Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, JULY 2016

SUBJECT: THEORY OF MACHINES [MTE 2201]

REVISED CREDIT SYSTEM

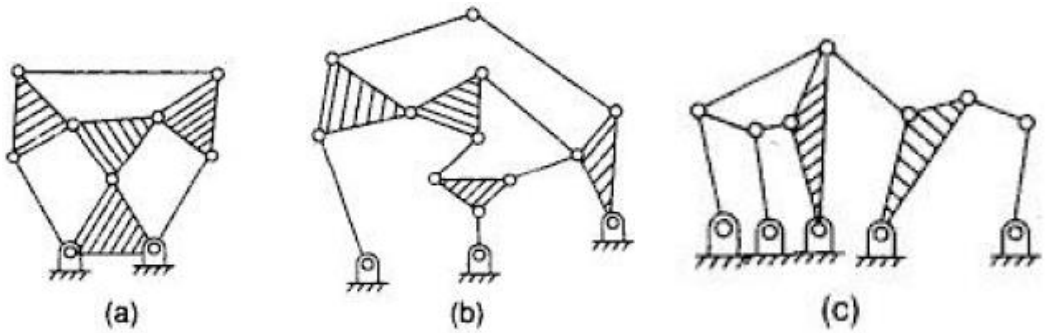
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A How are the kinematic pairs classified? Explain with examples. **4**

1B For the figures A, B, and C of mechanisms shown below, determine whether it is a constrained chain or unconstrained chain or locked chain (rigid frame) by showing appropriate calculations. **3**



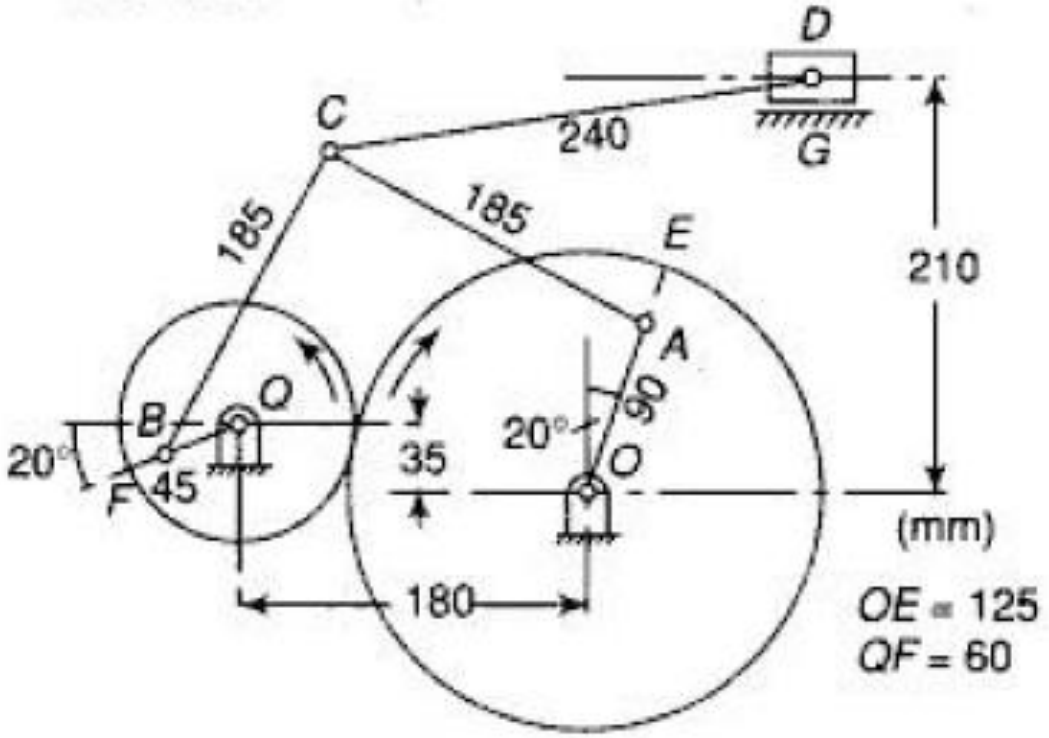
1C The length of the fixed link of a crank and slotted lever mechanism is 250mm and the crank is 100mm. Determine **3**

i. Inclination of slotted lever with the vertical in extreme position.
ii. Ratio of time of cutting stroke to the time of return stroke.

