

FS – 21 / 15-16

Mechanical Engineering

Paper – I

Time : 3 hours

Full Marks : 200

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. Answer any **two** of the following : $20 \times 2 = 40$

(a) What do you mean by constrained motion ?

Explain the different types of constrained motions with examples and neat sketches.

(b) A flat bar 80 mm × 12 mm is subjected to an axial pull of 150 kN. One side of it is polished and lines are drawn on it to form a square of 50 mm side ; one diagonal is of the square

being along the middle line of the polished side. If $E = 210 \text{ GN/m}^2$ and Poisson's ratio is 2.8, calculate the alteration in the angles and sides of the square.

(c) Explain briefly the following processes and their effect on the materials :

(i) Full annealing

(ii) Spheroidizing

2. (a) State and prove Kennedy's theorem of three centres in a line. 20

(b) Two involute gears of 20° involute are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch is expressed in module is 5 mm and pitch line speed is 1.2 m/sec assume addendum is equal to one module, find : 20

(i) The angle turned through by pinion when one pair of teeth in mesh

(ii) The maximum velocity of sliding

3. (a) What is the distinction between matrix and dispersed phase in a composite materials ?

10

(b) Explain the difference between the following :

10×3 = 30

- (i) Toughness and resilience
- (ii) Hardness and brittleness
- (iii) Ductility and malleability

4. Elaborately explain the following with example :

10×4 = 40

- (i) Whirling of shafts
- (ii) Annealing
- (iii) Importance of Mohr's circle
- (iv) Necessity of Balancing

SECTION – B

5. Answer any **two** of the following : 20×2 = 40

- (a) State any **four** types of patterns used in castings with neat sketches.
- (b) Define CNC and DNC. With the help of a diagram, explain the working of NC machine tool.
- (c) Describe the various classifications of operators in C and give their precedence.

6. (a) What is method study ? Explain the basic steps of method study with an example. 20

(b) What is the importance of inspection in industry ? Describe various kinds of inspections. 20

7. (a) Write a programme using structures to display the following information for each customer name, account number, street, city, old balance, current payment, new balance, account status. 20

(b) Explain nested for and while loop with syntax with an appropriate example. 20

8. Explain the following : $10 \times 4 = 40$

(i) Flexible automation

(ii) Jigs and fixtures

(iii) Value analysis

(iv) Importance of flow charting

