CBCS SCHEME

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17ME52

Fifth Semester B.E. Degree Examination, July/August 2022
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. State the condition of equilibrium of a body subjected to a system of
i) Two forces ii) Three forces iii) Two forces and a Torque. **(06 Marks)**

b. For the static equilibrium of the four bar mechanism shown in Fig.Q1(b), determine the input toque T_2 on the link AB for a force of 2000N on link CD. Dimensions are AB = 300mm , BC = 455mm , BE = 175mm. **(14 Marks)**

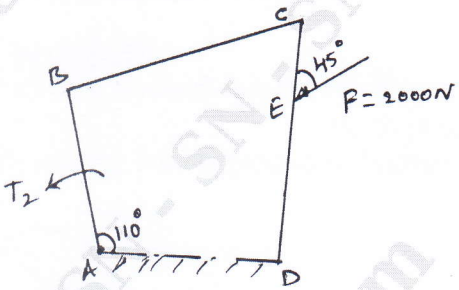


Fig. Q1(b)

OR

2 a. State D'Alembert's principle and its significance. **(06 Marks)**

b. In slider crank mechanism, the crank is 300mm long and connecting rod 850mm long. The piston is of 90mm in diameter and gas pressure acting on the piston is 5MPa. When the crank has moved through 45° from IDC. Find i) Thrust in connecting rod ii) Reaction from guide (piston side thrust) iii) Torque acting on the crank shaft iv) Load on main bearings. **(14 Marks)**

Module-2

3 a. Explain Static and Dynamic balancing of rotating masses. **(06 Marks)**

b. The four masses A, B, C and D having their radius of rotation as 200mm , 150mm , 250mm and 300mm are 200kg , 300kg , 240kg and 260kg in magnitude respectively. The angle between the successive masses are 45° , 75° and 135° respectively. Determine the position and magnitude of the balance mass required, if it's radius of rotation is 200mm. **(14 Marks)**

OR

4 A four cylinder inline engine has two outer cranks placed at 120° apart and their individual reciprocating masses are 200kg. The distance between cranks are 200mm , 600mm and 500mm respectively. The crank radius is 300mm and the length of connecting rod is 1200mm. The crank rotates at 340 rpm. If the engine is to be in complete primary balance, find the reciprocating masses and the relative angular positions for each of the inner cranks. Also find the magnitude of secondary unbalance force. **(20 Marks)**

Module-3

5 a. Define the following terms with respect to working of governors :
i) Sensitiveness ii) Isochronisms iii) Stability iv) Controlling force. **(08 Marks)**

b. A porter governor has all four arms 300mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to a sleeve at a distance of 35mm from the axis. Each ball has a mass of 7kg and the mass of the load on the sleeve is 540 N. Determine the speed of governor at the radius of rotation of the ball is 200mm and 260mm. **(12 Marks)**

OR

6 a. Derive an expression for Gyroscopic couple C = IWWp with usual notations. **(08 Marks)**

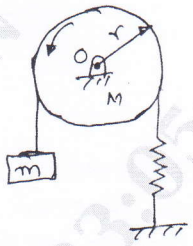
b. Each wheel of a four wheel , rear engine automobile has a moment of Inertia of 2.4kg m^2 and an effective diameters of 660mm. The rotating parts of the engine have a moment of Inertia of 1.2kg m^2. The gear ratio of engine to back axle is 3:1. The engine axis is parallel to the rear axle and the crank shaft rotates in the same sense as the road wheel. The mass of the vehicle is 2200kg and the centre of mass is 550mm above the road level. The track width of the vehicle is 1.5m. Determine the limiting speed of the vehicle around a curve with 80m radius so that all the four wheel maintain contact with the road surface. **(12 Marks)**

Module-4

7 a. Derive the equation for natural frequency of the spring mass system considering the mass of the spring into account. **(10 Marks)**

b. Evaluate the natural frequency of the system shown in Fig. Q7(b) using Newton's method. **(10 Marks)**

Fig. Q7(b)



OR

8 a. Define the following with respect to vibration : i) Natural frequency ii) Resonance iii) Damping factor iv) Logarithmic decrement. **(08 Marks)**

b. A mass of 2kg is supported on a spring of 3kN/m and has a dash pot having damping co-efficient of 5N sec/m. If the initial displacement of 8mm is given, find i) Damped natural frequency ii) Logarithmic decrement iii) Amplitude after 3 cycles. **(12 Marks)**

Module-5

9 a. Derive equation of motion for free damped vibration. **(10 Marks)**

b. A gun barrel , weighing 600kg has a recoil spring of stiffness 345N/mm. If the barrel recoils one meter on firing , find : i) The initial recoil velocity of the gun.
ii) The critical damping co-efficient which is engaged at the end of the recoil stroke.
Assume no energy is lost in the recoil of the barrel. **(10 Marks)**

OR

10 a. Define Logarithmic , Logarithmic decrement and prove that Logarithmic decrement $f = \frac{2\pi\xi}{\sqrt{1-\xi^2}}$, where ξ is damping ratio. **(10 Marks)**

b. Write a short notes on the following :
i) Magnification factor ii) Transmissibility. **(10 Marks)**

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