

Seat No. \_\_\_\_\_

SUB: METALLURGY ENGINEERING (MT)

Time: 1 Hour 30 minutes

**Instructions:**

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

- 1 What shape of impression present on sample after Brinell Hardness Test  
A Square B Circle  
C Diamond Pyramid D Hexagon
- 2 In case of Ferritic steels Impact Energy----- with increase in temperature.  
A No change B Decreases  
C Increases D Negative
- 3 In case of creep the deformation of metals is noticeable at temperature above-----  
T<sub>m</sub>=Melting Temperature  
A 0.4T<sub>m</sub> B 0.5T<sub>m</sub>  
C 0.55T<sub>m</sub> D 0.6T<sub>m</sub>
- 4 Wear rate of metals depends on  
A Hardness B Tensile strength  
C Compressive strength D All of above
- 5 A Nicol prism uses a natural polarizing crystal material, like a-----  
A Magnesite crystal B Calcite Crystal  
C Ferrite crystal D Oxide Crystal
- 6 A grain size index of 8 has how many numbers of grains per square inch at 100X magnification.  
A 127 B 128  
C 126 D 122
- 7 Which kind of window is used in X-ray tube for material testing?  
A Cu B Fe  
C C D Be
- 8 Internal stress in the material is determined by  
A X-ray diffraction B Radiography  
C Ultrasonic method D TEM (Transmission electron microscope)
- 9 Simple Hexagonal Lattice has which pair of vector and inter axial angles?  
A  $a=b=c, \alpha=\beta=\gamma=90^\circ$  B  $a \neq b \neq c, \alpha=\beta=\gamma=90^\circ$   
C  $a=b \neq c, \alpha=\beta=90^\circ$  and  $\gamma=120^\circ$  D  $a \neq b \neq c, \alpha \neq \beta \neq \gamma=90^\circ$
- 10 Bismuth and Gallium when melts there volume  
A Increases B Equal  
C Decreases D None of above
- 11 The basic functioning of radiography is based on the -----and -----of radiation by materials  
A Transmission and absorption B Absorption and Transmission  
C Both of above D None of above
- 12 2% HNO<sub>3</sub> in alcohol as etchant is used for

- A Copper alloy  
 B Aluminium  
 C Steel and Cast Irons  
 D Nickel alloys
- 13 Shrinkage porosity under radiography is seen as a
- A Circular regular white region  
 B Fibrous irregular dark region with an irregular outline  
 C Dark area with sharp boundaries  
 D White area with an irregular out line
- 14 What is the objective of normalizing ?
- A To refine grain Size  
 B To improve machinability of medium carbon steel  
 C To reduce internal stresses  
 D All above
- 15 To control the warpage and distortion which heat treatment can be useful?
- A Tempering  
 B Spheroidising  
 C Annealing  
 D Austempering
- 16 The size of sample use for Jominy hardenability test is
- A 60mm long 25mm dia  
 B 75 mm long 20 mm dia  
 C 75mm long 25 mm dia  
 D 60mm long 20mm dia
- 17 The twin is always----- dimensional.
- A Three  
 B Two  
 C One  
 D All above
- 18 Plastic deformation is a function of stress, temperature and ----
- A Time  
 B Force  
 C Rate of straining  
 D All above
- 19 Twin lines appear during the ----- operation of some materials.
- A Normalizing  
 B Annealing  
 C Hardening  
 D Carburizing
- 20 High angle grain boundaries means orientation difference between neighboring grains is more than
- A  $25-30^{\circ}$   
 B  $10-15^{\circ}$   
 C  $5-8^{\circ}$   
 D  $30-45^{\circ}$
- 21 BauSchinger effect is seen in----- of metals
- A Cold working  
 B Hot working  
 C Both  
 D None of above
- 22 In case of boiler tubes without lowering the strength generated during cold working which process is required to reduce the internal stresses
- A Recrystallization  
 B Recovery  
 C Normalizing  
 D Hardening
- 23 Recrystallization and melting temperature of Pb is
- A  $0^{\circ}$  and  $337^{\circ}$   
 B  $150^{\circ}$  and  $337^{\circ}$   
 C  $0^{\circ}$  and  $232^{\circ}$   
 D  $150^{\circ}$  and  $232^{\circ}$
- 24 Chemical formula for Ni Ferrite is
- A  $\text{Ni Fe}_2\text{O}_4$   
 B  $\text{Ni Fe}_2\text{O}_3$   
 C  $\text{Ni FeO}$   
 D  $\text{NiO FeO}$
- 25 Surface tension of liquid is measured in
- A dyne /cm  
 B dyne.cm  
 C Erg  
 D  $\text{dyne/cm}^2$
- 26 Jigging is a process of ore concentration based on differences in
- A Conductivity of minerals  
 B Specific gravity of minerals  
 C Hardness of minerals  
 D Surface tension of minerals
- 27 Examples of basic refractories are
- A Quartz  
 B Silica brick



