L-3/T-2/MME **Date : 06/04/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **MME 365** (Ceramics and Glass Engineering)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Discuss the various mechanisms to increase wetting characteristics for ceramic joining by Brazing. **(15)**

   (b) Analyze the different physical and chemical factors that control the diffusion bonding process. **(20)**

2. (a) Illustrate the mechanism by which spiny structure of $(CaO)_3(SiO_2)_2(H_2O)_3$ grows during the hardening reaction of Portland cement. **(15)**

   (b) Why do you need glaze in a state of compression on the finished product of a ceramic? **(10)**

   (c) "Body and glaze react with each other to form an intermediate layer" - Explain. **(10)**

3. (a) What sort of commercial glass composition is used for making lighting glass? Mention the key characteristics of this specific glass composition. **(10)**

   (b) Evaluate a sheet glass making process that would give excellent surface properties. **(15)**

   (c) Describe the removal process of fine gas bubbles from the molten glass. **(10)**

4. (a) Explain the various mechanisms for the development of permanent stress in glass. **(10)**

   (b) For a soda-lime-silicate glass with $\alpha = 90\times10^{-7}$/°C, E = 70 GPa, $\kappa = 0.0084$ cm^2/s, $\nu = 0.2$, and d = 0.3 cm, calculate the cooling rate for what surface compression will rise to 4 MPa. Assume any missing data. All the symbols have their usual meaning. **(8)**

   (c) Mention and discuss the different viscosity reference temperatures with the help of a typical viscosity-temperature diagram for a soda-lime-silicate glass. **(10)**

   (d) Identify the significance of critical cooling rate. Calculate the critical cooling rate of a bulk metallic glass-forming alloy with a melting point of 1300°C from the following Fig. 1. **(7)**

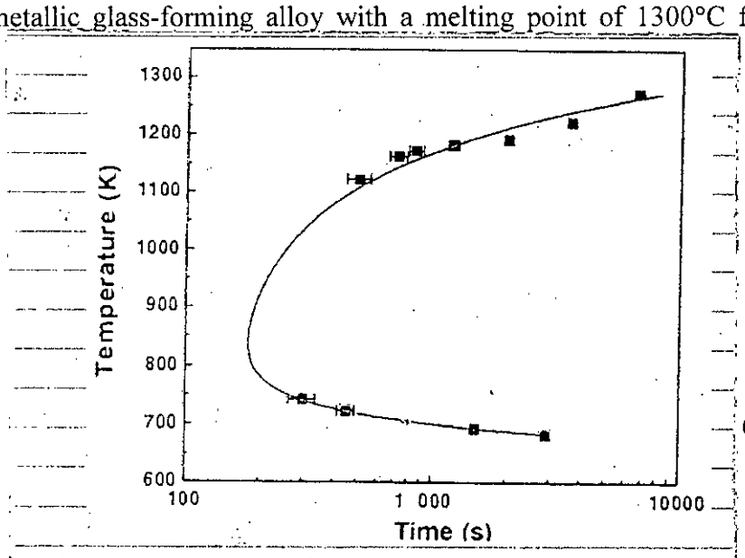


Fig. 1 A time-temperature-transformation (T-T-T) diagram for glass formation.

Ans Q. 4(d)

Contd. P/2

MME 365

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) 'The structure of silicates depends on MO/SiO_2 ratio'-Explain the assertion. **(15)**

   (b) With neat sketch, discuss the crystal structures of cubic alumina, Al_2O_3 and cubic zirconia, ZrO_2. **(14)**

   (c) List the raw materials that are vital to the preparation of the ware. **(6)**

6. (a) Explain the process of sedimentary clay formation. **(12)**

   (b) Why are fillers added in ceramic body? **(7)**

   (c) List the uses of lithium compounds as a raw material. **(6)**

   (d) Explain the stage of drying in which all the shrinkage water is evaporated and surface no longer behave as free water surface. **(10)**

7. (a) What is the major concern about solid state sintering? How can this problem be solved? **(8)**

   (b) Explain porosity removal and grain growth that occurs during the final stage of sintering. **(15)**

   (c) How can you measure the specific surface area of a powder? **(12)**

8. (a) What are the major limitations of uniaxial pressing? What can be done to solve these problems? **(12)**

   (b) Mention the key characteristics that should be considered during extrusion. **(8)**

   (c) Explain the effects of particle size and particle surface on slip casting process. **(15)**

L-3/T-2/MME Date : 10/04/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 211** (Sociology)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Define capitalism. Write down the consequences of capitalism. **(12)**

   (b) Briefly describe the important characteristics of post-industrial societies. **(6)**

