Hall Ticket No | | | | | | | | | | | Question Paper Code:AAEB43

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
(Dundigal-500043, Hyderabad)

B.Tech VI SEMESTER END EXAMINATIONS (SUPPLEMENTARY) - DECEMBER 2022

Regulation:R18

MECHANISM AND MACHINE DESIGN

Time: 3 Hours **(AERONAUTICAL ENGINEERING)** **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain any three inversions of single slider crank chain with neat sketches out of the available inversions. [BL: Understand| CO: 1|Marks: 7]

   (b) A Whitworth quick return motion mechanism, as shown in Figure 1 has the following particulars: Length of stroke = 150 mm; Driving crank length = 40 mm; Time of cutting stroke/ Time of return stroke = 2; Find the lengths of CD and PD and determine the angles $\alpha$and β. [BL: Apply| CO: 1|Marks: 7]

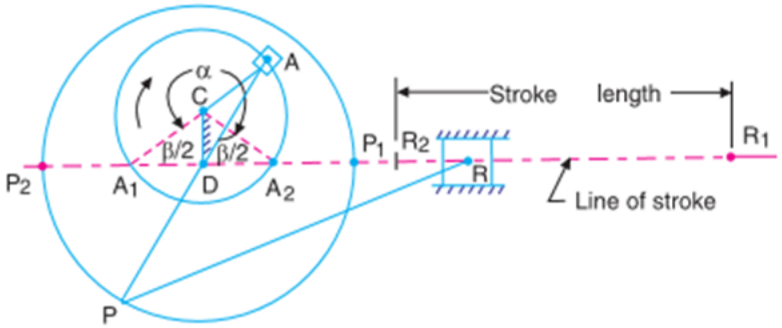

Figure 1

2. (a) Discuss about different types of constrained motions widely used in various mechanisms with examples. [BL: Understand| CO: 1|Marks: 7]

   (b) In a crank and slotted lever quick return mechanism, as shown in Figure 2 the driving crank length is 75 mm. The distance between the fixed centres is 200 mm and the length of the slotted lever is 500 mm. Find the ratio of the times taken on the cutting and idle strokes. Determine the effective stroke also. [BL: Apply| CO: 1|Marks: 7]

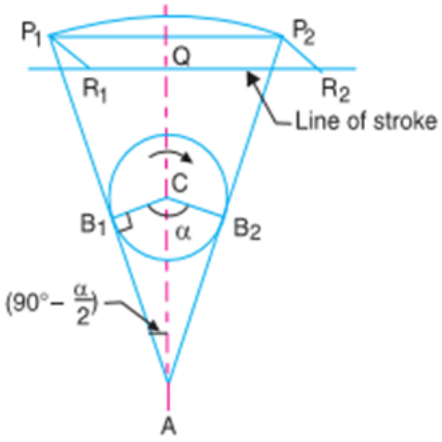

Figure 2

MODULE – II

3. (a) Mention different types of instantaneous centres used for a mechanism with examples of each. [BL: Understand| CO: 2|Marks: 7]

   (b) A four-bar mechanism has links AB = 300 mm, BC = CD = 360 mm and AD = 600 mm. Angle $\angle BAD = 60^0$, Crank AB rotates in CW direction at a speed of 100 rpm. Locate all the instantaneous centers and determine the angular velocity of link BC. [BL: Apply| CO: 2|Marks: 7]

4. (a) Describe velocities in slider crank mechanism with neat sketches of slider crank mechanism and velocity diagram. [BL: Understand| CO: 2|Marks: 7]

   (b) A slider crank mechanism has lengths of crank and connecting rod equal to 40mm and 200mm respectively, locate all the instantaneous centers of the mechanism for the position of the crank when it has turned through 30^0 from instantanious center. Also find velocity of slider and angular velocity of connecting rod if crank rotates at 40 rad/sec. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

5. (a) Illustrate in detail with a neat figure about the cylindrical cam with reciprocating follower and cylindrical cam with oscillating follower. [BL: Understand| CO: 3|Marks: 7]

   (b) Draw the profile of a cam operating a knife-edged follower having a lift of 30 mm. The cam raises the flower with SHM for 150^0 of its rotation followed by a period of dwell for 60^0. The follower descends or the next 100^0 rotation of the cam with uniform velocity, again followed by a dwell period. The cam rotates at uniform velocity of 120 rpm and has the least radius of 20 mm. what will be the maximum velocity and acceleration of the follower during the lift and return. [BL: Apply| CO: 3|Marks: 7]

6. (a) Classify different types of belts used in these days to transmit power from one shaft to another by means of pulleys. [BL: Understand| CO: 4|Marks: 7]

   (b) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160° and maximum tension in the belt is 2500 N. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

7. (a) State and prove law of gearing with a condition for constant velocity ratio of toothed wheels. Show that involute profile satisfies the conditions for correct gearing.
[BL: Understand| CO: 5|Marks: 7]

   (b) A pair of gears having 20^0 involute teeth is required to transmit motion at a velocity ratio of 1:4. If the module of both pinion and gear is 5 mm and centre distance is 250 mm. Determine the number of teeth & base circle radius of pinion and gear. Take addendum as 1 module.
[BL: Apply| CO: 5|Marks: 7]

8. (a) Explain in detail about epicyclic gear train with a neat sketch and mention its specific applications.
[BL: Understand| CO: 5|Marks: 7]

   (b) An epicyclic gear consists of 3 gears A, B and C as shown in Figure 3. 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. [BL: Apply| CO: 5|Marks: 7]

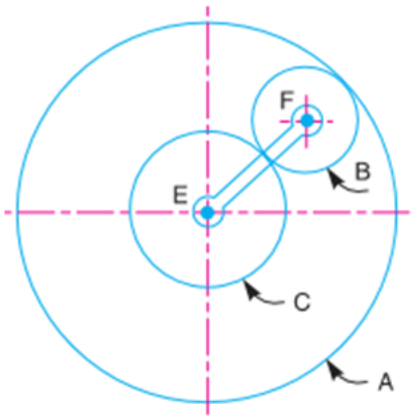

Figure 3

MODULE – V

9. (a) Summarize the concepts "plane of spinning" and "plane of precession" from gyroscopic couple by considering a disc spinning with an angular velocity. [BL: Understand| CO: 6|Marks: 7]

   (b) A shaft of mass 500 kg revolving about its geometric axis. If the centre of mass has an eccentricity of 90 mm. Determine the balancing masses required at a radial distance of 120 mm and 150 mm. When i) The two balancing masses attach on the same side ii) The two balancing masses attach on the opposite side. The distance between two balancing masses is 6 m and distance between first balancing mass and disturbing mass is 2 m. [BL: Apply| CO: 6|Marks: 7]

10. (a) Elaborate the effect of the gyroscopic couple on an aeroplane when an aeroplane is taking left turn and right turn. [BL: Understand| CO: 6|Marks: 7]

    (b) The heavy turbine rotor of a sea vessel rotates at 1500 r.p.m. clockwise looking from the stern, its mass being 750 kg. The vessel pitches with an angular velocity of 1 rad/s. Demonstrate the gyroscopic couple transmitted to the hull when bow is rising, if the radius of gyration for the rotor is 250 mm. Also show in what direction the couple acts on the hull? [BL: Apply| CO: 6|Marks: 7]

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