- C Deposition D Hydrogenation
- 42 ----- means measurement of randomness.  
A Entropy B Enthalpy  
C Free energy D Gibbs free energy
- 43 A chemical reaction may generate heat or absorb heat from the surroundings. It is called ----- and ----- reaction.  
A Forward or Backward B Positive or negative  
C Exothermic or endothermic D Oxidation or reduction
- 44 % Oxygen required in Cu for better ductility and electrical conductivity is <  
A < 0.1 B < 0.01  
C > 0.1 D ≤ 0.3
- 45 Henry's law states that the activity of a component is proportional to its-----  
A % concentration B Atomic wt%  
C Mol fraction D None of above
- 46 Hydrometallurgy is very important in the extraction of metals particularly for treating ----- ores.  
A Oxides B Sulphides  
C Complex D A and B
- 47 The positive and negative conductors immersed in the electrolyte during electrolysis are called as -----and ----- respectively  
A Cathode and anode B Anode and cathode  
C +ve cathode and -ve cathode D +Ve Anode and- Ve anode
- 48 An isolated system does not exchange ----- and ----- with its surrounding.  
A Matter and mass B Matter and energy  
C Temperature and Pressure D None of above
- 49 Fugacity indicates the ----- tendency of the component or a substance  
A Ideal B Non-escaping  
C Escaping D Non ideal
- 50 Most of the metallurgical reactions are -----  
A Homogeneous reaction B Hetrogeneous  
C Both D None of above
- 51 When the rate of reaction is constant a reaction is said to be ----- order  
A First B Second  
C Zero D Non order
- 52 Electro winning means-----  
A Extraction of metals B Purification of metals  
C Dissolutions of metals D None of above
- 53  $\text{Fe}_2\text{O}_3 \rightarrow \text{Fe}_3\text{O}_4 \rightarrow \text{Fe}$  Sequence of reduction of iron oxide takes place at----- °C  
A Above 750 B At 750  
C Below 570 D Above 570
- A large mass of material get stuck as a single block in the top portion of the bosh called as  
54 A Scaffolding B Slip  
C Choking D Pillaring
- 55 De-sulphurisation inside blast furnace can be control by -----  
A Having higher basicity B Raising the hearth temperature  
C Increasing the slag volume D All above
- 56 Sponge iron is a term given to the product that is obtained by reduction of iron oxide

