Code No: RT31031 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, May - 2017
DYNAMICS OF MACHINERY
(Common to Mechanical Engineering and Automobile Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART –A

1 a) What is meant by Gyroscope? Differentiate 'Natural Precession' from 'Forced Precession'. [4M]
b) Write simple notes on Friction Circle. [3M]
c) What is meant by Dynamically Equivalent System [4M]
d) Differentiate Governor from Flywheel [3M]
e) Why Reciprocating Engines are partially balanced? [4M]
f) What are sources of Vibrations and how they can be eliminated? [4M]

PART –B

2 a) Derive the expression for Gyroscopic Couple [4M]
b) Each wheel of a motor cycle is of 600 mm dia and has a moment of inertia of 1.2 kg m^2. The total mass of the motor cycle and the rider is 180 kg and the combined center of mass is 580 mm above the ground level when the motor cycle is upright. The moment of inertia of the rotating parts of engine 0.2 kgm^2. The engine speed is 5 times the speed of the wheel and is in the same sense. Determine the angle of heel necessary when the motor cycle takes a turn of 35 m radius at a speed of 54 km/hr. [12M]

3 a) An engine developing 22kW at 1000 rpm is fitted with a cone clutch having mean diameter of 300mm. The cone has a face angle of 12^0. If the normal pressure on the clutch face is not to exceed 0.09 N/mm^2 and the coefficient of friction is 0.2, determine (a) the face width of the clutch, and (b) the axial spring force necessary to engage the clutch. [8M]
b) Explain with a neat sketch the functioning of a belt transmission dynamometer. [8M]

4 a) Derive the equation for the energy stored in fly wheels [6M]
b) The crank and connecting rod of a vertical petrol engine running at 1800 rpm are 60 mm and 270 mm respectively. The diameter of the piston is 100 mm and the mass of the reciprocating parts is 1.2 kg. During the expansion stroke when the crank has turned 20^o from the top dead center, the gas pressure is 650 kN/m^2. Determine : (**i**) The net force on the piston (**ii**) The net load on the connecting rod (**iii**) Thrust on the cylinder walls (**iv**) The speed at which the gudeon pin load is reversed in direction. [10M]
~~~~~~

Code No: RT31031 **R13** SET - 1

5 a) Define the terms: Controlling Force and Hunting in governors [4M]

b) In a spring loaded governor of the hartnell type, the mass of each ball is 5 kg and the lift of the sleeve is 50 mm the speed at which the governor begins to float is 240 rpm and at this speed the radius of the ball path is 110 mm, the mean working speed of a governor is 20 times the range of the speed when friction neglected. If the length of the ball and roller arm of the bell crank lever are 120 mm and 100 mm respectively, if the distance between the center of pivot of bell crank lever and axis of the governor spindle is 140 mm. Determine (**i**) The initial compression of the spring taking into account the obliquity of arms (**ii**) equilibrium speed corresponding to radius of rotation of 150 mm. [12M]

6 a) Differentiate Static Balancing from Dynamic Balancing. [4M]

b) The firing order in a 6 cylinder vertical 2-stroke in line engine is 1-4-5-2-3-6. The piston stroke is 100 mm and length of each connecting rod is 200 mm. The cylinder center lines are spaced at 300 mm. In the end view, the cranks are 60^{o} apart the mass of reciprocating parts is 100 kg per cylinder and that of rotating parts 50 kg per crank. The engine rotates at 200 rpm. Examine the engine for the balance of primary and secondary forces and couples. Find the maximum unbalanced forced and couples. [12M]

7 a) What are over damped, critical damped and under damped systems and derive solutions in each case. [8M]

b) An electric motor is supported on a spring and a dashpot. The spring has the stiffness 6400 N/m and the dashpot offers resistance of 500 N at 0.25 m/sec. The unbalanced mass 0.5 kg rotates at 5 cm radius and the total mass of vibratory system is 20 kg. The motor runs at 400 rpm. Determine **a**) damping factor **b**) amplitude **c**) resonant speed and resonant amplitude. [8M]

*****