No. of Printed Pages : **5 + Drawing Sheet**

**BME-020**

# BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) (BTMEVI)

00147

## Term-End Examination

## June, 2013

## BME-020 : KINEMATICS & DYNAMICS OF MECHANISMS

*Time : 3 hours* *Maximum Marks : 70*

***Note :*** *Attempt **any five** questions. Use of **scientific** non-programmable calculator is **allowed.***

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**1.** (a) Differentiate between 4+10

(i) mechanism and machine

(ii) lower pair and higher pair

(b) Locate all the instantaneous centres for the following mechanisms shown in fig. 1.

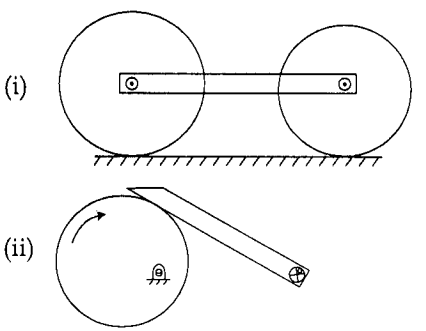


Fig. 1

2. (a) Explain four important kinematic pairs with neat sketches and state their applications. **4+10**

(b) Fig. 2 shows Andreau variable stroke engine mechanism in which links 2 and 7 have pure rolling motion. The dimensions of various links are indicated in figure. Determine acceleration of slider D if link 2 rotates at 1000 rpm.

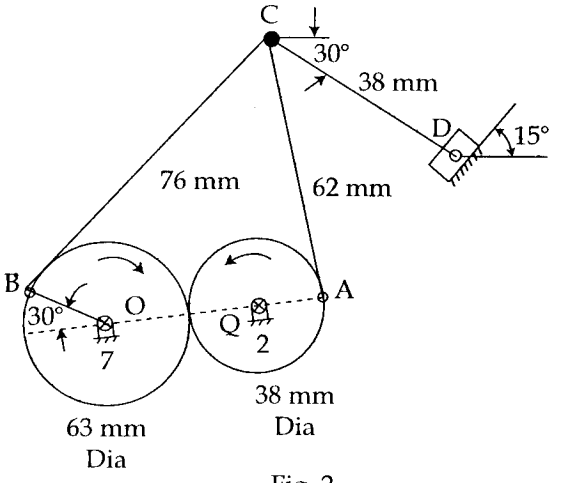


Fig. 2

3. (a) State and prove law of gearing and explain how involute profile satisfies it ? **6+8**

(b) A uniformly rotating cam operates a flat faced follower. Draw cam profile for the following data :

Lift of the follower = 30 mm

Base circle radius of the cam = 30 mm

Angle for ascent with uniform acceleration and retardation = 120°

Dwell angle after ascent = 30°

Return angel with SHM = 120°

**4.** (a) Explain how a single cylinder engine can be balanced ? Can it be balanced completely or not ? If not explain the reason. **6+8**

(b) What do you mean by accuracy points ? Determine chebyshev's accuracy points for a four bar chain for which

$y = \log_{10} x$ where $1 \leq x \leq 10$

$45° \leq \theta \leq 105°$ and $135° \leq \phi \leq 225°$

**5.** (a) Discuss stability of spring controlled governors. **5+9**

(b) The mass of reciprocating parts in a horizontal reciprocating single cylinder engine is 120 kg. The crank length is 90 mm and engine speed is 600 rpm. Length and mass of the connecting rod is 450 mm and 90 kg respectively. The radius of gyration of connecting rod about its centre of gravity is 150 mm. The distance of centre of gravity from the small end is 180 mm . Find the magnitude and sense of inertia torque on the crank shaft when crank has turned 30° from the inner dead centre.

6. (a) Explain with the help of neat sketch the linear vibration, transverse vibration and torsional vibration. Name the systems in which these vibrations occur. 5

(b) The flywheel of a generator set weighs 150 kg and its radius of gyration is 25 cm. The diameter of the flywheel shaft is 4.5 cm and its length is 22cm. The mass of armature is 90 kg and radius of gyration is 20 cm. The armature shaft is 4 cm in diameter and 18 cm long. The armature and flywheel are directly connected through a coupling. Determine natural frequency of torsional vibration. Assume $G = 8.24 \times 10^6$ N/cm$^2$. 9

7. (a) Explain Klein's construction for the slider crank mechanism. Determine the maximum acceleration and the acceleration opposite to this position of crank for the piston. The crank rotates at 10 r/s. The crank radius is 15 cm and the length of the connecting rod is 60 cm. 6+8

(b) Four masses weighing 1000N, 1500N, 1200N and 1300N revolve in planes A, B, C and D respectively. Their respective radii are $r_a = 225$mm, $r_b = 175$mm, $r_c = 25$mm and $r_d = 300$ mm. The angular position of

masses at B, C, and D from mass at A are 45°, 75°, and 135°. The balancing masses are to be mounted on planes L and M at radii 600 mm for each. Plane L is between planes of A and B whereas plane M is between C and D . The distance of planes A, B, C and D from plane L is 300 mm, 375 mm, 750 mm and 1500 mm respectively. The distance of plane A, B, C, and D from plane M is 1800 mm, 875 mm, 500 mm and 250 mm respectively. Find balancing masses and orientation of their radii with respect to mass at A.

8. (a) Explain force analysis of a simple bevel gear train. 6+8

(b) Explain the following :

(i) Vehicle differential

(ii) Methods of avoiding interference in involute gears.