- in----- state
- A Liquid B Gaseous  
C solid D All three
- 57 First COREX process installed in 1988 at-----  
A Brazil B South Africa  
C India D Japan
- 58 ----- is the only mechanism by which heat can flow in opaque solids  
A Quantum theory B Conduction  
C convection D Wave theory
- 59 Penetration of carbon to a certain depth in a mild steel specimen during the carburising process is due to  
A Thermal diffusion B Pressure diffusion  
C Molecular diffusion D Radiation
- 60 Slag basicity is the ratio of  
A  $\text{SiO}_2$  to  $\text{CaO}$  B  $\text{CaO}$  to  $\text{SiO}_2$   
C Basic to acid oxides D Both B and C
- 61 Which is the most stable oxide product during refining of Pig iron?  
A  $\text{SiO}_2$  B  $\text{MnO}$   
C  $\text{CaO}$  D  $\text{MgO}$
- 62 The efficiency of steel making processes is assessed by the ----- of steel  
A Yield and quality B Production rate  
C Refractory consumption per ton D All a, b & c
- 63 Which of the following alloying elements when added to plain carbon steel increases its corrosion/oxidation resistance?  
A Chromium B Cobalt  
C Molybdenum D Tungsten
- 64 Which of the following is a demerit of electric arc steel making?  
A Higher temperature can not be attained B Capacity is low compared to other processes  
C It can not remove S and P D All types of steel can not be made by this process
- 65 L D slag contains maximum percentage of-----  
A  $\text{CaO}$  B  $\text{FeO}$   
C  $\text{SiO}_2$  D  $\text{MnO}$
- 66 Grade of pig Iron is decided by its-----content  
A Silicon B Manganese  
C Sulphur D Carbon
- 67 Oxygen is blown in the L.D. convertor through a water cooled lance whose tip is made of  
A Copper B Aluminium  
C Brass D Nickel
- 68 Cores in a centrifugal casting are made of  
A Cast iron B Steel  
C Hard sand D None of above
- 69 ----- patterns are required in shell moulding processes  
A Metal B Wooden  
C Plastic D Sand
- 70 The purpose of inoculation is to----- of the cast metal  
A Decrease the melting B Alter the chemical composition

- temperature
- C Modify the structure and properties
- D Improves the finishing
- 71 Sprue in casting refers to
- A Riser
- B Runner
- C Gate
- D Vertical passage
- 72 Which is the most suitable for welding of heavier sections subjected to severe Load condition?
- A Butt Joint
- B Double V butt joint
- C Open square butt joint
- D Close square butt joint
- 73 TIG is especially useful in welding of
- A Stainless Steel
- B Cast Iron
- C Aluminium
- D Titanium
- 74 Welding of ----- essentially requires preheating
- A Aluminium
- B Cast iron
- C Stainless steel
- D High speed steel
- 75 Supersaturated solid solutions are important for
- A Forming Cementite
- B Precipitation hardening
- C Diffusion
- D Pearlite lamellae spacing
- 76 The following thermocouple may be used for measuring temperature upto 1600 °C
- A Chromel-alumel
- B Copper-constant
- C Iron-Constant
- D Platinum-Platinumrhodium
- 77 There is a change in----- during phase transition
- A Volume
- B Pressure
- C Temperature
- D All a,b,c
- 78 German Silver is an alloy of
- A Silver, Nickel and zinc
- B Silver, Zinc and aluminium
- C Copper, aluminium and silver
- D Copper, Nickel and zinc
- 79 Stainless steel is not corroded by
- A Hydrochloric acid ( 10%)
- B Nitric acid(10%)
- C Sulphuric acid (10%)
- D Saturated brine
- 80 Presence of high phosphorous in cast iron increases its
- A Fluidity
- B Melting point
- C Shrinkage
- D Tensile strength
- 81 The rank of a matrix  $\begin{bmatrix} 3 & 2 & 5 \\ 0 & 4 & 6 \\ 0 & 0 & 7 \end{bmatrix}$  is
- A 3
- B 2
- C 1
- D 0
- 82 A linear system  $x + y + z = 2$ ,  $x + 3y + 3z = 0$ ,  $x + 3y + 5z = 2$  has
- A No Solution
- B Infinite number of solutions
- C Unique solution
- D None of these
- 83 If  $A = \begin{bmatrix} 5 & 2 & 1 \\ 0 & 3 & 6 \\ 0 & 0 & -1 \end{bmatrix}$  then eigen values of  $A^{-1}$  are
- A 5, 3, 2
- B 5, 6, 3
- C 3, 6, 1
- D  $\frac{1}{5}, \frac{1}{3}, \frac{1}{2}$
- 84 If  $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$  then  $A^3 + A^2 - 5A - 5I$  is equal to

