

SECTION – A

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

1. (a) (i) Explain the terms "heat source efficiency" and "melting efficiency" in fusion welding. (10)
 - (ii) Describe a suitable method to measure the heat source efficiency of a welding process. (7)
 - (b) Bead-on-plate welding of a wide thick steel plate is carried out by GTAW process using 20 V and 200 A at a welding speed of 2 mm/s.
 - Given:
 - Heat source efficiency = 0.65.
 - Thermal conductivity of steel = 60 W/m.°C.
 - Thermal diffusivity of steel = 1.8×10^{-5} m²/s.
 - Melting point of steel = 1500°C.
 - Ambient temperature = 20°C.
 - (i) Predict the width of weld bead. (8)
 - (ii) Calculate the cooling rate at 50 mm from the heat source along the central axis of the weld. (3)
 - (iii) Calculate the cooling rate at temperature 550°C along the central axis of the weld. (3)
 - (iv) If preheating is required to keep the maximum cooling rate of 15°C/s at 550°C along the central axis of the weld, what must be the minimum preheating temperature? (4)
2. (a) What is epitaxial growth of weld metal? How does it occur? (5)
 - (b) Discuss the weld metal nucleation mechanisms. (10)
 - (c) Explain the formation of partially melted zone during welding. (10)
 - (d) Discuss the problems associated with the partially melted zone in welding. (10)

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3. (a) Fig. 3(a) shows the hardness profiles of a 3.2-mm-thick 6061 aluminium welded in T6 condition (right after welding, postweld natural aging for 7 days and postweld artificial aging at 155°C for 18 hours).

(i) Explain the existence of hardness minimum after both aging processes and recovery of full hardness near fusion boundary due to artificial aging. (15)

(ii) How can the loss of strength in the HAZ be minimized? (5)

(iii) Is there any method to recover full strength in the HAZ? Explain. (7)

(b) A 12.7-mm-thick plate of 6061-T6 aluminium ($T_L = 652^\circ\text{C}$) was gas-tungsten arc welded with DC electrode negative. The welding parameters were $I = 222\text{ A}$, $E = 10.4\text{ V}$, and $v = 5.1\text{ mm/s}$. Microhardness measurements after welding indicated that softening starts about 5.3 mm from the fusion line and gradually increases as the fusion line is approached. Thermal measurements during welding revealed a peak temperature of about 300°C at the position where softening started. Calorimetric measurements showed that the arc efficiency was around 80%. (8)

How is the width of the HAZ compared with that predicted from Adam's equation?

Density of aluminium = $2.7 \times 10^3\text{ kg/m}^3$

Specific heat of aluminium = $903\text{ J/kg}^\circ\text{C}$

Initial plate temperature = 20°C .

4. (a) What is lamellar tearing in a weldment? How does it form? How many lamellar tearings be avoided by modifying the design of weldments? (10)

(b) Briefly discuss any suitable method for detecting surface defects of a weldment of non-magnetic material. (7)

(c) What are the causes of distortion in a weldment? How can distortion in weldments be reduced? (10)

(d) A circular plate and a rectangular plate have been welded as shown in Fig. 4(d). Find the greatest twisting moment that can be resisted by the fillet weld. Assume permissible shear stress in the weld as 1040 kg/cm^2 . (8)

SECTION – B

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

5. (a) How are the joining processes classified? Compare and contrast between mechanically formed joints and metallurgical joints. (18)

(b) What are the properties required of a flux for soldering operation? With a neat sketch explain the action of flux during a soldering operation. (17)

