Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: B.Tech**
Sub_Code: RME5C002

5th Semester Back Examination: 2025-26
SUBJECT: Mechanisms and Machines
BRANCH(S): Mechanical Engineering
Time: 3 Hours
Max Marks: 100
Q.Code: U022

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) State the two reasons why Ackerman steering gear mechanism is preferred to the Davis steering gear mechanism.
b) Define the term 'coefficient of fluctuation of energy'.
c) Name the cam followers generally used in automobile engines and air-craft engines.
d) How does flywheel differ from that of a governor ?
e) Name the type of gears used to connect two non-parallel non-intersecting shafts.
f) What do you understand by gyroscopic couple ?
g) The rotor of a ship rotates in clockwise direction when viewed from the stern and the ship takes a left turn. What is the effect of the gyroscopic couple acting on it?
h) Distinguish between 'static balancing' and 'dynamic balancing'.
i) Distinguish between free vibrations and forced vibrations.
j) What do you understand by transmissibility?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Sketch and show the Ackermann Steering Gear and discuss the advantages.
b) Sketch and discuss the different types of cams and followers.
c) Draw the turning moment diagram of a single cylinder double acting steam engine.
d) In a turning moment diagram, the areas above and below the mean torque line taken in order are 4400, 1150, 1300, and 4550 mm^2 respectively. The scales of the turning moment diagram are:
Turning moment, 1 mm = 100 N-m; Crank angle, 1 mm = 1°
Find the mass of the flywheel required to keep the speed between 297 and 303 r.p.m., if the radius of gyration is 0.525 m.

e) The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and the module is 8 mm. If the arc of contact is 1.5 times the circular pitch, find the addendum.

f) What do you understand by the term 'interference' as applied to gears? Discuss.

g) Write short note on Proell governor.

h) Explain the term height of the governor. State the limitations of a Watt governor.

i) Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn.

j) Discuss how a single revolving mass is balanced by two masses revolving in different planes.

k) Derive an expression for the natural frequency of free transverse and longitudinal vibrations by equilibrium method.

l) A vibrating system consists of a mass of 200 kg, a spring of stiffness 80 N/mm and a damper with damping coefficient of 800 N.s/m. Determine the frequency of vibration of the system.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Construct the profile of a cam to suit the following specifications: **(16)**
Cam shaft diameter = 40 mm; Least radius of cam = 25 mm; Diameter of roller = 25 mm; Angle of lift = 120°; Angle of fall = 150°; Lift of the follower = 40 mm; Number of pauses are two of equal interval between motions. During the lift, the motion is S.H.M. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5 mm from the center of the cam.

Q4 Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. If the addendum on each wheel is such that the path of contact is maximum and interference is just avoided, find **(16)**
a) the addendum for each gear wheel
b) path of contact
c) arc of contact and
d) contact ratio.

Q5 What do you mean by stability of a governor? Sketch the controlling force versus radius diagrams for a stable, unstable, and isochronous governor. Derive the conditions for stability. **(16)**

Q6 A rotating shaft carries four masses A, B, C, and D which are radially attached to it. The mass centers are 30 mm, 38 mm, 40 mm, and 35 mm respectively from the axis of rotation. The masses A, C, and D are 7.5 kg, 5 kg and 4 kg respectively. The axial distances between the planes of rotation of A and B is 400 mm and between B and C is 500 mm. The masses A and C are at right angles to each other. Find for a complete balance, **(16)**
(i) the angles between the masses B and D from mass A
(ii) the axial distance between the planes of rotation of C and D
(iii) the magnitude of mass B.