Q. Code:658259

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

AE18306 – MECHANICS OF MACHINES

(Automobile Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Explain the concepts of mechanisms and apply the basics to analyze various automotive and mechanical applications.	**3**
CO 2	Examine different types of gears and gear trains.	**3**
CO 3	Solve problems involving friction and cam.	**3**
CO 4	Evaluate the motion and the dynamic forces acting on mechanical systems.	**3**
CO 5	Apply and analyze the concept of balancing and vibrations on mechanical systems.	**3**

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Give the classification of kinematic link.	**1**	**1**
2.	In what way a mechanism differ from a machine?	**1**	**2**
3.	Explain the terms : (i) Module, (ii) Pressure angle.	**2**	**2**
4.	Discuss the various types of gear trains.	**2**	**2**
5.	Explain the following: (i) Limiting friction, (ii) Angle of friction.	**3**	**2**
6.	Why a roller follower is preferred to that of a knife-edged follower?	**3**	**2**
7.	State D-Alembert's principle.	**4**	**1**
8.	Give the expression for Inertial torque.	**4**	**1**
9.	How the different masses rotating in different planes are balanced?	**5**	**2**
10.	Define free and forced vibration.	**5**	**1**

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	In a slider crank mechanism, the length of crank OB and connecting rod AB are 125 mm and 500 mm respectively. The centre of gravity G of the	**(14)**	**1**	**3**

connecting rod is 275 mm from the slider A. The crank speed is 600 rpm. clockwise. When the crank has turned 45° from the inner dead centre position, determine:

1. velocity of the slider A,
2. velocity of the point G, and
3. angular velocity of the connecting rod AB.

(OR)

(b)	In a four-bar chain LMNP, LP is fixed and is 150 mm long. The crank LM is 40 mm long and rotates at 120 rpm clockwise, while the link NP = 80 mm oscillates about P, MN, and LP are of equal length. Find the angular velocity of the link NP when angle MLP = 60 ^{o}	**(14)**	**1**	**3**

12. (a)	A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 rpm. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.	**(14)**	**2**	**3**

(OR)

(b)	In an epicyclic gear train, an arm carries two gears A and B having 70 and 90 teeth respectively. (i) If the arm rotates at 200 rpm. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. (ii) If the gear A instead of being fixed makes 350 rpm. in the clockwise direction, what will be the speed of gear B?	**(14)**	**2**	**3**

13. (a)	**(i)**	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 rpm. The outer and inner radii of friction surfaces are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3.	**(7)**	**3**	**3**
	(ii)	A plate clutch has three discs on the driving shaft and two discs on the driven shaft, Providing four pairs of contact surfaces. The outside	**(7)**	**3**	**3**

diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and co-efficient of friction between plates μ=0.3; find the total spring load pressing the plates together to transmit 25 kw at 1575 rpm.

(OR)

(b)	A cam is to give the following motion to a knife-edged follower: 1. Out stroke 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 60 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft.	**(14)**	**3**	**3**

14. (a)	The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2. The connecting rod length between centers is 1.2m and the cylinder bore is 0.5m. If the engine runs at 250 rpm. and if the effect of piston rod diameter is neglected, calculate: 1. Pressure on slide bars, 2. Thrust in the connecting rod, 3. Tangential force on the crank-pin, and 4. Turning moment on the crankshaft.	**(14)**	**4**	**3**

(OR)

(b)	A connecting rod is suspended from a point 25 mm above the centre of small end, and 650 mm above its centre of gravity, its mass being 37.5 kg. When permitted to oscillate, the time period is found to be 1.87 seconds. Find the dynamical equivalent system constituted of two masses, one of which is located at the small end centre.	**(14)**	**4**	**3**

15. (a)	Four masses m_1 , m_2 , m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m	**(14)**	**5**	**3**

and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.

(OR)

		Marks	CO	RBT LEVEL
(b)	A single cylinder engine runs at 250 rpm. and has a stroke of 180 mm. The reciprocating parts has a mass of 120 kg and the revolving parts are equivalent to a mass of 70 kg at a radius of 90 mm. A mass is placed opposite to the crank at a radius of 150 mm to balance the whole of the revolving mass and two-thirds of the reciprocating mass. Determine the magnitude of the balancing mass and the resultant residual unbalance force when the crank has turned 30° from the inner dead centre, neglect the obliquity of the connecting rod.	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Discuss any two inversions of Inversions of Single Slider Crank Chain with a neat sketch.	**(10)**	**1**	**2**

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