

SECTION – A

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

1. (a) List the principle manufacturing processes of materials. What are the advantages and disadvantages of casting process? (10 $\frac{2}{3}$)
 (b) Write short notes on the mechanisms of clay-water bonding in green molding sand aggregates. (13)
 (c) What are the effects of sand grain on the mold permeability and refractoriness? Discuss the effect of clay and moisture content on the green and dry compressive strength and permeability of green molding sand aggregate. (23)
2. (a) List the defects in casting. (8 $\frac{2}{3}$)
 (b) During the cooling of a casting from the molten state to shop temperature, the mechanical properties can be related to four stages of behavior. Explain these four stages with the related defects that may occur during cooling. (23)
 (c) What is meant by hot tears? Describe briefly the factors which influence the occurrence of hot tears. (15)
3. (a) What are the basic differences in the solidification of gray cast iron and ductile cast iron? (18)
 (b) Is it possible to modify the properties of ductile iron by heat treatment? Explain. (8 $\frac{2}{3}$)
 (c) What is continuous casting process? Write the advantages of this process over conventional steel ingot casting process. (13)
 (d) How would you identify the internal defects in castings? (7)
4. (a) Write a short note on CO₂ process of molding. (6)
 (b) Discuss important factors to be considered in designing gating and feeding system of copper base alloys. (16 $\frac{2}{3}$)
 (c) Describe briefly the techniques that are employed to remove gates and raisers which are firmly attached to the casting. (14)
 (d) Sketch a plant layout for a foundry which produces different types of pumps. (10)

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SECTION – B

There are **FOUR** questions in this section. Answer **Q. No. FIVE** and any **TWO** from the rest. **Question No. 5 is Compulsory.**

5. (a) Figure 1 shows a cylindrical feeder attached to a casting. Estimate the relative solidification time for the casting section and the feeder. Determine whether the feeder will be effective if the casting is made of LM25 alloy. Show all assumptions and calculations. (5+25=30)
- (b) A thin-wall cylindrical casting of 100 mm diameter inside dimension, 10 mm thickness, and 250 mm length is to be cast using cast iron in greensand mould. Determine the following:
- (i) Using 20% longer than solidification time, calculate the pouring time required for the casting. The mould constant in Chvorinov's rule is 1.20 s/mm^2 . (5)
 - (ii) Using a 50 mm-high pouring basin, calculate the effective metal head pressure developed in the gating system. List all assumptions you made during this calculation. (5)
 - (iii) Calculate the choke area of the 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 gate area of the gating system. Use critical velocity = 500 mm/s for this unpressurised gating system with a gating ratio = $1 : 2 : 4$. Also use a safety factor of 25% to oversize the sprue top area. (15)
6. (a) Explain the concept of homogeneous and heterogeneous nucleation. Using suitable figures or equations, discuss and compare the conditions that favour heterogeneous nucleation of a solid or a gas phase on top of a foreign particle inside a liquid metal. (10+10=20)
- (b) Explain using neat sketches the concept of directional solidification and progressive solidification. How does directional solidification help in producing sound casting? Discuss the various practical measures that can be used to achieve directional solidification in casting. (6+6+8=20)
7. (a) Explain the laws of fluid flows that aid the design of gating system. (20)
- (b) Figure 2 shows two gating systems (indicated as "Type 1" and "Type 2") used for casting an aluminium plate in sand mould. Discuss the advantages and disadvantages of these two gating systems. (20)
8. (a) Discuss the functions of using a feeder in casting. Indicate the cases for which the use of a feeder can be avoided. (20+5=25)
- (b) With a neat figure explain the working principle of a blind feeder and an open feeder. Give their advantages and drawbacks. (10+5=15)
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SECTION – A

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

1. A single weld bead is made on a wide thick steel plate by SMAW process at a welding speed of 2.5 mm/s using welding current of 150 A at 20 V.

