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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

B.Tech II Year II Semester Supplementary Examinations February-2022

THEORY OF MACHINES

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 60

(Answer all Five Units 5 x 12 = 60 Marks)

UNIT-I

- 1 A ship is pitching through a total angle of 150, the oscillation may be taken as simple harmonic and the complete period is 32 seconds. The turbine rotor weighs 6 tons, its radius of gyration is 45cm and it is rotating at 2400 r.p.m. Calculate the maximum value of gyroscopic couple set up by the rotor and its effect, when the bow is descending and the rotor is rotating clockwise looking from aft. What is the maximum angular acceleration to which the ship is subjected to while pitching ? L1 12M

OR

- 2 The turning moment diagram for a multi-cylinder engine has been drawn to scale of 1mm = 4500N-m vertically and 1mm = 2.4 0 horizontally. the intercepted areas between output torque curve and mean resistance line taken in order from one end are 342, 23, 245, 303, 115, 232, 227 and 164 mm², when the engine is running at 150 r.p.m. if the mass of the fly wheel is 1000 kg and the total fluctuation of speed does not exceed 3% of mean speed, find the minimum value of the radius of gyration. L1 12M

UNIT-II

- 3 A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressure between the discs for transmitting 25 kW at 1575 r.p.m. L1 12M

OR

- 4 Describe with sketches one form of torsion dynamometer and explain in detail the calculations involved in finding the power transmitted. L2 12M

UNIT-III

- 5 a Explain with neat sketch the working principle of centrifugal/porter governor L2 6M
b Calculate the vertical height of a Watt governor when it rotates at 60 r.p.m. L1 6M
Also find the change in vertical height when its speed increases to 61 r.p.m.

OR

- 6 A Porter governor has all four arms 250 mm long. The upper arms are attached on the axis of rotation and the lower arms are attached to the sleeve at a distance of 30 mm from the axis. The mass of each ball is 5 kg and the sleeve has a mass of 50 kg. The extreme radii of rotation are 150 mm and 200 mm. Determine the range of speed of the governor. L5 12M

UNIT-IV

- 7 Four masses m_1 , m_2 , m_3 , and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45° , 75° and 135° . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. **L1 12M**

OR

- 8 The following data refer to two cylinder locomotive with cranks at 90° : **L5 12M**
Reciprocating mass per cylinder = 300 kg ; Crank radius = 0.3 m ; Driving wheel diameter = 1.8 m ; Distance between cylinder centre lines = 0.65 m ; Distance between the driving wheel central planes = 1.55 m. Determine : 1. the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/hr. ; 2. the variation in tractive effort ; and 3. the maximum swaying couple.

UNIT-V

- 9 Derive an expression for the natural frequency of the free longitudinal vibration by (i) Equilibrium method (ii) Energy method (iii) Rayleigh's method **L3 12M**

OR

- 10 A shaft of 100 mm diameter and 1 metre long has one of its end fixed and the other end carries a disc of mass 500 kg at a radius of gyration of 450 mm. The modulus of rigidity for the shaft material is 80 GN/m². Determine the frequency of torsional vibrations. **L5 12M**

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