L-3/T-2/MME **Date : 20/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2015-2016

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

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**.

Table of modified Bessel function supplied.

1. (a) A single pass full penetration weld is made on 5-mm-thick 6061 aluminum (T_L = 652 °C) plate in the T6 condition by GTAW process using 18 V and 120 A at a welding speed of 125 mm/min.

(i) Calculate the temperature of a point (50,15) mm with respect to the arc as origin. **(10)**

(ii) Calculate the width of HAZ (Softening of base metal occurs due to θ′ reversion at temperature above 300 C°). **(5)**

Given:
Heat source efficiency = 0.65
Density of aluminium =2.7 × 10^3 kg / m^3
Thermal conductivity of aluminum = 273 W/ (m. °C)
Specific heat of aluminum = 905 J/(kg °C).
Thermal diffusivity of aluminum = 9.7 × 10^{-5} m^2/s.
Ambient temperature = 20 °C.

(b) Bead-on-plate welding of a wide thick steel plate is carried out by SAW process using 34 V and 1100 A at a welding speed of 8 mm/s. Calculate:

(i) The cooling rate at the rear boundary of the weld. **(5)**

(ii) The cooling rate at a distance 200 mm along the weld axis from the source as origin. **(5)**

(iii) The cooling rate at 550 °C along the weld axis. **(5)**

(iv) The cooling rate at 550 °C along the weld axis if the plate is preheated to 250 °C. **(5)**

Given:
Heat source efficiency = 0.99
Thermal conductivity steel = 64 W/ (m. °C)
Melting point of steel = 1500 °C.
Ambient temperature = 20 °C.

2. (a) Fig. 1 shows the effect of welding speed on the columnar gain structure of gas-tungsten are welds of high-purity (99.96%) aluminum. 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)**

Contd P/2

MME 347

Contd... Q. No. 2

(b) Explain the variation of growth mode from fusion boundary to the weld centerline due to the variation of temperature gradient, G and growth rate, R along weld pool boundary. **(10)**

(c) Discuss the problems associated with the partially melted zone in welding. How can these problems be overcome? **(15)**

3. (a) Fig. 2 shows the effect of heat input per unit length of weld on HAZ hardness in a work-hardened 5356 aluminium alloy. Explain the loss of strength (hardness) in the HAZ with the help of thermal cycles during welding. **(10)**

(b) "Welding of higher carbon steels is more difficult than welding lower carbon steels." – Why? **(10)**

(c) "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. **(15)**

4. (a) How does residual stresses develop in weldment? **(15)**

(b) What are porosities? How do they form in the weld metal? How can these be avoided? **(10)**

(c) Discuss the effect of sulfur on solidification cracking of carbon steel weld metal. How can this effect be reduced? **(10)**

SECTION-B

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

5. Digital Electronics, Inc. produces different types of printed circuit board such as through-hole, surface mount, mixed technology, single- and double-sided, and leaded and lead-free RoHS-compliant printed circuit board (PCB). The company hired you for designing the soldering procedure of PCB. You were asked to select the followings: **(17.5)**

(i) Soldering process suitable for PCB

(ii) Low cost and high creep strength solders

(iii) Suitable non-corrosive flux

Explain the reasons behind the selection.

6. (a) What are the important characteristics of a brazing flux? How do the brazing fluxes differ from soldering fluxes? **(10)**

Contd P/3

MME 347

Contd... Q. No. 6

(b) Briefly discuss the brazing process where the heat for brazing is mainly generated in the electrodes and flows into the work by conduction. **(7.5)**

7. (a) Differentiate between straight polarity and reverse polarity in GTAW (Gas-tungsten arc welding). **(10)**

   (b) Briefly narrate the shielding gases used in GTAW. **(7.5)**

8. (a) Explain the weld symbol in fig 3 (a) and 3 (b) and sketch the desired welds. **(12)**

   (b) Write a short note on Lap seam welding. **(5.5)**

9. (a) Discuss the molten metal transfer mode to weld pool for overhead-position welding by Gas-metal arc welding (GMAW). **(8.5)**

   (b) Compare and contrast submerged arc welding and electro slag welding. **(9)**

10. (a) Explain the temperature variation of oxyacetylene flame along its length. **(10)**

    (b) Discuss the basic operations in flame cutting. **(7.5)**

11. (a) In diffusion welding, explain the roles of key parameters like temperature, time and pressure. Which one among these three parameters are the most important and why? **(10)**

    (b) Discuss the unique features of Explosion Welding. **(7.5)**

12. 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. Considering the following facts: **(17.5)**

    (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 any type of shielding gas.

