(Following Roll No. to be filled by candidate)

Roll No. | 1 | 0 | 4 | 3 | 4 | 0 | 0 | 4 | 3 |

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B. TECH.
FIFTH SEMESTER EXAMINATION 2013-14
EME502
THEORY OF MACHINE – I

Time: 3 Hours

Max. Marks: 100

Note:
- Attempt all questions.
- Marks and numbers of questions to be attempted from the section is mentioned before each section.
- Assume missing data suitably. Illustrate the answers with suitable sketches.

1. Attempt **any four parts** of the following:

[4 x 5]

a. What is kinematic pair? Explain different types of kinematic pairs.
b. What is mechanism? In what way a mechanism differ from a machine? Explain Grubler's criterion for determining degree of freedom for mechanism.
c. What do you mean by inversion of a mechanism? Explain the various inversions of slider crank mechanism.
d. Sketch and describe the working of two different types of quick return mechanisms. Give example of their applications.
e. In a slider crank mechanism, the crank is 480 mm long and rotates at 20 rad/s in the counter-clockwise direction. The length of the connecting rod is 1600 mm. When the crank turns 60^0 from inner-dead centre, determine
   i. The velocity of the slider.
   ii. The position and velocity of a point E on the connecting rod having the least absolute velocity.
   iii. The angular velocity of the connecting rod.
f. State and prove the Kennedy's theorem of three instantaneous centres.

2. Attempt **any four parts** of the following:

[4 x 5]

a. Explain with sketch the coriolis component of acceleration. In what situation, it should be calculated?
b. Draw the acceleration diagram of a slider crank mechanism.
c. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r. p. m. The crank is 150 mm and connecting rod is 600 mm long. Determine the acceleration of the midpoint of the connecting rod.
d. What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch.
e. Describe the Hook's joint. Explain why two Hook's joints are used to transmit motion from the engine to the differential of an automobile.
f. What is steering gear mechanism? What is the condition for correct steering?

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10

3. Attempt **any two parts** of the following:

[2 x 10]

a. What is the law of belting? Derive an expression for ratio of tension for V belt drive.
b. What is collar? Derive the expression for friction torque for the flat collar using uniform pressure theory.
c. What is the difference between brakes and dynamometers? Describe the construction of any absorption type dynamometer and find the power transmitted.

4. Attempt **any two parts** of the following:

[2 x 10]

a. What are cams and followers? Explain and classify cams and followers which are used for different applications.
b. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with simple harmonic motion. Derive the expression for velocity and acceleration during outstroke and return stroke of the follower.
c. Draw the profile of a cam operating a knife edge follower having a lift of 30 mm. The cam raises the follower with simple harmonic motion for 150^0 of its rotation followed by a period of dwell for 60^0. The follower descends for the next 100^0 rotation of the cam with uniform velocity, again followed by dwell period. The cam rotates at a uniform velocity of 120 r. p. m. and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the follower during the lift and the return?

5. Attempt **any two parts** of the following:

[2 x 10]

a. State the law of gearing? What forms of tooth satisfy the law of gearing? Compare the involute and cycloidal tooth forms.
b. What is arc of contact? Derive an expression for the length of arc of contact in a pair of meshed gears.
c. Two parallel shafts, about 600 mm apart are to be connected by spur gears. One shaft is to run at 360 r. p. m. and other at 120 r. p. m. Design the gears, if the circular pitch is considered to be 25 mm.