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6. (a) Explain with a neat sketch the process of submerged arc welding. Discuss its advantages and limitations. (18)
- (b) What are the distinguished advantages of electron beam welding? (5)
- (c) Write a short note on resistance spot welding. (12)
7. (a) Name the essential components of a welding symbol. Explain the meaning of its basic components. (10)
- (b) What is Thermit Welding (TW)? Describe the process mentioning the most common thermit reactions used to produce welds. Which components are joined by TW? (18)
- (c) Compare the electroslag process with the submerged arc welding process. (7)
8. (a) What do you understand by solid state welding? Mention the principal ways in which solid state welding is made. (12)
- (b) 'Diffusion welding offers some very special and often unique advantages.' — Explain the advantages. (10)
- (c) In diffusion welding, explain the roles of key parameters such as temperature, time and pressure. Which one among these three parameters are the most important and why? (13)
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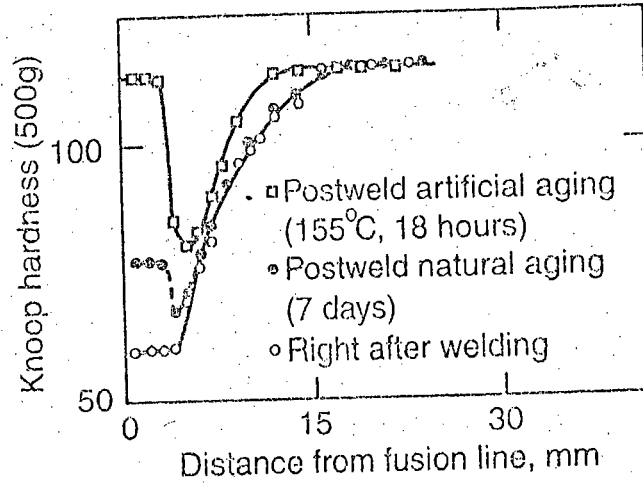


Fig. 3(a) for Q. No. 3(a)

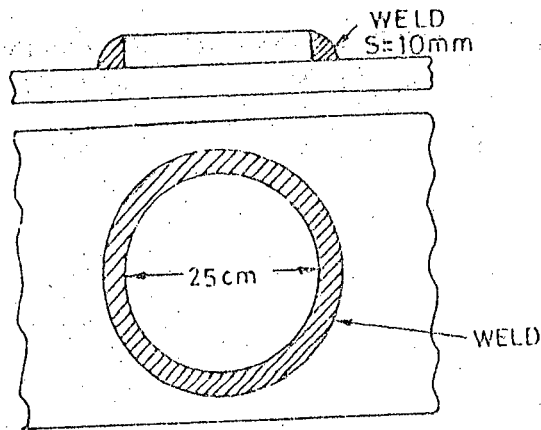


Fig. 4(d) for Q. No. 4(d)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2014-2015

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

Full Marks: 210

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – AThere are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Discuss the mechanism by which spiny structure of $(CaO)_3(SiO_2)_2(H_2O)_3$ grows during the hardening reaction of Portland cement. (17)
- (b) List the ways by which the strength of cement and concrete can be increased. (10)
- (c) Mention the problems associated with high alumina cement in warm and wet condition. (8)

2. (a) Why do you need glaze in a state of compression on the finished product of a ceramic. (13)
- (b) "Body and Glaze react with each other to form an intermediate layer" — Explain. (10)
- (c) Explain why both ionic and covalent ceramics are intrinsically hard. (12)

3. (a) Describe the effect of Pb on the properties of soda-lime-silicate glass. (5)
- (b) Mention and discuss the different viscosity reference temperatures with the help of a typical viscosity-temperature diagram for a soda-lime-silicate glass. (10)
- (c) Explain the various mechanisms for the development of permanent stress in glass. (15)
- (d) With the help of the following equation determine the center compression, σ_c for a Pb-silicate glass with a cooling rate of 2.8°C/minute and $\alpha = 90 \times 10^{-7}/^\circ C$, $E = 70$ GPa, $\kappa = 0.0084$ cm²/s, $\nu = 0.2$, $d = 0.2$. All the symbols have their usual meaning. Assume any missing data. (5)