    Considering the facts mentioned above, choose a suitable welding process and explain the reasons of your selection.

Table of Modified Bessel Function of Second Kind Zero Order (For Q. No. 1a)

x	Kv(x)
0	∞
0.01	4.721245
0.02	4.028457
0.03	3.62353
0.04	3.336541
0.05	3.114234
0.06	2.93288
0.07	2.779818
0.08	2.647489
0.09	2.531017
0.1	2.427069
0.11	2.333268
0.12	2.247857
0.13	2.169503
0.14	2.097168
0.15	2.030028
0.16	1.967419
0.17	1.908798
0.18	1.853714
0.19	1.801789
0.2	1.752704
0.21	1.706185
0.22	1.661998
0.23	1.619937
0.24	1.579826
0.25	1.541507
0.26	1.504842
0.27	1.469709
0.28	1.435998
0.29	1.403611
0.3	1.37246
0.31	1.342466
0.32	1.313556
0.33	1.285665
0.34	1.258734
0.35	1.232707
0.36	1.207535
0.37	1.183172
0.38	1.159576
0.39	1.136707
0.4	1.114529
0.41	1.093009
0.42	1.072116
0.43	1.05182
0.44	1.032095
0.45	1.012915
0.46	0.994256
0.47	0.976098
0.48	0.958418
0.49	0.941198

x	Kv(x)
0.5	0.924419
0.51	0.908064
0.52	0.892116
0.53	0.87656
0.54	0.861382
0.55	0.846568
0.56	0.832105
0.57	0.81798
0.58	0.804182
0.59	0.7907
0.6	0.777522
0.61	0.76464
0.62	0.752042
0.63	0.739721
0.64	0.727668
0.65	0.715873
0.66	0.70433
0.67	0.69303
0.68	0.681966
0.69	0.671132
0.7	0.66052
0.71	0.650124
0.72	0.639938
0.73	0.629956
0.74	0.620173
0.75	0.610582
0.76	0.60118
0.77	0.591959
0.78	0.582917
0.79	0.574048
0.8	0.565347
0.81	0.556811
0.82	0.548434
0.83	0.540214
0.84	0.532146
0.85	0.524226
0.86	0.516451
0.87	0.508818
0.88	0.501322
0.89	0.49396
0.9	0.48673
0.91	0.479629
0.92	0.472652
0.93	0.465798
0.94	0.459064
0.95	0.452447
0.96	0.445944
0.97	0.439552
0.98	0.43327
0.99	0.427095

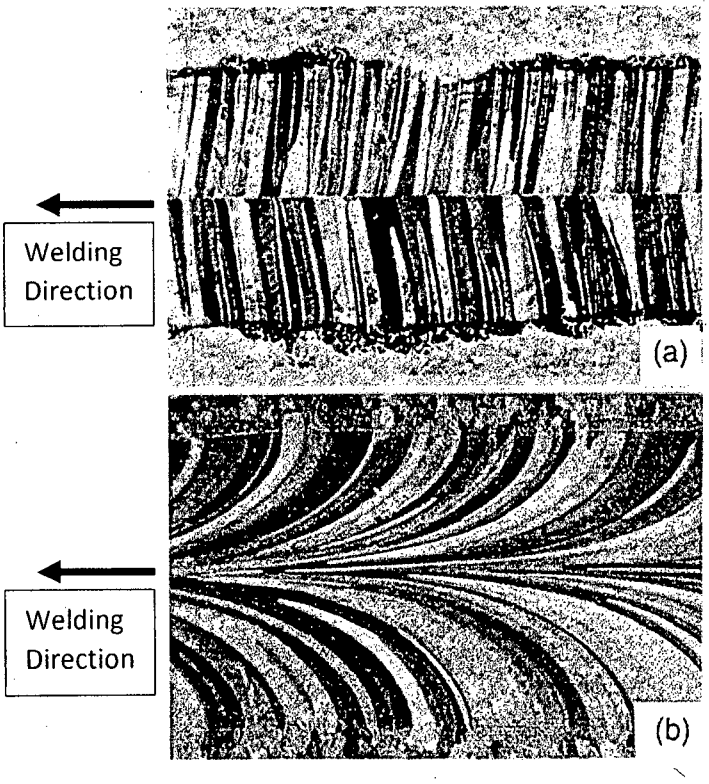


Fig. 1 for Q. No. 2(a)

