

Reg. No.

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**B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019**

Fourth Semester

**AE16402 – MECHANICS OF MACHINES***(Automobile Engineering)***(Regulation 2016)****Time: Three Hours****Maximum : 100 Marks**

Answer ALL questions

**PART A - (10 X 2 = 20 Marks)**

|  | CO | RBT |
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| 1. Define the terms Kinematic chain and kinematic pair   | 1  | R   |
| 2. Define Grashoff's law.                                | 1  | R   |
| 3. Define the law of gearing with the equation.          | 2  | R   |
| 4. Define module and pressure angle.                     | 2  | R   |
| 5. What is creep in belts?                               | 3  | R   |
| 6. What are the different types of friction clutches?    | 3  | R   |
| 7. State D'Alembert's principle.                         | 4  | R   |
| 8. Differentiate between static and dynamic equilibrium. | 4  | U   |
| 9. Differentiate between free and forced vibrations.     | 5  | U   |
| 10. What is meant by whirling speed?                     | 5  | U   |

**PART B - (5 X16 = 80 Marks)**

11. (a) Sketch and explain any two inversions of a double slider crank chain. (16) 1 U
- (OR)**
- (b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine : (16) 1 AN
1. linear velocity and acceleration of the midpoint of the connecting rod, and
  2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.
12. (a) Two Involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module Find length of arc of contact & the maximum velocity of sliding. (16) 2 AN
- (OR)**
- (b) In a epicyclic gear train an arm carries two gears A and B having 40 and 60 teeth. If arm rotates at 200 rpm in clockwise direction about (16) 2 AN

the centre of gear A which is fixed makes 300 rpm in the anticlockwise direction, what will be the speed of gear B.

13. (a) A single plate clutch effective on both sides is required to transmit 25KW at 3000 rpm. Determine the outer and inner radius of frictional surface if the coefficient of friction is 0.255 the ratio is radii is 1.25 and the maximum. Pressure is not exceed 0.1 N/mm<sup>2</sup>. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. **(16) 3 AN**

**(OR)**

- (b) An open belt drive connects two pulleys 120 cm and 50 cm diameters on parallel shafts 4 m apart. The maximum tension in the belt is 1855 N. The coefficient of friction is 0.3. The driver pulley of diameter 120 cm runs at 200 rpm. Calculate: (i) the power transmitted (ii) the torque on each of the two shafts. **(16) 3 AN**
14. (a) The length and connecting rod of a horizontal reciprocating engine are 200 mm and 1meter respectively. The crank is rotating at 400 rpm. When the crank has turned 30° from the inner dead center, the difference of pressure between cover end and piston rod is 0.4 N/mm<sup>2</sup>. If the mass of the reciprocating parts is 100Kg and a cylinder bore is 0.4 meters. Calculate (i)Inertia force (ii) Force on piston (iii) Piston effort (iv) Thrust on the side of the cylinder walls in the connecting rod. **(16) 4 AN**

**(OR)**

- (b) Four masses  $m_1$ ,  $m_2$ ,  $m_3$ , and  $m_4$  are 200 kg, 300 kg, 240 kg and 260 kg, respectively. The corresponding radius of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m, respectively and the angle 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. **(16) 4 AN**
15. (a) A vertical shaft 120mm in dia and 1m length has its upper end fixed. At the other end it carries a disc of weight 500N. The modulus of elasticity is 210 GPa. Neglecting the weight of the shaft, determine the frequency of longitudinal vibrations and transverse vibrations. **(16) 5 AN**

**(OR)**

- (b) The measurements on a mechanical vibrating system show that it has a mass of 8 kg and that the spring 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: (i) Critical damping co-efficient, (ii) Damping factor, (iii) Logarithmic decrement and (iv) Ratio of two consecutive amplitudes. **(16) 5 AN**