

R09

Code No: 09A50303

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year I Semester Examinations, May/June – 2013

Dynamics of Machinery

(Common to ME, MCT, AME, MIM)

Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

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- 1.a) How do the effects of gyroscopic couple and of centrifugal force make the rider of a two wheeler tilt on one side? Derive a relation for the limiting speed of the vehicle.
- b) A thin circular disc is fitted to a shaft as shown in figure 1. Weight of the disc is 500N and diameter is 1.2m. Shaft rotates at 300rpm in anticlockwise direction when seen from the right side. Find the effect of the gyroscopic couple on the shaft, and the bearing reactions at A and B taking the effect of the weight of the disc. [7+8]



Figure.1

2. A multi-disc clutch has 5 plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed  $127\text{kN/m}^2$ , find the power in kW transmitted at 500rpm, if the outer and inner radii of friction surfaces are 1.25 m and 75mm, respectively. Assume uniform wear and take the coefficient of friction as 0.3. [15]
- 3.a) Find a relation for the coefficient of fluctuation of speed in terms of the maximum fluctuation of energy and the kinetic energy of the flywheel at mean speed.
- b) What is meant by piston effort and crank effort? Explain. [9+6]
4. The arms of a Proell governor are 275 mm long and are pivoted on the axis of rotation. The extensions of the lower arms on which each ball is carried is 100 mm, long, and the weight of the ball is 5 kg. The central load on the sleeve is 75 kg. If the ball centres are vertically above the pin joint connecting the upper and lower arms when the radius of rotation is 187.5 mm, determine the corresponding equilibrium speed. **Deduce the expression used.** [15]
- 5.a) Three masses of 8 kg, 12 kg, and 15 kg attached at radial distances of 80, 100, and 60 mm respectively to a disc on a shaft are in complete balance. Determine the angular positions of the masses of 12 kg and 15 kg relative to the 8 kg mass.
- b) What do you understand by inside cylinder locomotives and outside cylinder locomotives? What is the effect of partial balancing of locomotive? [8+7]

- 6.a) A single cylinder engine of total mass 20 kg is to be mounted on an elastic support which permits vibratory movement in vertical direction only. The elastic support consists of three springs of stiffness ' $k$ ' N/m each. If the unit operates at 580 rpm, what should be the value of spring constant ' $k$ ', if only 10% of the shaking force of the unit is to be transmitted to the support structure?
- b) Explain what do you understand by over-damped system, under-damped system, and critically damped system. [10+5]
7. A reciprocating mechanism with two external forces  $P$  and  $F_3$  is shown in figure.2. For the configuration shown, the impending motion of the slider is to the right, and the friction angle is  $\phi$ . Determine the couple  $C_2$  on link 2 for static equilibrium. [15]

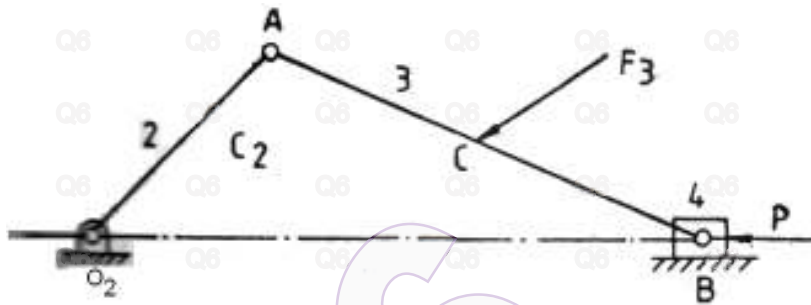


Figure.2

- 8.a) Distinguish between the three-position synthesis and four-position synthesis with respect to their applications.
- b) Write and explain the Freudenstein's equation with respect to a four bar mechanism. [7+8]

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