   (c) Critically discuss the Malthusian population theory. **(5 1/3)**

2. (a) What do you understand by urbanization and over urbanization. **(6)**

   (b) Discuss the classification of cities with examples. **(5 1/3)**

   (c) What is meant by mega city? Describe the factors that have led to the growth of cities. **(12)**

3. (a) Define environment, environmentalism and environmental justice. **(12)**

   (b) What do you mean by pollution? Briefly discuss the potential consequences of global warming. **(11 1/3)**

4. Write short notes on any THREE of the following: **(23 1/3)**

   (a) Save the environment

   (b) Sources of social change

   (c) Consequences of industrial revolution

   (d) Globalization.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) 'Sociological imagination is an empowering tool, allows us to look beyond our limited experiences' – Explain this statement with suitable examples. **(10)**

   (b) Critically discuss the functionalist theoretical perspective of sociology. **(13 1/3)**

Contd P/2

HUM 211 (MME)

6. (a) Define culture. Explain the meaning of ethnocentrism and dominant ideology with examples. **(10)**

   (b) What is social norm? Discuss different types of social norm with examples. **(13 1/3)**

7. (a) What do you understand by socialization? Explain G. H. Mead's theory of socialization. **(10)**

   (b) Critically evaluate the changing roles of agents of socialization. **(13 1/3)**

8. Write short notes on any THREE of the following: **(23 1/3)**

   (a) Caste system and class system.

   (b) Horizontal mobility and vertical mobility.

   (c) Subculture and counter culture.

   (d) Ascribed status and achieved status.

L-3/T-2/MME Date : 10/04/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 207** (Advanced English)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer all the **FOUR** questions.

1. Explain, with reference to the context, any one of the following: **(10)**

   (i) While with an eye made quiet by the power
   Of harmony, and the deep power of joy.
   We see into the life of things.

   (ii) Water, water, everywhere,
   And all the boards did shrink;
   Water, water, everywhere,
   Nor any drop to drink.

2. Answer any two of the following questions: **(20)**

   (i) Characterize the West Wind in the poem 'Ode to the West Wind'. What are its powers, what effects does it have on nature and the poet? In what way does it embody both danger and hope?

   (ii) Consider 'The Rime of the Ancient Mariner' as a tale of sin, penance and redemption.

   (iii) Write a critical appreciation of Shelley's 'To a Skylark.'

3. Answer any three of the following questions: **(20)**

   (i) Write on the feelings of the Prisoner in 'The Prisoner of Chillon.'

   (ii) Discuss the role of the wind in the process of thoughts and feelings as presented in 'Dejection: An Ode'.

   (iii) Why does the Mariner choose the wedding guest to hear his tale?

   (iv) What is the significance of the bird in 'The Prisoner of Chillon'? How does it cheer the Prisoner up?

4. Answer any one of the following: **(20)**

   (a) Write short notes on any four of the following:

   (i) Objectivity (ii) Ode (iii) Romanticism (iii) Imagery (iv) Metaphor (v) Simile

   (b) Write synonyms and antonyms (one synonym and one anatomy for a word) of any ten of the following words:

   Allure, Animus, Bellicose, Consummate, Diffident, Ephemeral, Fallible, Gossamer, Heedless, Ignominious, Latent, Malicious.

Contd P/2

HUM 207 (MME)

SECTION – B

There are **FOUR** questions in this section. Answer all the **FOUR** questions.

Symbols indicate their usual meaning.

5. Explain with reference to the context on any **ONE** of the following: **(10)**

   (a) 'It is humbug to pretend this is not a motive, a strong one.'

   (b) '... a thing that had no meaning and no purpose at all.'

6. Answer any **ONE** of the following questions: **(20)**

   (a) Describe the nature of Anglo-Indian Indian relationship as you find in 'Meeting in the Mosque'.

   (b) Why did the author extol poetry in the essay 'An Apology for Poetry'?

7. Answer any **THREE** of the following questions: **(20)**

   (a) What were Orwell's motives for writing in 'Why I write'?

   (b) What were the funs of earlier generations in Asimov's The Fun They Had'?

   (c) What are the characteristic traits of Elizabeth in the 'Odour of Chrysanthemums'?

   (d) Why did the man deliberately turn out to be incompatible with norms in 'A Wrong Man in Workers' Paradise'?

8. Answer any **ONE** of the following: **(20)**

   (a) Answer any **ONE** of the following questions:

   (i) What are generic features expected from a research paper?

   (ii) What are the differences between the linguistic features of describing 'contributions of a research' in the domains of sciences and social sciences?

