USN | | | | | | | | | | |

06ME53

Fifth Semester B.E. Degree Examination, June/July 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. Establish the condition for static equilibrium of a three force member for non parallel forces **(05 Marks)**

b. For static equilibrium of mechanism shown in Fig.Q1(b), find required input torque.

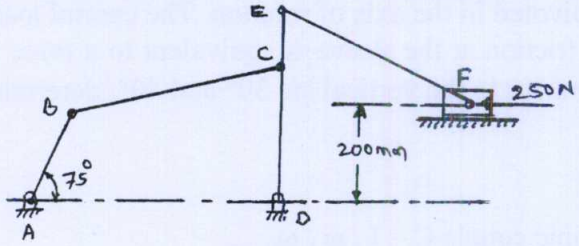

Fig.Q1(b)

The dimensions are
AB = 150mm
BC = AD = 500 mm
DC = 300 mm
CE = 100 mm
EF = 450 mm

(15Marks)

2 a. What are the requirements of an equivalent dynamic system? Explain. **(06 Marks)**

b. A horizontal cross compound steam engine develops 300 kW at 90 rpm. The coefficient of fluxuation of energy as found from turning moment diagram is to be 0.1 and speed is to be kept within 0.5% of mean speed. Find the mass of the flywheel required, if radius of gyration is 2 meters. **(14 Marks)**

3 a. Derive an expression for torque lost in friction for a flat collar bearing under uniform pressure condition. **(08 Marks)**

b. A belt embraces the shorter pulley by an angle of 165° and runs at a speed of 1700 meters/minute. Dimensions of the belt are : Width = 20 cm and thickness = 8 mm. Its density is 1 gm/cm^3. Determine the maximum power that can be transmitted at the above speed, if the maximum permissible stress in the belt is not to exceed 250 N/cm^2 and $\mu = 0.25$. **(12 Marks)**

4 a. Explain how a single revolving unbalanced mass is balanced by two masses revolving in different planes. **(06 Marks)**

b. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150 mm respectively. The planes in which masses revolve are spaced 600 mm 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. **(14 Marks)**

PART – B

5 a. Write a short note on primary and secondary balancing. **(05 Marks)**

b. The crank and connecting rods of a 4-cylinder in-line engine running at 1800 rpm are 60mm and 240 mm each respectively and the cylinders are spaced 150 mm 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. Reciprocating mass corresponding to each cylinder is 1.5 kg. Determine

(i) Unbalanced primary and secondary forces

(ii) Unbalanced primary and secondary couples with reference to central plane of the engine. **(15 Marks)**

6 a. Define the condition of stability, unstability and isochronism for a governor. **(06 Marks)**

b. The length of the upper and lower arms of a porter governor are 200 mm and 250 mm respectively. Both the arms are pivoted in the axis of rotation. The central load is 150 N, the weight of each ball is 20 N and friction at the sleeve is equivalent to a force of 30 N. If the limiting inclinations of the upper arms to the vertical arc 30° and 40°, determine the range of speed of governor. **(14 Marks)**

7 a. Derive an expression for gyroscopic couple $C = I \cdot \omega \cdot \omega_p$ **(04 Marks)**

b. An automobile is travelling along a curved track of 200 mts mean radius each of the four road wheels has a mass of 80 kg with a radius of gyration 0.4 mts. The rotating parts of the engine have a mass moment of inertia of 10 kg-m^2. The crankshaft rotates in the same direction as that of road wheels. The gear ratio of engine to back wheels is 5:1. The vehicle has a mass of 3000 kg and its c.g. is 0.5 mts above the road level. The width of track of the vehicle is 1.5 mts. Calculate the limiting speed of the vehicle around the curve for all the four wheels to maintain contact with road surface. **(16 Marks)**

8 a. Derive an expression for displacement, velocity and acceleration for a circular arc cam with flat faced follower when the follower is in contact with circular flank. **(10 Marks)**

b. In a symmetric tangent can operating a roller follower, the least radius of cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and total lift is 17.5 mm. The speed of the camshaft is 600 rpm. Calculate (i) The principal dimensions of the cam. (ii) The accelerations of the follower at the beginning of lift and where the straight flank merges into circular nose. Assume that there is no dwell between ascent and descent. **(10 Marks)**

* * * * *