Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(NEW)/ME/PE/AUE/SEM-4/ME-402/2012

2012
MECHANISMS

Time Allotted : 3 Hours *Full Marks* : 70

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

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) The cam and follower constitute a

a) Higher pair b) Lower pair

c) Helical pair d) Spiral pair.

ii) Two parallel shafts, the distance between whose axes is small and variable, are connected by

a) Clutch arrangement b) Oldham's coupling

c) Hooke's joints d) Universal coupling.

iii) If n links are connected at the same joint, the joint is equivalent to

a) $(n-1)$ binary joints b) $(n-2)$ binary joints

c) $(2n-1)$ binary joints d) None of these.

iv) Which of the fallowing mechanisms is used to enlarge or reduce the size of drawing ?

a) Grasshopper mechanism

b) Pantograph

c) Hart's mechanism

d) Watt's mechanism.

v) The motion of circular rod in a circula hol is an example of

a) successfully constrained motion

b) completely constrained mot on

c) incompletely constra ned m tion

d) partially constrained motion.

vi) The locus of instantaneous centre of a moving body relative to a fix d body is known as the

a) space centr de b) body centrode

c) moving centrode d) none of these.

vii) Angular ac eleration of a link *AB* is given by

a) centripetal acceleration/length of *AB*

b) tangential acceleration/length of *AB*

c) total acceleration/length of *AB*

d) centrifugal acceleration/length of *AB*.

viii) The point on the cam with the maximum pressure angle is known as the

a) cam centre b) pitch point

c) trace point d) prime point.

ix) A differential gear in automobile is used to

a) reduce speed

b) assist in changing speed

c) provide jerk-free movement of vehicle

d) help in turning.

x) The mechanism used in a shaping machine is

a) a closed 4-bar chain having 4 revolute pairs

b) a closed 6-bar chain having 6 revolut pairs

c) a closed 4-bar chain having 2 revolute pairs and 2 prismatic pairs

d) an inversion of singl slider crank mechanism.

xi) The contact ratio of gears is always

a) more than 1 b) 1

c) less than 1 d) zero.

xii) The minimum number of teeth in rack and pinion for a 20° pair angle teeth is

a) 20 b) 18

c) 22 d) 24.

xiii) If the axes of the first and last gears of a compound gear train are co-axial, the gear train is known as

a) simple b) epicyclic

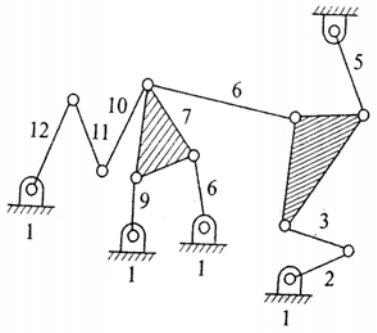
c) reverted d) compound.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Determine the Degree of Freedom of the kinematic linkage shown in Fig.-1.



Figur -1

3. Determine the movability f the mechanisms in Fig.-2 by Grashof's criterion (umbers indicate the respective link length in mm).

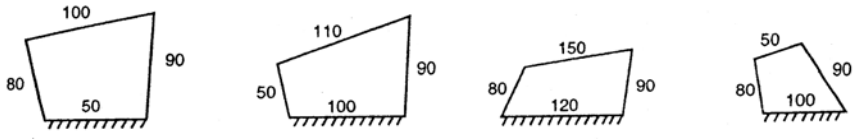


Figure-2

4. State the Aronhold – Kennedy theorem of three-centre.
5. With a suitable diagram differentiate the Davis steering gear mechanism with Ackermann steering gear mechanism.
6. Drive the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension.
7. Derive a relation for minimum number of teeth on the gear wheel and the pinion to avoid interference.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module, pressure angle = 20°. The pinion rotates at 90 r.p.m. De ermine :

   i) The No. of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel

   ii) The length of path and arc f contact

   iii) The number of pairs of teeth in contact

   iv) The maximum velocity of sliding.

   b) In a reverted epicycli gear train, the arm *A* carries two gears *B* and *C* and a compound gear *D* - *E*. The gear *B* meshes with gear *E* and the gear *C* meshes with gear *D*. The number of teeth on gears *B*, *C* and *D* are 75, 30 and 90 respectively. Find the speed and direction of gear *C* when gear *B* is fixed and the arm *A* makes 100 r.p.m. clockwise. 10 + 5

9. Draw a cam profile to drive an oscillating roller follower to the specification given below :

   i) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam ;

   ii) Follower to return to its initial position during next 120° rotation of the cam ;

iii) Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre = 120 mm ; distance between pivot centre and cam axis = 130 mm; minimum radius of cam = 40 mm; radius of roller = 10mm; inward and outward strokes take place with simple harmonic motion constant acceleration and retardation respectively. 5 + 5 + 5

10. In the toggle mechanism, as shown in *Fig.*-3. The s ider *D* is constrained to move on a horizontal path. The c ank *OA* is rotating in the counter-clockwise direction at a speed of 180 rpm, increasing at the rate of 50 rad/sec^2, the dimensions of various links are as fol ows :

OA = 180 mm, CB = 240 mm, AB = 360 mm and BD = 540 mm. For the given onfiguration, find,

i) Velocity of slider *D*

ii) Angular velocity of links *AB*, *CB* and *BD*

iii) Acceleration of slider *D* and angular acceleration of *BD*

iv) Velocity of rubbing on the pins of diameter 30 mm at *A* and *D*.

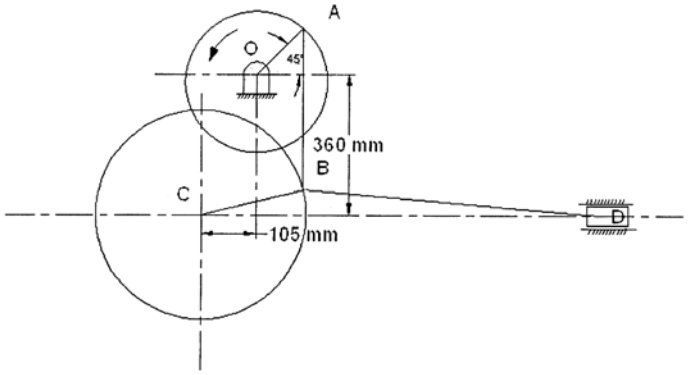


Figure - 3

11. a) What is the significance of degree of freedom of a kinematic chain when it functions as mechanism ? Explain Kutzback mobility criterion.

b) Show that Devis steering gear mechanism satisfies the condition for correct gearing.

c) A crank and slotted lever mechanism used in a shaper has a centre distance of 300 mm between the centers of oscillation of the slotted lever and the c ntre of rotation of the crank. The radius of crank is 120 mm. Find the ratio of time of cutting and time of returning strokes.

5 + 5 + 5