KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Marks Scored:

Level : B.E.
Year : II
Course : MEEG 217
Semester : I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration N.:
Date :

SECTION "A"
[20Q. × 1 = 20 marks]

Choose and mark [×] in the most appropriate option.

1. For a ductile material , toughness is a measure of
   [ ] Resistance to scratch [ ] Ability to absorb energy up to fracture
   [ ] Ability to absorb energy till elastic limit [ ] Resistance to indentation.

2. When temperature of solid metal increases,
   [ ] Strength of metal decreases but ductility increase
   [ ] Both the strength and ductility of metal decreases
   [ ] Both the strength and ductility of metal increases
   [ ] Strength of metal increases but ductility decreases

3. For casting of turbine blades made of high temperature and high strength alloys, the most suitable process is
   [ ] Semi centrifugal casting [ ] Investment casting
   [ ] Centrifugal casting [ ] Slush casting

4. A moving mandrel is used to
   [ ] Wire drawing [ ] Tube drawing [ ] Metal cutting [ ] Forging

5. In rolling process, the state of stress of material undergoing deformation is
   [ ] Pure compression [ ] Pure shear
   [ ] Shear and compression [ ] Tension and shear

6. Penetration is increased by
   [ ] Increasing welding speed and current
   [ ] Increasing current and decreasing speed
   [ ] Decreasing speed and current
   [ ] Increasing speed and decreasing current

7. In DC welding, Straight Polarity (Electrode negative) results in
   [ ] Lower penetration. [ ] Lower deposition rate.
   [ ] Less heating of work piece [ ] Smaller weld pool

8. The size of BUE in Metal cutting increases with
   [ ] Very high speed [ ] Large uncut chip thickness.
   [ ] Use of cutting fluid [ ] Increase in Positive rake angle.

9. BUE is formed while machining
   [ ] Ductile material with high speed [ ] Ductile material with low speed
   [ ] Brittle material with high speed [ ] Brittle material with low speed

10. Fluxes used in welding in order to protect the molten metal and the surfaces to be joined from
[ ] Oxidation [ ] Carburizing [ ] Dirt [ ] Distortion and warping

11. Metal Deposited on to the work piece from the electrode
[ ] is forced across the arc
[ ] falls because of gravity
[ ] is attracted towards the work piece due the positive polarity of the work piece
[ ] is attracted towards the work piece due to the negative polarity of the work piece

12. In arc welding operations the current value is decided by
[ ] Thickness of plate [ ] Size of the electrode.
[ ] Voltage across the arc [ ] Speed of travel

13. Two M.S. plates, 20 mm thick for boiler drum are to be butt welded. Which of the following processes would be best suited ?
[ ] Submerged arc welding [ ] Electro slag welding.
[ ] Electric resistance welding [ ] TIG/MIG welding

14. Chvorinov's Rule states that total solidification time is proportional to which one of the following quantities?
[ ] $(A/V)^n$ [ ] Hf
[ ] V/A [ ] $(V/A)^2$

where A = surface area of casting, Hf = heat of fusion, Tm = melting temperature, and V = volume of casting.

15. Given that Wm = weight of the molten metal displaced by a core and Wc = weight of the core, the buoyancy force is which one of the following?
[ ] downward force = Wm + Wc [ ] downward force = Wm – Wc
[ ] upward force = Wm + Wc [ ] upward force = Wm – Wc

16. Which of the following rolling mill types are associated with relatively small diameter rolls in contact with the work?
[ ] Cluster mill [ ] Continuous rolling mill
[ ] Reversing mill [ ] Three-high configuration.

17. Which of the following bulk deformation processes are not involved in the production of nails for lumber construction?
[ ] Bar and wire drawing [ ] Extrusion
[ ] Forging [ ] Rolling

18. Milling machine is classified as horizontal or vertical type, depending on the position of
[ ] Spindle [ ] Work piece [ ] Milling Cutter [ ] Work table or bed

19. Shrinkage allowance on pattern is provided for
[ ] Compensation for finishing operation after completion of casting
[ ] Easy removal of casting
[ ] Compensation for shrinkage during solidification
[ ] Compensation for shrinkage after solidification

20. What is the type of welding defect caused due to poor deposition of weld rod is called?
[ ] Porosity [ ] Undercut [ ] Under fill [ ] Crack

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Semester : I
F.M. : 55

SECTION "B"

Attempt *ALL* questions. Assume data if necessary.

1. Elaborate the various stages in product design process. What are the different factors influencing manufacturing of a product? [3+2]

2. Compare three different materials: Mild steel, Aluminum and Cast iron with the help of Stress Strain Diagram. Referring the diagram, Describe the behavior of the each material with key terms? [3+2]

3. A strip of Metal is originally 1.5 m long .It is stretched in three steps: First to a length of 1.75 m, then to 2.0 m, and finally 3.0 m. Show that the total true strain is the sum of the true strains in each step, i.e., that the strains are additive. Show that, using engineering strains, the strain for each step cannot be added to obtain the total strain. [5]

4. Describe the basic working principle and important parts of Lathe machine. What are the different operations performed on lathe machine? Explain each operation with illustrative figures. [3+4]

5. How is arc obtained in arc welding, Write different power sources used in the welding with their application? Draw a labeled diagram of three types of Oxy-acetylene gas welding flames with their applications. [3+3]

6. What is Destructive and Nondestructive testing in welded joint? Two similar material plates were welded together and tested, "it was found that the welded joint were stronger than of the parent material". Do you think that the above statement is incorrect? Do explain with valid reason. [2+2]

