

Code No: 55017

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November - 2015

DYNAMICS OF MACHINERY

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

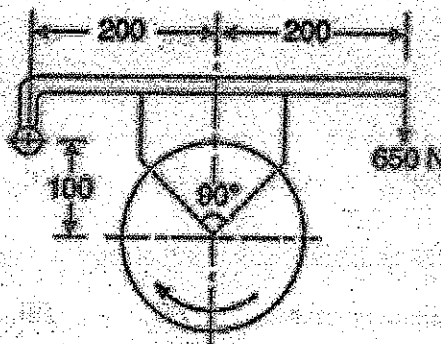
Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) Derive the expression for the gyroscopic couple.
b) A disc of 5 kg mass with radius of gyration 70 mm is mounted at span on a horizontal shaft spins at 720 rpm in clockwise direction when viewed from the right hand bearing. If the shaft processes about the vertical axis at 30 rpm in clockwise direction when viewed from the top, determine the reactions at each bearing due to mass of the disc and gyroscopic effect. [7+8]
- 2.a) What is meant by dynamically equivalent system?
b) Calculate the torque required for the static equilibrium of an in-line slider crank mechanism in the position when crank angle is 45° from the inner dead center. The dimensions are, Crank length = 300 mm, Connecting rod length = 700 mm and the piston force = 40N. Also find the torque required assuming that the co-efficient for all bearing is 0.1. The three journal bearings all have radii of 10 mm, and the crank is rotating in the clockwise. Assume no friction in the bearing. [7+8]
3. Design a four bar mechanism when the motion of the input and the output links are governed by a function $y = 2x^2$ and x varies from 0 to 2. Assume input angle θ to vary from 50° to 150° and output angle ϕ from 80° to 160° . [15]
- 4.a) Which of the two assumptions - uniform intensity of pressure or uniform rate of wear is appropriate in the design of the friction clutches and why?
b) A single block brake, as shown in Figure, has the drum diameter 250 mm. The angle of contact is 90° and the coefficient of friction between the drum and the lining is 0.35. If the operating force of 650 N is applied at the end of the lever, determine the torque that may be transmitted by the block brake. All the dimensions are in mm only. [7+8]



5. A single-cylinder, four-stroke oil engine develops 25 kW at 600 rpm. The work done by the gases during expansion stroke is 2.5 times the work done on the gases during compression stroke and the work done during the suction and exhaust strokes is negligible. If the turning moment diagram during expansion is assumed to be triangular in shape and the speed is to be maintained within 1% of the mean speed, find the moment of inertia of the flywheel. [15]
- 6.a) What is the condition of isochronisms in governors? In what type of governors can it be achieved?
- b) In a Hartnell governor, the extreme radii of rotation of the balls are 40 mm and 60 mm and the corresponding speeds are 210 rpm and 230 rpm. The mass of each ball is 3 kg. The lengths of the ball and sleeve arms are equal. Determine the initial compression and the constant of the central spring. [7+8]
- 7.a) Explain the terms swaying couple and hammer blow.
- b) A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. [7+8]
- 8.a) Derive an expression for logarithmic decrement in terms of damping factor.
- b) Find the damping factor of a vibrating system which consists of a mass of 7 kg, spring of stiffness 5 N/mm and a damper of damping coefficient of 0.036 N/mm/s. Also find the logarithmic decrement and the ratio of any two successive amplitude. [7+8]

