

8.12.14

L-3/T-2/MME

Date : 08/12/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2012-2013

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

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**.

Table of modified Bessel function supplied.

1. (a) Explain the terms "heat source efficiency" and "melting efficiency" in fusion welding. Describe a suitable method to measure the heat source efficiency of a welding process. (15)
- (b) A single full penetration weld pass is made on steel plate of thickness 5 mm by GTAW process using 20 V and 200 A at a welding speed of 125 mm/min. (20)

Assume:

 - Heat source efficiency = 0.65
 - Density of steel = $7.85 \times 10^3 \text{ kg/m}^3$
 - Thermal conductivity of steel = 50 W/(m.°C)
 - Specific heat of steel = 398 J/(kg.°C)
 - ~~The~~ thermal diffusivity of steel = $1.6 \times 10^{-5} \text{ m}^2/\text{s}$
 - Melting point of steel = 1500°C
 - Ambient temperature = 25°C

 - (i) Calculate the temperature of a point (50, 20) mm with respect to the arc as origin.
 - (ii) Calculate the width of HAZ if the recrystallization temperature is 730°C.
 - (iii) Find the influence on the width of HAZ if the sample is preheated to 200°C.
 - (iv) Find the influence on the width of HAZ if the arc energy is increased by 10%.

2. (a) What is epitaxial growth of weld metal? How does it occur? (5)
- (b) Discuss the factors that affect the transformation of austenite to ferrite in low-carbon, low-alloy steel weld. (20)
- (c) Explain the formation of partially melted zone in a weldment. (10)
3. (a) With the help of phase diagram explain the microstructures that are observed in the HAZ of a 0.18% carbon steel welded by GTAW process. (17)
- (b) What is knife-line attack? Where and how does it form? Explain how the knife line attack can be avoided. (18)

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4. (a) What are the causes of distortion in a weldment? How can the weld distortion be reduced? (15)
- (b) Discuss the effect of sulfur on the solidification cracking of carbon steel. How can the effect of sulfur on solidification cracking be reduced? (10)
- (c) Discuss the principles of any suitable NDT method to detect the internal cracks in a weldment. (10)

SECTION - B

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

5. (a) How are the metallurgical joining processes classified? Compare and contrast the mechanically formed joints with the metallurgical joints. (17)
- (b) Define soldering. Explain the basic operations in soldering. Write a note on the typical applications of soldering. (18)
6. (a) What is a flux? What are the important characteristics of a brazing flux? How do the brazing fluxes differ from soldering fluxes? (15)
- (b) Draw neat sketches to show the different types of welds. (5)
- (c) Why are welding symbols used? What are the essential components of welding symbols? Explain with suitable examples. (15)
7. (a) Describe the principle of oxy-fuel gas welding process. Why is acetylene mainly used for oxy-fuel welding? (15)
- (b) With a neat sketch describe the electron beam welding process. Why do you need a vacuum work chamber in electric beam welding? What are the major advantages and limitations of electron beam welding? (20)
8. (a) Explain with a neat sketch the process of submerged arc welding. Discuss its advantages and limitations. (20)
- (b) Write a note on resistance spot welding. (15)

Table of modified Bessel function of second kind
zero order [for A. No. 1 (b)]

x	$K_0(x)$
0	∞
0.1	2.427069025
0.2	1.752703856
0.3	1.372460061
0.4	1.114529135
0.5	0.924419071
0.6	0.777522092
0.7	0.66051986
0.8	0.5653471053
0.9	0.4867303082
1	0.4210244382
1.1	0.3656023915
1.2	0.3185082203
1.3	0.2782476463
1.4	0.2436550612
1.5	0.2138055626
1.6	0.187954752
1.7	0.1654963181
1.8	0.1459314005
1.9	0.1288459793
2	0.1138938727
2.1	0.1007837409
2.2	0.0892690057
2.3	0.079139933
2.4	0.0702173415
2.5	0.0623475532
2.6	0.05539830329
2.7	0.04925540092
2.8	0.04381998198
2.9	0.03900623457
3	0.03473950439
3.1	0.03095470804
3.2	0.02759499768
3.3	0.02461063215
3.4	0.02195801881
3.5	0.01959889717
3.6	0.01749964102
3.7	0.01563065992
3.8	0.01396588453
3.9	0.01248232276
4	0.01115967609
4.1	0.009980007228
4.2	0.008927451542
4.3	0.007987966032
4.4	0.007149110623
4.5	0.006399857243
4.6	0.005730422917
4.7	0.005132123648
4.8	0.004597246317
4.9	0.004118936236
5.0	0.003691098334

15.12.14

L-3/T-2/MME

Date : 15/12/2014

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2012-2013

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 **EIGHT** questions in this Section. Answer any **SIX**.

