

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA, VADODARA

Ph. D. ENTRANCE TEST (PET) – 7<sup>th</sup> August 2022

Signature of Invigilator

Paper - II  
Metallurgical and  
Materials Engineering  
(22/39)

Roll.  
No.

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Maximum Marks: 50

No. Of Printed Pages: 8

**Instruction for the Candidate:**

1. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
2. There is no Negative Marking for Wrong Answer.
3. A separate OMR Answer Sheet has been provided to answer questions. Your answers will be evaluated based on your response in the OMR Sheet only. No credit will be given for any answering made in question booklet.
4. Defective question booklet or OMR if noticed may immediately replace by the concerned invigilator.
5. Write roll number, subject code, booklet type, category and other information correctly in the OMR Sheet else your OMR Sheet will not be evaluated by machine.
6. Select most appropriate answer to the question and darken appropriate oval on the OMR answer sheet, with black / blue ball pen only. **DO NOT USE PENCIL** for darkening. In case of over writing on any answer, the same will be treated as invalid. Each question has exactly one correct answer and has four alternative responses (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.  
**Example:** (A) ● (B) ● (C) ● (D) ● where (B) is correct response.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. Calculators, Log tables any other calculating devices, mobiles, slide rule, text manuals etc are **NOT** allowed in the examination hall. If any of above is seized from the candidates during examination time; he/ she will be immediately debarred from the examination and corresponding disciplinary action will be initiated by the Center Supervisor as deemed fit.
10. **DO NOT FOLD** or **TEAR** OMR Answer sheet as machine will not be able to recognize torn or folded OMR Answer sheet.
11. **You have to return the OMR Answer Sheet to the invigilator at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.



## Paper - II

### Metallurgical and Materials Engineering (22/39)

**Note:** This paper contains **FIFTY (50)** multiple-choice questions. Each Question carries **ONE (1)** mark.

- 01) Free energy change at equilibrium is ---  
A) Negative  
B) Positive  
C) Zero  
D) Indeterminate
- 02) Second law of thermodynamics is concerned with the ----  
A) Non –cyclic processes only  
B) Irreversible processes only  
C) Amount of energy transfer  
D) Direction of energy transfer
- 03) Entropy is a measure of the ----of a system.  
A) Orderly behaviour  
B) Disorder  
C) Pressure changes only  
D) Temperature changes only
- 04) Metastable means sort of-----phase  
A) Stable  
B) Highly stable  
C) Unstable  
D) Equilibrium
- 05) In Ellingham diagram, the line of M-MO which is in lower position than other that MO is—  
A) More Stable  
B) Less stable  
C) Inactive  
D) Higher active
- 06) Which is not a deoxidizer of steel?  
A) Nickel  
B) Ferro –manganese  
C) Ferro-Silicon  
D) Aluminium
- 07) Which is the most suitable process for improving mechanical properties of steel casting?  
A) Hardening  
B) Phase annealing  
C) Tempering  
D) Recrystallisation annealing
- 08) Eutectoid steel has a structure of  
A) Martensite  
B) Sorbite  
C) Banite  
D) Pearlite
- 09) The micro structure consists of grains and grain boundaries. Normally grain boundaries are -----  
--to the grain by considering galvanic corrosion.  
A) Anodic  
B) Cathodic  
C) Anodic – cathodic  
D) Cathodic – anodic
- 10) Austenite is not----  
A) Soft  
B) Ductile  
C) Magnetic  
D) Malleable
- 11) The density of pure gold is-----gram/cm<sup>3</sup>  
A) 13.31  
B) 14.19  
C) 19.3  
D) 22.57
- 12) Minimum percentage of carbon in cast iron is----  
-----  
A) 0.05  
B) 0.5  
C) 1  
D) 2
- 13) Addition of ----to steel improves its corrosion resistance property.  
A) Cobalt  
B) Chromium  
C) Copper  
D) Copper
- 14) The reduction of iron oxide takes place by Fe<sub>2</sub>O<sub>3</sub>