2A An engine mechanism figure is shown below. The crank OA rotates at 100 rpm clockwise. By using graphical approach find : **4**

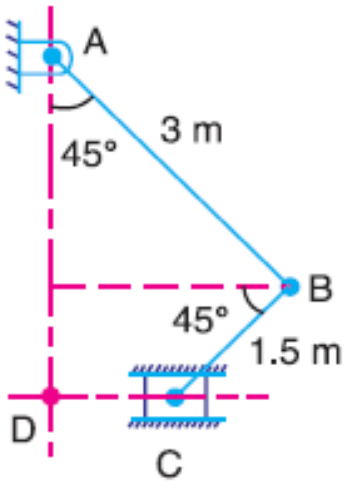
i. Angular velocity of link AC and CG.

ii. Velocity of slider D. (all dimensions are in mm)



2B In the mechanism shown in the figure below, slider C is moving to the right with a velocity of 1 m/s and acceleration of 2.5m/s^2. The dimensions of the links are AB= 3m inclined at 45^0 with the vertical and BC is 1.5m at 450 with the horizontal. If the velocity of AB= 0.72 m/s and velocity of BC= 0.72 m/s. Determine: **3**

Angular Acceleration of AB and BC by using graphical approach.



2C A single plate clutch, effective on both sides, is required to transmit 25kW at 3000 rpm. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.255, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **3**

3A A cam rotating clockwise at uniform speed of 400 rpm operates a reciprocating follower through a roller 20 mm diameter. The follower motion is defined as below. **5**

i. Outward during 60^0 with Simple Harmonic Motion

ii. Dwell for next 45^0

iii. Return during next 90^0 with uniform acceleration and Deceleration Motion

iv. Dwell for the remaining period

Stroke of the follower is 36 mm. Minimum radius of the cam is 40 mm. Draw the cam profile when follower axis is passing through cam axis.

3B A cam is to be designed for a knife Edge follower having cam lift of 36 mm for 60^0 of cam rotation with SHM and dwell for next 90^0, during next 120^0 of cam rotation follower returns to its original position with Uniform Acceleration and Deceleration motion and dwells for rest of the rotation. Determine the maximum velocity & acceleration during the outward & return stroke, if the cam rotates with 320 rpm. **2**

3C Derive an expression to determine the power lost due to friction in a flat pivot bearing using uniform pressure theory. **3**

4A A shaft running in bearings carries masses 20, 30 and 40kg, in planes A, B and C with center of gravity from the axis of the shaft 30mm, 20mm and 15mm, respectively. The distances of planes B and C from A are 1000mm and 2000mm to the right of A. The relative angular positions of the center of gravity of the unbalanced masses are such that they are in static equilibrium. Find these. **5**

To obtain complete dynamic balance suitable masses are introduced in planes D and E with center of gravity 100mm from the axis. D is 500mm to the left of A, and E 500mm to the right of C. Determine the position and magnitude of the balance masses.

4B Define in short, free vibration, forced vibration and damped vibration **2**

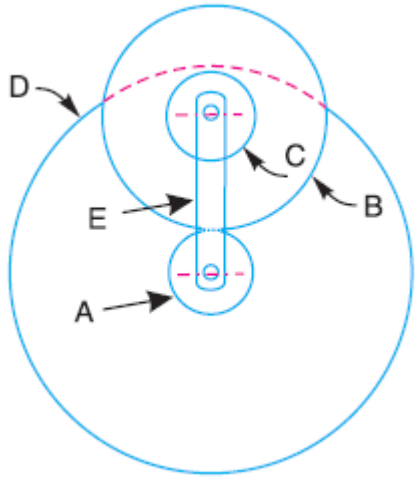
4C State and prove the law of gearing. **3**

5A A reverted epicyclic gear train is shown in the figure below. Gear B and C are compound and rotates at the end of arm E. Annular wheel D and gear A are mounted on different shafts. Gear A and B have 16 and 36 teeth respectively with module 3mm. The wheel D have 52 teeth with module 4mm. **4**

Determine:

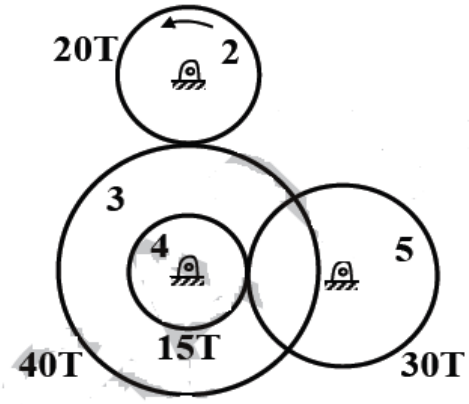
i. Number of teeth on gear C.

ii. Speed of Annular D when gear A is fix and arm E rotates at 450 rpm anticlockwise.



5B In the gear train given below, gear 2 rotates at 1200 rpm in counter clockwise direction and engages with Gear 3. Gear 3 and Gear 4 are mounted on the same shaft. Gear 5 engages with Gear 4. The numbers of teeth on Gears 2, 3, 4 and 5 are 20, 40, 15 and 30, respectively. **2**

Find angular speed of Gear 5.



5C Two gear wheels mesh externally and are to give a velocity ratio of 3. The teeth are of involute form of module 6mm and standard addendum one module. Pressure angle = 18^0. Pinion rotates at 90 rpm. **4**

Find;

i. Number of teeth on each wheel so that interference is just avoided.

ii. Length of path of contact.

iii. Maximum velocity of sliding between teeth.