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Total number of printed pages – 3

B. Tech  
CPME 6201

**Third Semester (Special) Examination – 2013**

**MACHINE DYNAMICS – I**

**BRANCH : MECH**

**QUESTION CODE : D215**

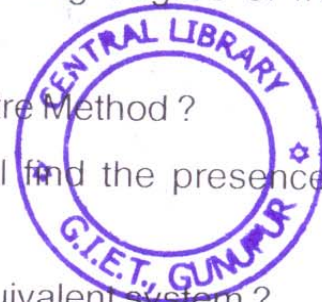
**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which are compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.*

*Draw neat sketches wherever necessary. Assume any missing data suitably.*

1. Answer the following questions : 2×10
- What do you mean by kinematic link, kinematic pair and kinematic chain ?
  - Explain Grübler's equation for determining degree of freedom of a mechanism.
  - What do you mean by Instantaneous Centre Method ?
  - Name any one machine where you will find the presence of Coriolis component of acceleration.
  - What do you understand by dynamical equivalent system ?
  - What is the functional difference between a brake and a clutch ?
  - What is friction circle and friction axis ?
  - Describe the working principle of single plate clutch.
  - What do you mean by a gear train ?
  - What do you mean by creep and slip in belt drive ?
2. In a slider crank mechanism : Crank radius : 150 mm, length of the connecting rod 600 mm, crank angle  $60^\circ$ , crank speed 250 rpm in counter clockwise direction.



Determine graphically the angular positions, angular velocities and angular accelerations of all the members of the above mentioned slider crank mechanism. Also find the velocity and acceleration of the piston. 10

3. In a slider crank mechanism, the crank radius: 70 mm and length of the connecting rod 270 mm. When the crank rotates at 2000 rpm in clockwise direction and has travelled  $60^\circ$  from dead center, find analytically : 10

(i) Velocity and acceleration of the piston and

(ii) Angular Velocity and angular acceleration of the connecting rod. 10

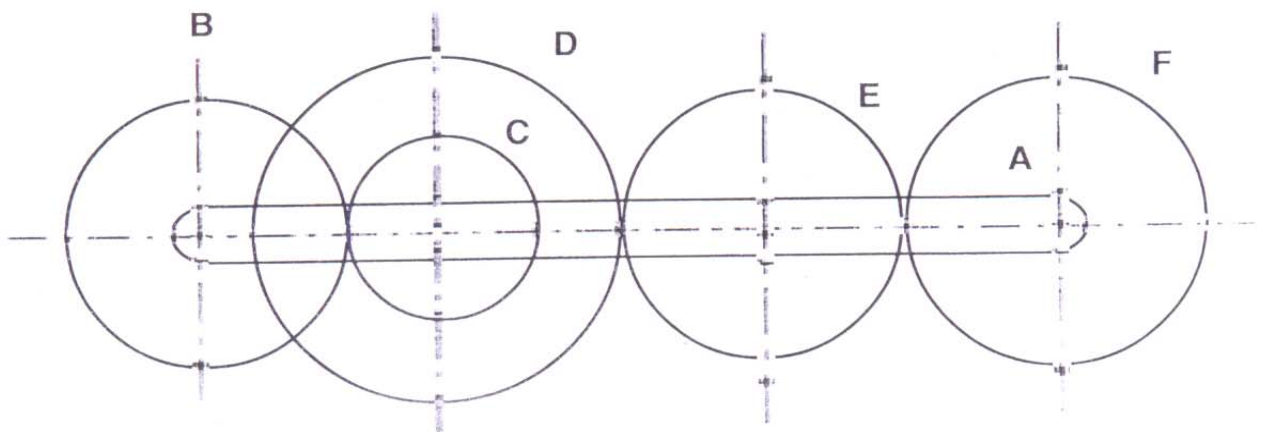
4 (a) Derive an expression for the frictional torque for flat collar bearing assuming uniform wear, 5

(b) Explain with figure about belt transmission dynamometer. 5

5 Describe with the help of neat sketch the principles of operation of an internal expanding shoe brake. Derive an expression for the braking torque in terms of applied effort exerted by cam. Neglect the pull on the spring used to keep the brake shoes in position. 10

6 An epicyclic gear train arrangement is shown in Figure below. Gear E is a fixed gear and gears C and D are compounded and mounted on one shaft. If arm A makes 80 rpm in clockwise direction, determine the speed and direction of rotation of gears B and F. The number of teeth on different gears are as given below : 10

$Z_b = 20, Z_c = 12, Z_d = 45, Z_e = 20$  and  $Z_f = 25$  where Z represent number of teeth.



7. A flat belt of  $180 \times 10 \text{ mm}^2$  cross section runs between two pulleys. The allowable strength of belt material is  $2.25 \text{ N/mm}^2$ . The density of the belt material is  $1200 \text{ kg/m}^3$ . Determine the maximum power that can be transmitted by the belt drive if the ratio of tension is 2. 10
8. Answer any **two** from the following : 5 × 2
- (a) Explain with figure about rope brake dynamometer.
- (b) Define the following terms :
- (i) Coefficient of fluctuation of speed and
- (ii) Coefficient of fluctuation of energy.
- (c) What is the difference between simple and differential band brake? Which is more suitable for large torque capacity?
- (d) Explain the procedure to construct turning moment diagram of a four stroke IC engine.