   (b) Write an Essay on any **ONE** of the following topics:

   (i) Ceramic Industries in Bangladesh: Prospects and Challenges.

   (ii) Sights and Sounds of Spring in Rural Bangladesh.

L-3/T-2/MME Date : 10/04/2019

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **HUM 305** (Economics of Development and Planning)

Full Marks : 140 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols indicate their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What do you understand by labour intensive and capital intensive techniques of production? **(8)**

   (b) What are the arguments for labour intensive and capital intensive techniques? **(15 1/3)**

2. (a) What do you understand by export promotion and import substitution industrialization policy? **(8)**

   (b) What are the arguments for export promotion and import substitution industrialization policy? **(15 1/3)**

3. (a) What do you understand by private foreign investment? **(5)**

   (b) Explain the role of private foreign investment in a developing country. **(10)**

   (c) What are the demerits of private foreign investment? **(8 1/3)**

4. (a) Explain the merits and demerits of multinational corporations? **(15 1/3)**

   (b) What are the safe limits of deficit financing? **(8)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Describe the Lewis Theory of Development. **(13 1/3)**

   (b) Discuss the criticisms of the theory. **(10)**

6. (a) How is HDI calculated? Explain in detail. **(9)**

   (b) Illustrate the ways of measuring poverty and inequality. **(9)**

   (c) What is Kuznets' inverted-U hypothesis? Discuss. **(5 1/3)**

Contd P/2

HUM 305 (MME)

7. (a) Why is it important to invest in education and health during the process of development? **(10)**

   (b) Effective ban on child labor will make the situation better off for the children and the family as well – Discuss in the light of multiple equilibria. **(13 1/3)**

8. (a) What is capital budgeting? Discuss all types of capital budgeting methods. **(10)**

   (b) Provide a comparative analysis of the capital budgeting methods for the projects given here. Also mention the advantages and disadvantages of the different methods in your comparison. **(13 1/3)**

	Cash Flows	
Year	**Project A**	**Project B**
0	-$300,000	-$2,000,000
1	$100,000	$600,000
2	$100,000	$600,000
3	$100,000	$600,000
4	$100,000	$600,000
5	$100,000	$600,000
Total	**$200,000**	**$1,000,000**
Payback Period	3 Yrs.	3.33 Yrs.
Discounted Payback Period	3.75 Yrs.	4.26 Yrs.
NPV	$79,079	$274,472
Profitability Index	1.26	1.14
IRR	19.9%	15.2%

Note: **discount rate and reinvestment rate of return is 10%.**

L-3/T-2/MME **Date : 31/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **MME 343** (SURFACE ENGINEERING OF MATERIALS)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Name different tests to judge the quality of coating. **(5)**

   (b) Describe the factors you should consider during selection of coating. **(15)**

   (c) With schematic diagram show that few milliseconds may be needed to initiate relative motion. **(7)**

   (d) Draw the force equilibrium diagram for a body on an inclined plane and deduce the equation for expression of static co-efficient of friction. **(8)**

2. (a) Derive the equation expressing the ploughing component of the co-efficient of friction for a spherical shaped wear particle in contact with a softer body. **(17)**

   (b) 'Transition of friction may occur in four different patterns' - state the patterns with necessary diagrams. Also mention the material condition applicable to each pattern. **(18)**

3. (a) How does rest time affect the static friction? What is its importance on industrial applications? **(10)**

   (b) 'High friction interfaces exhibit high wear rates.' - Necessary not true. Justify the statement with suitable examples. **(7)**

   (c) Draw and explain the schematics of adhesive wear progresses as a result of plastic shearing. **(18)**

4. (a) A hard steel surface consisting of an array of conical asperities of an avg. semi-apex angle of 60° slides on a soft Pb surface (H = 75 MPa) under a load of 10 N. Calculate the volume of Pb displaced in unit slide distance. Given that the volume of Pb material removed is 10^{-6} m^3 for a sliding distance of 1 km, calculate the wear co-efficient of Pb. **(12)**

   (b) 'Wear resistance of pure metals is directly proportional to their hardness but is more complex for alloys' - Justify with necessary diagram and examples. **(13)**

   (c) State and explain the conditions under which abrasive wear takes place by means of fracture. **(10)**

Contd. P/2

MME 343

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Why does corrosion provide a major source of failure in metallic structures? **(10)**

   (b) Briefly describe how variation in both compositions affects electrodeposition of alloys. **(15)**

   (c) Draw a typical curve of metal percentage in deposit versus metal percentage in bath for anomalous co-deposition. **(10)**

6. (a) Electrode potential is important in electroplating - explain. **(10)**

   (b) Write down the functions of surfactant present in an electroplating bath. **(10)**

   (c) Electroless plating is necessary for deposition on a polymer substrate - justify. **(15)**

7. (a) Compare and contrast physical vapour deposition with chemical vapour deposition. **(20)**

   (b) Briefly describe six principles of alloy deposition. **(15)**

8. (a) Define solid state laser. Mention the advantages of solid state laser over CO_2 laser. **(11)**

   (b) Write short notes on **(24)**

   (i) diffusion coating

   (ii) composite plating

   (iii) selective plating

L-3/T-2/MME **Date : 25/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub : **MME 347** (Metal Joining Technology)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

The questions are of equal value.

