



B.E DEGREE EXAMINATIONS: JUNE 2015

(Regulation 2009)

Third Semester

AUTOMOBILE ENGINEERING

AUE101: Mechanics of machines

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The method of obtaining different mechanisms by fixing different links in a kinematic chain is known as
 - a) Actuator
 - b) Inversion of the mechanism
 - c) Kinematic Chain
 - d) Compound mechanism
2. The instantaneous centre of rotation of a circular disc rolling on a straight path is
 - a) At their point of contact
 - b) At infinity
 - c) At the centre of gravity of the disc
 - d) At the centre of the disc
3. The friction that exists when one surface slides over another surface is known as
 - a) Rolling friction
 - b) Sliding friction
 - c) Fluid friction
 - d) Dynamic friction
4. The ratio between the velocities of the driver and the follower or driven is known as
 - a) Speed ratio
 - b) Belt Ratio
 - c) Acceleration ratio
 - d) Velocity Ratio
5. A differential gear in auto mobiles is used to -----
 - a) Assist in changing speed
 - b) Provide jerk free movement of vehicle
 - c) Reduce speed
 - d) Help in turning
6. The size of the cam depends on
 - a) Base circle
 - b) Prime circle
 - c) Pitch circle
 - d) Pitch curve
7. Select a condition to have a complete balance of the several revolving masses in different planes
 - a) resultant force $\neq 0$
 - b) resultant moment = 0
 - c) resultant couple $\neq 0$
 - d) resultant force = 0

lever is 700 mm, what would be the length of the stroke, assuming that the line of the stroke passes through the extreme positions of the free end of the slotted lever?

22. a) In a thrust bearing the external and internal radii of the contact surfaces are 210mm and 160mm respectively. The total axial load is 60 kN and co-efficient of friction = 0.05. The shaft is rotating at 380 r.p.m. Intensity of pressure is not to exceed 350 kN/m^2 . calculate :
- (i) Power lost in overcoming the friction
 - (ii) Number of collars required for the thrust bearing.

(OR)

- b) A 100 mm wide and 100 mm thick belt transmits 5 kW between two parallel shafts. The distance between the shaft centers is 1.5 m and the diameter of the smaller pulley is 440 mm. The driving and the driven shafts rotate at 60 rpm and 150 rpm respectively. Find the stress in the belt if the two pulleys are connected by : (i) an open belt, and (ii) a cross belt. The coefficient of friction is 0.22.

23. a) (i) What do you mean by gear train? Mention the different types of the gear train. (6)
Explain the term train value. How is it related to velocity ratio?
- (ii) Determine the number of teeth and speed of the driver if the driver gear has 60 (8)
teeth of 8mm module and rotates at 240 rpm. The two spur gears have a velocity ratio of $1/4$. Also calculate the pitch line velocities.

(OR)

- b) A cam rotating clockwise with a uniform speed is to give the roller follower of 20 mm diameter the following motion :
- (a) Follower to move outwards through a distance of 30 mm during 120° of cam rotation.
 - (b) Follower to dwell for 60° of cam rotation.
 - (c) Follower- to return to its initial position during 90° of cam rotation.
 - (d) Follower to dwell for the remaining 90° of cam rotation.
- The minimum radius of cam is 45 mm and the line of stroke of the follower is off set 15 mm from the axis of the cam and the displacement of the follower is to take place with simple harmonic motion on both the outward and return strokes. Draw the cam profile.

24. a) (i) Explain field balancing of large rotors. (4)
- (ii) A shaft carries three pulleys A, B and C. The distance between A and B is 600 mm and that between B and C is 1200 mm. The pulleys A, B and C weigh 25 N, 20 N and 30 N respectively. Each of these pulleys has eccentricity equal to 25 mm. The angular position of out of balance masses in pulleys B and C with respect to that in pulley A are 90° and 210° respectively. Determine balancing masses to revolve each at radii 125 mm in two planes located mid way between the pulleys. (10)

(OR)

- b) (i) Examine whether a six cylinder Inline I.C. engine which is being used in buses and trucks is balanced or not. If it is not balanced, determine the magnitude of unbalance. (6)
- (ii) The arms of a Porter governor are each 25 cm long and pivoted on the governor axis. The mass of each ball is 5 kg and mass of central load on the sleeve is 30 kg. The radius of rotation of the balls is 15 cm when the sleeve begins to rise and reaches a value of 20 cm for the maximum speed. Determine speed range. (8)
25. a) (i) Explain free vibrations and forced vibrations with neat sketch. What do you understand by damped vibrations? (6)
- (ii) A shaft 60mm diameter and 3m long is simply supported at the ends and carries three vertical loads 1100N, 1600N and 800N at 1m, 2m and 2.5m from the left support. The young's modulus of elasticity for shaft material is 200 GN/m^2 . Find the frequency of transverse vibration. (8)

(OR)

- b) A reciprocating IC engine is coupled to a centrifugal pump through a pair of gears. The shaft from the flywheel of the engine to the gear wheel has a 52mm diameter and is 900mm long. The shaft from the pinion to the pump has 38 mm diameter and is 300mm long. Pump speed is four times the engine speed. Moments of inertia of fly wheel, gear wheel, pinion and pump impeller are 1000 kg-m^2 , 14 kg-m^2 , 5 kg-m^2 and 18 kg-m^2 respectively. Find the natural frequency of the torsional Oscillations of the system. $G = 80 \text{ GN/m}^2$.
