CSM – 54/20

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 any ***three*** *of the remaining questions, selecting at least* ***one*** *from each Section.*

SECTION – A

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

   (a) Prove that the sensitiveness of a Proell governor is greater than that of a Porter governor.

   (b) Deduce an expression for the velocity and acceleration of the follower when it moves with simple harmonic motion.

(c) A pendulum clock beats seconds at a place where $g = 9.82\ m/s^2$. If it is brought to a place where g is slightly reducing by $0.01\ m/s^2$. How much the clock does it loss or gain in a day ?

(d) (i) Explain the difference between hardness and hardenability.

(ii) Why should the steel be agitated when a gear is quenched ?

2. (a) What are primary and secondary balancing for reciprocating Engines ? 20

(b) Determine moment of inertia of the L section shown in Fig. 1 about the centroidal axes parallel to the legs. Also determine polar moment of inertia. 40

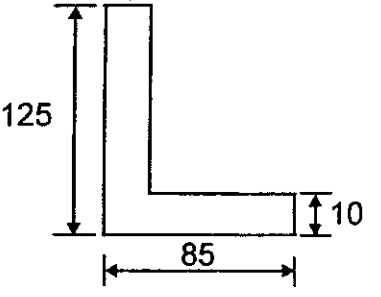

Fig. 1

3. (a) Explain Castigliono's Theorem. 15

(b) Draw the shear force and bending moment diagrams for the beam shown in Fig. 2 : 45

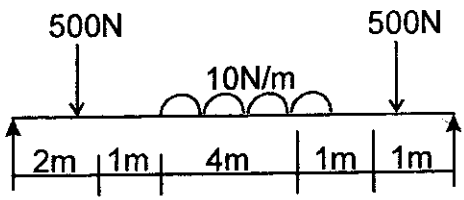

Fig. 2

4. (a) Explain the different defects with figures. 15

(b) Compare and contrast the following terms : 45

(i) Martensite and tempered martensite

(ii) Tempered martensite and pearlite

(iii) Tempered martensite and sphoridite

SECTION – B

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

(a) Explain briefly Chip reduction coefficient.

(b) What are the main types of Jigs ? Explain any one type with a neat sketch.

(c) What is ABC analysis ? Explain its significance with reference to inventory control.

(d) Explain the importance of flow charting.

6. (a) Explain with neat figures different types of chip formation. 20

(b) A cylindrical bar of 100 mm and 550 mm length are turned in a single pass operation. The spindle speed used is 144 rpm and total feed is 0.2 mm/rev. Taylor's tool life relation is $VT^{0.75}$, where V is cutting speed (m/min) and T is tool life in minutes. Calculate : 40

(i) Time for running one piece

(ii) Time required to produce one piece Assume handling time as 4 min

(iii) Average total tool change time per piece if time taken is 4 min for a single piece

7. (a) From the given data, determine the break even point.

Variable cost per unit is ₹ 20

Fixed expenses ₹ 56,000

Selling price per unit ₹ 22

What sould be the selling price per unit, if the break even point should be restricted to 6000 units ? 30

(b) Compare and contrast the Project Evaluation and Review Technique (PERT) with the critical Path Method (CPM) with an example. 30

8. (a) Explain the following control flow statements with detailed examples : 30

(i) If – Else

(ii) Else – If

(iii) Switch

(b) Write a Fortran programme to identify and print positive numbers among the given input. 30