

CBCS SCHEME

21AE/AS51

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Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024

Mechanism & Machine Theory

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define the following :
- (i) Kinematic link
 - (ii) Kinematic pair
 - (iii) Structure
 - (iv) Mechanism
 - (v) Degree of freedom. (10 Marks)
- b. With the help of neat sketches, explain the following :
- (i) Peaucellier's mechanism. (10 Marks)
 - (ii) Ratchet and Pawl mechanism. (10 Marks)

OR

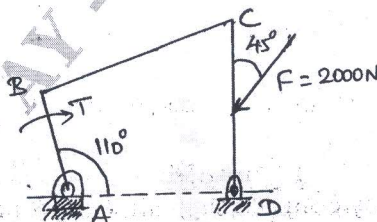
- 2 a. Explain the following inversions :
- (i) Crank and Slotted lever mechanism. (10 Marks)
 - (ii) Beam engine (10 Marks)
- b. Illustrate the Gnome engine and explain its inversion. (10 Marks)

Module-2

- 3 In a four-bar mechanism ABCD, the link lengths are as follows :
Input link AB = 25 mm, Coupler link BC = 85 mm,
Output link CD = 50 mm, Frame AD = 60 mm.
The angle between the frame and the input link is 100° measured anticlockwise. The velocity of point B is 1.25 m/s in the clockwise direction.
- (i) Sketch the mechanism.
 - (ii) Find the angular velocity and angular acceleration of links BC and CD.
 - (iii) Determine the velocity and acceleration of the mid-point of the link BC. (20 Marks)

OR

- 4 a. Explain the static force analysis in slider crank mechanism with two known forces. (10 Marks)
- b. A four bar chain mechanism ABCD is shown in Fig. Q4 (b). Calculate the required value of Torque (T) and all the constraint forces on links for static equilibrium of the mechanism, if $F = 2000\text{ N}$ in the direction shown. The dimensions of linkages are as follows :



AB = 200 mm
BC = 370 mm
CD = 250 mm
AD = 215 mm
CE = 100 mm

Fig. Q4 (b)

(10 Marks)

Module-3

- 5 a. Explain the classifications of Gear. (06 Marks)
- b. Two mating gear have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum of each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length.
- The addendum height for each gear wheel.
 - The length of path of contact.
 - The length of arc of contact.
 - The contact ratio.
- (14 Marks)

OR

- 6 a. In an epicyclic gear train as shown in Fig. Q6 (a), the number of teeth on gear wheel A, B and C are 48, 24 and 50 respectively. If the arm rotates at 400 rpm clockwise, find
- Speed of gear wheel C when A is fixed and
 - Speed of gear wheel A when C is fixed.
- (14 Marks)

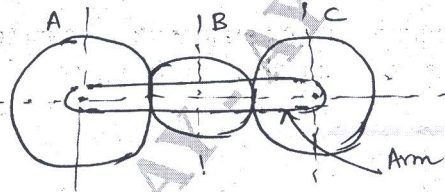


Fig. Q6 (a)

- b. With help of neat sketch, explain Compound Gear Train. (06 Marks)

Module-4

- 7 a. Define Balancing. Explain in detail and its types. (06 Marks)
- b. A rigid motor has all its unbalance in one plane and can be considered to consist of three masses, $m_1 = 5$ kg, $m_2 = 3$ kg, at an angle of 165° counter clockwise from a m_1 and $m_3 = 8$ kg, at angle 85° clockwise from m_1 . The radii, $r_1 = 20$ cm, $r_2 = 8$ cm, $r_3 = 14$ cm. Determine the balancing mass required at a radius of 10 cm. Specify the location of this mass with respect to m_1 . (14 Marks)

OR

- 8 A four cylinder inline marine oil engine has cranks at angular displacement of 90° . The outer cranks are 3 m apart and inner cranks are 1.2 m apart. The inner cranks are placed symmetrically between the outer cranks. The length of each crank is 450 mm. If the engine runs at 90 rpm and the mass of reciprocating parts for each cylinder is 900 kg, find the firing order of the cylinders for the best primary balancing forces of reciprocating masses. Determine the maximum unbalanced primary couple for the best arrangement. (20 Marks)

Module-5

- 9 a. Define governor and list the classification of governors. (08 Marks)
- b. In a porter governor the arms and links are each 10 cm long and intersect on the main axis. Mass of each ball is 9 kg and the central mass is 40 kg. When the sleeve is in its lowest position the arms are inclined at 30° to the axis. The lift of the sleeve is 2 cm. What is the force of friction at the sleeve, if the speed at the beginning of ascend from the lowest position is equal to the speed at the beginning of descend from the highest position. What is the range of speed of governor, if all other things remains same. (12 Marks)

OR

- 10 a. Define gyroscopic couple and explain the effect of gyroscope in airplanes. (10 Marks)
- b. An aeroplane makes a complete quarter circle of 40 m radius towards left when flying at 175 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 2500 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft. What will be the effect if the airplane turns towards right instead of left? (10 Marks)