7. In a Given arc welding operation, the power source is at 20 V and current is 300 A. If the electrode travel speed is 9 mm/sec, calculate the CSA of joint. The overall heat transfer efficiency of the process is 75%. Heat required to melt the steel is 10 J/mm^3. [4]

8. What is the ideal profile of sprue? Explain how it is principally governed and actually practiced? Draw labeled diagram of a mould box showing pattern, gates, runner and riser. What do you understand by directional solidification of casting? [1+2+3]

9. In the casting of steel under certain mold conditions, the mold constant in Chvorinov's Rule is known to be Cm = 4.0 min/cm^2, based on previous experience. The casting is a flat plate whose length = 30 cm, width = 10 cm, and thickness = 20 mm. Determine how long it will take to solidify. [5]

10. For hot working, it is often necessary to heat the work piece in a furnace and there are scale losses and other problems. Why is hot working sometimes preferred over cold working in spite of such disadvantages? With Illustrative labeled diagram, compare similar product manufactured by Forging, forming, casting and machining with the help of mechanical properties and grain structures. [3+5]

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SECTION "A"
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Choose and mark [X] in the most appropriate option.

1. Which of these materials have typically higher strength?
   [ ] Silicon Carbide Ceramics [ ] Carbon Epoxy Composites
   [ ] Carbon Metal Alloys [ ] Glass Polyester

2. Calculate the number of electrons capable of conducting an electrical charge in 15 cubic centimeters of silver. Given: density of silver = 10.49 g/cm^3, atomic mass of silver = 107.868 g/mol, Avogadro's number = 6.023E23, atomic number of silver = 47
   [ ] 8.79×10^{22} [ ] 8.79×10^{23} [ ] 8.79×10^{24} [ ] 8.79×10^{25}

3. For monoclinic crystal system, edge lengths (a, b and c) and inter-axial angles (α, β, and γ) are .....
   [ ] $a = b \neq c, \alpha = \beta = 90°, \gamma = 120°$ [ ] $a = b = c, \alpha = \beta = \gamma \neq 90°$
   [ ] $a \neq b \neq c, \alpha = \beta = \gamma = 90°$ [ ] $a \neq b \neq c, \alpha = \beta = 90° \neq \gamma$

4. What is atomic packing factor of BCC crystal structure?
   [ ] 0.68 [ ] 0.52 [ ] 0.74 [ ] 0.32

5. What is the approximate optimal grain size for highest yield strength?
   [ ] 1 nm [ ] 10 nm [ ] 100 nm [ ] 0.1 nm

6. For a specimen with ASTM grain size number of 6.5, how many grains per square inch will be there at a magnification of 70x?
   [ ] 9.236 grains/in^2 [ ] 22.17 grains/in^2
   [ ] 92.36 grains/in^2 [ ] 2.217 grains/in^2

7. Which of the following is **NOT TRUE** for a tie line?
   [ ] Tie line is used to determine different phases present
   [ ] Tie line is used to the composition of phases present
   [ ] Tie line is used to determine the mass fraction of phases present
   [ ] Tie line is used to determine the volume fraction of phases present

8. Calculate number of atoms in a critical nucleus when solid Pb forms by homogeneous nucleation. ($a_o = 0.3615\ nm$ for FCC, solid-liquid interfacial energy = $33 \times 10^{-7} J/cm^2$, freezing temperature = $327°C$, heat of fusion = $237\ J/cm^3$, undercooling for nucleation = $80°C$)
   [ ] 1616 [ ] 808 [ ] 3232 [ ] 40

9. Increase in temperature of an undercooled uninoculated liquid metal as a result of liberation of heat during nucleation is called .....
[ ] thermal arrest [ ] recalescence [ ] superheat [ ] solidification

10. A three-phase reaction in which two solids transform into one solid on cooling is known as .....
[ ] peritectic [ ] eutectoid [ ] monotectic [ ] peritectoid

11. During solidification, ... austenite transforms into ..... ferrite.
[ ] FCC, BCC [ ] BCC, FCC [ ] FCC, SC [ ] SC, BCC

12. Annealing is done ..... upper critical temperature for hypoeutectoid steels and ..... upper critical temperature for hypereutectoid steels.
[ ] above, below [ ] above, above [ ] below, above [ ] below, below

13. Ductility is the highest for .....
[ ] fine pearlite [ ] coarse pearlite [ ] bainite [ ] martensite

14. ..... is never obtained with continuous cooling.
[ ] fine pearlite [ ] coarse pearlite [ ] martensite [ ] bainite

15. ..... are used in cutleries.
[ ] medium carbon steels [ ] high carbon steels
[ ] mild steels [ ] low carbon steels

16. Which of these uses spherical steel indenter?
[ ] Vickers hardness [ ] Rockwell hardness
[ ] Brinell hardness [ ] Knoop hardness

17. Chevron markings in the failed material indicates .....
[ ] ductile fracture [ ] brittle fracture
[ ] fatigue fracture [ ] corrosion failure

18. Closely packed striations represent .....
[ ] low stress, many cycles [ ] high stress, few cycles
[ ] brittle fracture [ ] crack origin

19. In which type of point defect, positive and negative ions are missing from the crystal?
[ ] Vacancy [ ] Interstitial [ ] Schottky [ ] Substitutional

20. The highest relative length of stream in spark test is seen in .....
[ ] Aluminum [ ] White cast iron [ ] High speed steel [ ] Wrought Iron