Assume:

Efficiency of heat source = 0.8

Thermal conductivity of steel = 50 W/(m.°C)

Thermal diffusivity of steel = 1.4×10^{-5} m²/s

Melting point of steel = 1500°C

Ambient temperature = 25°C

- (a) Using Rosenthal's three-dimensional heat equation calculate the temperatures at different locations along weld axis during welding. Show your result on a graph paper considering heat source as origin. **(10)**
- (b) Calculate the temperature at a point (50,15,0) mm with respect to the arc as origin. **(10)**
- (c) Determine the cooling rate at the rear boundary of the weld pool curing welding. **(5)**
- (d) Determine the cooling rate at 550°C along weld axis. **(5)**
- (e) Calculate the preheating temperature of the plate required to keep the cooling rate not over 20°C/s at 550°C. **(5)**
2. (a) Fig. 1 shows the effect of welding speed on the columnar grain structure of gas-tungsten arc welds of high-purity (99.96%) aluminium. At the welding speed of 1000 mm/min straight columnar grains point toward the centerline (Fig. 1a), while at 250 mm/min curved columnar grains point in the welding direction (Fig. 1b). Explain the formation of these structures. **(10)**
- (b) Show that the G/R ratio at the centerline of a weld pool is less than that at the fusion line. **(10)**
- (c) Explain the variation in growth mode (planar-to-cellular and cellular-to-dendritic transitions shown in Fig. 2) observed across the weld in 1100 aluminum (essentially pure Al) welded with a 4047 (Al-12 Si) filler metal. **(15)**

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3. (a) "Weld decay in austenitic stainless steels does not occur immediately next to the fusion boundary, where the peak temperature is highest during welding. Instead, it occurs at a short distance away from it, where the peak temperature is much lower." — Explain with the help of thermal cycles during welding. (10)
- (b) How can weld decay in austenitic stainless steels be avoided? Explain. (15)
- (c) "Although niobium-and titanium-stabilized austenitic stainless steels are not susceptible to weld decay, they can be susceptible to a different kind of corrosion attack." What is the name of this attack? Where and how does it occur in a weldment? (10)
4. (a) How does residual stresses develop in a weldment? (13)
- (b) What are porosities? How does it form in the weld metal? How can these be avoided? (10)
- (c) How can the internal defects in a weldment be identified by NDT? Discuss the principles of any NDT method to identify internal defects in weldments. (12)

SECTION – B

There are **EIGHT** questions in this section. Answer any **SIX**.

5. In a consultancy firm, your job responsibilities include design of welding processes for different types of joining of metallic alloys. For welding of dissimilar steel plates, you were asked to schedule a welding procedure. You were asked to consider the following facts. (17½)
- (a) High-energy-density beam welding is preferred by the client.
- (b) Single pass welding is preferred.
- (c) Client agrees to provide high initial investment for quality welding.
- (d) Client does not want to put extra cost in surface modification of metallic alloys surface prior to welding.
- (e) Also, client is not interested in investment in type of shielding gas.
- Considering the facts mentioned above, choose a suitable welding process and explain the reasons of your selection.
6. You are working as an engineer in a project titled "Construction of double line track from Tongi to Bhairabbazar including signaling (01.07.2006 to 30.06.2016)" under Bangladesh Railway. What type of welding procedure would you suggest for joining rail roads? Discuss how you can accomplish the welding using schematic diagrams of the process. (17½)

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7. Describe different types of seam welding by resistance method. (17 ½)

 8. Diffusion welding is a solid-state welding procedure. Explain with necessary schematic diagrams. (17 ½)

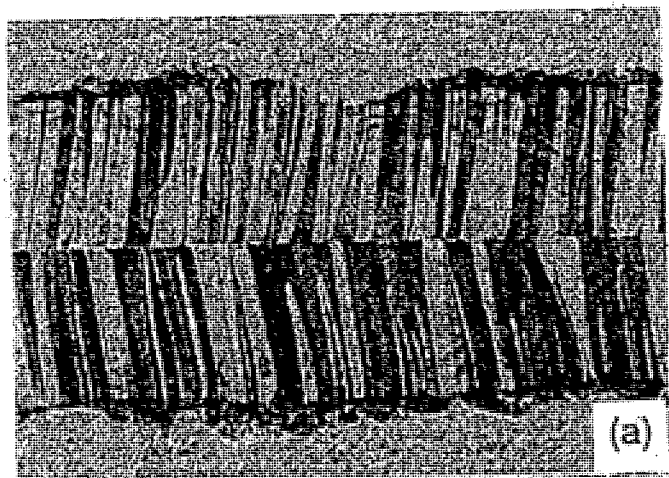
 9. During gas metal arc welding processes, molten metal transfers from the tip of the electrode to the weld pool through several transfer modes. Narrate these modes briefly. (17 ½)

