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10MR42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What is a free body diagram of a mechanism? List any two advantages of free body diagram. **(04 Marks)**

b. For the static equilibrium of the mechanism, Fig. Q1(b), find the required input torque. The dimensions are AB = 150mm ; BC = AD = 500mm ; DC = 300mm, CE = 100mm and EF = 450mm. **(16 Marks)**

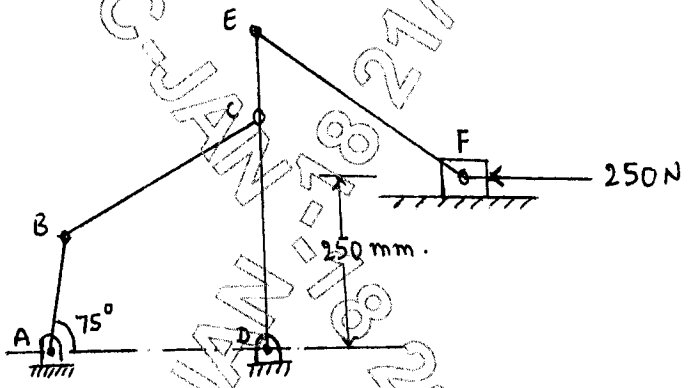

Fig. Q1(b)

2 a. Explain D' Alembert's principle and state why it is used. **(04 Marks)**

b. A punching press is driven by a constant electric motor. The press is provided with a fly wheel that rotates at a maximum speed of 250 rpm. The radius of gyration of the fly wheel is 0.5m. The press punches 750 holes per hour, each punching operation takes 1.8 seconds and requires 14kN-M of energy. Find the power of the motor and minimum mass of the fly wheel if speed of the same is not to fall below 225 rpm. **(16 Marks)**

3 a. Define static and dynamic friction and state the laws of dry friction. **(06 Marks)**

b. An open belt drive is required to transmit 35kW from a pulley of 1.5m effective diameter running at 300rpm. The angle of contact is spread over 11/24 of circumference and co-efficient of friction between the belt pulley surfaces is 0.3. The belt is 9.5 mm thick and has a mass density of 0.001gm/mm^3. Safe stress in the belt is not to exceed 2.5MPa. Determine the width of the belt taking centrifugal tension into account. **(14 Marks)**

4 a. Explain how a single rotating mass is balanced by balancing mass in same plane. **(05 Marks)**

b. Four masses A, B, C and D are completely balanced. Masses C and D makes angles 90° and 210° respectively with B in the same sense. The planes containing B and C are 300mm apart. Masses A, B, C and D can be assumed to be concentrated at radii of 360, 480, 240 and 300mm respectively. The masses B, C and D are 15kg, 25kg and 20kg respectively. Determine : i) The mass of A and its angular position
ii) The position of planes A and D. **(15 Marks)**

PART – B

5 A four cylinder vertical engine has cranks 300mm long. The planes of rotation of the first, third fourth cranks are 750mm, 1050mm and 1650mm respectively from that of second crank and their reciprocating masses are 150kg, 400kg and 250kg respectively. Find the mass of the reciprocating parts for the second cylinder and the relative angular positions of the crank in order that the engine may be in complete primary balance. If each connecting rod of all four cylinders is 1.35m long and the speed is 300rpm, find the maximum unbalanced secondary force and couple. **(20 Marks)**

6 a. Explain the principle of operation of a centrifugal governor with a neat sketch. **(05 Marks)**

b. In a porter governor, each of the four arms is 400mm long. The upper arms are pivoted on the axis of the sleeve, whereas the lower arms are attached to the sleeve at a distance of 45mm from the axis of rotation. Each ball has a mass of 8kg and the load on the sleeve is 60kg. Determine the range of speed of the governor for extreme radii of rotation of 250mm and 300mm of rotation of the governor balls. **(15 Marks)**

7 a. Describe the effect of gyroscopic couple during pitching of the ship. **(05 Marks)**

b. A motor cycle with rider has a mass of 200kg. The centre of gravity of motor cycle and rider falls 550mm above the ground level when the motor cycle is upright. Each road wheel diameter is 600mm with mass moment of inertia of 1.5kg M^2. The engine rotates 5 times faster than the wheel in the same direction and rotating parts of the engine have mass moment of inertia 0.25kg M^2. Determine the angle of heel required if is speeding 60 Km/hr and rounding a curve of radius 40M. **(15 Marks)**

8 The following particulars relate to a symmetrical tangent cam having roller follower.

Minimum radius of the cam	=	40mm
Lift	=	20mm
Speed	=	360rpm
Roller diameter	=	44mm
Angle of ascent	=	60°

Calculate the acceleration of the follower :

i) At the beginning of lift

ii) When the roller just touches of nose. **(20 Marks)**

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