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

Question Paper Code : 71422

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third/Fourth Semester

Automobile Engineering

AT 6302 — MECHANICS OF MACHINES

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

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Note : A3 Size drawing sheet is to be supplied to the students)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. How many numbers of turning and sliding pairs are possible in a single slider crank mechanism?

2. What is the difference between the knife-edge and roller cam follower?

3. What is the main requirement for two gears to mesh each other?

4. What is meant by reverted gear train?

5. What is the effective coefficient of friction for V-threads of thread angle 2β?

6. What is the effect of centriftigal tension in belts?

7. What is meant by three-force member and state its conditions of equilibrium?

8. Write the mathematical expression for the crank pin effort in a reciprocating engine.

9. If the balance mass is to be placed in a plane parallel to the plane of the unbalance mass, then what is the minimum number of balance masses are required?

10. Differentiate between damped and undamped free vibrations.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss in detail about any two inversions of the Single slider crank mechanism. (The line diagram of each inversion is to be drawn). (13)

Or

(b) Discuss in detail about

(i) cylindrical cam with reciprocating follower.

(ii) cylindrical cam with oscillating follower with line diagram. (13)

12. (a) Two gears of module 4 mm have 24 and 33 teeth. The pressure angle is 20° and each gear has a standard addendum of one module. Find the length of arc of contact and the maximum velocity of sliding if the pinion rotates at 120 r.p.m. (13)

Or

(b) In a reverted gear train, as shown in Fig. 12 b, two shafts A and B are in the same straight line and are geared together through an intermediate parallel shaft C. The gears connecting the shafts A and C have a module of 2 mm and those connecting the shafts C and B have a module of 4.5 mm. The speed of shaft A is to be about but greater than 12 times the speed of shaft B, and the ratio at each reduction is same. Find suitable number of teeth for gears. The number of teeth of each gear is to be a minimum but not less than 16. Also find the exact velocity ratio and the distance of shaft C from A and B. (13)

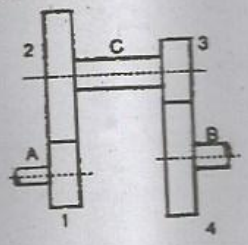

Fig. 12 (b)

13. (a) The lead screw of a lathe has acme threads of 50 mm outside diameter and 10 mm pitch. The included angle of the thread is 29°. It drives a tool carriage and exerts an axial pressure of 2500 N. A collar bearing with outside diameter 100 mm and inside diameter 50 mm is provided to take up the thrust. If the lead screw rotates at 30 r.p.m., find the efficiency and the power required to drive the screw. The coefficient of friction for screw threads is 0.15 and for the collar is 0.12. (13)

Or

(b) A pulley is driven by a flat belt running at a speed of 600 m/min. The coefficient of friction between the pulley and the belt is 0.3 and the angle of lap is 160°. If the maximum tension in the belt is 700 N; find the power transmitted by a belt. (13)

14. (a) A petrol engine has a stroke of 120 mm and connecting rod is 3 times the crank length. The crank rotates at 1500 r.p.m. in clockwise direction. Determine : (i) Velocity and acceleration of the piston, and (ii) Angular velocity and angular acceleration of the connecting rod, when the piston had travelled one-fourth of its stroke from I.D.C. (13)

Or

(b) A horizontal steam engine running at 240 r.p.m. has a bore of 300 mm and stroke 600 mm. The connecting rod is 1.05 m long and the mass of reciprocating parts is 60 kg. When the crank is 60° past its inner dead centre, the steam pressure on the cover side of the piston is 1.125 Mpa while that on the crank side is 0.125 MPa. Neglecting the area of the piston rod, determine (i) the force in the piston rod; and (ii) the turning moment on the crankshaft.

15. (a) A single cylinder horizontal engine runs at 120 r.p.m. The length of stroke is 400 mm. The mass of the revolving parts assumed concentrated at the crank pin is 100 kg and mass of the reciprocating parts is 150 kg. Determine the magnitude of the balancing mass required to be placed opposite to the crank at a radius of 150 mm which is equivalent to all the revolving and 2/3rd of the reciprocating masses. If the crank turns 30° from the inner dead centre, find the magnitude of the unbalanced force due to the balancing mass. (13)

Or

(b) A shaft of 100 mm diameter and 1 metre long is fixed at one end and other end carries a flywheel of mass 1 tonne. Taking Young's modulus for the shaft material as 200 GN/m^2, find the natural frequency of longitudinal and transverse vibrations. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A multiplate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surfaces are 100 mm and 50 mm respectively. The maximum axial spring force is limited to 1 kN. If the coefficient of friction is 0.35 and assuming uniform wear, find the power transmitted by the clutch at 1500 r.p.m. (15)

Or

(b) A mass of 500 kg is mounted on supports having a total stiffness of 100 kN/m and which provides viscous damping, the damping ratio being 0.4. The mass is constrained to move vertically and is subjected to a vertical disturbing force of the type $F\cos\omega t$. Determine the frequency at which resonance will occur and the maximum allowable value of F if the amplitude at resonance is to be restricted to 5 mm. (15)