 10. What do you understand by soldering? Write down the working principle of flame/torch soldering. (17 ½)

 11. Write down the names of different types of brazing operations. Explain how you would choose a brazing filler metal for a particular job. What properties do a brazing filler metal must processes. (17 ½)

 12. Using sketches, describe the characteristics of current types in gas tungsten arc welding. (17 ½)
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welding
direction ←



welding
direction ←

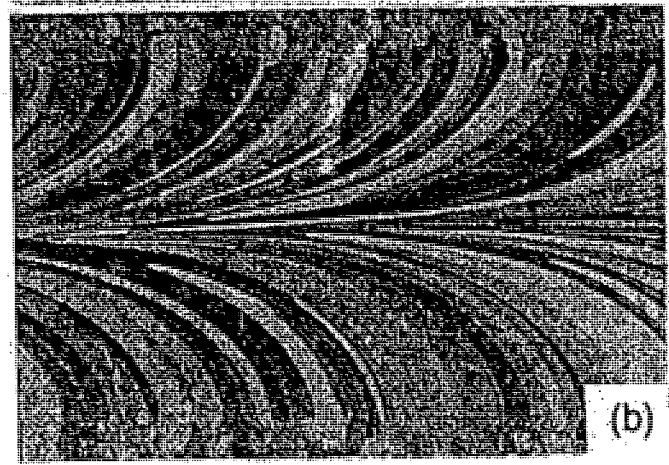


Fig. 1. for Q. No. 2 (a)

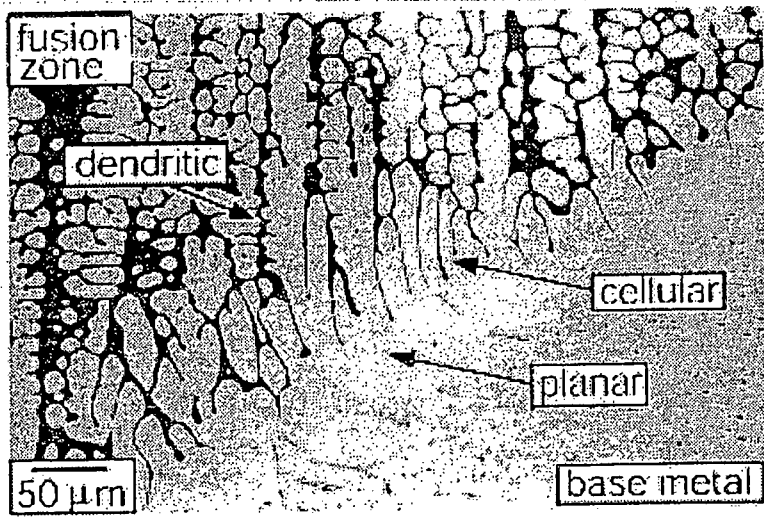


Fig. 2 for Q. No. 2 (c)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2013-2014

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

Full Marks: 140

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**.

Symbols indicate their usual meaning.

1. (a) Illustrate the measurement of inequality using a typical size distribution of income by income shares. (15)
- (b) Why is inequality among those above the poverty line a matter of concern? Discuss. (8 1/3)
2. (a) What do you know about Human Development Index (HDI)? Describe the traditional method of measuring HDI with an example. (12)
- (b) What is new in the New Human Development Index (NHDI)? (6 1/3)
- (c) Distinguish between absolute poverty and poverty gap. (5)
3. (a) What is the main focus of the structural change models. Illustrate the Lewis Theory of Development. (18)
- (b) State the contrasting features of the Patterns-of-Development Analysis and the Lewis model. (5 1/3)
4. Write short notes on any **THREE** of the following: (23 1/3)
 - (i) Three core values of development;
 - (ii) The Neocolonial Dependence Model;
 - (iii) The procedure of cost-benefit analysis;
 - (iv) The rationale for development planning.