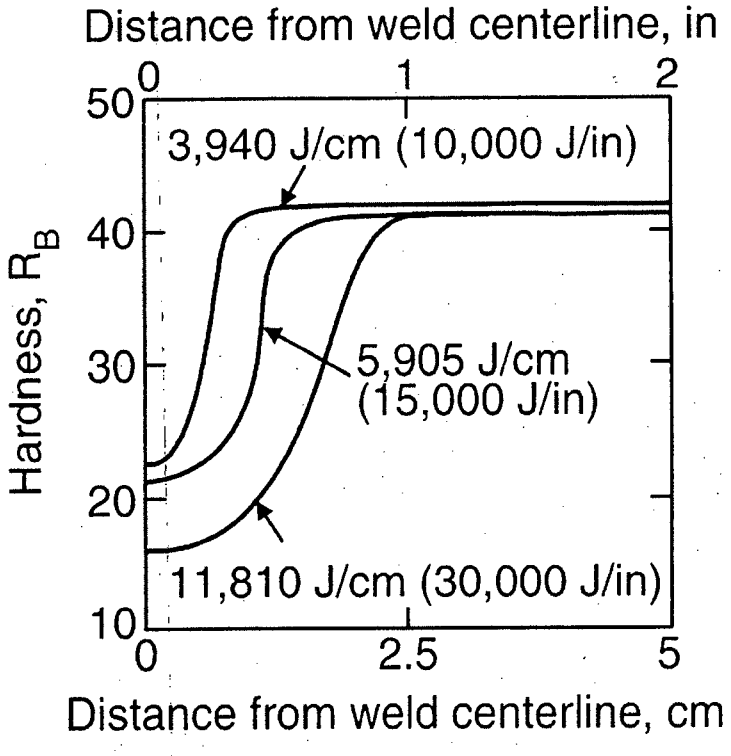


Fig. 2 for Q. No. 3(a)

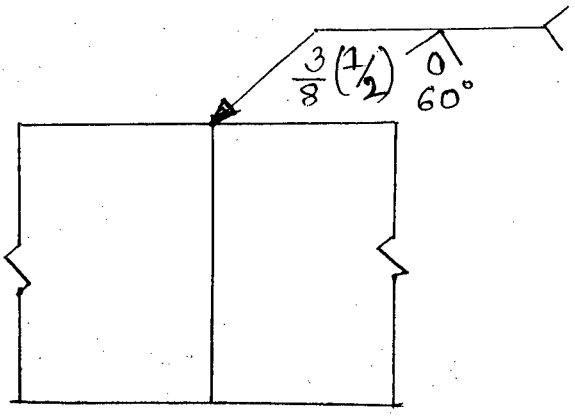


Fig. 3(a) for Q.no. 8(a)

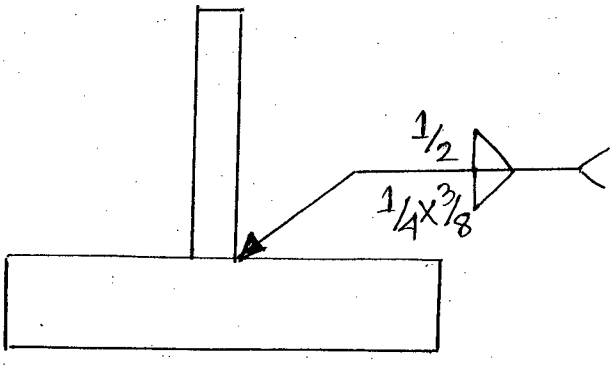


Fig. 3(b) for Q. no. 8(a)