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Consider a carbon steel (AISI 1018) hot-rolled plate. It has been TIG welded. From the welded plate, you have taken samples from four different regions- one in base metal and three from HAZ. Draw a schematic of the welded plate showing the positions of samples taken. The three HAZ positions were just above Ac_1, just above Ac_3 and just below peritectic reaction in the single austenite region. Now draw the microstructures of these four regions and suggest the evolution of microstructures after welding.

2. Consider welding of a work-hardened aluminium alloy. In EBW process, there has been little evidence of recrystallization near fusion boundary (i.e., in HAZ). In TIG welding process, both recrystallization and grain growth were observed near fusion boundaries. Using microstructural evidence, clarify the reasons for such differences. Also, draw thermal cycles and hardness profiles for both processes. Discuss any possible variation.

3. As a research student in a welding research group, you have summaries that "The less ductile a solidifying weld metal is, the more likely it will crack during solidification". Your supervisor has asked you to prepare a note to validate your conclusion based on the following factors.

   Ductility Curves; Brittle Temperature Range (BTR); Critical Strain Rate for Temperature Drop (CST)

   The note should be made comparing two materials having different CST due to different ε_{min}.

4. During welding of metallic materials, solidification can occur by epitaxial or non-epitaxial growth at fusion boundary. Using schematic diagrams, explain both features. What are the reasons for obtaining competitive growth in the bulk fusion zone?

5. Weld pool shape can be tear-drop or elliptical depending on welding speed. Based on this, evaluate development of columnar grain structure in the fusion zone of a welded metal at different welding speeds.

6. To explain development of residual stresses during welding, Figure 1 for Question 6 shows a schematic of a welded plate having four different sections: A-A, B-B, C-C and D-D. Draw curves showing the changes in thermal and stress conditions of this welded plate.

Contd P/2

MME 347

7. Liquation in PMZ during welding of Al-Cu alloy plates can occur by five different mechanisms. Such liquation is shown in Figure 2 for Question 7. In Figure 3 for Question 7, the five mechanisms are shown. One of such mechanism is A_xB_y reacting with matrix, where A_xB_y is an intermetallic compound, such as Al_2Cu in the case of Al-Cu alloys. Assess and resolve the liquation mechanism for aluminium alloy 2219 with the aid of the Figure 4 for Question 7.

8. As a materials engineer, you have recommended low-hydrogen electrodes or welding processes and a small amount of preheating for welding of Quenched-and-Tempered Low-Alloy Steels. Using the continuous-cooling transformation diagram shown in Figure 5 for Question 8, justify your recommendation. You should consider carbon content, heat input from various welding processes and cooling rates.

SECTION – B

The figures in the margin indicate full marks.

There are **FOUR** questions in this section. Answer any **THREE**.

9. (a) Hydrogen porosity is mostly prominent for Al welding – explain with necessary graph. **(10)**

   (b) Show the effect of post weld heat treating temperature and time on weld hydrogen content. **(10)**

   (c) Nitrogen has severe detrimental effect on mechanical properties while welding Cr unlike Ni- explain. Describe the source of nitrogen as well as the protection procedure against this gas during welding. **(15)**

