Roll No .....

ME-505

B.E. V Semester

Examination, December 2016

Dynamics of Machines

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each questions are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

1. a) State and explain D' Alembert's principle.
   b) What is meant by piston effort and crank effort?
   c) What do you mean by dynamical equivalent system? Explain.
   d) Describe the graphical method of considering the inertia of the connecting rod of a reciprocating engine.

OR

A three-cylinder single-acting engine has its cranks at 120°. The turning-moment diagram turning-moment diagram for each cycle is a triangle for the power stroke with a maximum torque of 60N.m at 60° after the dead center of the corresponding crank. There is no torque on the return stroke. The engine runs at 400 rpm. Determine the :

i) Power developed

ii) Coefficient of fluctuation of speed if the mass of the flywheel is 10kg and radius of gyration is 88mm

iii) Coefficient of fluctuation of energy

iv) Maximum angular acceleration of flywheel.

5. a) Name the materials of the flat belts, V-belts and ropes.
   b) What is meant by a self-locking and a self-energized brake?
   c) Discuss the effect of slip of belt on the pulleys on the velocity ratio of a belt drive.
   d) Describe the working of a band and block brake with the help of a neat-sketch. Deduce the relation for ratio of tight and slack side tensions.

OR

An open-belt drive is required to transmit 10 kW of power from a motor running at 600 rpm. Diameter of the driving pulley is 250 mm. The speed of the driven pulley is 220 rpm. The belt is 12mm thick and has a mass density of 0.001 g/mm^2. safe stress in the belt is not to exceed 2.5/mm^2.The two shafts are 1.25m apart. The coefficient of friction is 0.25. Determine the width of the belt.

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2. a) What is the function of a governor? How does it differ from that of a flywheel?

   b) Explain the terms sensitiveness, hunting and stability related to governors.

   c) Describe the function of a simple Watt governor. What are its limitations?

   d) A gramophone is driven by a Pickering governor, each spring of which is 4mm wide and 0.1mm thick with a length of 40mm. The distance between the spindle axis and the centre of mass when the governor is at rest is 6mm. A mass of 20 g is attached to each leaf spring at the centre. Determine the speed of the turn table for a sleeve lift of 0.5mm if the ratio of the governor speed to the turn table speed is 8. $E = 205\ GN/m^2$.

   OR

   In a power governor, each of the four arms is 400mm 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 45mm from the axis of rotation. Each ball has a mass of 8kg and the load on the sleeve is 60kg. What will be the equilibrium seeds for the two extreme radii of 250mm and 300mm of rotation of the governor balls?

3. a) What do you mean by primary and secondary unbalance in reciprocating engines?

   b) Why is balancing necessary for rotors of high-speed engines?

   c) What are in-line engine? How they are balanced?

   d) Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90° and 195° respectively with that of mass B in the counter-clockwise direction. The rotating masses have the following properties :

   $m_b = 25$ mk $r_a = 150$ mm mk

   $m_c = 40$ mk $r_b = 200$ mm mk

   $m_d = 35$ mk $r_c = 100$ mm mk

   $r_d = 180$ mm mk

   Planes B and C are 250 mm apart. Determine the :

   i) Mass A and its angular position with that of Mass B

   ii) Position of all the planes relative to plane of Mass A

   OR

   Explain the effects of Partial balancing in locomotives.

4. a) What do you mean by Film Friction? State its laws.

   b) Explain the term friction circle.

   c) Do you recommend the uniform pressure theory or uniform wear theory for the friction torque of a bearing? Explain.

   d) What is a Clutch? Make a sketch of a single-place clutch and describe its working.

   OR

   A thrust bearing of a propeller shaft consists of a number of collars. The shaft is of 400mm diameter and rotates at a speed of 90 rpm. The thrust on the shaft is 300 kN. If the intensity of pressure is to be 200 kN/m^2 and coefficient of friction is 0.06, determine external diameter of the collars and the number of collars. The power lost in friction is not to exceed 48 kW.