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B.TECH
(SEM V) THEORY EXAMINATION 2017-18
THEORYOF MACHINES I

Time: 3 Hours   *Total Marks: 100*

Note: 1.   Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   Attempt *all* questions in brief.   2 x10 = 20

(a)   What do you understand by interference?
(b)   State the law of gearing.
(c)   What is Klein's construction for four bar & slider crank mechanism?
(d)   State Kennedy's theorem.
(e)   Define for the gear base circle, pitch circle & pressure angle.
(f)   What is centode and axode?
(g)   Draw the velocity acceleration curve for SHM motion of follower in cam.
(h)   Explain velocity ratio & slip for the friction drives..
(i)   What is the cycloidal profile?
(j)   Explain inversions of single slider crank mechanism.

SECTION B

2.   Attempt any *three* of the following: 10 x 3 = 30

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(a)	The crank & connecting rod of a theoretical steam engine are 0.5 m & 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 450 from the inner dead centre position , determine: a)- velocity of piston, b)- angular velocity of connecting rod , c)- velocity of point E on the connecting rod 1.5m from the gudgeon pin, d)- velocity of rubbing at the pins of the crank shaft, crank and crank cross head when the diameters of their pins are 50 mm , 60 mm & 30 mm respectively
(b)	Define mechanical advantage and transmission angle of a mechanism.
(c)	Show that either the cycloidal or the involute shape for the profile of the wheel teeth satisfies the fundamental condition for the transmission of uniform motion. What are the principal advantages of the involute shape over cycloidal shape?
(d)	Draw neat sketch of Hart mechanism. Prove that it produce an exact straight line motion.
(e)	A flat belt is required to transmit 35 kW from a pulley of 1.5 m effective diameter running at 300 rpm . the angle of contact is spread over 11/24 of the circumference and coefficient of friction b/w belt & pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 9.5 mm, density of its material is 1.1×10^3 kg/m^3 & the related permissible working stress is 2.5N/mm^2.

SECTION C

3.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

 (a) An intermediate parallel shaft 'Z' is used for gearing together two shafts 'X' & 'Y' which are co-axis to each other. The gear will connecting X & Z have a module of 2 & those connecting Z & Y a module of 3. The speed of Y is to be about, but less than, 1/12 that of X. If the two pinion have 24 teeth each find suitable no of teeth for the gears & pinions, the actual velocity ratio & the corresponding distance of shaft Z from shaft X.

 (b) Two shaft A & B are coaxial. A gear C (50 teeth) is rigidly mounted on shaft A. A compounded gear D/E gears with C & an internal gear G. Gear D has 20 teeth & gears with C & E has 35 teeth & gears with an internal gear G. Gear G is fixed & is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B: a)- sketch the arrangement , b)- find no of teeth on internal gear G assuming that all gears have the same module, c)- If shaft A rotates at 110 rpm , find the speed of shaft B.

4.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

 (a) A load of l5kN is raised by means of a screw jack. The mean diameter of the square threadis42 mm and the pitch is l0 mm. A force of 120 N is applied at the end of a lever to raise the load. Determine the length of the lever to be used and the mechanical advantage obtained. Is the screw self locking? Take $p = 0.15$.

 (b) Below figure shows Withworth quick return motion.Determine the velocity & Acceleration of slider D.

CD = 50 cm, QB = 26 cm, CQ = 15 cm
CQB = 41 cm, OA = 20 cm, OQ = 10 cm
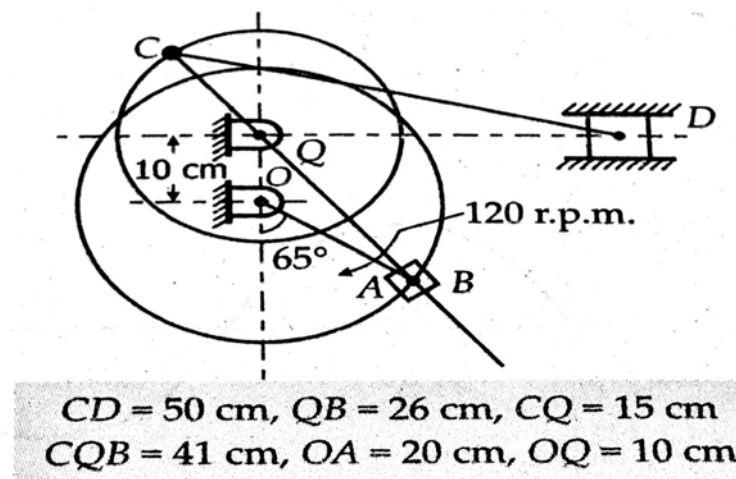
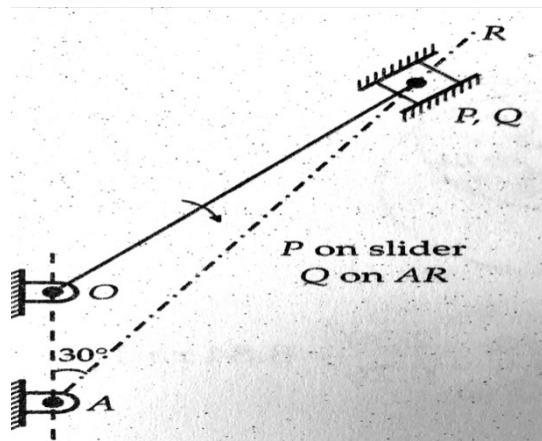**5.**   **Attempt any *one* part of the following:**   **10 x 1 = 10**

 (a) Define mechanical advantage and transmission angle of a mechanism.

 (b) Draw the profile of cam: Cam shaft diameter =40 mm ; least radius of cam = 25mm; diameter of roller= 25mm; angle of lift= 120°; angle of fall =150°; lift of the follower =40mm ; no of pauses are two of equal interval b/w motions.

During the lift the motion is S.H.M during the fall the motion is uniform acceleration & deceleration. The speed of cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the centre of cam

6. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) Determine velocity ratio in Hooke's joint & Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 rpm. If the total permissible variation in speed of the driven shaft is not to exceed ±6% of the mean speed find the greatest permissible angle between the centre lines of the shafts. Calculate also the maximum & minimum speeds of the driven shaft.

(b) One cylinder of an rotary engine is shown in the configuration diagram below. OA is a fixed crank, 200 mm long. OP is connecting road and is 520 mm long. The line of stroke is along AR and at the instant is inclined at 30^0 to the vertical. The body of the engine consisting of cylinders rotate at a uniform speed of 400 r.p.m about the fixed center A. Determine: (a) acceleration of piston (slider) inside the cylinder. (b) angular acceleration of connecting rod.

7. **Attempt any *one* part of the following:** 10 x 1 = 10

(a) A multiplate disc clutch transmits 55kw of power at 1800 rpm .µ for the friction surface is 0.1. axial intensity of pressure is not to exceed 160 kN/m^2.The internal radius is 80 mm & is 0.7 times the external radius. Find the no of plates needed to transmit the required torque.

(b) A pinion having 18 teeth with an internal gear having 72 teeth and pressure angle is 20^0 module is 4 mm addendum of gear & pinion is 3.5 & 8.5 respectively. Find path of contact.