GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

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Registration No: | | | | | | | | | | |

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4th Semester Regular Examination-April-May 2019

BMEPC4020 Kinematics of Machinery

(Regulations 2017) MECHANICAL ENGG.

Time : 3 Hours Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 2=20 Mark

Q.1. Answer *All* Questions.

a Which of the following is a turning pair [CO1] [PO1]
   a) Piston and cylinder of a reciprocating steam engine
   b) Shaft with collars at both ends fitted in a circular hole
   c) Ball and socket joint
   d) Lead screw of a lathe and nut

b Which of the following is a lower pair [CO1] [PO1]
   a) ball and socket joint (c) piston and cylinder
   b) cam and follower (d)both (a) and (b) above

c The direction of linear velocity of a point on a link with respect to another point on the same link is [CO1] [PO2]
   a) Parallel to the link joining the point c)Perpendicular to the link joining the points
   b) At 45° to the link joining the points d)None of these

d If the number of instantaneous centres are 6 then the number of links are [CO2] [PO2]
   a) 4 b) 5 c) 6 d) Data is insufficient

e The coriolis component of acceleration is encountered in [CO2] [PO1]
   a) Slider crank mechanism b)Four bar chain c) Quick return motion mechanism
   d) None of these

f Relative pole of moving link is its centre of rotation relative to a _____ link [CO3] [PO1]
   a) Fixed link b)Moving link c)Any link d) None of these

g Offset is provided to a cam follower mechanism to [CO3] [PO1]
   a) Minimse the side thrust b)Accelerate c)Avoid jerk d)None of these

h In which type of profile of gear, there occurs interference? [CO4] [PO1]
   a) Involute profile b)Cycloidal profile c)Both (a) and (b) d)None of these

i The radial distance of a tooth from the pitch circle to the bottom of the tooth, is called [CO4] [PO1]
   a) Dedundum b)Addendum c)Clearance d) Working depth

j A 1.5 kW motor is running at 1440 rpm. It is to be connected to a stirrer running at 36 rpm. The gearing arrangement suitable for this application is [CO4] [PO2]
   a) Differential gear b)Helical gear c)Spur gear d)Worm gear

PART – B: (Short Answer Questions) 10 × 2 = 20 Marks

Q.2. Answer *ALL* questions

a Explain completely constrained motion with an example [CO1] [PO1]

b Differentiate between rigid and resistant bodies.. [CO1] [PO2]

c State Kennedy's three centre theorem. [CO2] [PO1]

d Write down the expression for finding the number of instantaneous centres in a mechanism and calculate number of I-Centres for a four bar mechanism. [CO2] [PO2]

e State the two components of acceleration and write the expressions for both. [CO2] [PO1]

f Define transmission angle. What is the optimum value of transmission angle? [CO3] [PO2]

g What do you mean by dimensional synthesis? [CO3] [PO1]

h Why large pressure angle is not used in cam curves? [CO3] [PO2]

i Explain circular pitch of a gear. [CO4] [PO1]

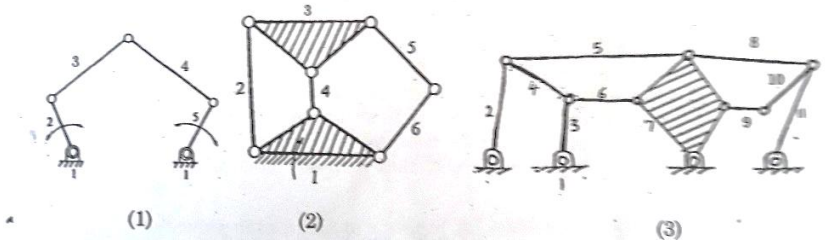
j What are the advantages of epicyclic gear train? [CO4] [PO1]

PART – C: (Long Answer Questions) 4 × 15 = 60 Marks

Answer *ALL* questions

Q.3

a Find the degrees of freedom for the mechanisms shown in Fig. 7 Marks [CO1] [PO1]



b What is inversion of a mechanism? With neat sketches explain any two inversions of double slider crank chain mechanism. 8 marks [CO1] [PO1]

OR

c ABCD is a four bar mechanism with the link AD fixed. The lengths of the links are: AB = 60 mm, BC = 175 mm, CD = 110 mm and DA = 200 mm. The crank AB rotates at 100 rpm constant clockwise and the angle BAD = 60°. At this instant 12 Marks [CO1] [PO2]