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

5. (a) Development is the way of achieving growth with equity — Explain. (6 1/3)
- (b) Explain the operation of four wheels of growth in least development countries. (7)
- (c) Show that the growth rate of a country is directly related to its savings-ratio and inversely related to its capital-output ratio. (10)

HUM 305

6. (a) What is meant by unbalanced growth? **(3 1/3)**
- (b) If the doctrine of balanced growth is to be fully implemented, then investment will have to be made in consumer goods industries, agriculture, capital goods industries and social overhead capital — Explain the statement in the context of least developed countries. **(10)**
- (c) Briefly discuss the following theories of economic development: **(10)**
- (i) The Structural Changes Model
 - (ii) The International Dependence Revolution
 - (iii) The Asian Managed-Market Approach.
7. (a) What are the main obstacles to economic development in the least developed countries? Discuss them. **(11 1/3)**
- (b) Explain the following criterion for making an investment decision: **(12)**
- (i) Capital output ratio criterion
 - (ii) Marginal social productivity criterion
 - (iii) Balance of payment criterion
 - (iv) Labour intensive vs. capital intensive technique.
8. Write short notes on any FOUR of the following: **(23 1/3)**
- (i) Objectives of the sustainable development goals (SDG)
 - (ii) The take off period of economic growth
 - (iii) Capital formation as a factor of economic growth
 - (iv) Non-economic factors of economic development
 - (v) Forward linkage and backward linkage of unbalanced growth.
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SECTION – A

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

1. (a) Why do sociologists intend to understand social relationships without arguing of value judgment? (10)
(b) Do you think structural functionalism is an inherently conservative theoretical approach? Show arguments in favour of your answer. (13 1/3)

2. (a) What is social stratification? How do various systems of social stratification perpetuate social inequality? (10)
(b) Discuss Karl Marx's theory of social stratification. (13 1/3)

3. (a) Write the meaning of deviant behaviour. Evaluate the theory of Anomie given by E. Durkheim for explaining deviant behaviour in capitalist society. (10)
(b) How do different modes of socially accepted means and goals create deviance in a society? Explain with Merton's theory of deviance. (13 1/3)

4. (a) Define social norms. Does cultural lag resist social change? Show arguments in favour of your answer. (8)
(b) Explain the following concepts with suitable examples: (15 1/3)
 - (i) Subculture,
 - (ii) Counter culture,
 - (iii) Dominant ideology,
 - (iv) Ethnocentrism,
 - (v) Cultural relativism.

HUM 211

SECTION – B

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

5. (a) Respond to the following quote, 'Globalization, as defined by rich people like us, is a very nice thing... you are talking about the internet, you are talking about cell phones, you are talking about computers. This doesn't affect two-thirds of the people of the world' (Jimmy Carter). (13 $\frac{1}{3}$)
- (b) Discuss the contribution of agricultural revolution and transport revolution to the industrial revolution in Europe. (10)
6. (a) In industrial society we found 'formal schooling open to the masses and viewed as a means of advancing the social order' — R. T. Schaefer. Discuss the statement. (13 $\frac{1}{3}$)
- (b) Identify causes and effects of the major environmental pollution usually happen in Bangladesh. (10)
7. (a) How will recent international migration not only profoundly affect the lives of the migrants, but also lead to significant economic and social transformations in Middle East and in Europe. (13 $\frac{1}{3}$)
- (b) How did a simple religious belief – 'protestant ethics' motivate capitalism in Europe? (10)
8. Write short notes on any THREE of the followings: (23 $\frac{1}{3}$)
- (a) Flying Shuttle.
- (b) Top ten megalopolises in the world.
- (c) Infant Mortality Rate (IMR).
- (d) Population pyramid.
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2013-2014

Sub : **MME 343** (Surface Engineering of Materials)

