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B.Tech. DEGREE EXAMINATION, NOVEMBER 2013
Seventh 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. Define Rubbing velocity at a pin joint.
2. List the three types of instantaneous centres for a mechanism.
3. Define the following terms as applied to a cam.
(i) Base circle (ii) Pressure angle
4. What is Pantograph?
5. Define the following:
(i) Limiting friction (ii) Static friction
6. What is the application of gyroscopic principles to aircrafts?
7. Mention the various types of gear trains.
8. Define Coefficient of fluctuation of energy.
9. What is the function of a flywheel?
10. Why is balancing of rotating parts necessary for high speed engines?

PART – B (5 × 16 = 80 Marks)

11. a. The crank of a slider crank mechanism rotates crank clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine
(i) Linear velocity and acceleration of the midpoint of the connecting rod.

b. The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 300 rpm clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 1855 m/hrs. Calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 sec. and the total angular displacements between the two extreme positions of pitching is 12°. Find the maximum acceleration during pitching motion.

15. a. The equation of the turing moment curve of a three crank engine is $(5000+1500 \sin 3\theta)$ N-m where θ is the crank angle in radian. The moment of inertia of the flywheel is 1000 kg-m^2 and the mean speed is 300 rpm. Calculate (i) power of the engine (ii) the maximum fluctuation of the speed of the flywheel in percentage when the resisting torque is constant and the resisting torque is $(5000 + 600 \sin \theta)$ N-m.

(OR)

b. Four masses A, B, C and D as given below are to be completely balanced. $m_b = 30 \text{ kg}$, $m_c = 50 \text{ kg}$, $m_D = 40 \text{ kg}$ and $r_a = 180 \text{ mm}$, $r_b = 240 \text{ mm}$, $r_c = 120 \text{ mm}$, $r_D = 150 \text{ mm}$. The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°, B and C makes angles of 210° and 120° respectively with D in the same sense. Find (i) magnitude and the angular position of mass A and (ii) the position of planes A and D.

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- (ii) Angular velocity and angular acceleration of the connecting rod at a crank angle of 45° from inner dead center position.

(OR)

- b. Write short notes on the following inversion mechanisms with neat sketch:
- (i) Pendulum pump (or) Bull engine (5 Marks)
 - (ii) Oscillating cylinder engine (5 Marks)
 - (iii) Elliptical trammels (6 Marks)

12. a. A cam drives a flat reciprocating follower in the following manner. During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

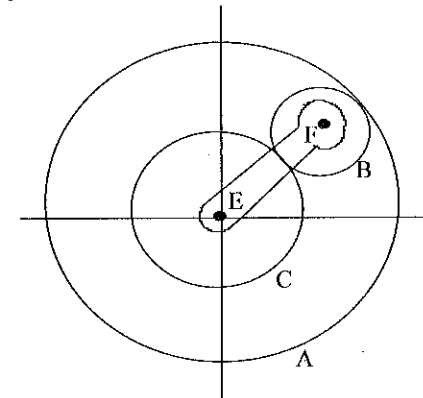
(OR)

- b. Show the expression for simple steering gear mechanism $\cot\phi - \cot\theta = c/b$, where c is the distance between the pivots of the front axle and b is wheel base.
13. a. A square threaded bolt of root radius 22.5 mm and pitch 10 mm is tightened by screwing a nut whose mean diameter of bearing surface is 50 mm. If coefficient of friction for nut and bolt is 0.1 and for nut and bearing surface 0.16. Find the force required at the end of a spanner 500 mm long when the load on the bolt is 10 kN.

(OR)

- b. A dry single plate clutch is to be designed for an automotive vehicle whose engine is rated to give 100 kW at 2400 rpm and maximum torque 500 N-m. The outer radius of friction plate is 25% more than the inner radius. The intensity of pressure between the plate is not to exceed 0.07 N/mm^2 . The coefficient of friction may be assumed equal to 0.3. The helical springs required by this clutch to provide axial force necessary to engage the clutch are eight. If each spring has stiffness equal to 40 N/mm, determine the initial compression in the springs and dimensions of the friction plate.

14. a. An epicyclic gear train consists of three gears A, B and C as shown in figure. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 rpm. If the gear A is fixed, determine the speed of gears B and C.



(OR)