Model Question

13.504 - MECHANICS OF MACHINERY (U)

3Hrs 100 Marks

(Answer ***all questions*** from PART – A and any ***one question*** from ***each module*** from PART-B)

PART – A

1. Sketch the inversions of 3R-1P kinematic chain.
2. Differentiate between static force analysis and dynamic force analysis.
3. What are conditions of static equilibrium of a three force member and a member with two forces and a torque.
4. Explain about piston effort and crank effort.
5. What is meant by kinetically equivalent systems.
6. What do you mean by direct and reverse crank method of balancing?
7. Discuss the gyroscopic effect on sea vessels.
8. Draw the displacement, velocity, acceleration and jerk diagrams for a follower when moves with cycloidal motion.
9. Write the significance of magnification factor and frequency ratio.
10. What is critical damping? Explain.

(10 x 2 = 20)

PART – B

MODULE-I

11. (a) With neat sketch explain Paucillier straight line mechanism. (10)

    (b) Explain with neat sketch Ackermann steering gear mechanism. (10)

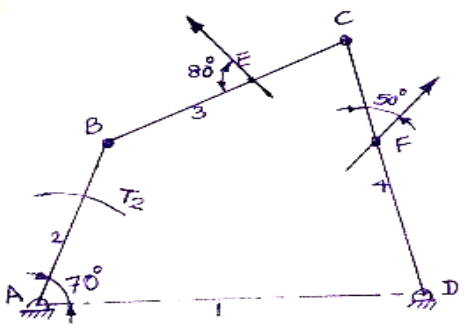
OR

12. The crank of a slider crank mechanism is 15cm and the connecting rod in 60cm long. The crank makes 300 rpm in the clockwise direction. When it has turned 45^0 from the inner dead centre position, determine:
    (i) acceleration of the mid point of the connecting rod and
    (ii) (ii) angular acceleration of the connecting rod. (20)

MODULE-II

13. For the mechanism shown below, determine the magnitude and direction of torque T_2 acting on the link AB for equilibrium.

AB = 80 mm
BC = 100 mm
CD = 120 mm
DF = 90 mm
CE = 80 mm
BE = 70 mm
AD = 140 mm



(20)

OR

14. The dimensions of a four link mechanism are AB=500mm, BC=660mm, CD=560mm and AD=1000mm. The link AB has an angular velocity of 10.5 rad/s counter clock wise and an angular retardation of 26 rad/s^2 at the instant when it makes an angle of 60^0 with AD, the fixed link. The mass of the links BC and CD is 4.2 kg/m length. The link AB has a mass of 3.54kg, the centre of which lies at 200mm from A and a moment inertia of 88500kg-mm^2 . Neglecting gravity and frictional effects determine the instantaneous a value of the torque required to be applied on AB to overcome the inertia forces

(20)

MODULE-III

15. Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90^0 and 210^0 respectively with B in the same sense. The plane containing B and C are 300 mm apart. Masses A, B, C and D can be assumed to be concentrated at radii of 360mm, 480mm, 240mm and 300mm respectively. The masses B, C and D are 15 kg, 25kg and 20 kg respectively. Determine
    (i) the mass A and its angular position and
    (ii) the positions of planes A and D. (20)

OR

16. The total mass of the four wheel trolley car is 1800 kg. The car runs on rails of 1.6 m gauge and rounds a curve of 24 m radius at 36 km/hr. The track is banked at 10^0.The external diameter of the wheels is 600 mm and each pair with axle has a mass of 180kg with radius gyration of 240mm. The height of the centre of mass of the car above the wheel base is 950mm. Determine the pressure on each rail allowing for centrifugal force and gyroscopic couple actions.

(20)

MODULE-IV

17. A cam with 30 mm minimum radius is rotating clockwise at 1200 rpm to give the follower motion to the roller follower with 12 mm roller diameter.
    (i) Lift - 25 mm
    (ii) Follower rises during 120^0 cam rotation with SHM
    (iii) Follower to dwell for 60^0 cam rotation
    (iv) Follower to return during 90^0 cam rotation with uniform acceleration and retardation
    (v) Follower dwell the remaining period.

    Draw the profile of the cam and determine the maximum velocity and acceleration of the follower during rise and fall. (20)

OR

18. (a) Write notes about logarithmic decrement and also derive the expression for logarithmic decrement.

    (b) The damped vibration record of a spring-mass-dash pot system shows the following data.

Amplitude on second cycle	:	1.2 cm
Amplitude on third cycle	:	1.05 cm
Spring constant	:	7840 N/m
Mass on the spring	:	2 kg

    Determine the damping constant, assuming it to be viscous.

(20)
