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Roll No ....

ME-5004 (CBGS)
B.E. V Semester
Examination, December 2017
Choice Based Grading System (CBGS)
Dynamics of Machines

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Assume missing/misprint data suitably if required.

1. a) What do you mean by dynamically equivalent system?

    b) The lengths of crank and connecting rod of a horizontal reciprocating engine are 210mm and 1.0m respectively. The crank is rotating at 420 r.p.m. When the crank has turned 30° from the inner dead centre, the difference of pressure between the cover end and piston end is 0.4 N/mm². If the mass of the reciprocating parts is 100kg and cylinder bore is 0.4m, then calculate:

        i)   Inertia force

        ii)   Force on piston

        iii) Piston effort

        iv)   Thrust on the sides of cylinder walls

        v)   Thrust in the connecting rod

        vi)   Crank-effort and

    Neglect the effect of piston rod diameter and frictional resistance.

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2. The torque exerted on the crank-shaft of a two-stroke engine is given by the equation:

    $T(Nm) = 7000 + 1000 \sin 2\theta - 2000 \cos 2\theta$

    Where θ is the crank displacement from the inner dead centre. Assuming the resisting torque to be constant, determine:

    i)   The power developed when the engine speed is 300 r.p.m.

    ii)   The total fluctuations in speed in percentage and

    iii) The maximum retardation of the flywheel.

    The mass of flywheel is 500kg and its radius of gyration is 750mm.

3. a) Explain the terms : Sensitiveness; stability; isochronisms and hunting in connection with governors.

    b) Calculate the minimum speed, maximum speed and range of the speed of a Porter governor, which has equal arms each 225mm long and pivoted on the axis of rotation. The mass of each ball is 5kg and the central mass on the sleeve is 25kg. The radius of rotation of the ball is 110mm when the governor begins to lift and 135mm when the governor is at maximum speed.

4. A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50kg, 85kg and 75kg respectively. The masses C and D make angle of 90° and 210° respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75mm, 100mm, 50mm and 90mm respectively. The plane of rotation of masses B and C are 250mm apart. Determine:

    i)   The mass A and its angular position

    ii)   The position of planes of A and D

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5. The cranks of a two-cylinder uncoupled inside cylinder locomotive are at right angles and are 300mm long. The distance between the centre lines of the cylinder is 650mm. The wheel centre lines are 1.6m apart. The reciprocating mass per cylinder is 300kg. The driving wheel diameter is 1.8m. If the hammer blow is not to exceed 45kN at 100km/hr, determine:·

    i) The fraction of the reciprocating masses to be balanced

    ii) The variation in tractive effort

    iii) The maximum swaying couple

6. a) Explain with sketch the working of single plate clutch.

    b) In a thrust bearing the external and internal radii of the contact surfaces are 220mm and 170mm respectively. The total axial load is 60kN and co-efficient of friction = 0.05. The shaft is rotating at 400 r.p.m. Intensity of pressure is not to exceed 350kN/m². Calculate:

        i) Power lost in overcoming the friction and

        ii) Number of collars required for the thrust bearing

7. a) Find the condition for a differential band brake to be self-locking for clockwise rotation and anti-clockwise rotation of the brake drum.

    b) Explain the working principle of epicyclic train dynamometer.

8. Write short notes on any three:

    a) Watt governor

    b) Direct and reverse crank method

    c) Controlling force diagram

    d) Balancing of V-engine

    e) Fraction Circle

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