Printed Pages : 4   **TME-503**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4076   Roll No. [ ][ ][ ][ ][ ][ ][ ][ ]

B. Tech.

(SEM. V) EXAMINATION, 2008-09
DYNAMICS OF MACHINE

Time : 3 Hours]   *[Total Marks : 100*

Note :   *Attempt for 100 marks. Assume **suitably** missing*
             ***data** if any. All questions are of **equal** marks.*

             *Attempt any **two** parts of each of the following*
             questions.

1   (a)   Discuss inertia force analysis in a four bar   10
            mechanism.

     (b)   A single cylinder, single acting, four stroke   10
            gas engine develops 25 kW at 320 rpm.
            The work done by the gases during expansion
            stroke is three times the work done on the gases
            during the compression stroke. The work done
            during the suction and exhaust strokes being
            negligible. The fluctuation of speed is not to
            exceed ± 2% of the mean speed. The turning
            moment diagram during compression and
            expansion is assumed to be triangular in shape.
            Find the weight of the flywheel if its radius of
            gyration is 0.5m.

(c) A shaft has three eccentrics of mass 1 kg each.   10
The central plane of eccentrics is 50 mm apart. The
distance of the centers from the axis of rotation are
20 mm, 30 mm, and 20 mm and their angular
positions are 120° apart. Find the amount of out-of-
balance force and couple at
600 rpm. If the shaft is balanced by adding two
masses at radius of 70 mm and at a distance of 100
mm from the central plane of the middle eccentric.
Find the amount of the masses and their angular
position

2 (a) The three cylinders of an air compressor   10
have their axes 120° to one another and their
connecting rods are couple to a common crank.
The stroke is 100 mm and the length of each
connecting rod is 150 mm. The mass of
reciprocating parts per cylinder is 2 kg. Find the
maximum primary and secondary forces acting on
the frame of the compressor when running at
3000 rpm.

(b) The lengths of crank and connecting rod of a   10
vertical reciprocating engine are 400 mm and
2m respectively. The crank is rotating clockwise
at a speed of 400 rpm. The mass of the
connecting rod is 250 kg and the distance of its
centre of gravity from cross-head pin centre is
1.2 m. Find the torque exerted on crank-shaft due
to the inertia of moving parts analytically when
crank has turned through 40° from the top dead
centre and piston is moving downwards. The radius
of gyration of connecting rod about an axis passing
through its centre of gravity is
900 mm

(c) Develop axial force required to engage cone   10
clutch through neat sketch

3   (a)   What do you mean by friction circle ?   **10**

     (b)   Discuss effect of initial tension on power   **10**
           transmission in belt drive.

     (c)   The radius of rotation of the balls of a   **10**
           Hartnell governor is 100 mm at the minimum
           speed of 300 rpm. Neglecting gravity effects,
           determine the speed after the sleeve has lifted by
           50 mm. Also, determine the initial compression of
           the spring, governor effort and power. Take
           length of ball arm of lever -- 150 mm, length of
           sleeve arm = 100 mm, weight of each ball =
           40 N and stiffness of spring - 25 N/mm.

4   (a)   Explain the term "Damped Vibration"   **10**
           Prove that the equation of motion for a damped

           vibration is given by $\ddot{x} + \dfrac{C}{M}\dot{x} + \dfrac{S}{M}x = 0$,

           where x, C, M and S has standard notation.

     (b)   Develop equations for calculating axial force   **10**
           and frictional forces in double-shoe brake.

     (c)   An engine developing 50 kW at 1200 rpm   **10**
           is fitted with a cone clutch. The cone angle is
           $12°$ and a maximum mean diameter of 500 mm.
           The coefficient of friction is 0.25. The normal
           pressure on the clutch face is not to exceed
           0.1 MPa. Determine : (i) the axial force (spring)
           to engage the clutch, and (ii) the face width
           required.

5   (a)   A gyrowheel of mass 0.6 kg and radius of   10
          gyration 20 mm is mounted in a pivoted frame.
          The axis of the pivots passes through the centre of
          rotation of the wheel, but the centre of gravity "G"
          of the frame is 10 mm below the centre of
          rotation "O". The frame has a mass of 0.25kg
          and the speed of rotation of the wheel is 3000
          rpm in counter clockwise direction. If the vehicle
          travels at 15 m/s in a curve of 60 m radius, find
          the inclination of the gyrowheel from the vertical,
          when

          (i)   the vehicle moves forward taking a left hand
                turn along curve and

          (ii) the vehicle moves in opposite direction.

    (b)   Prove that the sensitiveness of a Proell   10
          governor is greater than that of a Porter

          governor.

    (c)   Derive equations for acceleration with respect   10
          to braking of a vehicle when vehicle moves

          (i)   on a level track

          (ii) down track

          (iii) brakes are applied to rear wheel only and

          (iv) brakes are applied to front wheels only.

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