

Subject: Theory of Machines

Maximum Marks :60

Subject Code: BMA 204

Time : 3 Hours

Note: Q1 is compulsory. Attempt one question each from the Units I, II, III & IV.

(2.5*8=20)

Q1

- (a) Differentiate between Closed Pair and unclosed Pairs. Draw neat sketch to explain each?
- (b) Find degree of freedom for Cases:
 (i) A cylinder inside a cylinder &
 (ii) A prism on a plane?
- (c) What is Grashof's Law? Explain with an example for a 4 bar mechanism having link length- 3mm, 6 mm, 9 mm, 10 mm, all connected through revolute pairs and one link is fixed.
- (d) Explain Logarithmic Decrement?
- (e) Brief about classification of CAM on the basis of surface of point in contact and motion of the follower.
- (f) Differentiate between, Simple gear train, Compound gear train, reverted gear train and Epicyclical gear train. Make neat sketches to show each?
- (g) Explain analytical method for balancing of four (4) masses rotating in the same plane?
- (h) What is a Gyroscope. Where is it used?

UNIT-I

Q2

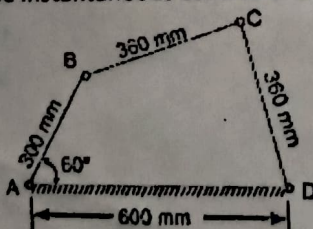
- a) With a neat sketch explain working of a) scotch yoke mechanism and Oldham's coupling?
- b) Explain 3 Centers in line theorem.

(5+5=10)

Q3

- a) Explain method of locating instantaneous centers in a mechanism, having 4 links with revolute pairs.
- b) In a pin jointed four bar mechanism, as shown in Figure. below, AB = 300 mm, BC = CD = 360 mm, and AD = 600 mm. The angle BAD = 60°. The crank AB rotates uniformly at 100 r.p.m in clock wise direction. Locate all the instantaneous centres and find the angular velocity of the link BC.

(5+5=10)



UNIT-II

Q4

- a) With a neat figure, show following on a radial cam with a reciprocating roller mechanism: (i) Base circle, (ii) Pitch point, (iii) Pressure angle, (iv) Prime circle, (v) Lift or stroke. Write one line about each.
- b) What is a cycloid? Write in points with neat sketches technique for making displacement, velocity and acceleration diagrams,

(10)

	when the follower moves with Cycloidal motion.		
Q5	A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 Kg at its free end. The young's modulus for the shaft material is 200 G N / m^2 . (a) Determine the frequency of longitudinal vibration of the shaft. (b) Determine Frequency of transverse vibrations of the shaft.	(5+5=10)	

UNIT-III

Q6	a) Explain what is meant by Interference in Gears, with a neat diagram. b) The speed ratio of the reverted gear train as shown in figure 3 is to be 12. The module pitch of gears A & B is 3.125 mm and of gears C & D is 2.5 mm. Calculate the suitable number of teeth for the gears. No gear is to have less than 24 teeth?	(5+5=10)	
Q7	Explain Kiel's construction technique with a neat figure to find velocity relations for a slider crank mechanism. The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of Klein's construction, the Velocity of the piston.	(5+5=10)	

UNIT-IV

Q8	An Airplane makes a complete half circle of 50 metres radius towards left, when flying at 200 km per hour. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m clockwise, when viewed from the rear. A) Find the gyroscopic couple on the aircraft and explain its effect on the plane. B) What will be the gyroscopic couple and the effect on plane if direction of rotation of engine is reversed?	(5+5=10)	
Q9	A shaft is supported in bearings 1.8 m apart and projects 0.45 m beyond bearings at each end. The shaft carries three pulleys one at each end and one at the middle of its length. The mass of end pulleys on left is 48 kg and on right is 20 kg and their centre of gravity are 15 mm and 12.5 mm respectively from the shaft axis. The centre pulley has a mass of 56 kg and its centre of gravity is 15 mm from the shaft axis. If the pulleys are arranged so as to give static balance, determine : 1. Relative angular positions of the pulleys, and 2. Dynamic forces produced on the bearings when the shaft rotates at 300 r.p.m.	(5+5=10)	

