



B.E DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Seventh Semester

AUTOMOBILE ENGINEERING

U18AUT5103: Mechanics of Machines

COURSE OUTCOMES

- CO1:** Calculate the velocity and acceleration of simple mechanisms.
CO2: Create the cam profile for different follower motions.
CO3: Identify the different gear trains and calculate the gear ratio.
CO4: Solve and draw the plots for the static and dynamic balancing of various mechanical systems.
CO5: Evaluate the free and forced vibrations for different applications.
CO6: Summarize the kinematic aspect of the mechanisms in automotive applications

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|---|-----|-------------------|
| 1. Define the following (i) Kinematic link (ii) Kinematic chain | CO6 | [K ₂] |
| 2. What is mechanical advantage for a mechanism? | CO1 | [K ₂] |
| 3. Classify the cam follower according to their shape and motion. | CO2 | [K ₁] |
| 4. What is a tangent cam? | CO2 | [K ₂] |
| 5. A gear train is used to reduce the speed of a motor from 1440 rpm to 36 rpm. What is the required train value of the gear train? | CO3 | [K ₂] |
| 6. What is Epicyclic gear train? | CO3 | [K ₂] |
| 7. Why is balancing of rotating parts necessary for high-speed engines? | CO4 | [K ₁] |
| 8. In the case of unbalanced masses revolving in different planes, what are the conditions to be fulfilled in order to obtain a complete balance. | CO4 | [K ₁] |
| 9. What is meant by free vibration and forced vibrations? | CO5 | [K ₂] |
| 10. Depict 'under-damped vibrations', 'over-damped vibrations' and 'critically damped vibrations' with the help of amplitude vs time plot. | CO5 | [K ₂] |

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

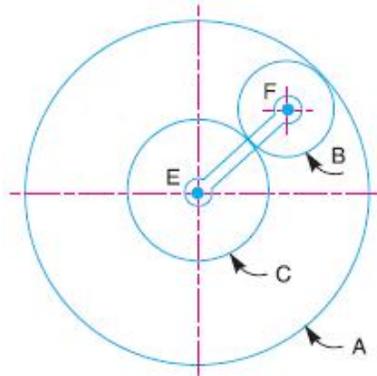
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|--|----|-----|-------------------|
| 11. The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine: 1. velocity of piston, 2. angular velocity of connecting rod, 3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin and 4. velocities of rubbing at the pins of the crank shaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, | 16 | CO1 | [K ₃] |
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12. A cam is to give the following motion to a knife-edged follower : 16 CO2 [K₃]
1. Outstroke during 60° of cam rotation ;
 2. Dwell for the next 30° of cam rotation ;
 3. Return stroke during next 60° of cam rotation, and
 4. Dwell for the remaining 210° of cam rotation.

The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The

follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when (a) the axis of the follower passes through the axis of the cam shaft, and (b) the axis of the follower is offset by 20 mm from the axis of the cam shaft.

13. An epicyclic gear consists of three gears A, B and C as shown in figure. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C. 16 CO3 [K₃]



14. Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135°, and 270° from the mass 'A'. Find the magnitude and position of the balancing mass at a radius of 100 mm. Use graphical method only. 16 CO4 [K₃]

15. The measurements on a mechanical vibrating system show that it has a mass of 8kg and that the springs can be combined to give an equivalent spring of stiffness 5.4 N/mm. If the vibrating system have a dashpot attached which exerts a force of 40 N when the mass has a velocity of 1 m/s, find: 1. critical damping coefficient, 2. damping factor, 3. Logarithmic decrement, and 4. ratio of two consecutive amplitudes. 16 CO5 [K₃]

16. Sketch and explain the inversion of a four-bar mechanism, all the four pairs are turning pairs. 16 CO6 [K₂]