(i) Draw the velocity diagram with suitable scale
(ii) Find the velocity of the point C.
(iii) Find the magnitude and direction of the angular velocity of the link BC.

d Define rubbing velocity in a pin joint and write expression for calculating the same when two links move in the same and opposite directions. 3 marks [CO1] [PO2]

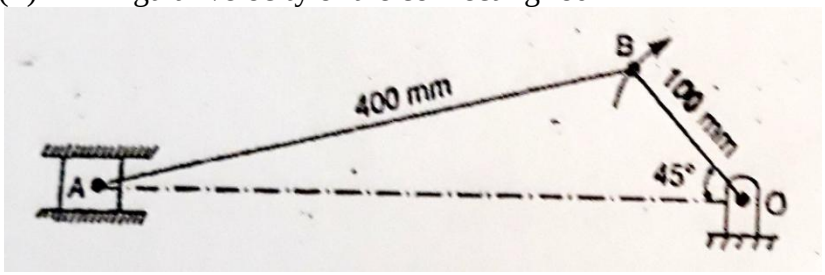
Q.4

a What is angular velocity ratio theorem? Give the generalized equation for it. 3 Marks [CO2] [PO1]

b Locate the instantaneous centres of the slider crank mechanism as shown in Fig. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank 12 Marks [CO2] [PO2]

rotates clockwise with an angular velocity of 10 rad/s, find

(i) Velocity of slider A, and
(ii) Angular velocity of the connecting rod AB



OR

c What is the expression to find the Coriolis component of acceleration? Explain how the direction of it is obtained with neat sketch. 5 Marks [CO2] [PO1]

d The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and connecting rod is 600 mm long. Determine: i) linear velocity and acceleration of the midpoint of the connecting rod and ii) angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position. 10 Marks [CO2] [PO2]

Q.5

a	Explain the terms: function generation, path generation and motion generation	5 Marks	[CO3] [PO1]
b	What is Freudenstein's equation? Design a four-link mechanism to coordinate three positions of the input and the output links as follows: $\theta_1 = 20°$ $\phi_1 = 35°$ $\theta_2 = 35°$ $\phi_2 = 45°$ $\theta_3 = 50°$ $\phi_3 = 60°$	10 Marks	[CO3] [PO2]

OR

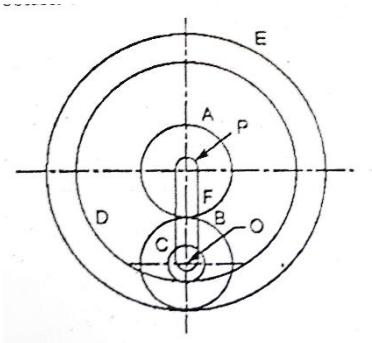
c	Draw the displacement, velocity and acceleration diagram for a follower when it moves with Simple Harmonic Motion	5 Marks	[CO3] [PO1]
d	Draw the cam profile for the following data: Base circle radius of the cam = 50 mm, Lift = 40 mm, Angle of ascent with SHM = 60°, Angle of dwell = 90°, Angle of descent with uniform acceleration and deceleration = 90°, Speed of cam = 300 rpm, Follower offset = 10 mm, Type of follower – knife edge. Also calculate the maximum velocity and acceleration during up and down strokes.	10 marks	[CO3] [PO2]

Q.6

a	Write short notes on interference and undercutting in involute gears	5 Marks	[CO4] [PO1]
b	Derive an expression for the minimum number of teeth required on the pinion meshing with gear, in order to avoid interference (in terms of gear ratio and pressure angle)	10 Marks	[CO4] [PO2]

OR

c	What is reverted gear train? Explain with a neat sketch.	3 Marks	[CO4] [PO1]
d	A compound epicyclic gear is shown in Fig. The gears A, D and E are free to rotate on axis P. The compound gear B & C rotate together on the axis Q at the end of arm F. All gears have equal pitch. The number of external teeth on gears A, B and C are 18, 45 and 21 respectively. The gears D & E are annular gears. The gear A rotates at 100 rpm in anticlockwise direction and gear D rotates at 450 rpm clockwise. Find the speed and direction of the arm and the gear E.	12 Marks	[CO4] [PO2]



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