



This exam measures the following ILOs(  $a_4, a_{13}, a_{19}, b_2, b_{17}, c_7$  )

ANSWER THE FOLLOWING QUESTIONS :- ( 85 MARKS )

( MARKS )

**Question No. 1 :-**

A- The driving crank **AB** of the quick-return mechanism, as shown in **Fig.1**, revolves at a uniform speed of **200 rpm**. Find the velocity and acceleration of the tool-box **R**, in the position shown in the figure, when the crank makes an angle of  $60^\circ$  with the vertical line of center **PA**. Also, what is the acceleration of sliding of the block at **B** along the slotted lever **PQ**. (15)

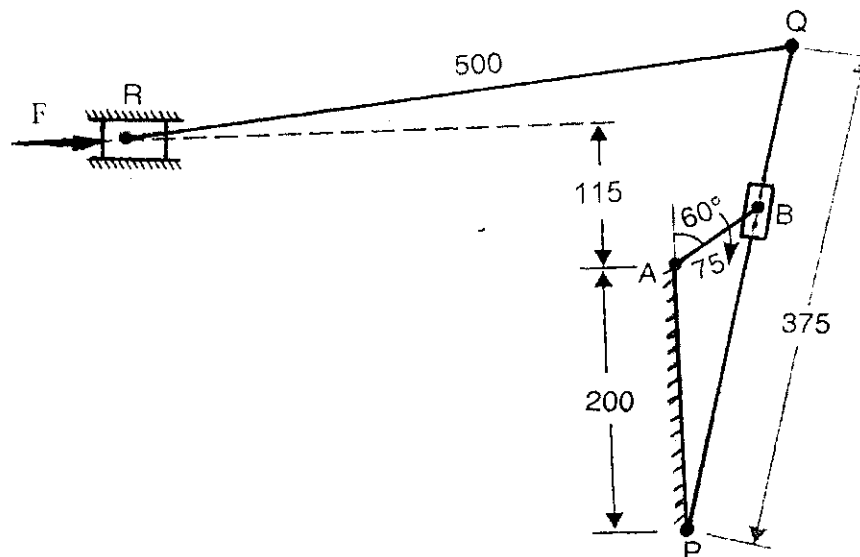
B- As show in **Fig.1**, for a horizontal force  $F = 5 \text{ kN}$  at the tool-box **R**, find the torque applied to the crank **AB** to maintain the mechanism in static equilibrium. (10)

( 20 )

**Question No. 2 :-**

The variation of crank shaft torque of **4-cylinder** petrol engine may be approximately represented by taking increase uniformly from **zero** to **480 N.m** during the half revolution, then decrease uniformly to **240 N.m** during the next half revolution. It then remain constant for the following one revolution. This cycle being repeated in every two revolutions. The average speed is **400 rpm**. Supposing that the engine drives a machine requiring a constant torque, determine:-

- A - The mass of the flywheel, of radius of gyration **0.6 m** to limit the total speed variation to **4** revolutions, and
- B - The horse power necessary to drive the machine.



All dimensions in mm

Fig.1

Please see page no. 2

**Question No. 3 :-**

( 20 )

A – Two gear wheels of 6 module have 28 and 72 teeth respectively. The pressure angle is  $20^\circ$  and each wheel has a standard addendum of one module . Find the arc of contact and the contact ratio. Also, find the maximum sliding velocity, if the angular velocity of the smaller wheel is 18 rad/s. ( 8 )

B - Determine the number of revolutions of the output shaft (Z) in the planetary gear train shown in Fig.2, when the shaft (Y) is rotating with 300 rpm (c.w) and the arm rotates with 150 rpm (c.w) through the X-axis. If both gears B and C are rotating by same number of revolutions and also the gears D and E are same. (12)

**Question No. 4 :-**

( 20 )

It is required to set out the profile of a cam to give the following motion to the reciprocating follower with a flat mushroom contact face :-

- i – Follower to have a stroke of 20 mm during  $120^\circ$  of cam rotation,
- ii – Follower to dwell for  $30^\circ$  of cam rotation,
- iii – Follower to return to its initial position during  $120^\circ$  of cam rotation and
- iv – Follower to dwell for remaining  $90^\circ$  of cam rotation.

The minimum radius of the cam is 25 mm. The out stroke of the follower is performed with simple harmonic motion and the return stroke with equal uniform acceleration and retardatio

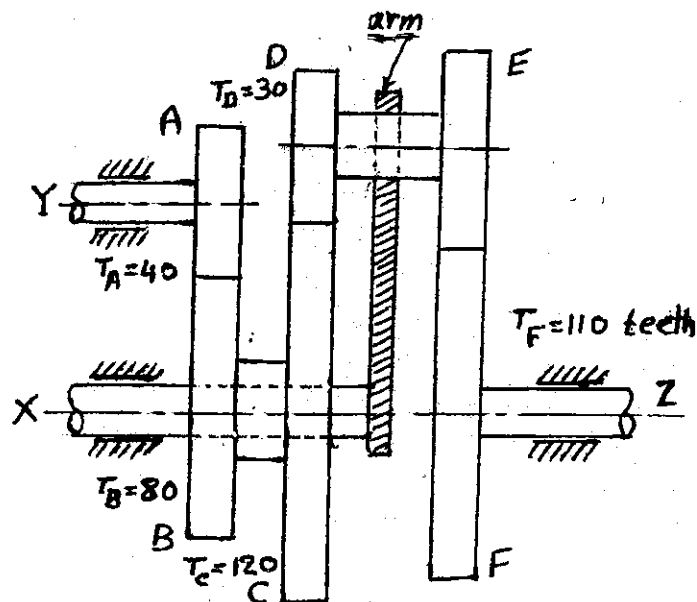


Fig. 2

**GOOD LUCK***With our best wishes.*

This exam measures the following ILOs													
Question Number	Q3-a	Q1	Q1	Q1	Q1	Q2	Q4	-			Q3-b		
Skills	a4-1	a13-1	a13-2	a13-3	a19-1	b2-1	b2-2	b17-1			C7-1		
	Knowledge & Understanding Skills					Intellectual Skills			Professional Skills				