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Question Paper Code : 52645

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third/Fourth Semester

Automobile Engineering

AT 6302 — MECHANICS OF MACHINES

(Common to : Aeronautical Engineering, Industrial Engineering, Industrial Engineering and Management, Manufacturing Engineering)

(Regulation 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare and contrast static and dynamic equilibrium.
2. Give any two applications of cam mechanism.
3. State law of gearing.
4. Draw a epicyclic gear train and mention all the gears clearly.
5. Compare and contrast the functions of clutch and brake.
6. Why crowning of pulleys is essential in belt drives?
7. Why rotating masses are to be dynamically balanced?
8. State D'Alemberts Principle.
9. What is node in case of vibration?
10. What is meant by viscous damping?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the kinematic inversions of four bar chain. (13)

Or

- (b) In a four bar chain ABCD, AD is fixed and is 150mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°. (13)

12. (a) Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with, (i) a wheel to give a gear ratio of 3 to 1; and (ii) an equal wheel.

The pressure angle is 20° and a standard addendum of 1 module for the wheel may be assumed. (13)

Or

- (b) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on 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 the arm A makes 100 r.p.m. clockwise. (13)

13. (a) A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed 0.127 N/mm^2 , find the power transmitted at 500 r.p.m. The outer and inner radii of friction surfaces are 125 mm and 75mm respectively. Assume uniform wear and take coefficient of friction = 0.3. (13)

Or

- (b) The mean diameter of a square threaded screw jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. What force must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and to lower it? (13)

14. (a) Applying dynamic force analysis, derive the expression for the velocity and acceleration of piston and angular velocity and angular acceleration of connecting rod of slider-crank mechanism. (13)

Or

- (b) Applying dynamic force analysis, determine the effective turning moment on the crank shaft for the following data: A vertical double acting steam engine has a cylinder 300mm diameter and 450mm stroke and runs at 200 r.p.m. The reciprocating parts has a mass of 225 kg and the piston rod is 50mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2 . Calculate the effective turning moment on the crank shaft. (13)

15. (a) Four masses A, B, C and D as shown below are to be completely balanced. (13)

	A	B	C	D
Mass (kg)	—	30	50	40
Radius (mm)	180	240	120	150

The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90° . B and C make angles of 210° and 120° respectively with D in the same sense. Find :

- (i) The magnitude and the angular position of mass A; and
- (ii) The position of planes A and D.

Or

- (b) A vibrating system consists of a mass of 8 kg, spring of stiffness 5.6 N/mm and a dashpot of damping coefficient of 40N/m/s. Find, (13)

- (i) Damping factor,
- (ii) Logarithmic decrement and
- (iii) Ratio of the two consecutive amplitudes.

PART C — (1 × 15 = 15 marks)

16. (a) Design a cam for a knife edge Off-set follower with the following data: (15)

- (i) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
- (ii) Dwell for the next 30° .
- (iii) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
- (iv) Dwell during the remaining 180° .

Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m.

Or

- (b) Construct velocity and acceleration polygons using the following data : P_1ABP_2 is a four bar mechanism with the link P_1P_2 fixed. The length of four links are as follows :

$P_1A = 300$ mm; $AB = 360$ mm, $P_2B = 360$ mm; and $P_1P_2 = 600$ mm. The angle $AP_1P_2 = 60^\circ$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2 , both clockwise. Determine the angular velocities and angular accelerations of P_2B , and AB and the velocity and acceleration of the joint B. (15)