USN

Fifth Semester B.E. Degree Examination, December 2012
Dynamics of Machines

Time: 3 hrs.

Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Explain principle of virtual work application to italic force analysis. **(08 Marks)**
   b. Explain the procedure for static force analysis of slider-crank mechanism. **(12 Marks)**

2 a. Discuss the following terms:
   i)   Co-efficient of fluctuation of energy.
   ii) Co-efficient of fluctuation of speed. **(04 Marks)**
   b. The turning moment diagram for four stroke gas engine may be assumed for a simplicity to be represented by four triangles. The areas of which from the line of zero pressure are as follows: suction stroke = 0.45×10^{-3} m^2, compression stroke = 1.7×10^{-3} m^2, expansion stroke = 6.8×10^{-3} m^2, exhaust stroke = 0.65×10^{-3} m^2 each m^2 of area represents 3 MN-m of energy.
   Assuming the resisting torque to be uniform find the mass of the rim of a flywheel required to keep the speed between 202 and 198 rpm. The mean radius of the rim is 1.2m. **(16 Marks)**

3 a. Derive an expression for the ratio of tensions in a flat belt drive. **(05 Marks)**
   b. A leather belt required to transmit 7.5 kW from a pulley 1.2m in diameter running at 250 rpm. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa density of leather 1000 kg/m^3 and thickness of belt 10mm determine the width of the belt taking centrifugal tension into account. **(15 Marks)**

4 A shaft carries four masses A, B, C, and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radie 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 700 mm. The angle between the crank measured anticlockwise are A to B 45°, B to C 70° and C to D 120° the balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm between X and Y is 400mm and between Y and D is 200mm. If the balancing manes revolved at a radius of 100mm find their magnitudes and angular position. **(20 Marks)**

PART – B

5 The cranks and connecting roads of a 4-cylinder in – line engine running at 1800 rpm are 60mm and 240mm each respectively and the cylinder are spaced 150mm apart. If the cylinders are numbered 1 to 4 in sequence from one end, the cranks appear at intervals of 90° in an end view in the order 1-4-2-3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine :
   i)   Unbalanced primary and secondary force.
   ii) Unbalanced primary and secondary couples with reference to central plane of the engine. **(20 Marks)**

6 a. Define the following with respect to the working of governor:
   i) Sensitiveness.
   ii) Hunting of governor. **(04 Marks)**

   b. In an engine governor of the porter type the upper and lower arms are 200mm and 250mm respectively and pivoted on the axis of rotation. The mass of the central load is 15kg the mass of each ball is 2kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24N at the sleeve. The limiting inclination of the upper arms to the vertical are 30° and 40° find taking friction into account range of speed of the governor. **(16 Marks)**

7 a. Derive an expression for the gyroscopic couple. **(04 Marks)**

   b. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45m and a speed of 3000 rpm clock wise 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 100m radius at a speed of 36 km/hr.
   ii) When the ship is pitching with 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 position of pitching is 12°. **(16 Marks)**

8 In a four stroke petrol engine the crank angle is 4° after IDC when the suction valve open and 50° after BDC when the suction valve closes. The lift is 10mm, the hole radius is 2.5mm and the least radius of the cam 20mm. The shaft rotates at 600 rpm the cam is of the circular type with a circular nose and flank while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighting 250 gram. **(20 Marks)**

* * * * *