1. (a) Classify ceramic raw materials according to their functional requirements. (12)
(b) Give a brief account on "thixotropy". (5 ½)
2. (a) Mention the factors, determining the crystal structure of ceramics. (5 ½)
(b) Sketch neatly the crystal structure of Magnesia (MgO) and Silicon carbide (SiC). (12)
3. (a) State the correlations of the following Parameters with relative casting rate: Unfired porosity, proportion of china clay to ball clay, amount of deflocculant. (10)
(b) "Heat capacity is relatively insensitive to crystal structure or composition of ceramics" - Explain. (7 ½)
4. (a) Illustrate the electric double layer model with surface potential and zeta potential for electrostatic stabilization. (8)
(b) What are the effects of counter ion concentration, valance and ion size on electric double layer thickness and hence flocculation-deflocculation. (9 ½)
5. Discuss the purpose and processing of safety glass. (17 ½)
6. With precise figures, describe the float process for glass making. What are the importances of glass annealing? (17 ½)
7. "The net thermal expansion coefficient can be very low for polycrystalline quartz, β -spodumene, β -encryptite, etc" - Explain with necessary schematics. (17 ½)
8. (a) Briefly discuss the sources of gaseous impurities during glass melting. (12)
(b) Write short note on glass-ceramic. (5 ½)

Contd P/2

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SECTION - B

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

9. (a) Discuss the steps involved in making plaster moulds. (12)
(b) Differentiate between drain casting and solid casting. (10)
(c) How can the proper selection of body and glaze composition improve the strength of whiteware product? (13)
10. (a) Mention the atomic mechanisms occur during sintering. (8)
(b) "Reactive liquid phase sintering is referred to as transient liquid sintering" - explain. (11)
(c) Briefly describe how the initial particle size, shape and distribution affect final microstructure of the sintered ceramic body. (16)
11. (a) Discuss unique properties and advantages of hot pressing. (8)
(b) Describe the strength, hardness and the lattice resistance properties of ceramics. (15)
(c) Briefly describe the hardening mechanism of portland cement. (12)
12. (a) Write short note on "dry bag isostatic pressing". (12)
(b) Explain the critical moisture content and its influence on the quality of ceramic whitewares. Mention the different drying defects encountered in a ceramic plate and causes of the defects. (23)
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B.Sc. Engineering Examinations 2012-2013

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 **Eight** questions in this Section. Answer any **Six**.

1. Define Coulomb friction. For a conical asperity in contact with a softer body, derive an equation for ploughing component of friction. (17 ½)

2. Write notes on: (17 ½)
 - (a) B. N. F Jet test
 - (b) Coating porosity measurement
 - (c) Thickness measurement using Eddy current

3. Deduce a quantitative expression for abrasive wear for plastic contacts considering a simplified model. (17 ½)

4. The flat face of a brass annulus having an outer diameter of 30 mm and an inside diameter of 20 mm is placed on a flat carbon steel plate under a normal load of 15 N and rotates about its axis at 120 rpm for 100 hr. 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 coefficient and wear depths for the brass and the steel. (Hardness of Steel = 2.5 GPa, Density of Steel = 7.8 mg/m³; Hardness of brass = 0.8 GPa, Density of brass = 8.5 mg/m³.) (17 ½)

5. Mention and explain the coatings that are usually used for the following purposes: (17 ½)
 - (i) Submarine Switchgear
 - (ii) Jewelleery
 - (iii) Food Cans

6. (a) What is static friction force? Explain the effects of Normal Load on Coefficient of friction with necessary diagram when, (13 ½)
 - (i) Steel sliding or Aluminium in air
 - (ii) Copper sliding on Copper in air
 - (iii) Stainless steel sliding on Na₃ Al.