$$\sigma_c = \frac{E\alpha d^2 R}{\kappa - \nu}$$

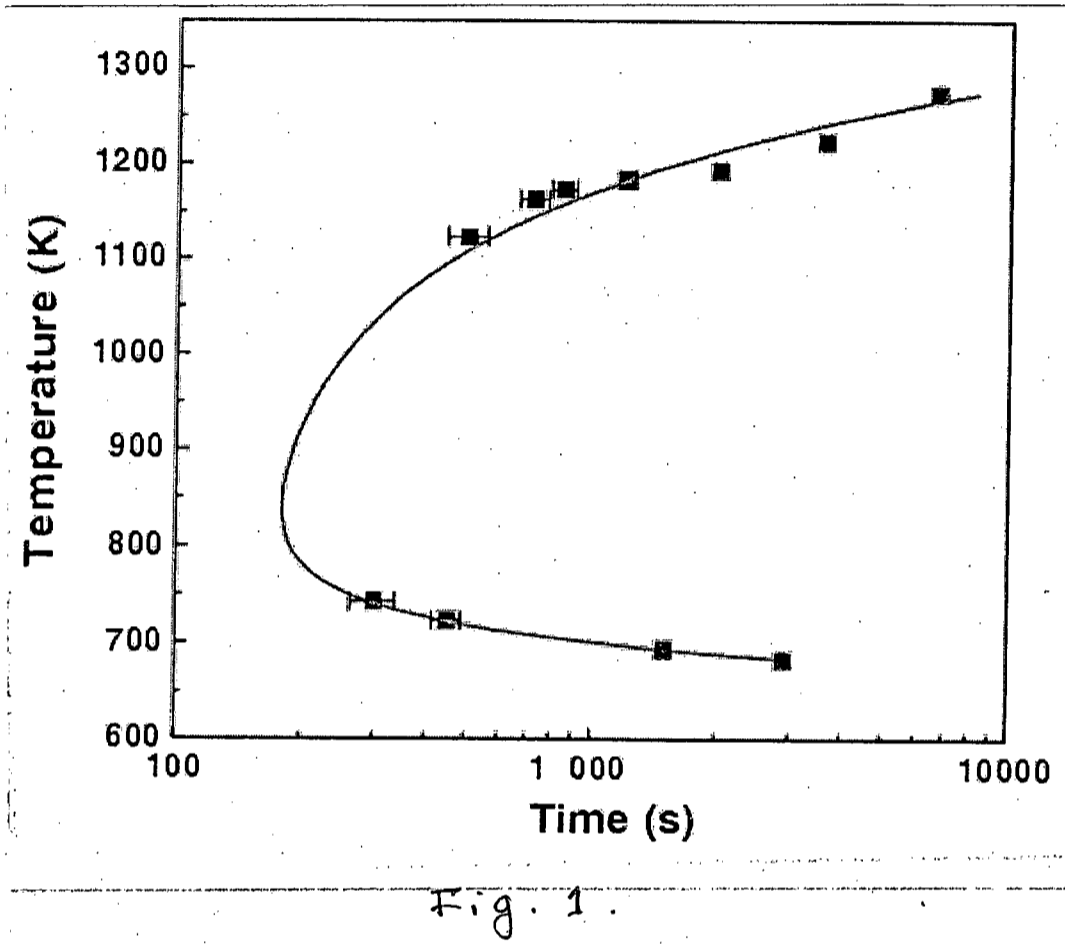
4. (a) With the help of volume-temperature (V-T) diagram distinguish between a typical glass-forming melt and crystal-forming melt upon cooling. In the same diagram also show the effect of cooling rate on glass formation. (10)
- (b) Schematically show the effect of alkali addition on the B₂O₃ structure. (10)

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Contd... Q. No. 4

(c) Describe 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. (15)



SECTION - B

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

5. (a) What are the general characteristics of ceramics? (7)
- (b) On the basis of crystal structure, compute the theoretical density of NaCl. Atomic radius $r_{Na} = 0.102$ nm, $r_{Cl} = 0.181$ nm. (5)
- (c) Discuss the difference between MgO and SiC crystal structure. (10)
- (d) Classify ceramic raw materials according to their functional requirements. (13)

6. (a) How do you identify the reasons of warpage in a sintered product? Recommend a suitable technique to solve the problem of warpage according to the type of reasons involved. (10)