- A Identity Matrix  
 C Non-Singular Matrix  
 B Null Matrix  
 D None of these
- 85  $\lim_{x \rightarrow 0} \frac{5 \tan x - 3 \sin x}{x^2}$  is equal to  
 A 1  
 C 3  
 B 2  
 D 0
- 86 The value of improper integral  $\int_0^\infty e^{-3x} dx$  is  
 A 0  
 C  $\frac{1}{3}$   
 B 1  
 D 3
- 87 If  $U = \tan^{-1} \left( \frac{x^2 + y^2}{xy} \right)$  then  $x \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y}$  is equal to  
 A 2U  
 C U  
 B 0  
 D 3U
- 88 If  $\phi = x^2 y^2 z^2$  then  $\text{curl}(\text{grad} \phi)$  is  
 A  $\mathbf{0}$   
 C  $\nabla^3 \phi$   
 B  $\nabla^2 \phi$   
 D  $\nabla \phi$
- 89 The value of  $\oint_C xy dy - y^2 dx$ , where C is square bounded by  $x = 0, x = 2, y = 0$  and  $y = 2$  is  
 A 2  
 C 1  
 B 6  
 D 12
- 90 Solution of  $(x^2 - 2xy)dx - (x^2 - \sin y)dy = 0$  is  
 A  $x^2 - (x^2 y + \cos y) = c$   
 C  $x^3 - 3(x^2 y + \cos y) = c$   
 B  $x^2 - x^2 y + \sin y = c$   
 D  $x^3 - \cos y = c$
- 91 Solution of  $\frac{d^2 y}{dx^2} - 14 \frac{dy}{dx} + 49y = e^{7x}$  is  
 A  $C_1 e^{7x} + C_2 e^{-7x} + x^2 e^{7x}$   
 C  $(C_1 + C_2 x) e^{-7x} + x^2$   
 B  $(C_1 + C_2 x) e^{-7x} + x^2 e^{-7x}$   
 D  $(C_1 + C_2 x) e^{7x} + \frac{x^2}{2} e^{7x}$
- 92 Inverse Laplace transformation of  $\frac{s+5}{s^2+10s+34}$  is  
 A  $\frac{1}{3} e^{-5t} \cos 3t$   
 C  $e^{-3t} \cos 5t$   
 B  $e^{-5t} \sin 3t$   
 D  $e^{-3t} \sin 5t$
- 93 Which one is Analytic function  
 A  $\sin Z$   
 C  $|Z|$   
 B  $\bar{Z}$   
 D  $Z\bar{Z}$
- 94 Value of  $\int_C \frac{3Z^2}{Z-1} dZ$ , (where C is  $|Z-1| < 2$ ) is  
 A  $\pi i$   
 C  $6\pi i$   
 B  $2\pi i$   
 D 0
- 95 Residue of  $f(Z) = \frac{1}{Z^2(Z-1)}$  at simple pole is  
 A 4  
 C 2  
 B 1  
 D 3
- 96 Newton-Raphson iteration formula for  $x^2 + x + 1 = 0$  is  
 A  $x_{n+1} = \frac{2x_n^2 + 1}{2x_n}$   
 B  $x_{n+1} = \frac{2x_n^2 - 1}{2x_n}$

- C  $x_{n+1} = \frac{x_n^2 - 1}{2x_n + 1}$  D  $x_{n+1} = \frac{3x_n^2 + 2}{2x_n + 1}$
- 97 Value of integral  $\int_0^1 \frac{1}{1+x} dx$  using Simpson's 1/3 rule with step size  $h = 0.25$  is
- A 0.6932 B 0.96733  
C 0.68333 D 0.96332
- 98 If  $\frac{dy}{dx} = 3x + y$ ,  $y(1) = 1.3$ ,  $h = 0.1$ , by Runge-Kutta second order method to what is an approximate value of  $y(1.1)$
- A 1.5677 B 1.7665  
C 1.6555 D 1.4566
- 99 Three coins are tossed together and let random variable  $X$  be the number of heads in each outcome then Mean is
- A 2 B  $\frac{1}{2}$   
C  $\frac{5}{2}$  D  $\frac{3}{2}$
- 100 In binomial distribution formula of calculating standard deviation is
- A  $\sqrt{p}$  B  $\sqrt{pq}$   
C  $\sqrt{npq}$  D  $\sqrt{np}$