A

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The mechanism forms a structure, when the number of degrees of freedom (n) is equal to   CO1- U

    (a) 0   (b) 1   (c) 2   (d) -1

2. In a kinematic chain, a quaternary joint is equivalent to   CO1- U

    (a) one binary joint   (b) two binary joints

    (c) three binary joints   (d) four binary joints

3. The _____ force is an imaginary force   CO2- R

    (a) Inertia   (b) Resultant   (c) Torque   (d) Sliding

4. Angular momentum of the disc   CO2- R

    (a) $I\omega$ (b) $I\omega^2$ (c) $m\omega$ (d) $I\alpha$

5. Cam size depends upon   CO3- U

    (a) base circle   (b) pitch circle   (c) prime circle   (d) outer circle

6. The cam follower generally used in aircraft engines is   CO3- U

    (a) knife edge follower   (b) flat faced follower

    (c) spherical faced follower   (d) roller follower

7. The size of a gear is usually specified by   CO4- U

    (a) pressure angle   (b) circular pitch

    (c) diametral pitch   (d) pitch circle diameter

8. When the axes of first and last gear are co-axial, then gear train is known as   CO4- U

   (a) simple gear train   (b) compound gear train

   (c) epicyclic gear train   (d) reverted gear train

9. When no external force acts on the body, after giving it an initial displacement, then the body is said to be __   CO5- U

   (a) free vibration   (b) forced vibration

   (c) resonance   (d) None of these

10. If the damping factor for a vibrating system is unity, then the system will be   CO5- U

   (a) critically damped   (b) without vibrations

   (c) over damped   (d) under damped

<div align="center">PART – B (5 x 2= 10 Marks)</div>

11. Explain the Grashof's law for a four bar mechanism and give out its significance   CO1- U

12. Explain the piston effort.   CO2- U

13. Explain tangential cam   CO3- U

14. Illustrate the law of gearing   CO4- U

15. Illustrate critical or whirling or whipping speed of a shaft.   CO5- U

<div align="center">PART – C (5 x 16= 80 Marks)</div>

16. (a) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: Angular velocity of the connecting rod, at a crank angle of 45° from inner dead centre position.   CO1- App   (16)

<div align="center">Or</div>

  (b) A link AB of a four bar linkage ABCD revolves uniformly at 120rpm in a clockwise direction. Given AB=75mm, BC=175mm, CD=150mm,DA=100mm and angle BAD equal to 90°.AD is fixed link. Using graphical approach, find the angular accelerations of links BC and CD and acceleration of point E on the link BC, if EC = 150mm.   CO1- App   (16)

17. (a) A Porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and 200 mm when the governor is at maximum speed. Find the minimum and maximum speeds.   CO2- App   (16)

Or

(b) The crank-pin circle radius of a horizontal engine is 200 mm. The length of connecting rod is 1 m. The crank is rotating at 400 rpm. When the crank has turned 30° from the IDC, the difference of pressure between the cover end and piston end is 4 bar. The mass of reciprocating parts is 100 kg and cylinder bore is 0.4 m. Determine, (1) Inertia forces of piston ; (2) Force on piston by gas ; (3) Piston effort   CO2-App   (16)

18. (a) Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.   CO3- App   (16)

Or

(b) The following data refer to two cylinder locomotive with cranks at 90°: 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. Find the magnitude M_A and position of the balancing mass at θ_A.   CO3- App   (16)

19. (a) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, calculate the length of path of contact   CO4- Ana   (16)

Or

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(b) Pressure angle of two gears is 20° and has a module of 10mm. The number of teeth on pinion and gear is same and equal to one module. Determine (i) the number of pairs of teeth in contact and (ii) the angle of action of pinion and gear and the ratio of sliding to rolling velocity at the beginning of contact.   CO4- Ana   (16)

20. (a) A bathroom scale should not oscillate. Ideally it would be critically damped. Show that if a scale is critically damped for a person of weight W it will be over damped for a person whose weight is less than W. If it is desired that for critical damping, platform deflect 2 cm for a 70 kg person, Analyze the spring constant k and the damping constant a .   CO5- Ana   (16)

Or

(b) A slap door 2 m height, 0.75 m wide, 40 mm thick and with a mass of 36 kg is fitted with an automatic door closer. The door opens against a torsion spring with a modulus of 10 N-m/radian. Analyze the necessary damping to critically damped the return swing of the door. If the door is opened 90º and released, how long will it take until the door is within 1º of closing?   CO5- Ana   (16)

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