10. (a) How does oxygen content affect toughness of weld? **(10)**

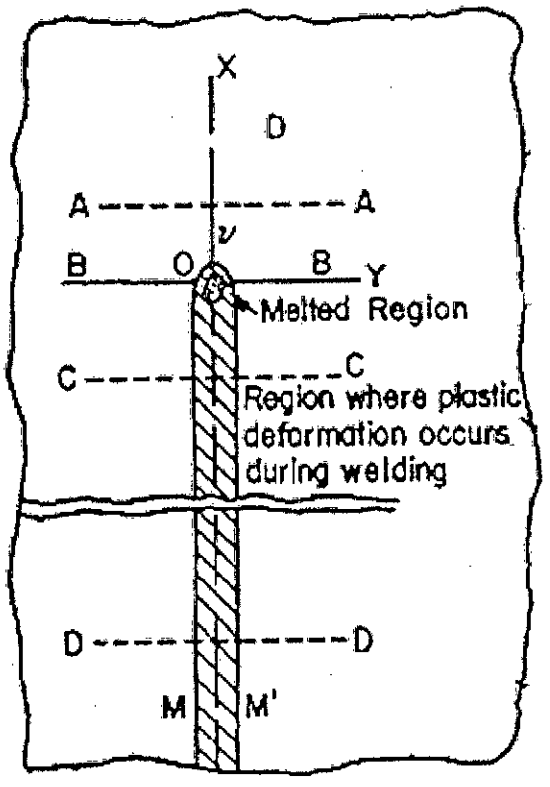
    (b) Describe the concept of basicity index and its effect on oxygen content of weld. **(25)**

11. (a) Why is flat end electrode preferable to sharp end one? **(10)**

    (b) Describe the driving forces for fluid flow in weld pools. **(25)**

12. (a) Write short note on neutral flame. **(10)**

    (b) Describe electroslag welding process with advantages and disadvantages. **(25)**



6

Figure 1 for Question 5. Changes in temperature and stresses during welding. Reprinted from Welding Handbook. Courtesy of American Welding Society.

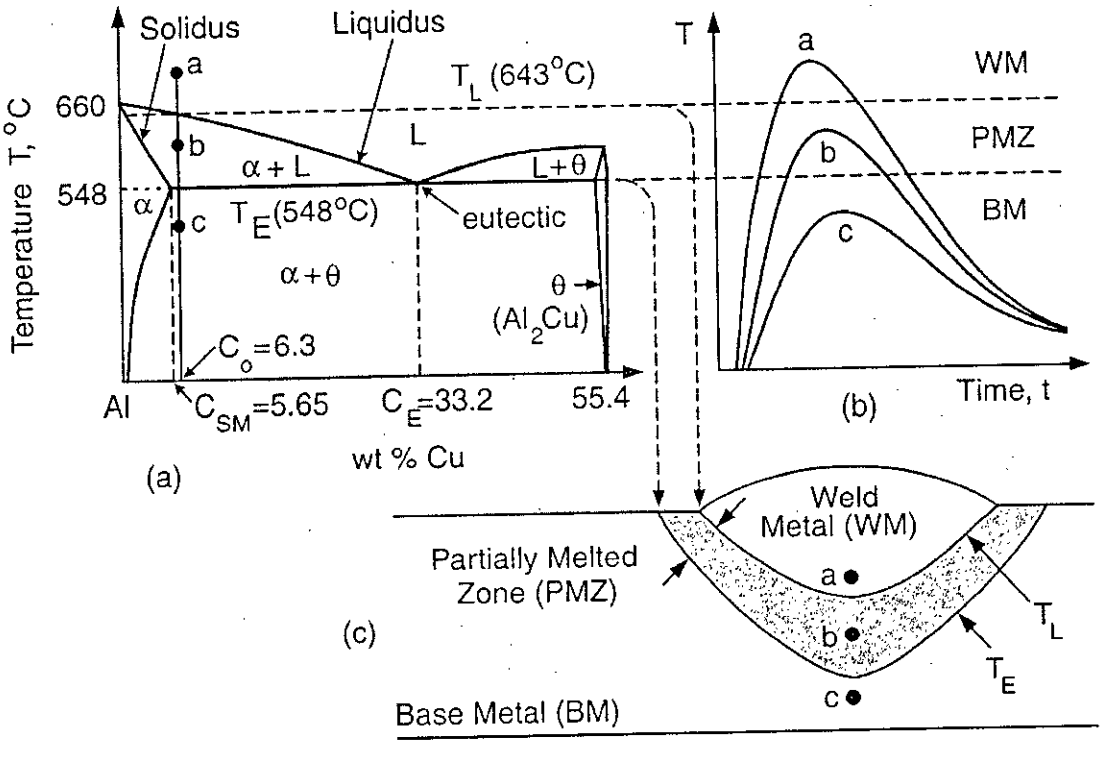
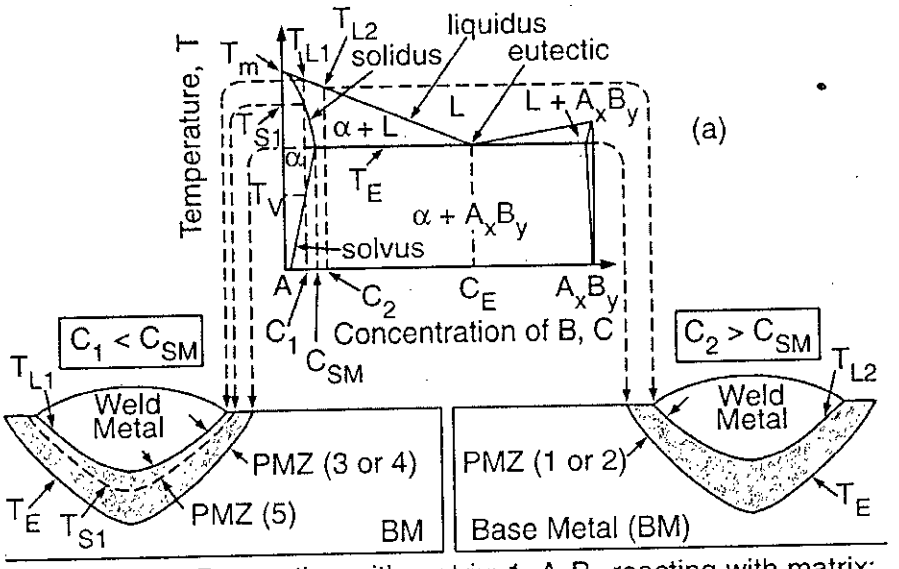


