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

Total No. of Questions : 09

B.Tech.(ME) (2011 Onwards)   (Sem.–4)
THEORY OF MACHINES – II
Subject Code : BTME-402
Paper ID : [A1212]

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) Define couple.

   (b) Define point of concurrency.

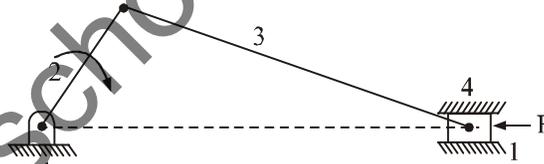   (c) For figure-1 make free body diagram of forces.

Fig.1

   (d) What is a compound pendulum ?

   (e) Explain equivalent offset inertia force.

   (f) What is crank effort?

   (g) What is partial balancing of locomotives?

   (h) Explain pressure angle of gears.

   (i) Show three planes *i.e.* couple, spin and precession on three axes.

   (j) Explain type synthesis.

SECTION-B

2. The length of crank and connecting rod of a reciprocating engine is 20 cm and 80 cm respectively. The crank rotates at 150 r.p.m. Find the velocity and acceleration of the piston when the crank makes an angle of 30° from I.D.C.

3. A V-twin engine has the cylinder axis at right angles and the connecting rods operate a common crank. The reciprocating mass per cylinder is 1.5 kg and the crank radius 75 mm. The length of the connecting rod is 0.3 m. Show that the engine may be balanced for primary forces by means of a revolving balance mass. If the engine speed is 500 r.p.m., what is the value of the maximum resultant secondary force ?

4. Determine the minimum number of teeth required on a pinion to avoid interference which is to gear with a wheel to give ratio 3 : 1. The pressure angle is 20° and a standard addendum of 1 module of gear may be assumed.

5. An epicyclic gear train is shown in Fig.-2. Find the r.p.m. of pinion D if the arm A rotates at 60 r.p.m. in anticlockwise direction. Given :
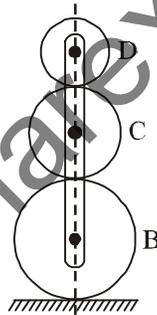
$T_B = 120$, $T_C = 60$, $T_D = 40$.

Fig. 2

6. A flywheel having a mass of 20 kg and a radius of gyration of 300 mm is given a spin of 500 r.p.m. about its axis which is horizontal. The flywheel is suspended at a point 250 mm from the plane of rotation of the flywheel. Find the rate of precession of the wheel.

SECTION-C

7. The mechanism shown in Fig.-3 is driven by turning A_0A. Find out geometrically the maximum and minimum transmission angles.
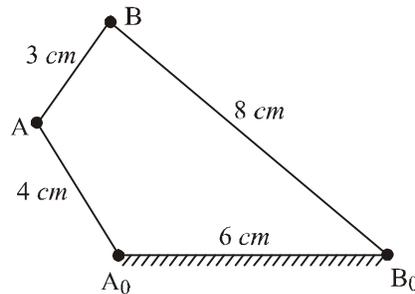

Fig.3

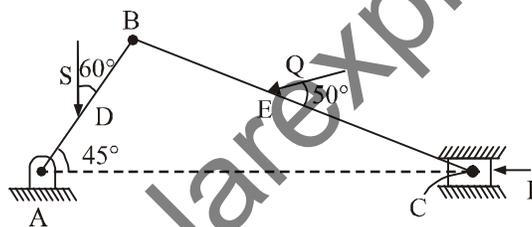8. Find T_2 in Fig.-4 where symbols have their usual meanings.

Fig.4

S = 2000 N, Q = 500 N, F = 4000 N, AB = 30 cm, BE = 17.5 cm, BC = 45.5 cm, AD = 15 cm

9. A horizontal steam engine running at 240 *r.p.m.* has a bore of 20 cm and stroke of 36 cm. The piston rod is 2 cm in diameter and connecting rod length is 90 cm. The mass of the reciprocating parts is 7 kg and the frictional resistance is equivalent to a force of 500 N. Determine the following when the crank is at 120° from I.D.C., the mean pressure being $50 \times 10^2 \, \text{N/m}^2$ on the cover side and $1 \times 10^2 \, \text{N/m}^2$ on crank side :

a. Thrust on the connecting rod.

b. Thrust on the cylinder walls.

c. Load on the bearings,

d. Turning moment on the crank shaft.