Code No: R1631241 **R16** SET - 1

III B. Tech I Semester Supplementary Examinations, May - 2019

DYNAMICS OF MACHINERY

(Automobile Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1. a) Write a short note on role of gyroscope in ships? [3M]
   b) Define friction circle and friction axis. [2M]
   c) Differentiate between brake and dynamometer. [2M]
   d) Name different types of governors. [2M]
   e) What is secondary balancing? [2M]
   f) Define free, forced and damped vibration. [3M]

PART -B

2. a) Derive an expression for the inertia force due to reciprocating mass in reciprocating engine, neglecting the mass of the connecting rod. [7M]
   b) What do you understand by gyroscopic couple? Derive a formula for its magnitude. Write application of gyroscopic principle? [7M]

3. a) Describe with a neat sketch the working of a single plate friction clutch. [7M]
   b) The thrust of a propeller shaft in a marine engine is taken up by a number of collars integral with the shaft which is 300 mm in diameter. The thrust on the shaft is 200 kN and the speed is 75 r.p.m. Taking μ constant and equal to 0.05 and assuming intensity of pressure as uniform and equal to 0.3 N/mm^2, find the external diameter of the collars and the number of collars required, if the power lost in friction is not to exceed 16 kW. [7M]

4. a) Explain the turning moment diagram of a four stroke cycle internal combustion engine. [5M]
   b) A shaft fitted with a flywheel rotates at 250 r.p.m. and drives a machine. The torque of machine varies in a cyclic manner over a period of 3 revolutions. The torque rises from 750 N-m to 3000 N-m uniformly during 1/2 revolution and remains constant for the following revolution. It then falls uniformly to 750 N-m during the next 1/2 revolution and remains constant for one revolution, the cycle being repeated thereafter. Determine the power required to drive the machine and percentage fluctuation in speed, if the driving torque applied to the shaft is constant and the mass of the flywheel is 500 kg with radius of gyration of 600 mm. [9M]

5. a) Explain the following terms relating to governors: [6M]
   i) Sensitiveness, ii) Isochronism, iii) Hunting.
   b) The radius of rotation of the balls of a Hartnell governor is 80 mm at the minimum speed of 300 r.p.m. Neglecting gravity effect; determine the speed after the sleeve has lifted by 60 mm. Also determine the initial compression of the spring, the governor effort and the power. The particulars of the governor are given as: Length of ball arm = 150 mm ; length of sleeve arm = 100 mm ; mass of each ball = 4 kg ; and stiffness of the spring = 25 N/mm. [8M]
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6. a) Explain the method of balancing of different masses revolving in the same plane. [6M]

   b) A five cylinder in-line engine running at 750 r.p.m. has successive cranks 144° apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the position of the central crank at which these maximum values occur. The reciprocating mass for each cylinder is 15 kg. [8M]

7. a) Deduce an expression for the natural frequency of free transverse vibrations for a simply supported shaft carrying uniformly distributed mass of m kg per unit length. [7M]

   b) A vertical shaft of 5 mm diameter is 200 mm long and is supported in long bearings at its ends. A disc of mass 50 kg is attached to the centre of the shaft. Neglecting any increase in stiffness due to the attachment of the disc to the shaft, find the critical speed of rotation and the maximum bending stress when the shaft is rotating at 75% of the critical speed. The centre of the disc is 0.25 mm from the geometric axis of the shaft. $E = 200\ GN/m^2$. [7M]

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