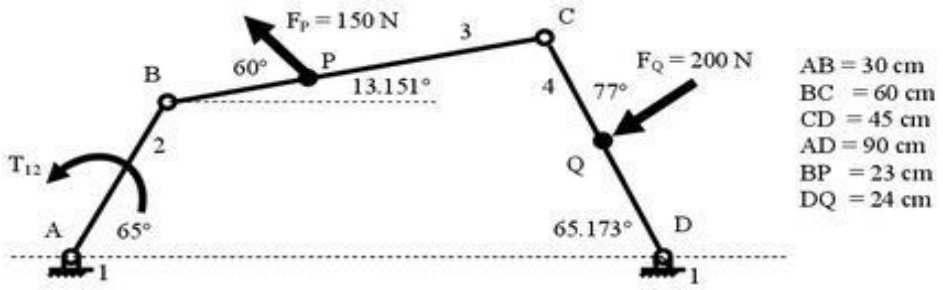
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

MODULE – I

1 **a** Calculate T2 and various forces on links for the equilibrium of the system shown in fig. (16 Marks)



OR

2 **a** Explain Dynamic force analysis, Alembert's principle, Inertia force and Inertia torque. (08 Marks)

b When the crank is 45^0 from the inner dead center on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5bar. the diameter of the cylinder = 0.75 m, stroke of the piston = 0.50 m and length of connecting rod=1 m. determine the torque on the crank shaft if the engine runs at 350 rpm and the mass of reciprocating parts is 200kg. (08 Marks)

MODULE – II

3 **a** A 3.6 m long shaft carries 3 pulleys, two at its two ends and the third at the midpoint. The two end pulleys have masses 79 Kg and 40 Kg with their radii 3 mm and 5 mm from the axis of the shaft respectively. The middle pulley has a mass of 50 Kg with radius 8 mm. The pulleys are so keyed to the shaft that the assembly is in static balance. The shaft rotates at 300 rpm in two bearings 2.4 m apart with equal overhangs on either side. Determine (i) Relative angular positions of the pulleys, (ii) Dynamic reaction on the bearings. (16 Marks)

OR

4 **a** Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses i.e., when c = 1/2 (04 Marks)

b The firing order in a 6 cylinder vertical 4 stroke in line engine 1-4-2-6-3-5, the piston stroke is 100 mm. length of each C.R = 200 mm. the pitch distance between cylinder centerlines are 100 mm, 100 mm, 150 mm, 100 mm and 100mm. determine the out of balance primary and secondary forces and couples on this engine taking a plane midway between cylinders 3 and 4 as reference plane. The reciprocating mass per cylinder is 2kg and the engine runs at 1500 rpm. (12 Marks)

MODULE – III

5	a	Define the following terms with respect to Governors: Sensitiveness, Stability, Isochronism, Hunting, Governor effort, Governor power.	(04 Marks)
	b	In a porter governor the arms and links are each 10 cm long and intersect on the main axis. Mass of each ball is 9 Kg and the central mass is 40 Kg. When sleeve is in its lowest position the arms are inclined at 300 to the axis. The lift of the sleeve is 2 cm. What is the force of friction at the sleeve, If the speed at the beginning of ascend from the lowest position is equal to the speed at the beginning of descend from the highest position. What is the range of speed of governor, if all other things remain same.	(12 Marks)

OR

6	a	Derive an expression for gyroscopic couple.	(06 Marks)
	b	A four wheeler trolley car weighing 25kN runs on rails which are 1.5 m apart and travels around a curve of 30 m radius at 24 km/hr. the rails are at the same level, each wheel of the trolley is 7.5 cm in diameter and each of two axels is driven by a motor running in direction opposite to that of wheels at a speed of 5 times the speed of rotation of wheel. The M.I of each axel with gear and wheel is 18 kgm^2. Each motor shaft with pinion has M.I of 12 kgm^2. C.G of car is 90 cm above rail. Determine the vertical force exerted by each wheel on the rail taking into consideration of centrifugal and gyroscopic effect. State the centrifugal and gyroscopic effect of the trolley.	(10 Marks)

MODULE – IV

7	a	Define the fallowing terms i) Simple Harmonic motion ii) Resonance iii) Degrees of Freedom iv) Natural Frequency v) Time Period	(06 Marks)
	b	Split the Harmonic function $X= 5 \sin(\omega t + \pi/4)$ into two Harmonic functions one having phase of zero and the other of 600.	(10 Marks)

OR

8	a	Derive differential equation for undamped free vibrations. (Newton's method).	(06 Marks)
	b	Determine the natural frequency of a spring mass system where the mass of is also to be taken in to account.	(10 Marks)

MODULE – V

9	a	Define logarithmic decrement and derive an expression for the same.	(06 Marks)
	b	The disc of a torsional pendulum has a moment of inertia of 0.06kgm^2 and is immersed in viscous fluid. The brass shaft attached to it is of 100 mm diameter and 400 mm long when the pendulum is vibrating, the amplitude on the same side for the successive cycles are 9^0, 6^0, and 4^0. Determine (i) logarithmic decrement (ii) damping torque at unit velocity (iii0 periodic time of vibration. Assume for brass shaft G= 4.4×10^{10} N/m^2. What would be the frequency if the disc is removed from the viscous fluid.	(10 Marks)

OR

10	a	Define magnification factor, vibration isolation and transmissibility ratio.	(06 Marks)
	b	A mass of 6kg suspended by a spring of stiffness 1180 N/m is forced to vibrate by the harmonic force 10N. Assuming viscous damping coefficient of 85 Ns/m, determine the resonant frequency, amplitude at resonance, phase angle at resonance, frequency corresponding to the peak amplitude and the phase angle corresponding to peak amplitude.	(10 Marks)