VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD
B.E. (Mech. Engg.) III Year I-Semester (Main) Examinations, Nov./Dec.-2016

Dynamics of Machines

Time: **3** hours   Max. Marks: **70**

Note: Answer ALL questions in Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

1. Explain the D'Alembert's Principle and how it is used in dynamic analysis of mechanisms?

2. Write the applications of Gyroscope.

3. Explain the body-fixed frame and inertial frame.

4. What is meant by the term generalized coordinates?

5. Prove that in single cylinder engines primary forces are partially balanced.

6. Explain the concept of two plane balancing with diagrams.

7. Discuss the working principle of clutch.

8. Describe the working principle of Prony brake.

9. Define the terms in governor   a) Hunting   b) Isochronism.

10. Draw the turning moment diagram of a four-stroke IC engine.

Part-B (5 × 10 = 50 Marks)

11. a) Derive the expression of Gyroscope Couple.   [3]

    b) What do you understand by dynamically equivalent system? List the conditions to be   [7]
       satisfied to fulfill the requirements of it.

12. a) Write the Newton-Euler equation with respect to centre of mass frame.   [4]

    b) What do you understand by the Rotation of Rigid bodies? Discuss with reference to the   [6]
       Euler's angles with reference to the co-ordinate frames. Give illustrations.

13. a) Discuss the balancing of V-type engine with appropriate equations.   [3]

    b) A single-cylinder engine has a reciprocating mass of 5kg and is running at a speed of 650   [7]
       r.p.m. the crank radius is 0.15m and the connecting rod is of length L= 0.5m. Two masses
       of 2.5kg are attached to the crank as shown in Figure 2. Determine the total out-of-balance
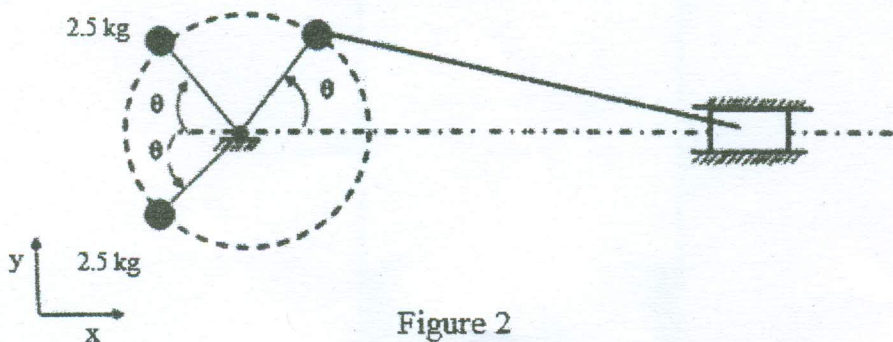   force when the crank is right at the top ($\theta = 0$), with and without the attached masses.

Figure 2

14. a) Derive the expression for a block or shoe brake in terms of the force applied at the lever. [3]

    b) A Plain collar type thrust bearing having inner and outer diameters of 200mm and 450mm is subjected to an axial thrust of 40 kN. Assuming coefficient of friction between the thrust surfaces as 0.025, find the power absorbed in overcoming friction at a speed of 120 r.p.m. The rate of wear is considered to be proportional to the pressure and rubbing speed. [7]

15. a) The turning moment of an engine as a function of crank angle is $100*\sin(\theta)$, where, θ is crank angle. Discuss the Torque variation at the end of positive loop with respect to beginning of motion. [3]

    b) A punching press is required to punch 40mm diameter holes in a plate of 15 mm thickness at the rate of 30 holes per min. It requires 6 N-m of energy per sq. mm of sheared area. If the punching takes 0.1 sec and the flywheel speed varies from 160 to 140 rpm. Determine the mass of the flywheel having radius of gyration of 1 meter. [7]

16. a) Write the equation of motion for the general three-dimensional motion of a body for the chosen body axis system. [3]

    b) A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg, respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. [7]

17. Answer any *two* of the following:

    a) Derive the expression for Mechanical advantage of Screw Jack. [5]

    b) Define shaking force and shaking moment of a slider crank mechanism. [5]

    c) Explain the working principle of Governor and its classification. [5]

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