



This exam measures the following ILOs(a4,a13,a19,b2,b17,c7)

ANSWER THE FOLLOWING QUESTIONS:-(85 MARKS) (MARKS)

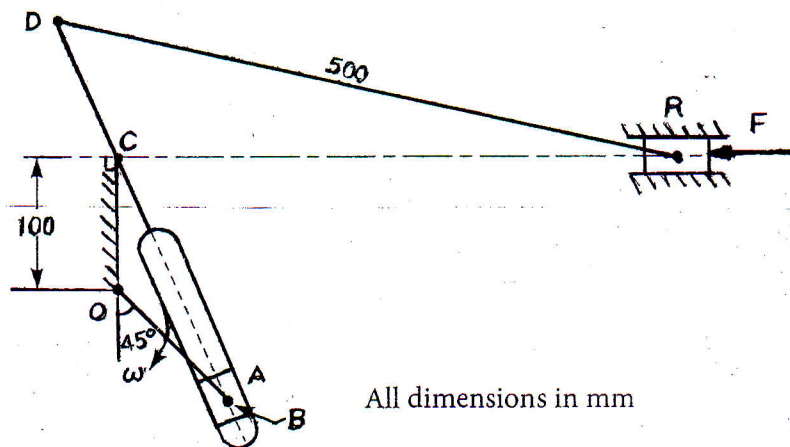
Question No.1 (25 marks)

- a)What is a machine ? (5)
- b)In a Whitworth quick return motion as shown in Fig.1, OA is a crank rotating at constant speed 30 rpm in clockwise direction. The dimensions of various links are: OA =150 mm, OC =100 mm, CD =125 mm, and DR =500 mm. Determine:
 - 1-The velocity and acceleration of the sliding block R.
 - 2-The torque required on the crank OA to maintain static force equilibrium, if a force of 2 kN acts on the block R as shown in Fig.1. (20)

Question No. 2 (20 marks)

- a)Define the function of the flywheel ? (5)
- b)The torque exerted on the crank-shaft of an engine is given by the equation;

$$T = 100 + 50 \sin 2\theta - 25 \cos 2\theta \quad \text{N.m}$$
 Where θ is the crank angle displacement from the inner dead center. Assuming the resisting torque to be constant and the engine with two stroke. Determine:-
 - a)The horse power HP of the engine when the speed is 300 rpm.
 - b)The mass of the flywheel, of radius of gyration 0.25 m, if the speed variation is not exceed $\pm 0.6 \%$ of the mean speed , and
 - c)The angular acceleration of the flywheel when the crank has turned through 60° from the inner dead center. (15)



All dimensions in mm

Fig.1

Please see page no. 2

Question No.3 (25 marks)

40

a) Find the path of contact and the contact ratio for a smaller gear of ~~36~~ ⁴⁰ teeth, (its pitch circle radius is 5 cm and addendum circle radius is 5.25 cm), drives a wheel of 80 teeth, (its pitch circle radius is 10 cm and addendum circle radius 10.25 cm)), at pressure angle 20° . Also, determine the maximum sliding velocity between the teeth if the pinion (smaller gear) rotates at 200 rpm. (10)

b) Determine the speed and direction of rotation of gear (A) in the planetary gear train shown in Fig.2, if the speed of gear (H) is 50 rpm in clockwise direction and speed of the arm-(a) is 100 rpm in clockwise direction and the teeth numbers of the gears are as follows:

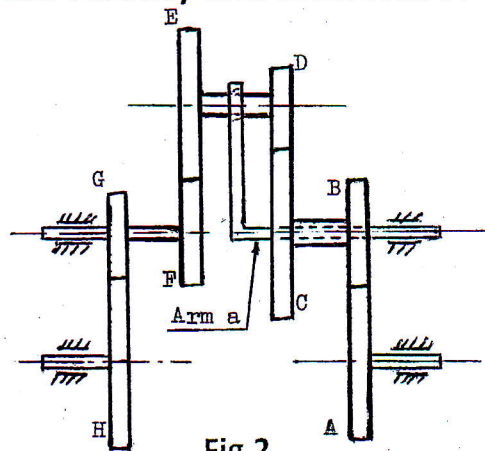
$T_A = 24, T_B = 30, T_C = 60, T_D = 52, T_E = 72, T_G = 18, T_H = 36$ Teeth (15)

Question No. 4 (15 marks)

A cam rotating clockwise at a uniform speed of 1000 rpm is required to give a roller follower the motion that defined below:

- 1-Follower to move outward through 50 mm during 120° of the cam rotation,
- 2-Follower to dwell for next 60° of cam rotation,
- 3-Follower to return to its starting position during next 90° of cam rotation,
- 4-Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 50 mm and the diameter of roller is 10 mm. The line of stroke of the follower is off-set by 20 mm from the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, draw the profile of the cam and find the maximum velocity and acceleration during outward stroke and return stroke. (15)



GOOD LUCK
With our best wishes

This exam measures the following ILOs									
Question Number									
Skills	Knowledge & Understanding Skills			Intellectual Skills			Professional Skills		