Code No: 55017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year I Semester Examinations, December - 2014
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) A flywheel of mass 10 kg and radius of gyration 200 mm is spinning about its axis, which is horizontal and is suspended at a point which is at 150 mm from the plane of rotation of the flywheel. Determine the angular velocity of precession of the flywheel. The spin speed of flywheel is 900rpm.

b) 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.

2. A 4 – stroke single cylinder IC engine develops 80 kW at 300 rpm. The fluctuation of energy can be assumed to be 90 % of the energy developed per cycle. If the coefficient of fluctuation of speed is not to exceed 2 % , and the maximum centrifugal stress in the rim of the flywheel is limited to 6 MN/m^2 , estimate the mean diameter of the rim and the M.I. of the flywheel. The density of flywheel material is 7500 kg/m^3.

3.a) State the conditions for equilibrium of a body under the action of (i) three forces, and (ii) two forces and a torque.

b) A slider – crank mechanism shown in Fig.1 is subjected to a piston load of 1 kN. The link lengths are : AB = 250 mm ; BC = 600 mm ; Determine the input torque to the link AB for static equilibrium of the mechanism.

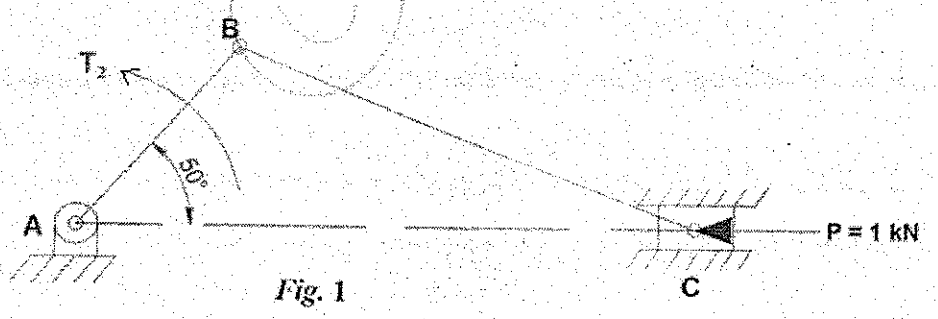


Fig. 1

4. Design a four – link mechanism if the motions of the input and output links are governed by a function $y = x^{1.5}$, and x varies from 1 to 4. Assume θ to vary from 30^0 to 120^0, and φ from 60^0 to 130^0. The length of the fixed link is 30 mm. Use Chebychev spacing of accuracy points.

5.a) Distinguish between Hartnell and Hartung governors.

b) The upper arms of a Porter governor are pivoted on the axis of rotation, and are each 300 mm long. The lower arms are 275 mm long, and are attached to the sleeve at a distance of 50 mm from the axis of rotation. The weight of each ball is 58.9 N, and the central weight is 470.9 N. Determine the equilibrium speed of the governor when the radius of rotation is 175 mm.

6.a) What are the different types of friction clutches? Describe with a neat sketch the working of a cone clutch.

b) The brake drum of a single block brake of diameter 600 mm is rotating at 400 r.p.m. as shown in **Fig.2.** The force required at the end of the lever to apply the brake is 300 N. If the angle of contact is 90^0, and the coefficient of friction between the drum and the brake block is 0.3, find the braking torque. Take b = 60 mm; a = 375 mm and L = 825 mm.

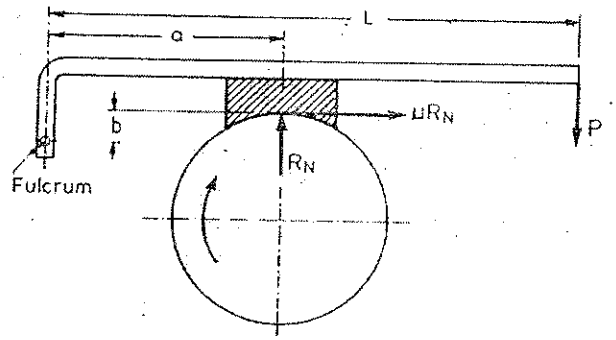
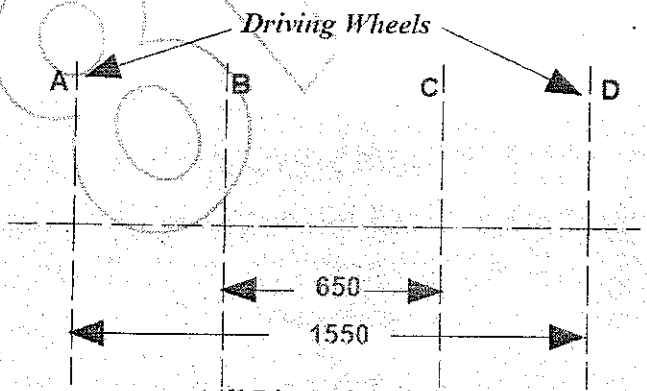


Fig. 2

7.a) What do you understand by 'Inside cylinder locomotives' and 'Outside cylinder locomotives'? What is the effect of partial balancing of locomotives?

b) The following data refer to a two cylinder locomotive shown in Fig.3 with the cranks placed at 90^0 to each other. The reciprocating mass per cylinder is 2943 N,



(All Dimensions in mm)

Fig. 3

the crank radius is 300 mm, the driving wheel diameter is 1800 mm, the distance between the cylinder center lines is 650 mm, and the distance between the driving wheels is 1550 mm. Find the variation in tractive effort.

8.a) A simply supported beam of span L carries a uniformly distributed load of mass ***m*** kg per meter length. Derive its natural frequency of transverse vibration in terms of the uniformly distributed mass.

b) Find the damping factor, logarithmic decrement, and the ratio of two successive amplitudes of a vibrating system which consists of a mass of 7 kg, a spring of stiffness 5 N/mm, and a damper of damping coefficient of 0.036 N/mm/s.