

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

**B.Tech II Year II Semester Supplementary Examinations May/June-2024**

**THEORY OF MACHINES**

(Mechanical Engineering)

**Time: 3 Hours**

**Max. Marks: 60**

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

**UNIT-I**

- 1 The propeller of aero weighs 550 N and has radius of gyration of 0.9m. The propeller shaft rotates at 1900 r.p.m, clockwise, as viewed from tail end. The plane turns left, making a U turns, i.e., through 180° of 125m radius, at a speed of 330 km/hr. Determine the gyroscopic couple and its effect on the aircraft. Also find the reaction on bearings if the distance between two bearings of the propeller is 0.8m. CO1 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° 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 mm<sup>2</sup>, 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. CO1 12M

**UNIT-II**

- 3 a Explain the working of a single-plate clutch with neat sketch. CO2 L2 6M  
b A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner radii of a frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm<sup>2</sup>. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. CO2 L5 6M

**OR**

- 4 Describe with sketches one form of torsion dynamometer and explain in detail the calculations involved in finding the power transmitted. CO2 L2 12M

**UNIT-III**

- 5 a Derive the expression for Porter governor. CO3 L3 6M  
b Derive the expression for Proell governor. CO3 L3 6M

**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. CO3 L5 12M

**UNIT-IV**

- 7 A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B  $45^\circ$ , B to C  $70^\circ$  and C to D  $120^\circ$ . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. CO4 L1 12M

OR

- 8 A single cylinder reciprocating engine has speed 240 r.p.m., stroke 300 mm, mass of reciprocating parts 50 kg, mass of revolving parts at 150 mm radius 37 kg. If two third of the reciprocating parts and all the revolving parts are to be balanced, find : 1. The balance mass required at a radius of 400 mm, and 2. The residual unbalanced force when the crank has rotated  $60^\circ$  from top dead centre. CO4 L1 12M

**UNIT-V**

- 9 Derive the natural frequency of Free Transverse Vibrations by (i) Rayleighs method (ii) Dunkerleys method. CO5 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/m<sup>2</sup>. Determine the frequency of torsional vibrations. CO5 L5 12M

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