Dr. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular / Supplementary End Semester Examination – Summer 2023

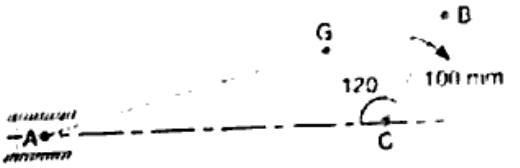
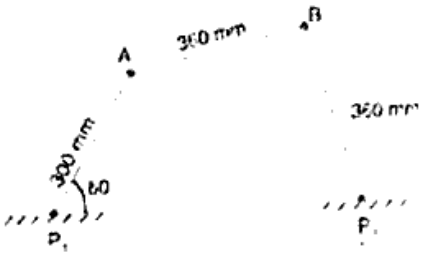
Course: B. Tech. **Branch: Mechanical Engineering** **Semester: IV**

Subject Code & Name: BTMC402 Theory of Machines - I

Max Marks: 60 **Date: 15/07/23** **Duration: 3.45 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any TWO of the following.**		
A)	Explain in brief the inversions of Four Bar Chain.	**Remember**	**06**
B)	An engine mechanism is shown in figure 1. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find: 1.Velocity of G and angular velocity of AB, and 2. Acceleration of G and angular acceleration of AB.  Fig. 1	**Apply**	**06**
C)	The dimensions and configuration of the four bar mechanism, shown in Fig. 2, are as follows: P_1A = 300 mm; P_2B = 360 mm; AB = 360 mm, and P_1P_2 = 600 mm. The angle $AP_1P_2 = 60°$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2, both clockwise. Determine the angular velocities and angular accelerations of P_2B, and AB and the velocity and acceleration of the joint B.  Fig. 2	**Apply**	06
Q.2	**Solve Any TWO of the following.**		
A)	State the laws of (i) Static friction ; (ii) Dynamic friction	**Understanding**	**06**

B)	conical pivot supports a load of 20 kN, the cone angle is 120° and the intensity of normal pressure is not to exceed 0.3 N/mm^2. The external diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 r.p.m. and the coefficient of friction is 0.1, find the power absorbed in friction. Assume uniform pressure.	Apply	06
C)	Derive the expression for a total torque acting on a conical pivot bearing considering uniform wear.	Analyze	06
Q.3	**Solve Any TWO of the following.**		
A)	With neat sketch, explain the Multi plate clutch.	Understanding	06
B)	A single block brake is shown in Fig. 3. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake.  All dimensions in mm Fig 3	Apply	06
C)	Discuss the Prony Brake Dynamometer and Rope brake Dynamometer with neat sketches.	Create	06
Q.4	**Solve the following.**		
A)	Explain the different types of followers.	Understanding	06
B)	Construct the profile of a cam to suit the following specifications : Least radius of cam = 50 mm ; Diameter of roller = 25 mm; Angle of lift = 90° ; Angle of Dwell = 45°; Angle of fall = 75° ; Lift of the follower = 24.5 mm ; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform.	Analyze	06
Q.5	**Solve Any TWO of the following.**		
A)	Explain the method of balancing of several masses in the same planes.	Understanding	06
B)	Explain the direct and reverse crank method for determining unbalanced forces in radial engines.	Understanding	06
C)	Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	Apply	06