

B.E/B.TECH. Degree Examination, December 2020

Third Semester

**MR18307- Material Science and Engineering**

(Regulation 2018)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions

**PART A - (8 X 2 = 16 marks)**

1. A part of a machine needs to absorb various shocks and still remain in shape to preserve the integrity of the machine and have good reliability over its life. The part should be
  - a) Hard
  - b) Tough
  - c) Resilient
  - d) Malleable
2. Case depth is the greatest for
  - a) Carburized steels
  - b) Through hardened steels
  - c) Nitrided steels
  - d) Induction hardened steels
3. In which stage does the strain rate begin to accelerate in creep testing
  - 1st stage
  - b) 2nd stage
  - c) 3rd stage
  - d) 4th stage
4. Welding using this flame is harmful to steel when performing oxyacetylene welding
  - Neutral flame
  - b) Oxidizing flame
  - c) reducing flame
  - d) mixed flame
5. Explain plasticity, ductility and malleability and relate them.
6. Differentiate Martempering and Austempering in heat treatment.
7. How is the creep strength measured? Explain with an example of your own.
8. What are the properties that make Silicon carbide useful as a cutting tool material?

**PART B - (4 X16 = 64 marks)**

09. (a) (i) What are the alloying elements you would use in a Steel cutting tool and Why? (8)  
(Elaborate your answer based on the properties).
- (ii) What is the difference between a Solid Solution and a Compound? Are alloys solid solutions or compounds – Elaborate? (4)
- (iii) What would you consider the most important reaction for use as an engineer in the Iron carbon phase diagram (in your domain)? Justify. (4)

**(OR)**

- (b) (i) What are the different phases and microstructures in the iron carbon phase diagram? Explain their significance. (8)
- (ii) How is Cast Iron Classified? Why and how they are different- Explain? (8)

10. (a) (i) Explain in detail the process used for making most ceramic objects and its significance. (12)
- (ii) Give the reasons behind why annealing and hardening are performed with real life examples. (4)

**(OR)**

- (b) (i) Where is case hardening/ surface hardening preferred? Explain with an example and justify its use? Explain a couple of types of case / surface hardening techniques in detail. (10)
- (ii) Explain the process used for hardening Aluminium alloys before their use. (6)
11. (a) Which stress would you use in the factor of safety formula for designing a machine – Yield stress or Ultimate tensile stress? Explain by first elaborating on the Tensile test used in testing of materials. (16)

**(OR)**

- (b) What are the two important material tests you expect to perform inside an engine room of a ship? Justify and also explain the two tests with drawings in detail. (16)
12. (a) (i) Given Steel, FRP, Aluminium and Titanium as starting materials, which one would you prefer as the choice material to build a ship and why? Elaborate. (10)
- (ii) Write in detail about the simplest type of arc welding that is used on board a ship and why it is used? (6)

**(OR)**

- (b) How are Nanomaterials' preparation process classified? Give two examples of each type and explain the processes in detail. (16)