CS/B.Tech(N)(ME/AUE/PE)/EVEN/SEM-4/
ME-402/2014

2014

Mechanism

ne Allotted : 3 Hours *Full Marks : 70*

The figure in the margin indicate full marks.
ndidates are required to give their answers in their own words as far as practicable

GROUP – A

Multiple type choice questions

Choose the correct alternatives for the following : 10X1=10

i) If *n* links are connected at the same joint, the joint is equivalent to -

(a) (n – 1) binary joint

(b) (n – 2) binary joint

(c) (n – 3) binary joint

(d) (n – 4) binary joint

ii) In gears, interference take place when :

(a) the tip of a tooth of a mating gear digs into the portion base and root circle

(b) gears do not move smoothly in absence of lubrication

(c) pitch of gears are not same

(d) gears tooth are undercut

iii) The difference between tensions on the light and slake side of the belt drive is 3000 N. If the belt speed is 15 m/s, the transmitted power in kW is :

(a) 45

(b) 22.5

(c) 90

(d) 100

iv) The centrifugal tension in belts :

(a) increases power transmitted

(b) decreases power transmitted

(c) have no effect on the power transmitted

(d) increases power transmitted upto a certain speed and then decreases

v) In a kinetic chain, a quaternary joint is equivalent to –

(a) one binary joints

(b) two binary joints

(c) three binary joints

(d) four binary joints

vi) The tooth profile most commonly used in a gear drives for power transmission is –

(a) a cycloid

(b) an involute

(c) an ellipse

(d) a parabola

vii) A Hook's joint is used to convert -

(a) two parallel shafts

(b) two intersecting shafts

(c) two non-parallel intersecting shaft s

(d) two non-parallel, non-intersecting shafts

viii) The most suitable follower motion program for high speed engine is –

(a) simple harmonic motion

(b) uniform velocity

(c) uniform acceleration and deceleration

(d) cycloidal

ix) In a four link mechanism the sum of shortest and longest link is less than the sum of other two links. It will act as drag link mechanism if :

(a) The longest link length is fixed

(b) The shortest link is fixed

(c) The link opposite to the shortest link is fixed

(d) Any link adjacent to shortest link is fixed

x) The pressure angle of the cam ..... With increase in the base circle diameter :

(a) decreases

(b) increases

(c) does not change

(d) may decrease or increase

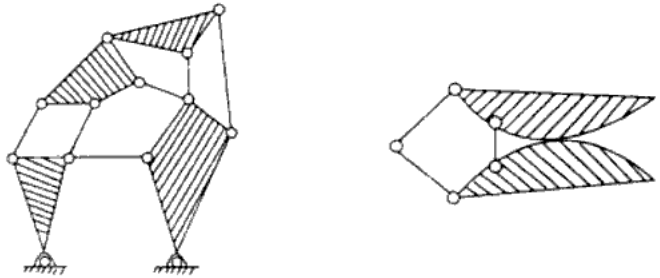
Group-B

(Short type answer questions)

Attempt any *three* of the following 3x5=15

2. In a four-bar linkage the lengths of the driver crank, coupler, follower crank and the fixed link are 100mm, 200mm, 300mm and 'L' respectively. Find the range of values of 'L' so as to make it a (i) crank-rocker mechanism and (ii) double-crank mechanism

3. Determine the degree of freedom of the mechanism.



3+2

4. For a flat belt drive, prove that $T_1 / T_2 = e^{\mu\theta}$, where T_1 and T_2 are the tensions in tight and slake side of the belt respectively μ and θ is friction coefficient between the belt and the pulley and angle of contact between the belt and the pulley (in radian). [5]

5. Two involute gears in a mesh have a module of 8 mm and a pressure angle of 20°. The larger gear has 57 while the pinion has 23 teeth. If the addenda on pinion and gear wheels are equal to one module. Find the contact ratio (the no of pairs of teeth in contact) [5]

6. Write short note on stepped pulley. [5]

Group – C

(Long Answer Type Questions)

Answer any *Three* from the following 3X15=45

7. In a slider crank mechanism the crank is 200 mm long and rotates at 40 rad/sec in a CCW direction. The length of the connecting rod is 800 mm. When the crank turns through 60° from Inner-dead centre. Determine -

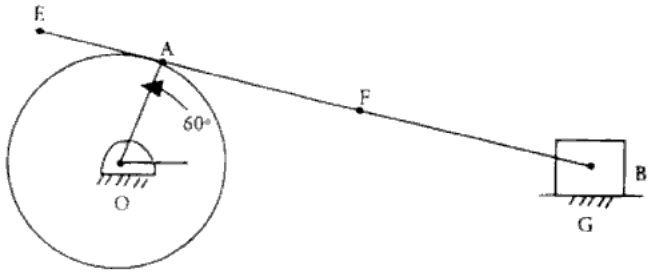
   (a) The velocity of the slider

   (b) Velocity of point E located at a distance of 200 mm on the connecting rod extended.

   (c) The position and velocity of point F on the connecting rod having the least absolute velocity.

   (d) The angular velocity of connecting rod.

   (e) The velocity of rubbing of pins of crank shaft, crank and cross head having pins diameters 80, 60 and 100 mm respectively.



8. (a) What is Kinematic [illegible]? What [illegible] condition to be a linkage? [illegible] differen[illegible] (3

(b) Using Grubler's criteria show that for achieving the constrained motion the minimum number of binary links is four. (3

(c) Define Grashof's law. State how is it helpful in classifying the four link mechanisms into different types. (3)

(d) In a crank and slotted layer quick return mechanism the distance between the fixed centres is 150 mm and the driving crank is 75 mm long. Determine the ratio of the time taken on the cutting and the return strokes.

(6

9. (a) State and prove law of gearing. What is velocity of sliding?

[5+2]

(b) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and gear ratio is 2. If the module is 5 mm and the pitch line speed is 1.2 m/s. Assume addendum as standard and equal to one module. Find –

i. The angle turned through pinion when one pair of teeth is in mesh.

ii. Maximum velocity of sliding

[4+4]

10. (a) Deduce an expression for the tension in a belt due to centrifugal force and prove that the velocity at which the maximum power can be transmitted is given by $\sqrt{T/3m}$ Where T=max tension on the tight side. m = mass of the belt / unit length

(b) A v-belt having a lap of 180° has a cross sectional area of 2.5cm² and groove angle as 45°. The density of belt is .0015 Kg/cm³ and maximum stress is limited to 400×10^4 N/m². If μ =0.15, find the power that can be transmitted if the wheel has a mean diameter of 30cm and runs at 1000rpm.

7+8=15

11. (a) Derive the condition for correct steering.

(b) In a Hooke's Joint the angle between the driving and driven shaft is 25°. The driving shaft rotates at a uniform speed of 180 r.p.m. The driven shaft carries a steady load of 7.5 kW. Calculate the mass of the flywheel of the driven shaft if its radius of gyration is 150mm and the output torque of the driven shaft does not vary by more than 15% of the input shaft.

(c) Derive analytically the expression of the velocity of the piston of a reciprocating engine.

[3+8+4]

____x-x-x____