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

Question Paper Code : 50121

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Third/Fourth Semester
Automobile Engineering
AT6302 – MECHANICS OF MACHINES
(Common to Aeronautical Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A (10×2=20 Marks)

1. Differentiate between mechanism and machine.
2. Classify types of follower motion in cam mechanisms.
3. State the law of toothed gearing.
4. What is undercutting in gear meshing ?
5. What is creep in the case of belt ?
6. Under what situation, 'uniform wear' condition is used in power transmission calculations of clutches.
7. Differentiate "applied force" and "inertia force".
8. State D' Alembert's principle.
9. Write down the difference between static and dynamic balancing.
10. What is vibration isolation ?

PART – B (5×13=65 Marks)

11. a) A engine mechanism is shown in Fig. Q. 11(a). The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crank shaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2. Find (i) velocity of G and angular velocity of AB and (ii) acceleration of G and angular acceleration of AB. (13)

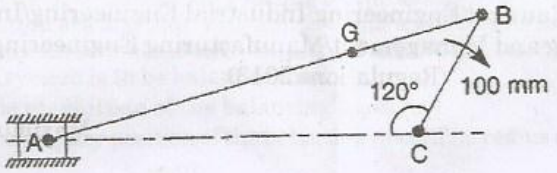

Fig. Q. 11(a)

(OR)

b) Draw the profile of a cam in which the follower moves with simple harmonic motion during rise while it moves with uniform acceleration and retardation motion during return from the following data :

Least radius of cam = 50mm

Roller diameter = 30 mm

Angle of rise = 88°

Angle of return = 80°

Offset of the follower = 20 mm right

Lift of the follower = 40 mm

Angle of dwell between rise and return = 72° (13)

12. a) An epicyclic gear consist of three gears A, B and C as shown in Fig. Q. 12(a). 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 rpm. If the gear A is fixed, determine the speed of gears B and C. (13)

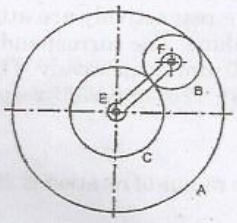

Fig. Q. 12 (a)

(OR)

b) A 14½° involute pinion with 20 teeth drives a 50 teeth gear. The pitch circle diameter of the pinion is 160 mm. Find the addendum of the pinion and gear, and the contact ratio without interference. (13)

13. a) 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 diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and coefficient of friction is 0.3. Find the total spring load pressing the plates together to transmit 25 kW at 1575 rpm. If there are 6 springs, each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear. (13)

(OR)

b) A leather belt is required to transmit 9 kW from a pulley 1.2 m in diameter running at 200 rpm. The angle of contact is spread over 11/24 of the circumference and the coefficient of friction between the belt and the pulley rim is 0.3. If the safe working stress for the leather belt is 1.4 MN/m^2, the density of the leather is 1000 kg/m^3, and the thickness of belt is 10 mm, determine the width of the belt taking the centrifugal tension into account. (13)

14. a) Using D' Alembert's concept, explain the method of conducting dynamic force analysis in a connecting rod of reciprocating engine. (13)

(OR)

b) Discuss the following (i) Applied and constrained forces (ii) static equilibrium conditions (iii) Superposition principle. (4+4+5)

15. a) A shaft is rotating at a uniform angular speed. Four masses m_1, m_2, m_3 and m_4 of magnitudes 300 kg, 450 kg, 360 kg and 390 kg respectively are attached to the shaft. The masses are rotating on the same plane. The corresponding radii of rotation are 200 mm, 150 mm, 250 mm and 300 mm respectively. The angles made by these masses with horizontal are 0°, 45°, 120° and 255° respectively. If the system is to be balanced, find
   i) The magnitude of the balancing mass and
   ii) The angular position of the balancing mass if its radius of rotation is 200 mm. (13)

(OR)

b) A shaft 1.5 m long, supported in flexible bearings at the ends carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 375 mm from the centre towards left. The shaft is hollow of external diameter 75 mm and internal diameter 40 mm. The density of the shaft material is 7700 kg/m^3 and its modulus of elasticity is 200 GN/m^2. Find the lowest whirling speed of the shaft, taking into account the mass of the shaft. (13)

PART – C (1×15=15 Marks)

16. a) The following data refer to a single cylinder vertical reciprocating engine

Mass of reciprocating parts	= 40 kg
Mass of revolving parts	= 30 kg at 180 mm radius
Speed	= 150 rpm
Stroke	= 350 mm

If 60% of the reciprocating mass and all the revolving mass are to be balanced, determine
   i) The balance mass required at a radius of 320 mm
   ii) The unbalanced force when the crank has turned 45° from the top dead centre. (15)

(OR)

b) A symmetrical tangent cam with a least radius of 25 mm operates a roller follower of radius 10 mm. The angle of ascent is 60° and total lift is 15 mm. if the speed of the cam is 400 rpm, then calculate : The principal dimensions of the cam (i.e.,) the distance the cam centre and nose centre : nose radius and angle of control of cam with straight flank. (15)