**Registration No:** | | | | | | | | | | |

**Total Number of Pages: 02** **IDD (B.Tech and M.Tech)**
**RME5C002**

**5th Semester Regular/Back Examination: 2024-25**
**Mechanisms and Machines**
**BRANCH(S): MMEAM, MECH, ME**
**Time: 3 Hours**
**Max Marks: 100**
**Q.Code: R130**

**Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.**
**The figures in the right-hand margin indicate marks.**



**Part-I**

**Q1** **Answer the following questions:** **(2 x 10)**

**a)** What is a cam? What are the basic types of cams?
**b)** What is lift or stroke in radial cams?
**c)** Why Ackerman steering gear is preferred to the Davis steering gear mechanism?
**d)** What are the significances of turning moment diagram?
**e)** State the law of gearing.
**f)** What is Sensitiveness of Governor?
**g)** What do you understand by gyroscopic couple?
**h)** What is the significance of dynamic balancing in rotating component?
**i)** Define free and forced vibration.
**j)** What do you mean by vibration isolation?

**Part-II**

**Q2** **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

**a)** Briefly explain the different types of followers with neat sketch.
**b)** Draw the displacement, velocity, and acceleration diagrams when the follower moves with simple harmonic motion.
**c)** The angle between the axes of two shafts connected by Hooke's joint is 20°. Determine the angle turned through by the driving shaft when the velocity ratio is maximum and unity.
**d)** The mass of flywheel of an engine is 10 tonnes and the radius of gyration is 1.8 metres. It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 100 rpm, find the maximum and minimum speeds.

e) The pitch circle diameter of the smaller of the two spur wheels which mesh externally and have involute teeth is 100 mm. The number of teeth are 16 and 32. The pressure angle is 20° and the addendum is 0.32 of the circular pitch. Find the length of the path of contact of the pair of teeth.

f) Calculate the vertical height of a Watt governor when it rotates at 80 rpm. Also find the change in vertical height when its speed increases to 81 rpm.

g) Differentiate governor with fly wheel in brief.

h) Explain the effect of gyroscopic couple on aero planes with schematic diagram.

i) Explain the method of balancing of different masses revolving in the same plane.

j) 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 60°, 105°, and 150°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.3 m.

k) Briefly explain the over damping, under damping, and critical damping conditions for a free damped vibration system.

l) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 30 kg at its free end. The Young's modulus for the shaft material is 230 GPa. Determine the frequency of longitudinal and transverse vibrations of the shaft.

## Part-III

**Only Long Answer Type Questions (Answer Any Two out of Four)**

**Q3** Derive the expression of correct steering for Davis Steering Gear Mechanism with neat sketch. **(16)**

**Q4** With a neat sketch, explain the turning moment diagram of a single cylinder double acting steam engine. **(16)**

**Q5** With a neat sketch, explain the terms and derive expressions for ‘effort’ and ‘power’ of a Porter governor. **(16)**

**Q6** Discuss briefly with neat sketches the longitudinal, transverse and torsional free vibrations. Also, derive an expression for the natural frequency of free transverse and longitudinal vibrations by equilibrium method. **(16)**