Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech(ME) (Sem.–4)

THEORY OF MACHINES-II

Subject Code : BTME405-18

M.Code : 77550

Date of Examination : 01-12-2023

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. Answer briefly :

a) What do you mean by free body diagram?

b) Explain the conditions of equilibrium for a three-force system.

c) Differentiate between 'Static force analysis' and 'Dynamic force analysis'.

d) Why is balancing of rotating parts necessary for high speed engines?

e) Explain the terms 'Module' and 'Pressure angle' as applied to gears.

f) What do you understand by the term 'interference' as applied to gears?

g) Write the advantages of helical gear over spur gear.

h) What do you understand by 'gear train'?

i) Define velocity ratio in context to gear train.

j) In case of rolling of ship what is the magnitude of gyroscopic couple?

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SECTION - B

2. Explain the procedure for static force analysis of slider crank mechanism.

3. The crank-pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from I.D.C., the difference between the driving and the back pressures is 0.35 N/mm^2. The connecting rod length between centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 r.p.m. and if the effect of piston rod diameter is neglected, calculate :

   a) Pressure on slide bars,

   b) Thrust in the connecting rod,

   c) Tangential force on the crank-pin

   d) Turning moment on the crank shaft.

4. The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.

5. Four masses A, B, C and D are attached to a shaft and revolve in the same plane. The masses are 12 kg, 10 kg, 18 kg and 15 kg respectively and their radii of rotations are 40 mm, 50 mm, 60 mm and 30 mm. The angular position of the masses B, C and D are 60°, 135° and 270° from the mass A. Find the magnitude and position of the balancing mass at a radius of 100 mm.

6. Describe the classifications of synthesis problem.

SECTION - C

7. The following data refer to two cylinder locomotive with cranks at 90° : Reciprocating mass per cylinder = 300 kg ; Crank radius = 0.3 m ; Driving wheel diameter = 1.8 m ; Distance between cylinder centre lines = 0.65 m ; Distance between the driving wheel central planes = 1.55 m. Determine : a) the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km. p.h.; b) the variation in tractive effort; and 3. the maximum swaying couple.

8. A four-wheeled trolley car of total mass 2000 kg running on rails of 1.6 m gauge, rounds a curve of 30 m radius at 54 km/h. The track is banked at 8°. The wheels have an external diameter of 0.7 m and each pair with axle has a mass of 200 kg. The radius of gyration for each pair is 0.3 m. The height of centre of gravity of the car above the wheel base is 1 m. Determine, allowing for centrifugal force and gyroscopic couple actions, the pressure on each rail.

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9. In a compound epicyclic gear train as shown in figure below, wheels A , D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally. If the wheel A is driven clockwise at 1 r.p.s. while D is driven counter clockwise at 5 r.p.s., determine the magnitude and direction of the angular velocities of arm OP and wheel E.

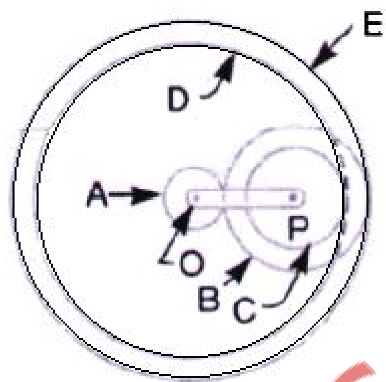

FIG-1

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