PRODUCTION

Engineers Hub
For GATE, ESE & PSUs

SYLLABUS

Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures.

Metrology and inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Analysis of Previous GATE Papers

Exam Year	Organized by	1 Mark Ques.	2 Marks Ques.	Total Marks
2009	IIT - ROORKEE	3	14	**31**
2010	IIT - GUWAHATI	6	7	**20**
2011	IIT-MADRAS	6	12	**30**
2012	IIT - DELHI	5	8	**21**
2013	IIT - BOMBAY	7	9	**25**
2014 Set-1	IIT-KHARAGPUR	6	2	**10**
2014 Set-2	IIT-KHARAGPUR	6	3	**12**
2014 Set-3	IIT-KHARAGPUR	6	4	**14**
2014 Set-4	IIT-KHARAGPUR	6	4	**14**
2015 Set-1	IIT – KANPUR	5	6	**17**
2015 Set-2	IIT - KANPUR	3	6	**15**
2015 Set-3	IIT – KANPUR	5	6	**17**
2016 Set-1	IISc - BANGALORE	6	5	**16**
2016 Set-2	IISc - BANGALORE	4	5	**14**
2016 Set-3	IISc – BANGALORE	5	7	**19**
2017 Set-1	IIT – ROORKEE	3	6	**15**
2017 Set-2	IIT - ROORKEE	3	4	**11**
2018 Set-1	IIT – GUWAHATI	7	6	**19**
2018 Set-2	IIT-GUWAHATI	6	7	**20**
2019 Set-1	IIT-MADRAS	3	6	**15**
2019 Set-2	IIT-MADRAS	4	5	**14**

CONTENTS

S. No.	NAME OF THE CHAPTER	PAGE No.
1.	*ENGINEERING MATERIALS*	1 – 5
2.	*METAL CASTING*	6 – 28
3.	*METAL FORMING & SHEET METAL OPERATION*	29 – 62
4.	*JOINING/WELDING*	63 – 83
5.	*MACHINING AND MACHINE TOOL OPERATION*	84 – 135
6.	*METROLOGY AND INSPECTION*	136 – 146
7.	*CIMS*	147 – 160
8.	*NONCONVENTIONAL MACHINING (EDM, HIGH ENERGY RATE FORMING)*	161 – 177
	SOLUTIONS	178 - 228

1 ENGINEERING MATERIALS

1. When 1.0 % plain carbon steel is showly cooled from the molten state to 740 °C, the resulting structure will contain
   A. Pearlite and Cementite
   B. Ferrite and Cementite
   C. Austinite and Ferrite
   D. Austenite and Cementite

[GATE-ME-90:1M]

2. The iron carbon diagram and the TTT curves are determined under
   A. Equilibrium and non-equilibrium conditions respectively.
   B. Non-equilibrium and equilibrium conditions respectively
   C. Equilibrium conditions for both
   D. Non-equilibrium conditions for both

[GATE-ME-96:1M]

3. During heat treatment of steel, the hardness of various structures in increasing order is
   A. martensite, fine pearlite, coarse pearlite, spherodite
   B. fine pearlite, martensite, spherodite, coarse pearlite
   C. Martensite, coarse pearlite, fine pearlite, spherodite
   D. spherodite, coarse pearlite, fine pearlite, martensite

[GATE-ME-03:1M]

4. Cold working of steel is defined as working
   A. At its recrystallisation temperature
   B. Above its recrystallisation temperature
   C. Below its recrystallisation temperature
   D. At two thirds of the melting temperature of the metal

[GATE-ME-03:1M]

5. Hardness of steel greatly improves with
   A. annealing B. cyaniding
   C. normalizing D. tempering

[GATE-ME-03:2M]

6. The percentage of carbon in grey cast iron is in the range of
   A. 0.25 to 0.75 percent
   B. 1.25 to 1.75 percent
   C. 3 to 4 percent
   D. 8 to 10 percent

[GATE-ME-04:1M]

7. From the lists given below, choose the most appropriate set of heat treatment process and the corresponding process characteristics

   Process

   P. Tempering
   Q. Austempering
   R. Martmpering

   Characteristics

   1. Austenite is converted into bainite
   2. Austenite is converted into martensite
   3. Cementite is converted into globular structure
   4. Both hardness and brittleness are reduced
   5. Carbon is absorbed into the metal

   A. P-3, Q-1, R-5 B. P-4, Q-3, R-2
   C. P-4, Q-1, R-2 D. P-1, Q-5, R-4

[GATE-ME-04:2M]

8. When the temperature of a solid metal increases
   A. strength of the metal decreases but ductility increases

B. both strength and ductility of the metal decreases

C. both strength and ductility of the metal increases

D. strength of the metal increases but ductility decreases

[GATE-ME-05:1M]

9. The main purpose of spheroidising treatment is to improve

A. hardenability of low carbon steels

B. machinability of low carbon steels

C. hardenability of high carbon steels

D. machinability of high carbon steels

[GATE-ME-06:1M]

10. The ultimate tensile strength of a material is 400 MPa and the elongation up to maximum load is 35 %. If the material obeys power law of hardening, then the true stress-true strain relation (stress in MPa) in the plastic deformation range is

A. $\sigma = 540\epsilon^{0.30}$ B. $\sigma = 775\,\epsilon^{0.30}$

C. $\sigma = 540\,\epsilon^{0.35}$ D. $\sigma = 775\,\epsilon^{0.35}$

[GATE-ME-06:2M]

11. Match the items in columns I and II

Column-I

P. Charpy

Q. Knoop

R. Spiral Test

S. Cupping Test

Column-II

1. Fluidity

2. Microhardness

3. Formability

4. Toughness

5. Permeability

A. P-4, Q-5, R-3, S-2 B. P-3, Q-5, R-1, S-4

C. P-2, Q-4, R-3, S-5 D. P-4, Q-2, R-1, S-3

[GATE-ME-06:2M]

12. If a particular Fe-C alloy contains less than 0.83 % carbon, it is called

A. high speed steel

B. hypoeutectoid steel

C. hypereutectoid steel

D. cast iron

[GATE-ME-07:1M]

13. The effective number of lattice points in the unit cell of simple cubic, body centered cubic, and face centered cubic space lattices, respectively,

A. 1, 2, 2 B. 1, 2, 4

C. 2, 3, 4 D. 2, 4, 4

[GATE-ME-09:1M]

14. Which of the following is the correct data structure for solid models?

A. Solid part→face→edges→vertices

B. solid part→edges→faces→vertices

C. vertices→edges→faces→solid parts

D. vertices→faces→edges→solid parts

[GATE-ME-09:1M]

15. The material property which depends only on the basic crystal structure is

A. fatigue strength

B. work hardening

C. fracture strength

D. elastic constant

[GATE-ME-10:1M]

16. The crystal structure of austenite is

A. body centered cubic

B. face centered cubic

C. hexagonal closed packed