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**B.Tech. DEGREE EXAMINATION, MAY 2014**  
Fourth Semester

ME0208 – MACHINES AND MECHANISMS  
(For the candidates admitted from the academic year 2007-2008 to 2012-2013)

Time: Three hours

Max. Marks: 100

Answer ALL Questions

**PART – A (10 × 2 = 20 Marks)**

1. What is meant by rubbing velocity at a pin joint?
2. Define: Kennedy's theorem.
3. List down the types of follower motions.
4. What is pantograph?
5. Define: Self locking in screws.
6. Compare plate clutches and cone clutches.
7. Why there is no effect of the gyroscope couple acting on the body of a ship during rolling?
8. What is meant by interference in involute gears?
9. Write the conditions for dynamic balancing?
10. What is centrifugal force and centrifugal couple?

**PART – B (5 × 16 = 80 Marks)**

11. a. Explain various types of inversions in four bar chain mechanism with neat sketches. Explain the types of constrained motions.

(OR)

- b. In a slider crank mechanism, the crank rotates at a constant speed of 300 rpm. The length of the crank is 150 mm and the connecting rod is 600 mm long. Determine
  - (i) Angular velocity and angular acceleration of the connecting rod at a crank angle of 45° from IDC.

15. a. The turning moment diagram of a four stroke engine is assumed to be represented by four triangles. The areas of from the line of zero pressure are:

Suction stroke = 440 mm<sup>2</sup>

Compression stroke = 1600 mm<sup>2</sup>

Expansion stroke = 7200 mm<sup>2</sup>

Exhaust stroke = 660 mm<sup>2</sup>.

Each mm<sup>2</sup> of area represents 3N-m of energy.

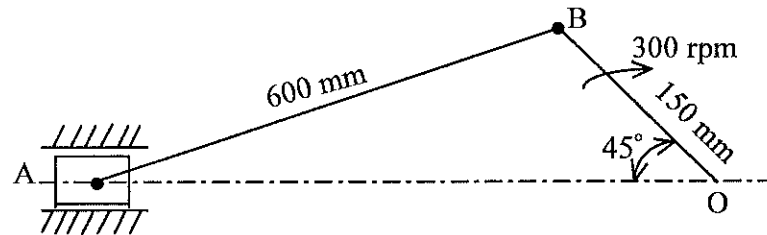
If the resisting torque is uniform, determine the mass of rim of the flywheel to keep the speed between 218 rpm and 222 rpm, when the main radius of the rim is to 1.25 m.

(OR)

- b. A, B, C, D are four masses carried by a rotating shaft at radii 100, 125, 200, 150 mm respectively. The planes in which the masses revolved are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass 'A' and the relative angular settings of the four masses so that the shaft shall be in complete balance.

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- (ii) Linear velocity and acceleration of the midpoint of the connecting rod.



12. a. Derive the equation for correct steering in Davis steering gear.

(OR)

- b. Draw the profile of the cam operating a roller reciprocating follower and with the following data:

Minimum radius of the cam = 25 mm

Lift = 30 mm

Roller diameter = 15 mm

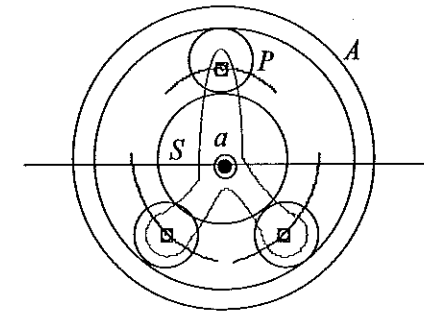
The cam lifts the follower for  $120^\circ$  with SHM followed by a dwell period of  $30^\circ$ . Then the follower lowers down during  $150^\circ$  of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration of the follower during the ascent and the descent period.

13. a. In a screw jack, the diameter of the threaded screw is 40 mm and the pitch 8 mm. The load is 20 kN and it does not rotate with the screw but it carried on a swivel head having a bearing diameter of 70 mm. The coefficient of friction between the swivel head and the spindle is 0.08 and between the screw and the nut 0.1. Determine the total torque required to raise the load and efficiency.

(OR)

- b. A power of 60 kw is transmitted by a multiple clutch at 1500 rpm. Axial intensity of pressure is not to exceed  $0.15 \text{ N/mm}^2$ . The coefficient of friction for the friction surfaces is 0.15. The external radius of the friction surface is 120 mm. Also the external radius is equal to 1.25 times the internal radius. Find the number of plates needed to transmit the required power. Assume uniform wear.

14. a. The annulus 'A' in the gear shown in the figure rotates at 300 rpm about the axis of the fixed wheel S which has 80 teeth. The three armed spider (only one arm 'a' is driven at 180 rpm). Determine the number of teeth required on the wheel 'P'.



(OR)

- b. i. An aeroplane flying at 240 km/hr turns toward left and completes a quarter circle of 60 m radius. The mass of the rotary engine and the propeller of the plane amounts to 450 kg with a radius of gyration of 320 mm. The engine speed is 2000 rpm clockwise when viewed from the rear. Determine the gyroscopic couple on the aircraft and state its effect. In what way is the effect changed when an aeroplane turns towards right, the engine rotates clockwise when viewed from the front (nose end) and the aeroplane turns left and then right.
- ii. Derive the effect of gyroscopic couple in 4-wheeled vehicle.