Roll No. | | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (ME) (Sem.–4)

THEORY OF MACHINES-II

Subject Code : BTME-405-18

M.Code : 77550

Date of Examination : 12-07-22

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) Explain the conditions for a body to be in equilibrium under the action of two forces and a torque.

b) What do you mean by 'inertia force' and 'inertia torque'? ,

c) What is meant by dynamically equivalent system?

d) What is meant by the term 'crank effort'?

e) Why is balancing necessary for rotors of high speed engines?

f) What are the main advantages of double helical gear over single helical gear?

g) Compare involutes and cycloidal tooth profiles.

h) What do you mean by gyroscopic couple?

i) Explain the term Synthesis of Mechanisms.

j) What are transmission angles?

SECTION-B

2. Derive the expression for velocity and acceleration of slider of a single slider crank mechanism.

3. The connecting rod of a gasoline engine is 300 mm long between its centres. It has a mass of 15 kg aid mass moment of inertia of 7000 kg-mm^2. It's centre of gravity is at 200 mm from it's small end centre. Determine the dynamical equivalent two-mass system of the connecting rod if one of the masses is located at the small end centre.

4. A pair of spur gears with involute teeth is to give a gear ratio of 4:1. The arc of approach is not to be less than the circular pitch and smaller wheel is the driver. The angle of pressure is 14.5°. Find : 1. the least number of teeth that can be used on each wheel, and 2. The addendum of the wheel in terms of the circular pitch.

5. Four masses ml, m2, m3 and m4 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°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.

6. Explain why only a part of the unbalanced force due to reciprocating masses is balanced by revolving mass.

SECTION-C

7. An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m.

8. A four wheeled motor car of mass 2000 kg has a wheel base 2.5 m, track width 1.5 m and height of centre of gravity 500 mm above the ground level and lies at 1 metre from the front axle. Each wheel has an effective diameter of 0.8 m and a moment of inertia of 0.8 kg-m^2. The drive shaft, engine flywheel and transmission are rotating at 4 times the speed of road wheel, in a clockwise direction when viewed from the front, and is equivalent to a mass of 75 kg having a radius of gyration of 100 mm. If the car is taking a right turn of 60 m radius at 60 km/h, find the load on each wheel.

9. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the number of teeth are: $T_c = 28$; $T_D = 26$; $T_E = T_F = 18$.

   a. Sketch the arrangement; b. Find the number of teeth on A and B; c. If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B; and d. If the arm G makes 100 r.p.m. clockwise & wheel A makes 10 r.p.m. counter clockwise; find the speed of wheel B.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.