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10AU54

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

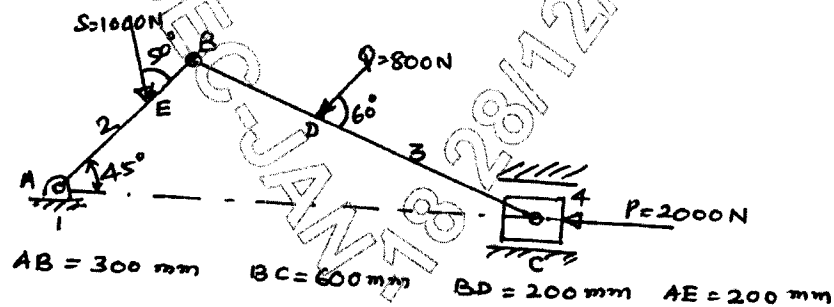
Time: 3 hrs.

Max. Marks:100

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

PART - A

- 1 a. Considering slider crank mechanism, state and explain principle of virtual work. (08 Marks)
b. Determine the various forces and couple T_2 as shown in Fig Q1(b). (12 Marks)



- 2 a. Determine the forces acting reciprocating parts of engine neglecting weight of connecting rod. i) piston effort ii) force on connecting rod iii) thrust on cylinder walls iv) crank pin effort v) turning moment. (12 Marks)
b. Find the inertia force for following data on I.C engine. Bore = 175mm, stroke = 200mm, engine speed = 500rpm, length of connecting rod = 400mm, crank angle = 60° from T.D.C mass reciprocating parts = 180kg, by i) graphical method ii) analytical method. (08 Marks)
- 3 a. Prove that maximum fluctuation of energy $\Delta E = E \times 2 C_s$ where E = mean kinetic energy of fly wheel ; C_s = coefficient of fluctuation of speed. (08 Marks)
b. The turning moment diagram for a multicylinder engine has been drawn to a scale of 1mm = 500 N-m torque and 1mm to 6° of crank angle displacement. The intercepted areas between output torque and mean resistance line taken in order from one end, in sq. mm are : -30, +410, -280, + 320, -330, + 250, -360, +280, -260 sq. mm, when engine running at 800 rpm. The engine has stroke of 300mm and flucturation of speed is not to exceed $\pm 2\%$ of the mean speed. Determine diameter and cross-section of the flywheel rim for limiting value of safe centrifugal stress of 7MPa material density = 7200 kg/m³ width of rim is to be 5 times thickness. (12 Marks)
- 4 a. Derive the expression for displacement, velocity and acceleration when roller follower has contact on flank. (10 Marks)
b. A cam has a straight working surfaces which are tangential to the base circle of the cam. The follower is roller follower with line of stroke passing through the axis of the cam. The particulars are the following : Base circle diameter = 100mm, Roller diameter = 50 mm. The angle between tangential faces of cam = 90° . The faces are joined by nose circle of radius = 10mm. The speed of rotation of the cam = 180 rpm. Determine acceleration of the roller centre. i) When roller just leaves contact of the flank on its ascent ii) when roller is at its outer end of its lift. (10 Marks)

PART – B

- 5 a. Explain static balance and dynamic balance as applied to revolving masses in different planes. (06 Marks)
- b. Three masses 10kg, 12kg and 8kg are revolving at radii 6cm, 7cm and 8cm in three parallel planes A, B and C respectively of the shaft. Plane B and C are at distance of 0.5m from A on either side of A (B is on left side). The three masses are placed in such a way that they are statically balanced. Find the unbalanced couple in a plane mid-way between A and B if the shaft revolves at 1000 rpm. (14 Marks)
- 6 a. What are inline engines and state how they are balanced? (06 Marks)
- b. The piston of a 4 cylinder vertical inline engine reach their upper most position at 98 interval in order of their axial position. Pitch of cylinder = 0.35m, crank radius = 0.12m, length of C.R = 0.42m. The engine runs at 600rpm. If the reciprocating parts of each engine has a mass of 2.5kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. Solve by graphical method. (14 Marks)
- 7 a. Define : i) governor ii) sensitiveness iii) isochronism iv) controlling force v) governor power. (10 Marks)
- b. The mass of each ball of a Hartnell type governor is 1.4kg. The length of ball arm of the bell crank lever is 100mm whereas the length of arm towards sleeve is 50mm. The distance of the fulcrum of bell-crank lever from the axis of rotation is 80mm. The extreme radii of rotation of the balls are 75mm and 112.5mm. The maximum equilibrium speed is 6% greater than minimum equilibrium speed which is 300 rpm. Determine : i) stiffness of spring ii) equilibrium speed when radius of rotation of the ball is 90mm. Neglect the obliquity of the arms. (10 Marks)
- 8 a. Explain effect of gyroscopic couple on aeroplane for cases i) viewing from rear engine rotating clockwise and plane turns to left and right. ii) viewing from nose end, engine rotate clock wise and plane turns to left and right with neat sketches. (10 Marks)
- b. The wheel of a motor cycle have a total moment of inertia of $2.5 \text{ kg} - \text{m}^2$. The gear ratio is 5 to 1 and the axis of the rotation of the engine crank shaft is parallel to that of rear wheel which have a diameter of 65cm. Determine magnitude and direction of the gyroscopic couple. When motor cycle rounds a curve of 25m radius at a speed of 50 km per hour. Total mass the system is 180kg and $h = 0.6\text{m}$. (10 Marks)
