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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**  
(AUTONOMOUS)**B.Tech III Year II Semester Regular Examinations May 2019****DYNAMICS OF MACHINERY****(Mechanical Engineering)**

Time: 3 hours

Max. Marks: 60

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

**UNIT-I**

- 1 a Write a short note on Gyroscope and Explain the application of Gyroscope principles to aircrafts. 4M
- b An aero-plane makes a complete half circle of 50 m radius towards left in a time of 20 seconds when flying at 200kmph. The rotary engine and the propeller of the plane has a mass of 400kg and a radius of gyration of 0.3 m. The engine rotor rotates at 2400 rpm clockwise when seen from the rear. Find the gyroscopic couple on the air craft and state its effect on the aero-plane. 8M

**OR**

- 2 a Explain the terms 'fluctuation of energy'. 2M
- b The turning moment diagram for a multi cylinder engine has been drawn to a scale of 1cm= 5000 Nm torque and 1cm= 60° respectively. The intercepted areas between output torque curve and mean resistance taken in order from one end are -0.3, +4.1, -2.8, +3.2, -3.3, +2.5, -3.6, +2.8, -2.6 square cm when the engine is running at 800rpm. The engine has a stroke of 300 mm and the fluctuation of speed is not to exceed 2% of mean speed. Determine a suitable diameter of cross section of the flywheel rim for limiting value of the shaft centrifugal stress of  $280 \times 10^3 \text{ N/m}^2$ . The material density may be assumed as  $7.2 \text{ g/cm}^3$ . Assume the thickness of the rim to be  $\frac{1}{4}$  th of the width. 10M

**UNIT-II**

- 3 a Write the principle of Dynamometer. 2M
- b In a vertical belt transmission dynamometer the diameter of the driving pulley rotating at 1500rpm is 80mm. The centre distance of the intermediate pulleys from the fulcrum is also 80mm each. The weighing pan on the lever is at a distance as 250mm. Find the power Transmitted when a mass of 20kg is required in the pan, including its own mass. 10M

**OR**

- 4 a Write different types bearings. 3M
- b A multi clutch internal and external diameter as 300 and 450mm. maximum intensity 12M pressure as  $0.075 \text{ N/mm}^2$ . the first disc had three plates and second disc had two disc the coefficient of frictional surface shaft and plate surfaces as  $0.02 \text{ N/mm}^2$ . power absorbed by disc is 5kw. Assuming uniform wear. Shaft rotating with speed of 580 rpm. Find out torque developed on the plate. 9M

**UNIT-III**

- 5 a Define and explain the following terms relating to governor: 6M  
(i) Stability (ii) Sensitiveness (iii) Isochronism
- b Each arm of a porter governor is 300 mm long and is pivoted on the axis of rotation. Each ball has a mass of 6 kg and the sleeve weighs 18kg. The radius of rotation of the ball is 200 mm when the governor begins to lift and 250 mm when the speed is maximum. Determine the maximum and minimum speeds and the range of speed of the governor. 6M

**OR**

- 6 **a** What is the function of the Governor? 2M  
**b** A Hartnell governor having a central sleeve spring and two right angled bell crank lever operates between 290rpm and 310rpm for a sleeve lift of 16 mm. The sleeve and ball arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the governor axis and mass of the ball is 2.5kg. The ball arms are parallel at lowest equilibrium speed. Determine (i) load on the spring at maximum and minimum speeds and (ii) Stiffness of the spring. 10M

**UNIT-IV**

- 7 **a** What is Balancing of rotating masses? 2M  
**b** Four masses A, B, C, and D are completely balanced masses C and D makes angles of  $90^\circ$  and  $195^\circ$  respectively with B in the same sense. The rotating masses have the following properties:  $m_a=25\text{kg}$   $r_a=150\text{mm}$   $m_b=40\text{kg}$   $r_b=200\text{mm}$   $m_c=35\text{kg}$   $r_c=100\text{mm}$   $r_d=180\text{mm}$  Planes B and C are 250 mm apart. Determine (i) the mass D and its angular position (ii) the position of planes A and D. 10M

**OR**

- 8 **a** Define direct and reverse cranks? 2M  
**b** A four cylinder vertical engine has cranks 150mm long. The plane of rotation of the first, second and fourth cranks are  $400\text{mm}$ ,  $200\text{mm}$  and  $200\text{mm}$  respectively from that of the third crank and their reciprocating masses are 50kg, 60kg and 50kg respectively. Find the mass of the reciprocating parts for the third cylinder and relative angular position of the cranks in order that the engine may be in complete balance. 10M

**UNIT-V**

- 9 **a** Deduce the expression for the free longitudinal vibration in terms of spring stiffness, its inertia effect and suspended mass. 4M  
**b** An instrument vibrates with a frequency of 1Hz when there is no damping. When the damping is provided, the frequency of damped vibration was observed to be 0.9Hz. Find, (i) damping factor (ii) logarithmic decrement. 8M

**OR**

- 10 **a** What are the causes of critical speed? 4M  
**b** A cantilever shaft 50mm diameter and 300mm long has a disc of mass 100kg at its free end. The young's modulus for the shaft material is  $200\text{GN/m}^2$ . Determine the frequency of longitudinal and transverse vibration of the shaft. 8M

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