Roll No. | | | | | | | | | | | | |

Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(Marine Engg.) (2013 Onwards) (Sem.–4)

# THEORY OF MACHINES-II

Subject Code : BTME-402

Paper ID : [72435]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION 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 free body diagram.

(b) What is the difference between static and dynamic force?

(c) Define primary balancing.

(d) Name the balancing used for aero-engines.

(e) Define module.

(f) What is a herringbone gear?

(g) Which gear train is used in wall-clocks? Draw the diagram.

(h) Explain gyroscopic couple.

(i) Explain transmission angle.

(j) What is a spiral gear?

## SECTION–B

2. The effective steam pressure on the piston of a vertical steam engine is 220 kN/m$^2$ when the crank is 40° from the inner dead centre on the down stroke. The crank length is 300 mm and connecting rod length is 1200 mm. The diameter of the cylinder is 800 mm. What will be the torque on the crank shaft if the engine speed is 300 *rpm* and the mass of the reciprocating parts 250 kg?

3. The reciprocating mass per cylinder in a 60° V twin engine is 1.5 kg. The stroke is 10 cm for each cylinder. If the engine runs at 1800 *rpm*, determine the maximum and minimum values of the primary forces and find the corresponding crank positions.

4. A pinion having 36 teeth drives a gear having 96 teeth. The profile of the gears are involute with 20° pressure angle, 10 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and contact ratio.

5. The turbine rotor of a sea vessel having a mass of 1050 kg rotates at 1200 *rpm*. Clockwise while looking from the stern. The vessel pitches with an angular velocity of 1.2 rad/sec. Find the gyroscopic couple to the hull when the bow rises? Take radius of gyration of rotor as 300 mm.

6. The lengths of the links of a four bar mechanism are in geometric progression. Discuss the movability of the four bar mechanism.



## SECTION–C

7. A compound gear train with gears P, Q, R and S has number of teeth 20, 40, 15 and 20 respectively. Gears Q and R are mounted on the same shaft as shown in Figure 1. The diameter of gear Q is twice that of gear R. If the module of gear R is 2 mm, find the centre distance in mm between P and S.

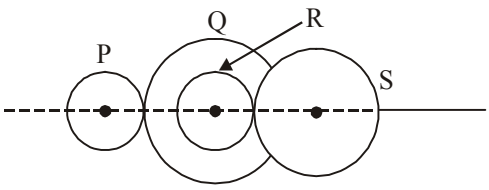


Fig. 1.

8. Figure 2 shows a quaternary link ABCD under the action of forces $F_1$, $F_2$, $F_3$ and $F_4$ acting at A, B, C and D respectively. The link is in static equilibrium. Determine the magnitude of forces $F_2$ and $F_3$.

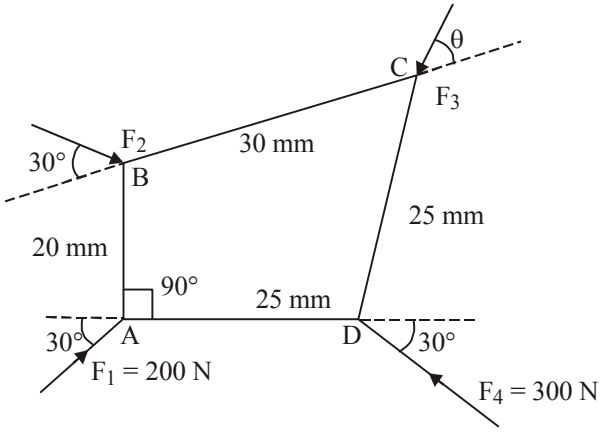


Fig. 2.

9. The following data refer to two cylinder locomotive with cranks at 90° :

| | |
|---|---|
| Reciprocating mass per cylinder | 300 kg |
| Crank radius | 0.30 m |
| Driving wheel diameter | 1.80 m |
| Distance between cylinder centre lines | 0.65 m |
| Distance between the driving wheel centre planes | 1.55 m |

**Determine**

(a) The fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 $\times 10^3$ N at 96.5 km/hr.

(b) Variation in tractive force

(c) The maximum swaying couple.