Figure 2 for Question 7. Formation of PMZ in 2219 aluminium weld: (a) Al-rich side of Al–Cu phase diagram; (b) thermal cycles; (c) transverse cross section.



3. Residual A_xB_y reacting with matrix:
(constitutional liquation)
$A_xB_y + \alpha \rightarrow L$ at T_E
if A_xB_y still present at T_E

4. Melting of residual eutectic:
eutetic(S) → eutectic(L) at T_E
if eutectic still present at T_E

5. Melting of matrix:
$\alpha \rightarrow L$ at T_{S1}
if no A_xB_y or eutectic present at T_E

(c)

1. A_xB_y reacting with matrix:
$A_xB_y + \alpha \rightarrow L$ at T_E
A_xB_y always present at T_E
regardless of heating rate

2. Melting of eutectic:
eutectic(S) → eutectic(L) at T_E
eutectic always present
at T_E regardless of heating rate

(b)

Figure 3 for Question 7. Five mechanisms for liquation in PMZ of aluminium alloys: (a) phase diagram; (b) two mechanisms for an alloy beyond the solid solubility limit (C_{SM}); (c) three mechanisms for an alloy within the solid solubility limit.

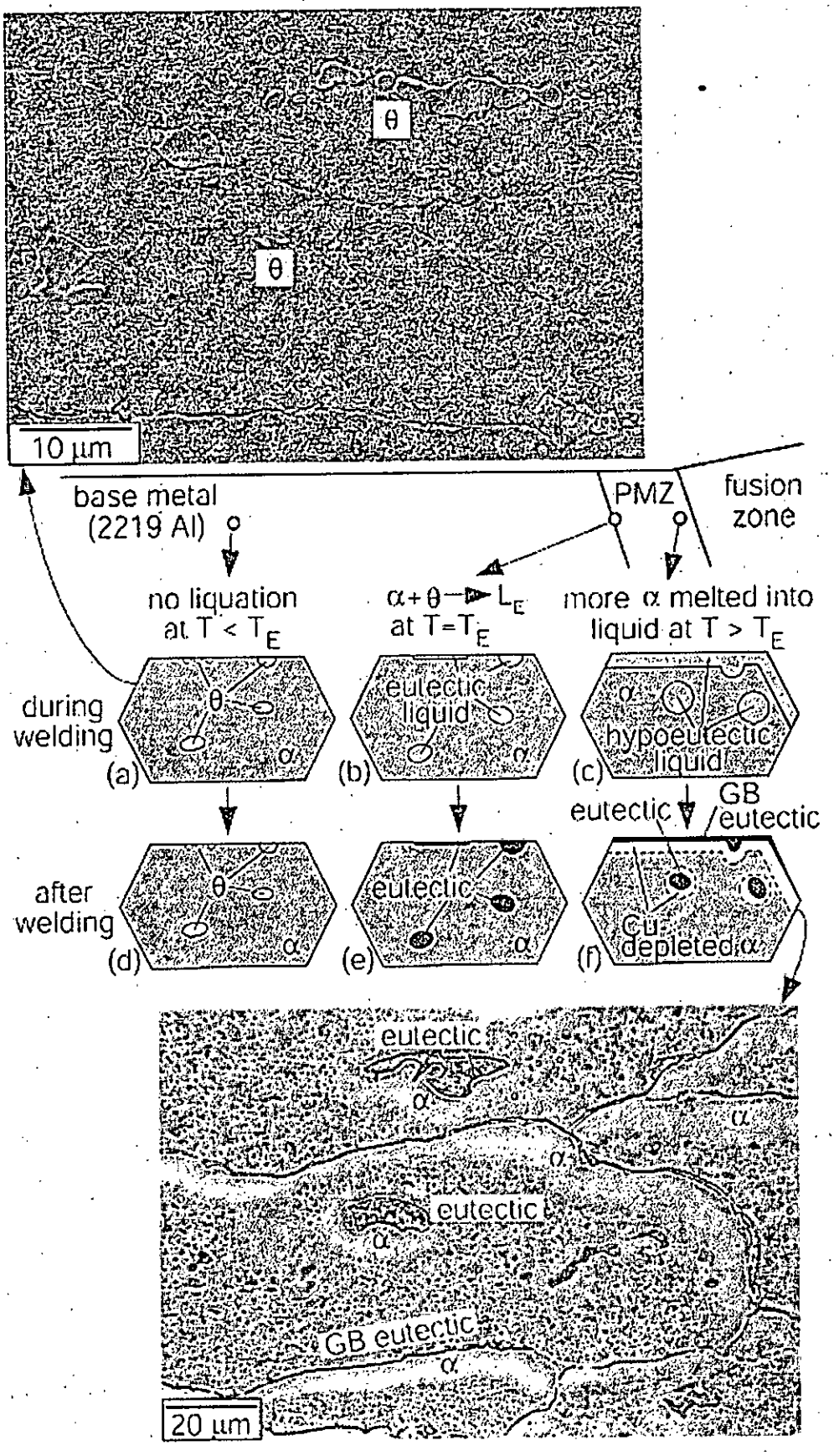


Figure 4 for Question 7. Microstructure evolution in PMZ of 2219 aluminium with SEM image of the base metal on the top and optical micrograph of the PMZ at the bottom. Courtesy of American Welding Society

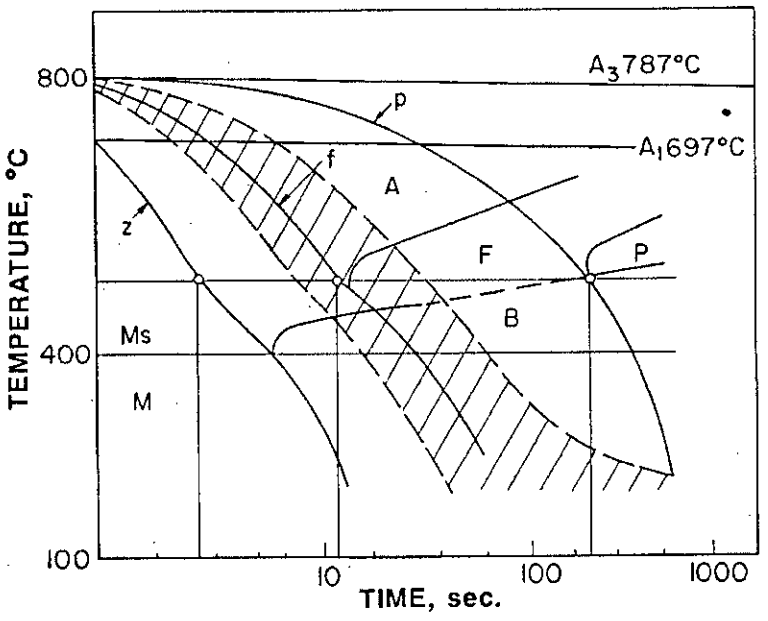


Figure 5 for Question 8. CCT Curves for A514 steel. Curves p, f, and z represent the critical cooling rates for the formation of pearlite, ferrite, and bainite. The hatched area represents the region of optimum cooling rates.

L-3/T-2/MME **Date: 14/03/2019**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2017-2018

Sub: **MME 345** (Foundry Engineering)

Full Marks: 280 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer **Q. No. 1** and any **TWO** from the rest.

Question 1 is compulsory.

1. Answer any FIVE questions. **(100)**

   (a) Explain briefly the ten rules of casting.

   (b) Analyse how an insulating mould resists the transfer of heat from a comparatively conductive liquid metal. Obtain a relation for the temperature gradient at the mould-metal interface and the thickness S of the solidified skin developed after a time t.

   (c) Explain why borides and nitrides are good nuclei for heterogeneous nucleation of solid particles while oxides are good nuclei for heterogeneous nucleation of gas porosity. Use suitable sketches, diagrams or equations to support your explanation.

   (d) Analyse why dendrites are formed during solidification of metal alloys but not of pure metals. Examine the rule of DAS in controlling the mechanical properties of cast materials.

