Code No: 55017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, February/March - 2016

DYNAMICS OF MACHINERY

(Common to ME, MCT, AME, MIM, MSNT)

Time: 3 hours **Max. Marks: 75**

Answer any five questions

All questions carry equal marks

Illustrate your answers with NEAT sketches wherever necessary

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1.a) Explain the effect of gyroscopic couple on the stability of an automobile negotiating a curve.

b) 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. [8+7]

2. The following data relate to a horizontal reciprocating engine: Mass of reciprocating parts = 120 kg; Crank length = 90 mm; Engine speed = 600 rpm; Mass of connecting rod = 90 kg; Length between centers = 450 mm; Distance of mass center from small end center = 180 mm; Radius of gyration about mass center axis = 150 mm; Find the magnitude and direction of the inertia torque on the crank shaft when the crank has turned through 30^0 from the IDC. [15]

3.a) With a neat sketch, describe the principle and working of a Bevis- Gibson flash light dynamometer.

b) A conical friction clutch is used to transmit 93.2 kW at 1500 rpm. The semi – cone angle is 20^0, and the coefficient of friction is 0.2. If the mean diameter of the clutch is 375 mm, and the intensity of normal pressure is not to exceed 24.53 N/cm^2, find the dimensions of the clutch. [8+7]

4.a) What do you mean by Primary and Secondary unbalance in reciprocating engines? Explain.

b) A single cylinder reciprocating engine has the following data: Speed of the engine = 240 rpm; Stroke = 320 mm; Mass of reciprocating parts = 67.5 kg; Mass of revolving parts at the crank radius = 52.5 kg; If 60 % of the reciprocating parts and all the revolving parts are to be balanced, find the unbalanced force when the crank has rotated 60^0 from the TDC. [7+8]

5.a) Write the differences between the Watt, Porter, and Proell governors.

b) In the Proell governor shown in Figure.1, each ball weighs 3 kg*f*, and the weight of the central sleeve is 25 kg*f*. The arms are 200 mm long, and are pivoted about axes which are displaced from the central axis of rotation by 37.5 mm. Other dimensions in the figure are: x = 303.5 mm; y = 238 mm; CE = 85 mm; MD = 142.5 mm. Determine the equilibrium speed of the governor. [8+7]

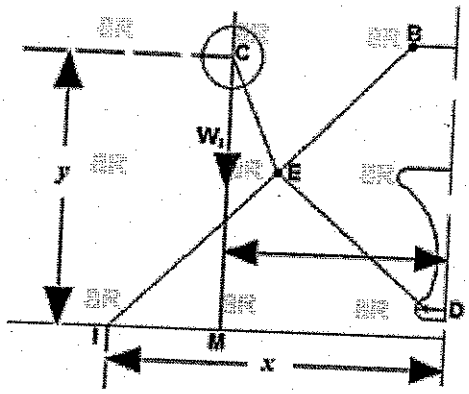

Figure 1

6.a) What are 'Free body diagrams' of a mechanism, and how are they helpful in finding the forces acting on the various members of the mechanism?

b) For the static equilibrium of the mechanism shown in Figure. 2, find the required input torque. The dimensions in the figure are : AB = 150 mm ; BC = AD = 500 mm ; DC = 300 mm ; CE = 100 mm ; EF = 450 mm. [7+8]

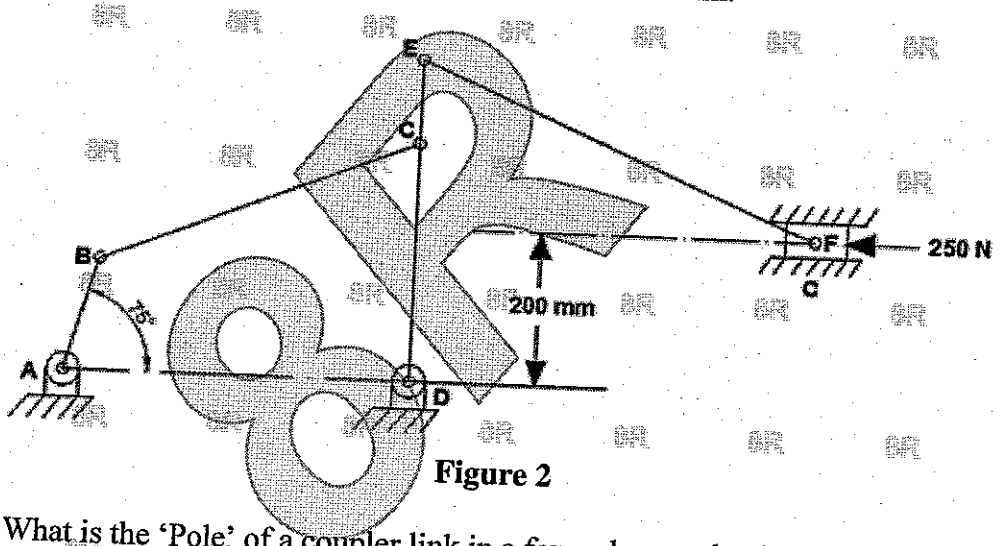

Figure 2

7.a) What is the 'Pole' of a coupler link in a four – bar mechanism? What is 'Relative Pole'?

b) Describe the procedure to design a slider crank mechanism by relative pole method when three positions of the input link (θ_1, θ_2, and θ_3), and the slider (s_1, s_2, s_3) are known. [7+8]

8.a) What is Logarithmic decrement? Find an expression for the logarithmic decrement in terms of the damping factor.

b) A machine having a mass of 100 kg and supported on springs of total stiffness 7.84×10^5 N/m has an unbalanced rotating element which results in a disturbing force of 392 N at 3000 rpm. Assuming a damping factor of 0.20, find the transmissibility and the transmitted force. [7+8]

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