12.06.2017

L-3/T-2/MME **Date : 16/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2015-2016

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) Briefly discuss the various mechanisms for permanent stress development in glass. **(10)**

   (b) For a soda-lime-silicate glass with $\alpha = 90 \times 10^{-7}/\,^{\circ}C$, 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. **(10)**

   (c) What is the difference between fully tempered glass and heat-strengthened glass? **(8)**

   (d) Mention the limitations of thermal tempering. **(7)**

2. (a) What are the key requirements for lighting glass? What sort of commercial glass composition is used for making lighting glass? And also mention the key characteristics of this specific glass composition. **(11)**

   (b) Discuss a sheet glass making process that would give excellent surface properties. **(13)**

   (c) Describe the process of removal of bubbles of 0.2 mm diameter or less from the molten glass. **(11)**

3. (a) Describe the hardening mechanism of Portland cement. **(10)**

   (b) What is the problem associated with high alumina cement in warm and wet conditions? **(7)**

   (c) Using schematic diagram discuss the crack propagation behavior in ceramic materials during tension and compression loading. **(9)**

   (d) "Most ceramics are intrinsically hard" – explain. **(9)**

4. (a) List the important physical requirements for a glaze slip. **(6)**

   (b) Explain the term "glaze fit". **(12)**

   (c) Compare and contrast between brazing and diffusion bonding for joining of ceramics. **(17)**

SECTION-B

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

5. (a) What are the general characteristics of ceramics? **(8)**

Contd P/2

MME 365

Contd... Q. No. 5

(b) Identify the structural difference among the sheet, double and single chain silicate structures. Give example in each cases. **(10)**

(c) Mention the factors determine the crystal structure of ceramics. **(5)**

(d) Classify ceramic raw materials according to their functional requirements. **(12)**

6. (a) Indicate the importance of silica as filler in the fabrication of traditional ceramics. **(7)**

(b) A ceramic body has the following target composition (by parts): **(18)**

$KNaO = 0.10$, $Al_2O_3 = 0.15$, $SiO_2 = 2.0$, $CaO = 0.27$, $ZnO = 0.63$

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

Raw materials	SiO_2	Al_2O_3	K_2O	Na_2O	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 (i.e. body raw materials composition).

(c) What do you understand by triaxial composition of a white ware system? Draw a typical triaxial composition of wall tile product. **(10)**

7. (a) What are the advantages og jiggering and also mention the factors that control this process. **(10)**

(b) Show with necessary figures that lowering of particle size ratio in a two components ceramic system results in improved packing. **(12)**

(c) What are the problems associated with uniaxial pressing? Explain their causes and suggest suitable remedial measures. **(13)**

8. (a) Why does ceramic product undergo sintering process? **(10)**

(b) Explain the mechanism of sintering process. **(13)**

(c) Calculate the enthalpy change for an oxide as the average particle diameter increases from 0.5 to 10 μm. Assume the molar volume of the oxide to be 10 cm^3/mol and a surface energy of 1 J/m^2. Recalculate the enthalpy change if instead of coarsening, the 0.5 μm spheres are sintered together as cubes, given that the dihedral angle for this system was measured to be 100°.

L-3/T-2/MME **Date : 16/07/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2016-2017

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

Full Marks: 280 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) "Materials, shape and processing interact with each other while selecting a manufacturing process" – Explain using suitable examples. **(18⅔)**

   (b) Write down the mechanisms of clay-water bonding in green sand aggregates. **(15)**

   (c) A hollow steel component was cast using a core prepared from natural sand. Fused sand was found at the inner side of the hole surface of the cast component. Explain the causes and possible remedies for the fusion of the sand at steel surface. **(13)**

2. (a) List the factors that control the green sand properties. Discuss the effect of sand ingredients on the green sand mould properties. **(18⅔)**

   (b) Differentiate critically green sand mold, core sand mold and shell mold. **(12)**

   (c) Deduce an expression for the determination of core print length X of a core having diameter D and Length L. A hollow steel component of having 20 mm inner dia and 40 mm length to be cast. Determine the length of the core print. Given: Steel density 7.8 g/ cm^3, core density 1.67 g/ cm^3, core compressive strength 2.5 g/ cm^2. **(16)**