Full Marks: 210

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) Compare and contrast regular co-deposition with irregular co-deposition. (20)
- (b) Briefly describe how variation in bath compositions effects electrodeposition of alloys. (10)
- (c) Draw a typical curve of metal percentage in deposit versus metal percentage in bath for anomalous co-deposition. (5)
2. (a) Complex ion bath is important in electroplating-explain (8)
- (b) Describe four purposes of electroplating. (20)
- (c) Define cathode current efficiency and polarization. (7)
3. (a) Differentiate between physical vapour deposition and chemical vapour deposition. (15)
- (b) Why does corrosion provide a major source of failure of metallic structures? (6)
- (c) Write short notes on composite plating and selective plating. (14)
4. (a) Select and describe a coating deposition technique suitable for ceramic powder deposition. (18)
- (b) How does laser surface alloying overcome the difficulties that are associated with laser surface melting? (10)
- (c) Mention the usefulness of electroless plating over electroplating. (7)

SECTION – B

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

5. (a) Discuss the chemical tests that are carried out in testing of coated products. (20)
- (b) Mention which coatings are applied on the following applications. Give reasons to your answer. (15)
 - (i) Cutlery
 - (ii) Motor car exhaust system
 - (iii) Food cans

MME 343

6. (a) What are the merits and demerits of friction? Give examples in engineering components. (10)
- (b) Discuss the chemical, structural and grain boundary effects on the co-efficient of sliding friction. (18)
- (c) A hard ball slides against a soft and flat surface of two different loads. At one load, the co-efficient of friction is 0.20 and the groove width is 0.5 mm. At another load, the co-efficient of friction is 0.25 and the groove width is 1 mm. Calculate the radius of the ball and the adhesive component of the co-efficient of friction. Assume that the dominant sources of friction are adhesion and ploughing and these are additive. (7)
7. (a) Derive equation expressing the ploughing component of the co-efficient of friction for a cylindrical shaped wear particle in contact with a softer body (consider both upright position and transverse position). (18)
- (b) With necessary diagrams, explain friction transitions during sliding. (17)
8. (a) Describe abrasive wear by three plastic deformation modes. (18)
- (b) Derive Archard's equation of adhesive wear. (17)
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2013-2014

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 – A

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

1. (a) Write the typical chemical reactions for the formation of clays from a basic rock. (10)
 (b) Distinguish between China clay and ball clay in terms of origin, particle size and properties. (15)
 (c) What do you understand by triaxial composition of a whiteware system? Show a typical triaxial composition of wall tile product. (10)
2. (a) What are the problems associated with uniaxial pressing? Explain their causes and suggest suitable remedial measures. (13)
 (b) Show that lowering of particle size ratio in a two components ceramic system results in improved packing, with necessary figures. (15)
 (c) Give brief account on Jiggering process for white ware products. (7)
3. (a) Discuss the difference between ZrO_2 and SiC crystal structure. (10)
 (b) Compare the dislocation motion in covalent ceramics with that in ionic ceramics. (12)
 (c) "For ceramics, the strength measured in compression is roughly 15 times larger than that measured in tension" — Explain. (13)
4. (a) Explain why the rate of drying falls sharply after the constant rate period. (10)
 (b) Differentiate between the mechanisms of solid state and liquid state sintering. (25)

SECTION – B

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

5. (a) Give a brief account on glass transition temperature and its dependence on cooling-rate. (15)
 (b) Discuss the purpose and processing of toughened glass by thermal and chemical strengthening technique. (20)

MME 365

6. (a) Discuss the steps involved in the fabrication process of lithium-aluminosilicate based glass-ceramics. (15)
- (b) Elucidate the roles of different firing agents during glass melting. (20)
7. (a) Mention the required physical properties of glaze slip. (10)
- (b) What do you understand by 'glaze frit' and 'glaze fit'? (10)
- (c) Illustrate different steps of glaze maturation during firing. (15)
8. (a) "Molten tin bath is more suitable for float glass process" – give reasoning. (8)
- (b) Why is portland cement stronger than pozzolona cement? (9)
- (c) Differentiate between setting and hardening reactions of portland cement with suitable schematic illustrations. (18)
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