- 16) Which of the following is never used as an alloying element in steel?  
 A) Lead  
 B) Silicon  
 C) Carbon  
 D) Chromium
- 17) Energy required for size reduction of a solid would be proportional to the new surface area created. Statement is given by----  
 A) Bond  
 B) Rittinger  
 C) Kick  
 D) None of above
- 18) A -----operation is termed as liquation.  
 A) Roasting  
 B) Smelting  
 C) Refining  
 D) Classification
- 19) Collaborator of Bhilai (BSP) plant is -----  
 A) Russian  
 B) German  
 C) British  
 D) Tata
- 20) Pure Iron can dissolve about -----per cent carbon at a temperature little above its melting point.  
 A) 3.5  
 B) 4.1  
 C) 4.5  
 D) 5.0
- 21) Which of the following is characterized as a light metal?  
 A) Sodium  
 B) Nickel  
 C) Magnesium  
 D) Copper
- 22) -----of a metal is termed as dross.  
 A) Oxide  
 B) Carbonate  
 C) Sulphide  
 D) Nitrate
- 23) Castability of aluminium is increased by the addition of -----in it.  
 A) Carbon  
 B) Magnesium  
 C) Silicon  
 D) Manganese
- 24) Liquid nitrogen containers can be made from:  
 A) Ferritic stainless steel  
 B) HSLA steel  
 C) Titanium  
 D) Austenitic stainless steel
- 25) The technique(s) which can be used for the direct observation of dislocations is (are):  
 A) Scanning electron microscopy  
 B) Transmission electron microscopy  
 C) Field-ion microscopy  
 D) Electron probe micro analysis
- 26) Creep resistance can be improved by allowing the-----  
 A) Uniformly dispersed coarse particles precipitation in the metal matrix  
 B) Directional solidification of alloys  
 C) Grains to grow coarse  
 D) Hard particles to precipitate along grain boundaries'
- 27) Tungsten filaments are produced by ----- techniques.  
 A) Powder Metallurgy  
 B) Die casting  
 C) Forging  
 D) Electro deposition
- 28) Length to Diameter ratio of a ball mill is-----  
 A) 1.5  
 B) 1  
 C) Less than 1  
 D) 2
- 29) Jigging is a technique by which different particles can be separated based on the particle---  
 -  
 A) Size  
 B) Shape  
 C) Colour  
 D) Wettability

- 30) The temporary shutdown of blast furnace is called-----  
 A) Blowing in  
 B) Blowing out  
 C) Banking  
 D) Back draughting
- 31) The reaction ,  $C+CO_2= 2CO$  Occurring In The Blast Furnace Is Called the ----- reaction.  
 A) Reduction  
 B) Solution loss  
 C) Neumann's  
 D) Calcinations
- 32) When the wave length of the incident X-ray increases, the angle of diffraction  
 A) decreases  
 B) Increases  
 C) remains constant  
 D) shows no systematic variation
- 33) Porosity of pellets is in the range of ----- percentage.  
 A) 10-15  
 B) 40-45  
 C) 20-30  
 D) 5-10
- 34) Melting point of pure iron is -----<sup>0</sup>C  
 A) 1200  
 B) 1350  
 C) 1539  
 D) 1600
- 35) Blast furnace hearth is lined with the -----  
 A) High alumina block  
 B) Corundum block  
 C) Zirconium block  
 D) Carbon block
- 36) The strength of material increases with  
 A) Increase in dislocation density  
 B) Decrease in dislocation density  
 C) Increase in grain size  
 D) Decrease in grain size
- 37) Tuyers in the blast furnace are cooled by----- circulation.  
 A) Water  
 B) Air  
 C) Cooling oil  
 D) Nitrogen
- 38) **Slip** plane in copper is  
 A) (100)  
 B) (110)  
 C) (111)  
 D) (0001)
- 39) Most of the phosphorous present in the blast furnace burden enters in to -----  
 A) Hot metal  
 B) Flue gases  
 C) Slag  
 D) Refractory lining
- 40) During LD blow in steel making the impurity that gets removed first is-----  
 A) Carbon  
 B) Phosphorous  
 C) Sulphur  
 D) Silicon
- 41) The single most important requirement for a turbine blade material is  
 A) Damping  
 B) Resilience  
 C) Creep resistance  
 D) DBTT
- 42) Intergranular corrosion occurs  
 A) Along grain  
 B) Along the grain boundary  
 C) At the surface  
 D) In the core of material
- 43) Which of the following is a measure of the ductility of a metal?  
 A) Young's modulus  
 B) U.T.S  
 C) Yield strength  
 D) Percentage elongation
- 44) ----- sand is used for making core.  
 A) Dry  
 B) Green  
 C) Oil  
 D) Loam
- 45) Which is a neutral refractory?  
 A) Graphite  
 B) Silica  
 C) Fireclay  
 D) Dolomite

- 46) Which is the most suitable for welding heavier sections subjected to severe load conditions?
- A) Butt joint
  - B) Double V-butt joint
  - C) Open square butt joint
  - D) Close square butt joint
- 47) In brittle material the type of fracture observed is known as
- A) cup and cone type
  - B) Cleavage
  - C) beach mark
  - D) chevron pattern
- 48) A pipeline buried in soil is commonly protected from corrosion by
- A) Anodic protection
  - B) Cathodic protection
  - C) Using inhibitor
  - D) Using a special alloy resistant to corrosion
- 49) A pool of molten metal is used in ----- welding.
- A) Thermit
  - B) Electro-slag
  - C) Submerged arc
  - D) Friction stir
- 50) The major problem in welding of stainless steel is ----
- A) Formation of Chromium carbide
  - B) Formation of Oxide film
  - C) High electrical resistance
  - D) Poor thermal conduction

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**Rough Work:**