   (e) List the functions of a gating system. An invaluable rule in designing a gating system is: "If in doubt, visualise water." Explain, with suitable examples, how this assertion helps in designing a good gating system.

   (f) Classify casting alloys based on their solidification behaviours. Which one of them requires feeding most? What happens to a poorly fed casting?

   (g) Analyse the characteristic differences of hot tear, shrinkage cavity and cold crack. Discuss how you can reduce or eliminate hot tear defects.

2. Design a suitable feeding system for a circular plate of 250 mm diameter and 20 mm thickness to be cast using Al-7Si-0.3Mg alloy in greensand mould at a pouring temperature of 750 °C. The density and volume contraction of the alloy are 2.7 g/cc and 7%, respectively. Indicate clearly all assumptions you made while designing the feeding system and show all calculations. **(20)**

3. Design a suitable gating system for a cylindrical pipe (150 mm outer diameter, 15 mm thickness, 200 mm length) made using grey iron of composition 3.0% C, 1.8% Si, 0.3% P and density 7.0 g/cc. The moulding system to be used is greensand and the pouring temperature is 2450 °F. Assume reasonable value for any missing data. List all basis and assumptions you made during the design. After design, sketch the 2D diagram of the mould layout showing the position of the casting and the gating system. **(20)**

   Empirical formulae for pouring time (in seconds) calculations of thin walled grey iron castings of thickness 8.0 - 15 mm and weight less than 450 kg it $t = 2.2\sqrt{W}$, where W is the weight of the liquid metal poured.

Contd P/2

MME 345

4. (a) With simple sketches explain the design rules for eliminating hot spot in T-junctions, directional solidification, and minimum casting stresses. **(10)**

(b) A cylindrical feeder must be designed for a sand-casting mould. The casting itself is a steel rectangular plate with dimensions 7.5 cm × 12.5 cm × 2.0 cm. Previous observations have indicated that the total solidification time (TST) for this casting = 16 min. The cylinder for the feeder will have a diameter - to - height ratio = 1.5. Determine the dimensions of the riser so that its TST = 2.0 min. **(10)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) "The correct process selection involves finding the best match between process attributes and design requirements". Explain this assertion. List the four problems you would anticipate in the casting of metals. **(10⅔)**

(b) Explain the functional requirements for sand materials in moulding and metal casting. **(14)**

(c) How is the strength of clay-bonded sands of the mould developed with the addition of water? What type of sand do you recommend for the preparation of mould to cast a Ni-Mo alloy (m.p. 1560°C)? **(22)**

6. (a) Discuss the significances of mould properties. Why should properties of mould be controlled to their optimum values? **(20⅔)**

(b) What sand moulding process do you recommend for casting of frames, engine cylinders, rolls, large gears and housings? Justify your answer. **(7)**

(c) What principles are involved in centrifugal casting? What types of object are best made by this process? **(7)**

(d) Differentiate critically between sand casting, investment casting and pressure die casting in terms of cycle time, flexibility, materials utilization and operation cost. **(12)**

7. (a) A foundry received an initial order of 5,000 pieces of aluminium cylinder casting (400 mm length, 300 mm outer dia and 260 mm inner dia) with a possibility of repeat order. It was decided to produce a master pattern made of aluminium from which steel working patterns were to be cast and machined. Using necessary allowances, determine the dimensions of the master pattern and its core prints. Assume reasonable values for any missing data. **(20)**

Density of steel = 7.8 g/cm^3, Al = 2.7 g/cm^3 and core sand = 1.6 g/cm^3.

Compressive strength of core sand = 2.0 kg/cm^2, chaplet = 2.0 kg/cm^2 and factor of safety = 5.

Contd P/3

MME 345

Contd ... Q. No. 7

(b) Discuss the chemical principles of cast iron melting. **(12)**

(c) How does nodular iron differ from compacted iron? What types of raw materials and physical facilities are needed to produce ductile iron in a foundry? **(14 2/3)**

8. (a) Select a suitable melting practice and write down the operating steps that are followed in producing ductile iron. **(8 2/3)**

(b) Explain how section size and microstructural variables affect the mechanical properties of nodular cast iron. **(12)**

(c) Which process is suitable for casting of automotive piston using aluminium alloy? Justify your answer. Discuss typical melting practices of aluminium alloys and list the ways by which you can modify the structure of foundry aluminium alloy. **(14)**

(d) What difficulties are generally encountered during melting of brass alloys and how would you overcome these difficulties? Write down the factors that are considered in gating and feeding design of cooper alloy casting. **(12)**