- (b) Briefly discuss why Cobalt with HCP crystal structure has lower coefficient of friction than FCC Aluminum. (4)

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7. Describe the effects of roughness factor, grain boundary, vacuum & air on coefficient of friction. (17 ½)
8. (a) How state friction is related to rest time? Mention its importance on industrial application. (7 ½)
- (b) Briefly discuss the effect of relative hardness of abrasive medium to work piece. (5)
- (c) The basic load capacity of a radial ball bearing is 8 kN. Calculate its life based upon a 90% probability of survival for the bearing operating at radial loads of 6 kN. (5)

SECTION – B

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

9. (a) List the functions of ingredient of electroplating bath. Why are these functions required? (22)
- (b) Explain why convection is much more important than the ionic transport for depositing metal on cathod. (13)
10. (a) What are the advantages of alloy deposition? Discuss the principles of alloy deposition. (18)
- (b) Differentiate between equilibrium codeposition and anomalous codeposition. (7)
- (c) Cr will be deposited on a 1.0 m wide stripe. The desired stripe speed is 50 m/min, current efficiency is 18% and thickness of deposited Cr to be 0.2 µm at a current density of 7,500 A/m². Calculate the length of plating tank. (Density of Cr = 7.19 gm/cc, A_{Cr} = 51.20). (10)
11. Write down the functions of surfactants present in an electroplating bath. (10)
- (b) What is the effect of P^H of bath on the composition of the deposit? (8)
- (c) Discuss the laser transformation surface hardening technique. (17)
12. (a) Distinguish between electroplating and electroless plating. (12)
- (b) Describe the mechanism of chemical vapour deposition. (15)
- (c) Write a short note on cladding. (8)
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SECTION – AThere are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Discuss metallurgical developments during industrial revolution. (8)
(b) What are the major factors that facilitated globalization? (15 ⅓)
2. (a) Elaborately discuss the elements of demography and cite example from your own society. (15 ⅓)
(b) Critically discuss the 'Functionalist view' on urbanization. (8)
3. (a) Make a comparison between 'pre-industrial', 'industrial' and 'post-industrial cities. (13 ⅓)
(b) Do you face any environmental pollution in your everyday life? What are these? (10)
4. Write short notes on THREE of the following: (23 ⅓)
 - (a) Socialism
 - (b) ICT in the era of globalization
 - (c) Proposition of 'Malthusian Theory of Population'
 - (d) Types of 'Human Migration'.

SECTION – BThere are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) 'Sociology is a categorical discipline not a normative discipline' – explain. (7)
(b) Illustrate Emile Durkheim's contribution to the development of sociology. (6)
(c) Discuss the functionalist theoretical perspective of sociology. (10 ⅓)
6. (a) What do you understand by culture? Explain why values and norms are considered important elements of culture. (10)
(b) Discuss Karl Marx's analysis of technology and ideology of a society. (13 ⅓)

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7. (a) What do you understand by deviance? Illustrate the cultural transmission theory of deviant behaviour. (10)
- (b) What is meant by juvenile delinquency? Discuss the socio-cultural factors behind juvenile delinquency. (13 1/3)
8. Write short notes on any three of the following: (23 1/3)
- (a) Types of socialization
 - (b) White collar crime
 - (c) Different stages of socialization
 - (d) Agents of socialization.
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SECTION – A

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

1. (a) What is meant by development? Explain. (5)
(b) Discuss Professor Rostow's various stages of economic development with reference to the context of Bangladesh. (10)
(c) Briefly explain the following factors of economic growth: (8 1/3)
(i) Capital formation
(ii) Technological progress.
2. (a) Mathematically derive the Harrod-Domar growth model of economic development. (10)
(b) What is meant by balanced growth? (3 1/3)
(c) Explain the strategy of unbalanced growth in the context of a least developed country like Bangladesh. (10)
3. (a) What do you understand by the concept of investment? Briefly narrate the criteria for making an investment decision. (13 1/3)
(b) Briefly discuss the various theories of economic development. (10)
4. (a) Define economic planning. (5)
(b) Briefly narrate the strategies of the Fifth Five Year Plan of Bangladesh. (8 1/3)
(c) Describe the development goals and objectives of the Fifth Five year Plan of Bangladesh. (10)

SECTION – B

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

5. (a) How does labour-intensive techniques of production help a developing country to develop? (13 1/3)
(b) What are the arguments for capital-intensive techniques of production? Explain. (10)

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6. (a) What do you understand by multinational corporations? What are the merits of multinational corporations? (13 1/3)
- (b) Explain the demerits of multinational corporations. (10)
7. (a) How does agricultural sector help a developing country like Bangladesh to develop? Explain. (10)
- (b) Explain the role of industrial sector for the economic development of a developing country. (13 1/3)
8. (a) What is fiscal policy? Explain the objectives of fiscal policy for the development of Bangladesh. (10)
- (b) "Taxation is the most effective instrument of fiscal policy". Justify the statement. (10)
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B.Sc. Engineering Examinations 2012-2013