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Contd... Q. No. 6

- (b) What is the driving force behind solid state sintering? Briefly describe the effects of various factors on the sintering rate of a solid state sintering. (3+15=18)
- (c) Categorize the shaping methods of ceramic products and give some examples in each category. (7)
7. (a) Discuss the steps involved in making plaster moulds. (10)
- (b) Explain why the rate of drying falls sharply after the constant rate period. (10)
- (c) Distinguish between china clay and ball clay in terms of origin, particle size and properties. (15)
8. (a) A ceramic body has the following target composition (by parts): (20)
- kNaO = 0.10 Al₂O₃ = 0.15 SiO₂ = 2.0
- CaO = 0.27
- ZnO = 0.63

The composition of the raw materials to be used to prepare the body are as follows:

Raw Materials	SiO ₂	Al ₂ O ₃	K ₂ O	Na ₂ O	CaO	MgO	ZnO
Feldspar	71.84	16.29	0.48	9.48	0.87	—	—
Clay	64.80	22.99	4.77	0.19	0.07	—	—
Flint	99.30	0.24	0.09	0.04	0.03	—	—
Limestone	0.80	0.47	0.05	—	54.17	0.95	—
Zinc Oxide	—	—	—	—	—	—	100

- Prepare the segar formula of the target composition.
- (b) What do you understand by morphology of ceramic powder materials? (3)
- (c) What are the problems associated with uniaxial pressing? Explain their causes and suggest suitable remedial measures. (12)
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L-3/T-2/MME

Date : 27/07/2016

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2014-2015

Sub : **HUM 211** (Sociology)

Full Marks: 140

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

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

1. (a) What do you understand by ethnocentrism? Critically explain the normative roles of culture in a society. (10)
(b) How does Marxian philosophy 'historical materialism' explain the relationship between technology and ideology? (13 1/3)
2. (a) What is juvenile delinquency? Discuss the socio-cultural causes of juvenile delinquency. (10)
(b) Explain E. Durkheim's anomie theory of social disorganization. (13 1/3)
3. (a) What is social stratification? Explain different systems of social stratification in the context of Bangladesh. (10)
(b) 'The history of all hitherto existing society is the history of class struggles' – explain this statement highlighting Marx's view of class differences. (13 1/3)
4. Write short notes on any three of the following: (23 1/3)
 - (a) Types of socialization.
 - (b) Cooley's looking glass self theory.
 - (c) Social mobility.
 - (d) Positive and negative aspects of deviant behavior.

Contd P/2

HUM 211

SECTION - B

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

5. (a) Describe the social problems emerging in favor of ever expanding cities during industrial revolution, and why was this so? (13 1/3)
- (b) In particular, what combination of advantages allowed Britain to experience industrialization first? (10)
6. (a) How should developed countries respond to the challenges presented by developing countries which have lower wage costs? (13 1/3)
- (b) Extend at least 10 elements of demography for studying population. (10)
7. (a) In industrial society we found "closed class system - mobility based on achieved Characteristics" – R.T. Schaefer. Evaluate the statement. (13 1/3)
- (b) Critically discuss the Malthusian theory of population. (10)
8. Write short notes on any **THREE** of the followings. (23 1/3)
- (a) Chernobyl disaster
- (b) Noise pollution
- (c) Top ten megalopolises in the world
- (d) Impacts of rural-urban migration.
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SECTION – A

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

1. (a) What do you understand by 'economic growth' and 'economic development'? (8 1/3)
 (b) 'Development is both a physical reality and a state of mind in which society has, through some combinations of social, economic, and institutional processes, secured the means of obtaining a better life.' Explain. (15)
2. (a) Define 'Lorenz curve' and 'Gini coefficient'. (10)
 (b) How would you measure inequality of income distribution of a society with the help of the above concepts? (You may use hypothetical data) (13 1/3)
3. (a) What is the main purpose of a Cost-Benefit Analysis (CBA)? Discuss different types of costs and benefits involved in a Cost-Benefit Analysis. (15)
 (b) What is the present value of a machine that lasts eight years, earns Tk. 100,000 in year 1, Tk. 110,000 in year 2 and Tk. 120,000 in each of the remaining years, and then has a scrap value of Tk. 115,000? Assume that the rate of discount is 8 per cent. If the machine costs Tk. 450,000, is the investment worthwhile? Would it be worthwhile if the rate of discount were 12 per cent? (8 1/3)
4. (a) Evaluate the miraculous economic development of China in your own words. (15)
 (b) What lessons can Bangladesh learn from the experience of Chinese economic development after 1978? (8 1/3)