3. (a) During the cooling of a casting from molten state down to shop temperature, the mechanical properties can be related to four stages of behavior. Explain these four stages with related defects that may occur during cooling. **(20)**

   (b) Susceptibility to tear is closely associated with mode of freezing and alloy composition. Explain this assertion. **(8⅔)**

   (c) What are the effects of C, Si, Cu, Ni, Mn, S, P, Al and Ti on the graphitization process of cast iron? **(18)**

4. (a) Discuss the magnesium treatments that are followed during production of nodular cast iron. **(15)**

   (b) What is austempered ductile iron (ADI)? Explain how you will obtain ADI from a grade of ductile iron? **(15)**

   (c) Give a comparison of common moulding variables that are followed in steel casting and aluminum casting? **(16⅔)**

Contd P/2

MME 345

SECTION-B

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

5. Grey iron casting of 450 kg in weight is to be cast with a composition of C = 3.8, Si = 2.5 and P = 0.6 per cent. The minimum wall thickness of the casting is 10 mm. With a yield not less than 75 per cent and a flask height of 40 cm design an appropriate gating and feeding systems for this casting. Indicate clearly all the assumptions you need to make to solve this design problem. **(46⅔)**

6. (a) What do you mean by homogeneous nucleation? How is heterogeneous nucleation different from homogeneous nucleation? **(10+6⅔)=16⅔**

   (b) Obtain a relation between the free energy changes required for homogeneous and heterogeneous nucleation and then, using the relation, analyse why oxides are not good nuclei for nucleation of solids but nitrides are. **(20+10=30)**

7. (a) What do you mean by the term "undercooling?" Examine how the depression of undercooling influences the solidified structure of pure metals and alloys. **(10+20=30)**

   (b) "Oxygen is responsible for the nucleation of gas porosity in casting while hydrogen is responsible for it growth"- Explain this assertion. **(16⅔)**

8. (a) State and explain the seven rules of feeding design. **(28)**

   (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 solidifications time (TST) for the 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. **(18⅔)**

