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

Third Semester

**AE18306 – MECHANICS OF MACHINES***(Automobile Engineering)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**

Answer ALL questions

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

	CO	RBT
1. Define Kinematic pair.	1	R
2. Name any two inversions of single slider crank chain.	1	R
3. Define the law of gearing with the equation.	2	R
4. Define module and pressure angle in gears.	2	R
5. Define the term "Limiting friction".	3	R
6. What do you mean by dwell in cam?	3	U
7. Define Inertia force.	4	R
8. State D'Alembert's principle.	4	R
9. Why rotating masses are to be dynamically balanced?	5	U
10. What are the causes of vibration?	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 and connecting rod of a theoretical steam engine are 0.5m and 2m long respectively. The crank makes 180 rpm in the clockwise direction, when it has turned 45degrees from the inner dead centre position (16) 1 AN
1. velocity of the piston
  2. angular velocity of the connecting rod
  3. velocity of point E on the connecting rod 1.5 m from the gudgeon pin
12. (a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20°pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. (16) 2 AN
- (OR)**
- (b) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. (16) 2 AN
- (i) If the arm rotates at 150 r.p.m. 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 300 r.p.m. in the clockwise direction, what will be the speed of gear B?

13. (a) Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear. (16) 3 AN

(OR)

- (b) A cam is to give the following motion to a knife-edged follower : (16) 3 AN  
 1. Out stroke during  $60^\circ$  of cam rotation; 2. Dwell for the next  $30^\circ$  of cam rotation; 3. Return stroke during next  $60^\circ$  of cam rotation, and 4. Dwell for the remaining  $210^\circ$  of cam rotation.  
 The stroke of the follower is 40 mm and the minimum radius of the cam is 50 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. (a) If the crank and the connecting rod are 300 mm and 1 m long respectively and the crank rotates at a constant speed of 200 rpm., determine: 1. The crank angle at which the maximum velocity occurs, and 2. Maximum velocity of the piston. (16) 4 AN

(OR)

- (b) A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 rpm. The reciprocating parts have a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through  $125^\circ$  from the top dead centre, the steam pressure above the piston is  $30 \text{ kN/m}^2$  and below the piston is  $1.5 \text{ kN/m}^2$ . Calculate the effective turning moment on the crankshaft. (16) 4 AN

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 and 0.3 m respectively and the angles between successive masses are  $45^\circ$ ,  $75^\circ$  and  $135^\circ$ . Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (16) 5 AN

(OR)

- (b) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is  $200 \text{ GN/m}^2$ . Determine the frequency of longitudinal and transverse vibrations of the shaft. (16) 5 AN