Registration No.:

Total Number of Pages: 02

Integrated Dual Degree (B.Tech and M.Tech)
Sub_Code: RME4C001/RAU4C001

4th Semester Regular/Back Examination: 2023-24
SUBJECT: Kinematics & Dynamics of Machines
BRANCH(S): MECH,MMEAM,ME,AUTO
Time: 3 Hour
Max Marks: 100
Q.Code: P061

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)   Explain the term i)Lower pair ii) Kinematic Chain.
   b)   What are the methods for determining the velocity of a point on a link?
   c)   What are the advantages of gear drive?
   d)   Define i) Circular Pitch ii) Diametral pitch.
   e)   What do you understand by 'gear train'? Discuss the various types of gear trains.
   f)   Define inertia force and inertia torque.
   g)   Explain Angle of friction.
   h)   Define creep of the belt.
   i)   Explain what you understand by 'initial tension in a belt'.
   j)   Write down the difference between self energizing brake and self locking brake.

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 × 8)
   a)   Sketch and Describe crank and slotted quick return motion mechanism. Derive an expression for the ratio of times taken in forward and return stroke.
   b)   Obtain an expression for the length of a belt in an open belt drive.
   c)   Write short note on Equivalent Dynamical System.
   d)   It is stated that the speed at which a belt or rope should be run to transmit maximum power is that at which the maximum allowable tension is three times the centrifugal tension in the belt or rope at that speed. Prove the statement.
   e)   Describe the construction and operation of a rope brake absorption dynamometer.
   f)   Determine the retardation of the vehicle when the braking is applied to rear wheels of a four wheeled moving vehicle.
   g)   Derive an expression for the minimum number of teeth required on the pinion in order to avoidinterference in involute gear teeth when it meshes with wheel.
   h)   In a screw jack, the helix angle of thread is $\alpha$and the angle of friction is $\emptyset$. Show that its efficiency ismaximum, when $2\alpha= (90^\circ – \emptyset)$.
   i)   How the velocity ratio of epicyclic gear train is obtained by tabular method?

j) Derive an expression for the inertia force due to reciprocating mass in reciprocating engine, neglecting the mass of the connecting rod.

k) Explain any one inversion of Four bar Chain.

l) Derive an expression for the friction moment for a flat collar bearing in terms of the inner radius r_1, outer radius r_2, axial thrust W and coefficient of friction µ. Assume uniform intensity of pressure.

Part-III

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

Q3 How are velocity and acceleration of the slider of a single slider crank chain determined analytically? In a slider crank mechanism, the length of the crank and connecting rod are 150 mm and 600 mm respectively. The crank position is 60° from inner dead centre. The crank shaft speed is 450 r.p.m. (clockwise). Using analytical method, determine Velocity and acceleration of the slider. **(16)**

Q4 Below figure shows diagrammatically a compound epicyclic gear train. Wheels A, D, and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally. If the wheel A is driven clockwise at 1 r.p.s. while D is driven counter clockwise at 5 r.p.s., determine the magnitude and direction of the angular velocities of arm OP and wheel E. **(16)**
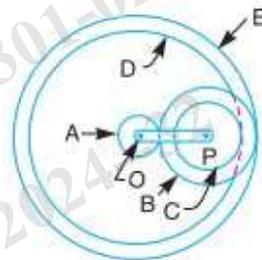
Q5 Describe with the help of a neat sketch the principles of operation of an internal expanding shoe. Derive the expression for the braking torque. **(16)**

Q6 a) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 r.p.m. The angle embraced is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^3 and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account. **(8)**

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 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^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **(8)**