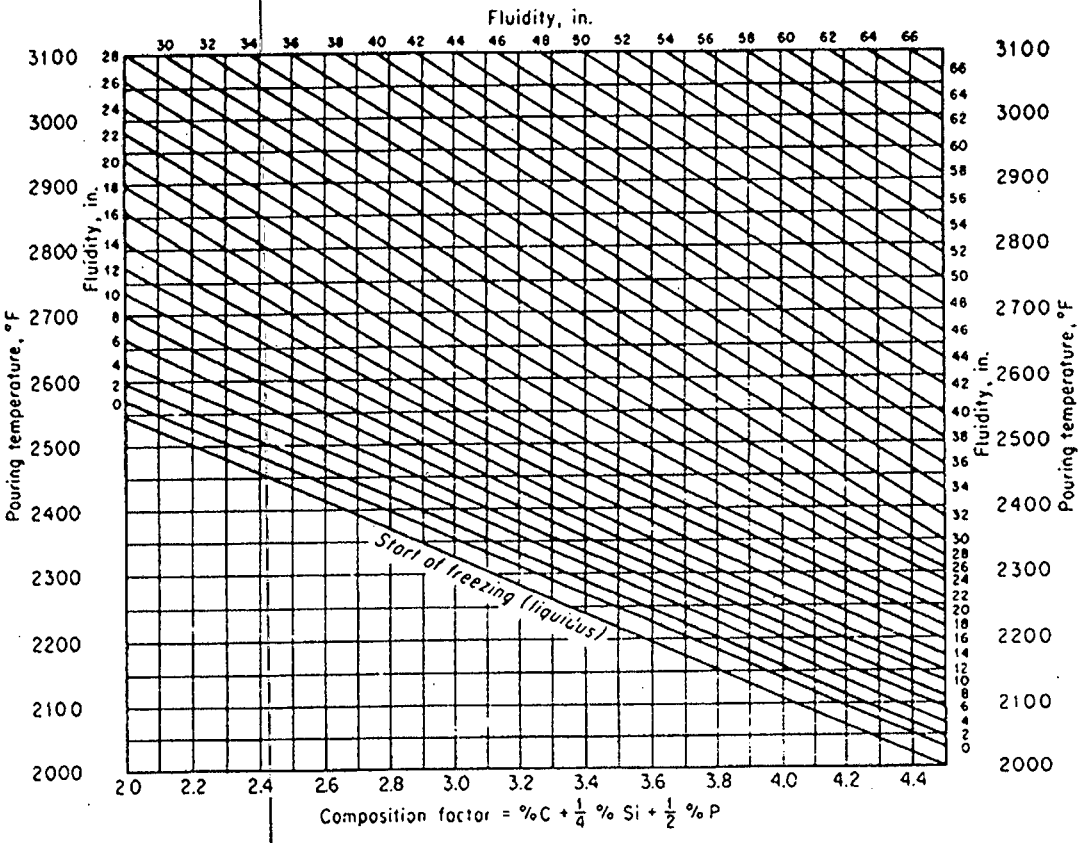


Fig. 1 for Q. #5: Fluidity related to pouring temperature and composition of grey cast iron.

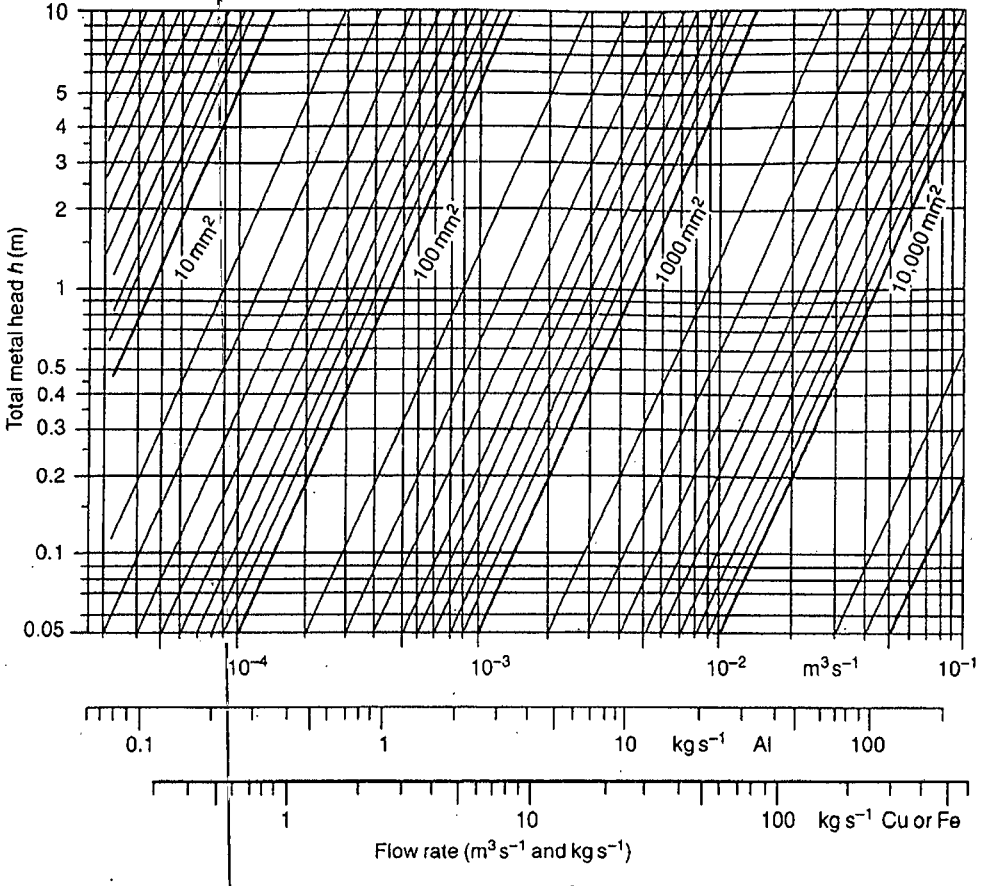
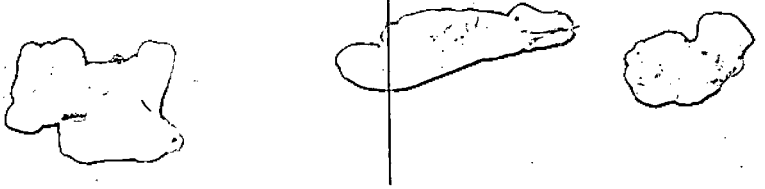


Fig. 2 for Q. #5: Nomogram giving approximate sprue area (mm^2) for light and dense metals as a function of initial flow rate and head height.