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SECTION – B

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

5. (a) What do you understand by development planning? (3 1/3)
(b) What are the arguments for development planning? (8)
(b) Discuss aggregate growth model of development planning. (12)
6. (a) Define deficit financing. (3 1/3)
(b) What are the roles of deficit financing in an economy? (8)
(c) Explain safe limits of deficit financing. (12)
7. (a) What are the arguments for foreign aid in economic development? (11 1/3)
(b) What are the arguments against foreign aid in economic development? (12)
8. (a) What do you understand by project appraisal? (3 1/3)
(b) Discuss methodology of project appraisal. (10)
(c) What decision criteria are to be followed in case of project appraisal? (10)
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SECTION – A

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

1. (a) What are the following tests used for? (18)
 - (i) BNF Jet test
 - (ii) Ferroxyd test
 - (iii) Copper accelerated salt spray test

Describe each test.

(b) Derive equation expressing the ploughing component of the co-efficient of friction for a spherical shaped wear particle in contact with a softer body. (17)
2. (a) 'Friction may increase in four different patterns.' — state the patterns with necessary diagrams. Also mention the material condition applicable to each pattern. (20)

(b) Differentiate between free rolling and tractive rolling. (6)

(c) Explain the co-efficient of friction as a function of temperature for cobalt sliding on stainless steel at a normal load of 5 Newton and sliding velocity of 25 mm/s. (9)
3. (a) 'High friction interfaces exhibit high wear rates — necessarily not true.' Justify the statement with suitable examples. (7)

(b) What is the role of metallurgical compatibility on wear? Give examples. (10)

(c) The flat face of a brass annulus having an outside diameter of 20 mm and an inside diameter of 10 mm is placed on a flat carbon steel plate under a normal load of 10 Newton and rotates about its axis at 100 r.p.m. for 100 h. As a result of wear during the test, the mass losses of the brass and steel are 20 mg and 1 mg, respectively. Calculate wear co-efficients and wear depths for the brass and the steel. (Hardness of steel = 2.5 GPa, density of steel = 7800 kg/m³; Hardness of brass = 0.8 GPa and density of brass = 8500 kg/m³. (18)
4. (a) Name the basic mechanisms of wear. Narrate, with schematic diagrams, the two general situations of abrasive wear. (10)

(b) Explain relative wear resistance of pure metals, heat treated steels and cold worked steels as function of hardness in 2-body abrasion. (10)

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Contd... Q. No. 4

(c) A hard steel surface consisting of an array of conical asperities of an average semi apex angle of 60° slides on a soft lead surface ($H_{pb} = 75 \text{ MPa}$) under a load of 10 Newton. Calculate the volume of lead displaced in unit sliding distance. Calculate the wear co-efficient of lead when the volume of lead material removed is 10^{-6} m^3 for a sliding distance of 1 km. (15)

SECTION – B

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

5. (a) Differentiate between regular co-deposition and irregular co-deposition. (14)
(b) Briefly describe how variation in temperature and pH of plating bath affect electrodeposition of alloys. (16)
(c) Draw a typical curve of metal percentage in deposit versus metal percentage in bath for anomalous co-deposition. (5)
6. (a) With appropriate mathematical relationship along with necessary examples show that complex plating bath is required for quality deposition. (20)
(b) "Electrical double layer formation is important in electroplating" — explain. (8)
(c) Write down the functions of surfactant present in an electroplating bath. (7)
7. (a) Compare and contrast physical vapour deposition with chemical vapour deposition. (20)
(b) Electroless plating is necessary for deposition on a polymer substrate— justify. (7)
(c) Write a short notes on diffusion coating. (8)
8. (a) Select and describe a coating deposition technique suitable for ceramic powder deposition. (20)
(b) Define solid state laser. Mention the advantages of solid state laser over CO_2 laser. (10)
(c) Why does corrosion provide a major source of failure of metallic structures? (5)
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