USN | | | | | | | | | |

Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Dynamics of Machines

Time: 3 hrs.

Max. Marks:100

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

PART – A

1 a. What is the principle of virtual work? Explain. **(05 Marks)**

   b. In a slider crank mechanism the crank is 100mm and the connecting rod is 300mm. A force of 2000N acts on piston the direction of which is towards crank shaft. If the Piston has moved such that the crank has made an angle of 60° from IDC, find the driving torque on the crank. **(15 Marks)**

2 a. Derive an equation for maximum fluctuation of energy of flywheel in terms of mean kinetic energy of coefficient of fluctuation of speed. **(06 Marks)**

   b. A punching press required to punch 30mm diameter holes in a plate of 20mm thickness at the rate of 20 holes per minute. It requires 6 N-m of energy per mm^2 of sheared area. If punching takes place in $\frac{1}{10}$ of a second and the rpm of the flywheel varies from 160 to 140, determine the weight of flywheel having radius of gyration 1m. **(14 Marks)**

3 a. Derive an expression for centrifugal tension in a belt. **(06 Marks)**

   b. A leather belt connects a 1.20m diameter pulley on a shaft running at 25r/s with another pulley running at 50r/s, the angle of lap on latter pulley being 150°. The maximum permissible load is 1200N and the coefficient of friction between the belt and pulley is 0.25. If the initial tension in the belt may have any value between 800N and 960N, what is the maximum power which the belt can transmit? **(14 Marks)**

4 a. Explain static and dynamic balancing. **(06 Marks)**

   b. Four masses A, B, C and D are carried by rotating shaft at radii 10mm, 125mm, 200mm and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 100kg, 50kg and 40kg respectively. Determine the required mass A and angular positions of the four masses so that the shaft is under complete balance. **(14 Marks)**

PART – B

5 a. What do you mean by primary and secondary unbalanced forces of reciprocating masses? Explain. **(06 Marks)**

   b. The reciprocating mass per cylinder in a 60V twin cylinder engine is 1.5kg. The stroke is 100mm for each cylinder. If the engine runs at 1800rpm. Determine the maximum and minimum values of primary forces and find out the corresponding crank position. **(14 Marks)**

6 a. With usual notations derive an expression for the speed of porter governor. **(08 Marks)**

b. For a spring controlled Hartnell type governor, following data is obtained:
Mass of ball   =   1.8kg
Length of vertical arm of bell crank lever   =   87.5mm
Length of other arms of bell crank lever   =   100mm
The speeds corresponding to radii of rotations of 120mm and 130mm are 296 and 304 rpm respectively. Determine the stiffness of the spring. **(12 Marks)**

7 a. With usual notations derive an expression for gyroscopic couple. **(08 Marks)**

b. Each road wheel of a motor cycle has a mass moment of inertia 1.5kgm^2. The rotating parts of the engine have a mass moment of inertia of 0.25kgm^2. The speed of engine is five times the speed of wheels and is in same sense. The mass of the motor cycle with its rider is 250kg and its centre of gravity is 0.6m above the ground level. Find the angle of heel if the vehicle is travelling at 50km/hr and taking a turn of 30m radius, wheel dia is 0.6m. **(12 Marks)**

8 A cam with convex flanks operating a flat faced follower has a base circle diameter of 75mm and nose radius of 10mm. The lift of the follower is 19mm. The cam is symmetrical about a line drawn through the centre of nose and centre of cam shaft. The total angle of action is 120°. Determine maximum velocity, acceleration and retardation of the follower when the cam shaft rotates at 600rpm. **(20 Marks)**

* * * * *