Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Dynamics of Machines

Time: 3 hrs.   Max. Marks:100

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

PART – A

1   a. Explain the static force analysis of two-force, three-force members and two forces with a
        torque.   (06 Marks)
    b. Explain the principle of virtual work application to analysis of static forces of a mechanism.
                                                                                                   (04 Marks)
    c. Write the procedure for dynamic analysis of four –bar mechanism.   (10 Marks)

2   a. Sketch and explain turning-moment diagram of a single-cylinder four-stroke engine.
                                                                                                   (05 Marks)
    b. A punching machine carries out 6 holes per minute. Each hole of 40 mm diameter in 35 mm
        thick plate, it requires 8 N-m of energy/mm^2 for the sheared area. Stroke of punch is 95 mm
        each. Find the capacity of motor required, if the mean speed of the flywheel is 20 m/s. If the
        co-efficient of fluctuation of speed is ±3% of mean speed, determine the mass of the
        flywheel.   (15 Marks)

3   a. Explain different kinds of friction.   (06 Marks)
    b. Prove that centrifugal tension is one – third of maximum tension in an open belt drive.
                                                                                                   (06 Marks)
    c. In a thrust bearing. The external and internal diameters of the contacting surfaces are
        320 mm and 200 mm respectively. The total axial load is 8 kN and the pressure intensity is
        350 kPa. The shaft rotates at 400 rpm, coefficient of friction is 0.06. Calculate the power lost
        in overcoming the friction and the number of collars required for the bearing.   (08 Marks)

4   a. Explain the static and dynamic balancing of rotating masses.   (06 Marks)
    b. A shaft carries four masses at different planes of magnitude m$_A$, 30 kg, 50 kg and 40 kg
        respectively at radii of 180mm, 240mm, 120mm and 150 mm. The planes containing
        masses B and C are 300 mm apart. The angle between the planes B and C is 90°, and make
        an angle of 210° and 120° respectively with the plane D in the same – sense. Find :
        i)   the magnitude and angular position of mass A
        ii) the position of planes A and D.   (14 Marks)

PART – B

5   a. Discuss the balancing of V-engines.   (06 Marks)
    b. In an in–line–six cylinder engine working on two–stroke cycle. The cylinder centre lines are
        spaced at 600 mm. In the end view the cranks are placed 60° apart and in the order
        1 – 4 – 5 – 2 – 3 – 6. The stroke of each piston is 400 mm and the connecting rod length is
        1 m. The rotating mass per crank is 100 kg and reciprocating mass per cylinder is 200 kg.
        The engine rotates at 300 rpm. Check for the balance of primary and secondary forces and
        their couples.   (14 Marks)

6   a.   Explain the terms related to Governors :
         i) Sensitiveness   ii) Isochronisms   iii) Effort   iv) Power.   **(08 Marks)**
    b.   In a porter governor, each of the four arms are 400 mm 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
         45 mm from the axis. Each ball has a mass of 8 kg and the load on the sleeve is 60 kg. What
         will be the equilibrium speeds for the two extreme radii of 250 mm and 300 mm of rotation
         of the governor balls?   **(12 Marks)**

7   a.   Explain the gyroscopic effect on naval ships during: steering, pitching and rolling.
                                                                                    (06 Marks)
    b.   The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a
         speed of 3000 rpm clockwise when looking from stern. Determine the gyroscopic couple
         and its effect upon the ship :
         i)   When the ship is steering to the left on a curve of 100 m radius at a speed of 36 kmph.
         ii) When the ship is pitching in a SHM, the bow falling with its maximum velocity. The
              period of pitching is 40 seconds and the total angular displacement between the two
              extreme positions of pitching is 12°.   **(14 Marks)**

8   a.   Derive an expression for velocity and acceleration of a tangent cam with roller follower.
                                                                                    (10 Marks)
    b.   A tangent cam with a base circle diameter of 50 mm operates a roller follower of 20 mm
         diameter. The line of stroke of the roller follower passes through the axis of the cam. The
         angle between the tangential faces of the cam is 60°, speed of the cam shaft is 200 rpm and
         the lift of the follower is 15 mm. Calculate :
         i)   The main dimensions of the cam
         ii) The acceleration of the follower at the beginning of lift.   **(10 Marks)**

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