CBCS Scheme

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15ME52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Dynamics of Machinery

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the equilibrium with respect to two force of three force member. **(02 Marks)**

b. A four link mechanism with the following dimensions is acted upon by a force 80N 150° on the link DC. Determine the input torque on the link AB for the static equilibrium of the mechanism for the given configuration. AB = 400mm ; BC = 1000mm, CD = 750mm and DE = 350mm, AD = 500mm. **(14 Marks)**

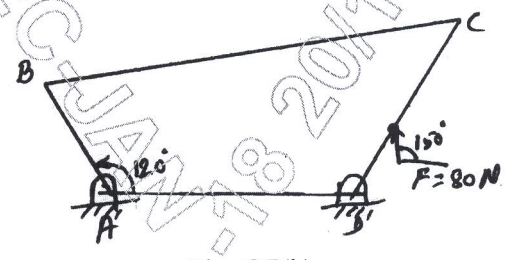

Fig. Q7(b)

OR

2 a. State 'D' Alembert's principle. **(08 Marks)**

b. The crank and connecting rod of a vertical single cylinder gas engine running at 1800 rpm are 60mm and 240mm respectively. The diameter of the Piston is 80mm and the mass of the reciprocating is 1.2kg. At a point during the power stroke when the Piston has moved 20mm from the top dead centre position, the pressure on the Piston is 800 kN/m^2. Determine :

i) Net force on the piston
ii) Thrust in the connecting rod
iii) Thrust on the sides of cylinder wall
iv) Engine speed at which the above values are zero. **(08 Marks)**

Module-2

3 For masses m_1 = 100kg, m_2 = 175kg, m_3 = 200kg and m_4 = 125kg are fixed to the crank of 200mm radius and revolve in planes Ist, IInd, IIIrd respectively. The angular position of the planes IInd, IIIrd and and IVth with respect to Ist plane are 75°, 135° and 240° take in the same sense. Distance of plane II^{n,} IIIrd and IVth from Ist are 600mm, 1800mm and 2400mm. Determine the magnitude and position of the balancing masses at the radius 600mm in planes L and M located in the middle of Ist and IInd and in the middle of IIIrd and IVth respectively. **(16 Marks)**

OR

4 The piston of a 4 cylinder vertical inline engine reach their upper most position at 90° interval in order of their axial position, pitch of the cylinder = 0.35m ; length of the connecting rod = 0.42m. the engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(16 Marks)**

Module-3

5 a. Derive an expression for gyroscopic couple. **(06 Marks)**

b. A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and the mass of the central load on the sleeve is 25kg. The radius of rotation of the ball is 150mm when the governor begins to lift and 200mm when the governor is at maximum speed. Find the minimum and maximum speeds and range of speed of the governor. **(10 Marks)**

OR

6 a. Define: i) Sensitiveness ii) Isochronism. **(04 Marks)**

b. A turbine rotor of a ship has a mass of 2.2 and Tonnes and rotates at 1800rpm clockwise when viewed from the stern. The radius of gyration of the rotor is 320mm. Determine the gyroscopic couple and its effect when the

i) Ship turns right at a radius of 250m with a speed of 25km/hr.

ii) Ship pitches with bow rising at on angular velocity of 0.8 rad/sec.

iii) Ship rolls at on angular velocity of 0.1 rad/sec. **(12 Marks)**

Module-4

7 a. Briefly explain, Free, Forced, damped and undamped vibration. **(08 Marks)**

b. Split up the harmonic motion $X = 6 \cos (wt + 45°)$ into two harmonic motions. One of them having phase angle of zero degree and other having phase angle of 60°. Check solution by graphically. **(08 Marks)**

OR

8 a. Obtain the equivalent stiffness of spring when springs are connected in series and parallel. **(08 Marks)**

b. Obtain the natural frequency of the system shown in Fig Q8 (b). **(08 Marks)**

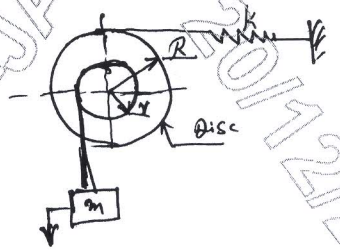

Fig. Q8(b)

Module-5

9 a. Define logarithmic decrement and derive the equation for same. **(08 Marks)**

b. Vibration system consisting of a mass 3kg a springs of stiffness 100kN/m and damper. Damping coefficient 30Ns/m. Determine Damping factor, critical damping coefficient logarithmic decrements, Ratio of two consecutive amplitudes.
Number of cycles after which the initial amplitude is reduced to 20%? **(08 Marks)**

OR

10 a. Derive an expression for magnification factor or amplitude ratio for spring mass system with viscous damping subjected to harmonic force. **(08 Marks)**

b. A vibratery body of mass 150kg supported on springs of total striffness 1050kN/m has a rotating unbalance force fo 525N at a speed of 6000rpm. If the damping factor is 0.3. Determine :

i) The amplitude caused by the unbalance and its phase angle

ii) The transmissibility

iii) The actual force transmitted and its phase angle. **(08 Marks)**