B. TECH
(SEM VI) THEORY EXAMINATION 2022-23
THEORY OF MACHINE

Time: 3 Hours   *Total Marks: 100*
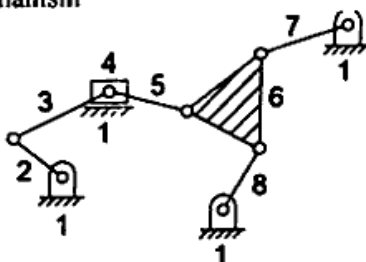
Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.**   2 x 10 = 20

a.   Find DOF of the given mechanism

b.   What do you understand by instantaneous Centre?

c.   What is the difference between radial follower & offset follower?

d.   Write the statement of law of gearing.

e.   Explain D'Alembert's principle.

f.   How function of flywheel is different from governors? Briefly explain.

g.   What do you mean by hunting of governor?

h.   Briefly explain Hammer-blow.

i.   What is dynamometer & why it is used?

j.   Write a note on hydrodynamic lubrication.

SECTION B

2. **Attempt any *three* of the following:**   10x3=30

a.   What do you understand by inversions of mechanism? Describe various inversions of 4 bar chain by giving examples.

b.   Derive the expression for minimum number of teeth required on gear & pinion to avoid interference.

c.   Describe the working of a band and block brake with the help of a neat sketch. Also derive the relation for ratio of tight & slack side tensions.

d.   Each ball of Porter governor has a mass of 3 kg and the mass of the sleeve is 15 kg. The governor has equal arms, each of 200-mm length and pivoted on the axis of rotation. When the radius of rotation of the balls is 120 mm, the sleeve begins to rise up 160 mm at the maximum speed. Determine the
(i) range of speed
(ii) lift of the sleeve
(iii) effort of the governor
(iv) power of the governor
What will be the effect of friction at the sleeve if it is equivalent to 8 N?

c. With the help of suitable diagram, derive the expression for velocity & acceleration of the piston of reciprocating engine.

SECTION C

3. **Attempt any *one* part of the following:** 10x1=10

a. In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°.
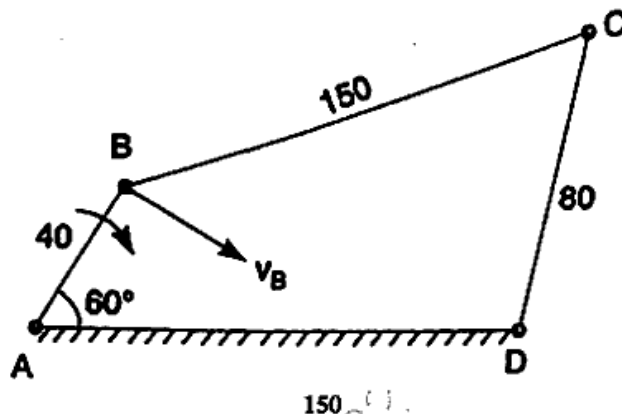

b. In a slider-crank mechanism, the crank is 480 mm long and rotates at 20 rad/s in the counter-clockwise direction. The length of the connecting rod is 1.6 m. When the crank turns 60° from the inner-dead centre, determine:
   (i) velocity of the slider
   (ii) velocity of a point E located at a distance 450 mm on the connecting rod extended.
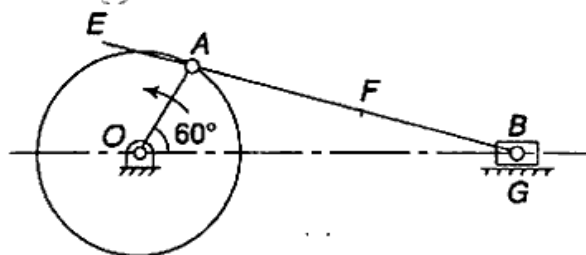
4. **Attempt any *one* part of the following:** 10x1=10

a. The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.
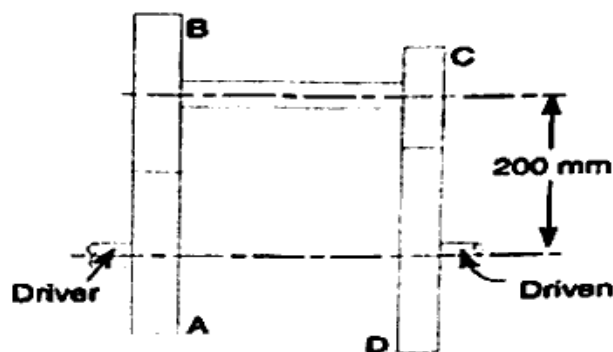
b. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below:
1. To move outwards through 40 mm during 100° rotation of the cam;
2. To dwell for next 80°;
3. To return to its starting position during next 90°,
4. To dwell for the rest period of a revolution.
Draw the profile of the cam when the line of stroke of the follower is off-set by 15 mm.

5. **Attempt any *one* part of the following:**   10x1=10

a. A horizontal cross compound steam engine develops 300 KW at 90 rpm. The coefficient of fluctuation of energy as found from the turning moment diagram is to be 0.1 and the fluctuation of speed is to be kept within ± 0.5% of the mean speed. Find the weight of the flywheel required, if the radius of gyration is 2 meters.

b. A petrol engine has a stroke of 120mm and connecting rod is 3 times the crank length. The crank rotates at 1500 rpm clockwise direction.
Determine:
    (i)   Velocity and acceleration of the piston
    (ii)   Angular velocity and angular acceleration of the connecting rod, when the piston has travelled one-fourth of its stroke from IDC.

6. **Attempt any *one* part of the following:**   10x1=10

a. Derive the expression for height of Watt governor. Write a note on inertia governor.

b. Four masses M1, M2, M3 & M4 are 200 kg, 300 kg, 240 kg & 260 kg respectively. The corresponding radii of rotations are 0.2 m. 0.15 m, 0.25 m and 0.3 m respectively & the angles between successive masses 45°, 75° and 135°. Find the position and magnitude. Find the position & magnitude of balance mass required, if its radius of rotation is 0.2 m. https://www.aktuonline.com

7. **Attempt any *one* part of the following:**   10x1=10

a. The turbine rotor of a ship has a mass of 2.2 tones and rotates at 1800 clockwise when viewed from the aft.The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when the
(i) ship turns right at a radius of 250 m with a speed of 25 km/h
(ii) ship pitches with the bow rising at an angular velocity of 0.8 rad/s
(iii)ship rolls at an angular velocity of 0.1 rad/s

b. Explain the construction & working of hydraulic dynamometer. Also mention its advantages.