DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

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

Subject Code & Name: BTMC402 Theory of Machines I

Max Marks: 60 Date: 18/08/22 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 the following.**		
A)	Fig. 1 shows part of an opposed piston engine mechanism. The velocity of the piston E for the given instant is 780 mm/s. the crank OA rotates at a uniform speed in a clockwise direction and makes an angle of 450 to vertical as shown in Fig. 1. Draw a velocity diagram and determine the speed of the crank in rpm. OA= 50mm, AB= 200 mm, BC= 110 mm, CD= 220 mm and DE= 100 mm.	**Apply**	**6**

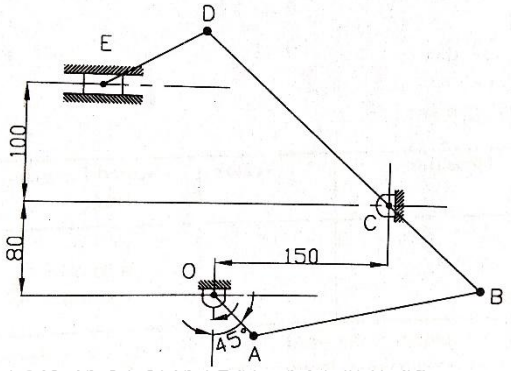


Fig. 1

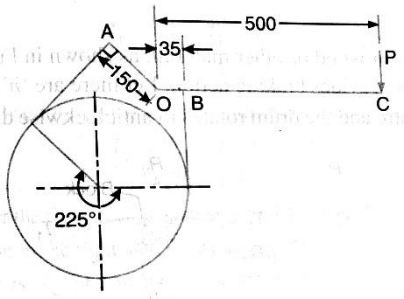
B)	Explain with sketches different types of constrained motions.	**Remember**	**6**
Q.2	**Solve Any Two of the following.**		
A)	A shaft has a number of collars integral with it. The external diameter of the collar is 400 mm and the shaft diameter is 250 mm. if the intensity of the pressure is 0.35 N/mm^2 and the coefficient of friction is 0.05. Estimate power absorbed when the shaft runs at 105 rpm carrying a load of 150 kN and a number of collars required.	**Apply**	**6**
B)	Derive the expression for a total torque acting on a truncated conical pivot bearing considering uniform wear,	**Remember**	**6**
C)	A conical pivot supports a load of 20 kN, the cone angle is 120^0 and the intensity of normal pressure is not to exceed 0.3 N/mm^2. The external	**Apply**	**6**

diameter is twice the internal diameter. Find the outer and inner radii of the bearing surface. If the shaft rotates at 200 rpm and the coefficient of friction is 0.1. Find the power absorbed in friction. Assume uniform pressure.

Q. 3 Solve Any Two of the following.

A) A centrifugal clutch is to transmit 15 kW at 900 rpm. The shoes are four in number. The speed at which the engagement is $3/4^{th}$ of the running speed. The inside radius of the pulley rim is 150 mm and the center of gravity of the shoe lies at 120 mm from the center of the spider. The shoes are lined with Ferrodo for which the coefficient of the friction may be taken as 0.25. Determine the mass of the shoes and size of the shoes, if the angle subtended by the shoes as the center of the spider is 60^0 and the pressure exerted on the shoes is 0.1 N/mm^2. **Apply** **6**

B) A differential band brake as shown in Fig. 2 has an angle of contact of 225^0. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 Nm and the coefficient of friction between the band and drum is 0.3. Find the necessary force 'P' for the clockwise rotation of the drum and the value of 'OA' for the brake to be self-locking when the drum rotates in clockwise. **Apply** **6**



All dimensions in mm.

Fig. 2

C) Differentiate between absorption type dynamometers and transmission type dynamometers. **Remember** **6**

Q.4 Solve the following.

A) Draw the profile of a cam operating a roller reciprocating follower having a lift of 40 mm. the roller diameter is 20 mm. the minimum radius of the cam is 30 mm. the cam raises the follower with simple harmonic motion for 110^0 of its rotation followed by a period of dwell for 80^0.the follower descends for the next 120^0 rotation of the cam follower with uniform acceleration and deceleration followed by a dwell period. **Apply** **6**

B)	Explain with figures any three types of followers.	**Remember**	**6**

Q. 5 Solve Any Two of the following.

A)	Explain the direct and reverse crank method for determining unbalanced forces in radial engines.	**Remember**	**6**
B)	Explain the method of balancing of several masses in the same planes.	**Remember**	**6**
C)	A four-cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks in order that the engine may be in complete primary balance.	**Apply**	**6**

***** End *****