B. Tech.

(SEM. IV) EXAMINATION, 2006-07

THEORY OF MACHINES

Time: 3 Hours] [Total Marks: 100

1 Attempt any two: 10x2=20

(a) A linkage has 14 links and the number of loops is 5. Calculate its degrees of freedom, number of joints and maximum number of ternary links that can be had. Assume that all the pairs are turning pairs.

(b) Explain with help of neat sketch a slider crank chain and its inversions.

(c) Draw the velocity polygon for the mechanism shown in Fig. 1. Find the angular velocity of AB. The ratio of EC/EB = 90/130

(d) Locate all the instances centers of the slider crank mechanism. The lengths of crank OB and connecting rod AB are 100 mm & 400 mm respectively. Crank OB makes an angle

[Contd...]
of 45° with OA and rotates with an angular velocity 10 rad/s such that piston moves towards the BDC. Find (i) Velocity of the slider A, and (ii) Angular velocity of the connecting rod AB.

2 Attempt any two:
(a) Explain how the coriolis component of acceleration arises when a point is rotating about some other fixed point and at the same time its distance from the fixed point varies.
(b) What is the condition of obtaining exact straight line in mechanisms? Discuss two important exact straight line motion mechanisms with neat sketches.
(c) The engine mechanism shown in Fig. 2 has crank OB=50 mm & length of connecting rod AB = 225 mm. The centre of gravity of the rod is at G which is 75 mm from B. The engine speed is 200 rpm for the position shown, find the acceleration of G and angular acceleration of AB using Klien's construction method.

![Fig. 2](image)

3 Attempt any two:
(a) (i) Discuss briefly different types of cams and followers with neat sketches. Mention the applications of these cams and followers.
(ii) Derive an expression for minimum number of teeth required on a pinion to avoid interference in involute gear teeth.

V-4085] 2 [Contd..
(b) A cam with a minimum radius of 50 mm, rotating clockwise at a uniform speed in outword stroke and SHM while returning is required to give a knife edge follower the motion as describe below:
   i) To move outwards through 40 mm during 100° rotation of the cam; (ii) To dwell for next 80°; (iii) To return to its starting position during next 90° and (4) to dwell for the rest period of revolution.
   Draw the displacement, velocity and acceleration diagram for one complete revolution of the cam. Determine the maximum velocities and acceleration of the follower when cam shaft rotates at 900 rpm

(c) (i) What do you understand by 'Gear train'? Discuss the various type of gear trains.
   (ii) State and prove the law of gearing.

4 Attempt any two:

(a) A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6 kW through belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt if it is a cross belt drive table μ = 0.3.

(b) (i) Explain the terms "static balancing" and "dynamic balancing".
   (ii) Explain the terms "fluctuation of energy" and "fluctuation of speed" as applied to flywheels.

(c) A single cylinder reciprocating engine has a reciprocating mass of 60 kg. The crank rotates at 60 rpm and the stroke is 320 mm mass of the revolving parts at 160 mm radius is 40 kg. If two-thirds of the reciprocating parts and the...
whole of the revolving parts are to be balanced, determine:
(i) The balance mass required at a radius of 350 mm.
(ii) The unbalanced force when the crank has turned 50° from the top dead centre.

5 Attempt any two:

(a) The upper arms of a porter governor have lengths 350 mm and are pivoted on the axis of rotation. The lower arms have lengths 300 mm and are attached to the sleeve of a distance of 40 mm from the axis. Each ball has a mass of 4 kg, and mass on the sleeve is 45 kg. Determine the equilibrium speed for radius of rotation of 200 mm and find also the effort and power of the governor for 1 per cent speed charge.

(b) The movement of inertia of an aeroplane air screw is 20kg.m² and the speed of rotation 1000 rpm clockwise when seen from the front. The speed of the flight is 200 km per hour. Find the gyroscopic reaction of the air screw on the aeroplane when it makes a left handed turn on a path of 150 m radius.

(c) A machine weighs 18 kg and is supported on springs and dash ports. The total stiffness of the springs is 12N/MM and damping is 0.2 N/M m/s. The system is initially at rest and a velocity of 120 mm/s is imparted to the mass. Determine.
(i) The displacement and velocity of mass a function of time
(ii) The displacement and velocity offer 0.4 s.