CSM – 54/18

Mechanical Engineering

Paper – I

Time : 3 hours

Full Marks : 300

The figures in the right-hand margin indicate marks.

Candidates should attempt Q. No. 1 from Section – A and Q. No. 5 from Section – B which are compulsory and ***three*** *of the remaining questions, selecting at least* ***one*** *from each Section.*

SECTION – A

1. Answer any **three** of the following questions : 20×3 = 60

   (a) Derive an expression for minimum number of teeth required on pinion in order to avoid interference in involute gear teeth.

   (b) A thing ring of weight 120N and radius 250mm is held against a smooth wall by

240mm long string AB as shown in fig.1. Determine :

(i) The tension in the string.

(ii) The reaction at C.

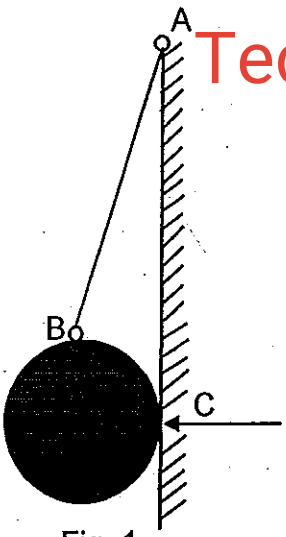

Fig. 1

(c) Explain the difference between hardness and hardenability with an example.

(d) What are the advantgaes of free body diagrams ? Explain the conditions for equilibrium.

2. (a) What is the coefficient of insensitiveness in Governors ? 20

(b) The following particulars of a cam with knife edge followers are given :

Cam lift = 60mm: during 90^{o} of cam rotation with simple harmonic motion and next 30^{o} dwell period. During the next 60^{o} of cam rotation, the follower with simple harmonic motion return to original position and the rest are dwell period. Draw the profile of the cam when the line of stroke of the follower pass through the axis of the cam shaft. 40

3. (a) Draw the shear force and bending moment diagrams for the beam shown in Fig. 2 : 20

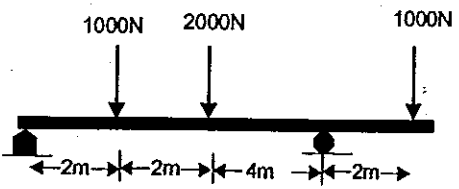

Fig. 2

(b) Explain the failure theory that can be adopted for brittle materials. 40

4. (a) Explain the different types of defects in crystalline materials. 15

(b) Explain the following heat treatment processes : 15×3 = 45

(i) Process annealing

(ii) Austenitizing

(iii) Quenching

SECTION – B

5. Answer any **three** of the following question : 20×3 = 60

(a) What are the different casting defects ? Explain methods to prevent them.

(b) What is break even analysis ? Explain its significance in production planning.

(c) Draw a flow chart to find all the roots of a quardratic equation $ax^2 + bx + c = 0$.

(d) Enlist the advantages of DBMS.

6. (a) What are expendable pattern techniques ? Explain any one technique. What are its advantages and limitations ? 35

(b) Explain the different types of chip formation. 25

7. (a) Explain elaborately value analysis. Briefly explain value analysis procedure. 20

(b) A steel manufacturing unit employs 35 persons. It consumes material worth Rs. 25,000 and pays the workers at the rate of Rs. 12 per hour with overheads Rs. 12000. In a particular month (24days) workers had an overtime of 150 hours and were paid at double their normal rate. Find (i) The total cost and (ii) the mean hour rate of overheads.

Note : Every worker works eight hour a day. 40

8. (a) What are the basic components of Computer Organization. 20

(b) Write a C program to find the largest number among n input Numbers. 20

(c) Program a FORTRAN program to find average of N Numbers. 20