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

1. (a) "Materials, shape and properties interact with each other while selecting a manufacturing process" - Explain using suitable examples. (10)
- (b) Why is casting process considered to be a major metal forming process? (5)
- (c) Discuss the characteristics of green moulding sand aggregates. (20)
- (d) Why are sand additions important? Write the name of some additives with their specific functions. (11 $\frac{2}{3}$)

2. (a) Differentiate critically green-sand mold, core sand mold and shell mold. (12)
- (b) What are the functions of pattern and core in metal casting? What is a core print? Deduce an expression for core print size X of a core having diameter D and length L. (16)
- (c) Select a suitable melting practice and write the operating steps in producing ductile iron. (13 $\frac{2}{3}$)
- (d) What is the effect of segregation on the casting property? (5)

3. (a) Briefly discuss the gas absorption during melting and principles involved in degassing of molten metal. (24 $\frac{2}{3}$)
- (b) What are the causes for the formation of cold crack and hot crack in a cast product? (10)
- (c) Write the causes and possible remedies of inclusion defects. (12)

4. (a) Give a comparative study on the common moulding variables used in steel and aluminium foundry practice. (21 $\frac{2}{3}$)
- (b) Explain how you would eliminate macro and micro shrinkages from Cu-base alloy castings using proper gating system. (15)
- (c) How can the surface defects of casting be detected? (10)

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SECTION – B

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

5. (a) What are gating systems? Using schematic diagram, show the elements of a typical gating system. Discuss the functions of gating system. (2 2/3 + 5 + 18 = 25 2/3)
- (b) Using suitable sketches, distinguish between the following: (21)
- (i) Directional and progressive solidifications
 - (ii) Top pouring and bottom pouring gating systems
 - (iii) Pressurised and unpressurised gating system
6. (a) For pressure-die casting and centrifugal casting, a pressure of 1 MPa and an acceleration of 10 g, respectively, are enough to produce very good surface finish and definition. But commercial pressure-die casting and centrifugal casting processes use about 100 MPa pressure and 50-100 g acceleration, respectively. Why industrial production processes use such a high value of pressure or centrifugal force? (5)
- (b) What do you mean by laminar flow and turbulent flow of fluids? Establish the conditions for which flow of fluid becomes turbulent. What will happen when the flow of liquid metal becomes turbulent inside the gating systems? (4 + 4 + 6 2/3 = 14 2/3)
- (c) A thin-walled cylindrical casting of 100 mm inside dimension, 10 mm thickness and 250 mm length is to be made using cast iron in greensand mould. Determine the following:
- (i) Using a 25% longer time than the solidification time, calculate the pouring time required for the casting. The mould constant in Chvorinov's rule is 2.2 s/mm². (5)
 - (ii) Using suitable sprue and pouring basin/bush, calculate the effective liquid metal head required for the gating system. List all assumptions you made during this calculation. (5)
 - (iii) Calculate the choke area for this gating system. Use 7.0 g/cc for liquid metal density and 0.80 for discharge coefficient. (5)
 - (iv) Calculate sprue top and bottom areas, runner area and ingate area of the gating system. Use 500 mm/s for critical velocity for this unpressurised system which has a gating ratio of 1:1:2. Also use a safety factor of 25% to oversize the sprue top area. (12)
7. (a) Define and classify feeding systems. Examine the necessity of using a feeder in metal casting. Discuss the rules of feeding that must be fulfilled during the design of a feeder when required. (4 2/3 + 4 + 18 = 26 2/3)
- (b) It was decided to use a cylindrical feeder having $H = 1.5D$ to cast a cast iron plate of 300 × 200 × 20 mm in dimensions in greensand mould. Design a suitable feeding system for this casting indicating placement, dimensions and number of feeders to be used. Use 0.5% shrinkage allowance for cast iron. (20)

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8. (a) What are dendrites? Discuss the mechanism of formation and growth of dendritic structures in cast metals. **(2+10=12)**
- (b) What is undercooling? How the undercooling of an alloy can be depressed during solidification? Discuss how the depression of undercooling affects the nucleation and solidification of impure metals and alloys. **(2 $\frac{2}{3}$ +4+8=14 $\frac{2}{3}$)**
- (c) Using neat sketches discuss how columnar, equiaxed and other grain structures are developed during cooling of a pure metal ingot. **(5+15=20)**
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