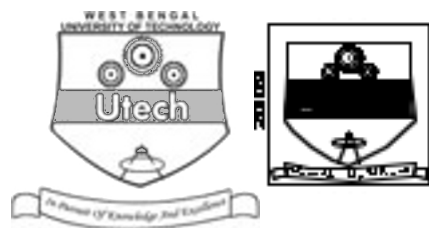


THEORY OF MACHINES (SEMESTER - 4)

CS/B.TECH(AUE-NEW)/SEM-4/AUE-404/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the
Candidate

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CS/B.TECH(AUE-NEW)/SEM-4/AUE-404/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
THEORY OF MACHINES (SEMESTER - 4)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
b) For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B					Group – C					Total Marks	Examiner's Signature
Question Number																						
Marks Obtained																						

.....
Head-Examiner/Co-Ordinator/Scrutineer

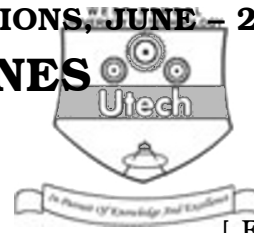
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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

THEORY OF MACHINES**SEMESTER - 4**

Time : 3 Hours]

[Full Marks : 70

Graph sheet is provided on Page 31.

GROUP – A**(Multiple Choice Type Questions)**

1. Choose the correct alternatives for the following : 10 × 1 = 10
- i) Typewriter constitutes
- | | |
|--------------|---------------|
| a) machine | b) structure |
| c) mechanism | d) inversion. |
-
- ii) Pantograph is a mechanism with
- | | |
|------------|--------------|
| a) 8 links | b) 6 links |
| c) 4 links | d) 12 links. |
-
- iii) Purpose of using differential gear in automobile is to
- | | |
|--------------------|-------------------|
| a) control speed | b) avoid jerks |
| c) help in turning | d) none of these. |
-
- iv) In a rotary engine the angular velocity of the cylinder centre line is 25 rad/sec and the relative velocity of a point on the cylinder centre line w.r.t. cylinder is 10 m/sec. Coriolis acceleration will be
- | | |
|----------------------------|------------------------------|
| a) 500 m/sec ² | b) 250 m/sec ² |
| c) 1000 m/sec ² | d) 2000 m/sec ² . |
-
- v) Two spur gears have a velocity ratio of 1/3. The driven gear has 72 teeth and rotates at 300 rpm. The number of teeth and speed of the driver are
- | | |
|------------------|------------------|
| a) 24 & 900 rpm | b) 30 & 1000 rpm |
| c) 35 & 1200 rpm | d) 20 & 900 rpm. |
-



4

vi) The path of contact in involute gear is

a) a straight line

b) involute path

c) curved line

d) circle.



vii) Whitworth quick return mechanism is an inversion of

a) double slider crank chain

b) single slider crank chain

c) four bar chain

d) crossed slider crank chain.

viii) A cam in which follower reciprocates or oscillates in a plane parallel to the axis of the cam is known as

a) cylindrical cam

b) circular cam

c) reciprocating cam

d) tangent cam.

ix) Total number of instantaneous centres for a mechanism of 4 links is

a) 8

b) 28

c) 4

d) 6.

x) The product of circular pitch and diametral pitch is equal to

a) π b) 2π c) $\pi/2$

d) 1.0.

GROUP – B**(Short Answer Type Questions)**Answer any *three* of the following.

3 × 5 = 15

2. Show that, the Paucellier mechanism generates an exact straight line as its path. 5

3. Determine degree of freedom of the following in *figure I*. 5**Fig. I**

4. What is Coriolis component of acceleration ? Derive an expression for it. 5



5. Explain in brief the working principle of differential gear of an automobile. 5
6. Explain the following nomenclatures for a cam profiles with neat sketch : 5
- | | |
|-------------------|-----------------|
| a) Base circle | b) Pitch circle |
| c) Pressure angle | d) Pitch point |
| e) Cam profile. | |



GROUP – C

(Long Answer Type Questions)

Answer any *three* questions.

3 × 15 = 45

7. a) Distinguish between Mechanism, Structure and Preloaded Structure.
 b) State and explain Grashof's criterion for four bar linkages.
 c) What do you mean by kinematic inversion ? Illustrate the different inversions of a four bar linkage with suitable examples.
 d) Establish Freudenstin's equation for four bar mechanism. 3 + 2 + 4 + 6
8. a) A Whitworth quick return mechanism has been shown in *figure II* given below. The dimensions of the links are : OP (crank) = 240 mm, OA = 150 mm, AR = 165 mm and RS = 430 mm. The crank rotates at an angular velocity of 2.5 rad/s. At the moment when crank makes an angle of 45° with the vertical, calculate graphically
- the velocity of the ram S
 - the velocity of the slider P on the slotted lever
 - the angular velocity of the link tRS .

Fig. II

- b) What do you mean by instantaneous centres ? Illustrate Arnold Kennedy's theorem of three centres. 12 + 3



9. a) Determine the Chebyshev spacing for function $y = 2x^2 - x$ for range $0 \leq x \leq 2$ when four precision points are required. For these precision points determine Φ_j and ψ_j if $\Delta\Phi = 45^\circ$ and $\Delta\psi = 90^\circ$.



- b) Following data relate to two meshing involutes gears :

Number of teeth on the gear wheel = 60

Pressure angle = 20°

Gear ratio = 1.5

Speed of the gear wheel = 100 rpm

Module = 8 mm

The addendum on each wheel is such that the path of approach and the path of recess on each side are 40% of the maximum possible length each. Determine the addendum for the pinion and the gear and the length of arc of contact. 7 + 8

10. a) Deduce an expression for minimum number of teeth on pinion of involutes profile to avoid interference.
- b) In a reverted epicyclic gear train, the arm A carries two B and C and a compound gear $D-E$, as shown in the *figure III* given below. The gear B meshes with gear E and gear C meshes with gear D . The number of teeth in gears B , C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and arm A makes 100 rpm clockwise.

5 + 10

Fig. III



11. Draw the profile of a cam operating a roller reciprocating follower and with following data :

Minimum radius of the cam = 25 mm

Lift = 30 mm

Roller diameter = 15 mm



The cam lifts the follower for 120° with SHM followed by a dwell period of 30° . Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150 rpm, calculate the maximum velocity and acceleration of the follower during the descent period.

15

END