L-3/T-2/MME **Date : 09/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2015-2016

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 – A

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

1. (a) Development is the way of achieving growth with equity- Explain. **(6⅓)**

   (b) Discuss the operation of four wheels of growth in the 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)**

2. (a) What is meant by balanced growth? **(3⅓)**

   (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 content of least developed countries. **(10)**

   (c) Briefly discuss Professor Rostow's various stages of economic development. **(10)**

3. Briefly discuss the following determinants of economic development: **(23⅓)**

   (i) Capital output ratio.
   (ii) Dynamic Entrepreneurship.
   (iii) Population growth.
   (iv) Social overhead.
   (v) Non-economic factors.

4. (a) Briefly discuss the strategy of unbalanced growth with reference to Bangladesh. **(11⅓)**

   (b) Briefly narrate the criteria for making an investment decision. **(12)**

SECTION-B

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

Symbols indicate their usual meaning.

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

   (b) What are the arguments for labour intensive techniques and capital intensive techniques? **(15⅓)**

Contd P/2

HUM 305

6. (a) Why do developing countries need planning for economic development? **(10)**
   (b) What are the pre requisites for successful planning? Explain them. **(13⅓)**

7. (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? **(8⅓)**

8. (a) Explain the merits and demerits of multinational corporations? **(15⅓)**
   (b) Show that both the countries will be benefited after trade in a two country two commodity model. **(8)**

L-3/T-2/MME **Date : 09/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2015-2016

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 is meant by family? Discuss the global practices of family system. **(10)**
   (b) Briefly discuss the recent trends of modern nuclear family. **(13⅓)**

2. (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. **(13⅓)**

3. (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' explained the relationship between technology and ideology? **(13⅓)**

4. (a) Discuss the factors that contribute to the emergence of sociology as an independent discipline. **(10)**
   (b) Critically discuss the structural functionalist perspective of sociology. **(13⅓)**

SECTION-B

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

5. (a) What do you mean by natural green house and man-made green house? **(8)**
   (b) What are the main sources of global warming? **(8)**
   (c) Define with examples 'green' category industry and 'red' category industry. **(7⅓)**

6. (a) How do you define industrialization and deindustrialization? What impact did the industrial revolution have on societies? **(10)**
   (b) 'Private property is the terra ferma of capitalism'– Explain this statement on the basis of the nature of capitalism. **(8)**
   (c) Illustrate the negative impacts of capitalism on a society. **(5⅓)**

Contd P/2

HUM 211

7. (a) How do you define demography, crude birth-rate and crude death-rate? Describe the stages of demographic transition theory. **(10)**

   (b) Define human migration. What is meant by 'pull factor' and 'push' factor in migration? Cite example from Bangladesh. **(8)**

   (c) What are the major effects of rural to urban migration? **(5 ⅓)**

8. Write short notes on any Three of the following: **(23 ⅓)**

   (a) Globalization.

   (b) Sources of social change

   (c) The growth of cities.

   (d) The potential consequences of global warming.

L-3/T-2/MME **Date : 05/08/2017**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2015-2016

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 bath composition and current density do affect eletrodeposition of alloys. **(15)**

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

   (b) Describe four purposes of electroplating. **(16)**

   (c) Define hydrogen overvoltage and polarization. **(9)**

3. (a) Differentiate between physical vapour deposition and chemical vapour deposition. **(15)**

   (b) List the functions of ingredients of an electroplating bath. **(15)**

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

4. (a) Select and describe a coating deposition technique suitable for using ceramic powder as starting coating material. **(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** questions.

5. (a) What is Coulomb friction? For a conical asperity in contact with a softer body, derive an equation for ploughing component of the co-efficient of friction. **(20)**

   (b) A hard ball is sliding against a soft and flat surface at two different loads. At one load, the co-efficient of friction is 0.20 and the groove width is 0.5 mm and at another load, the co-efficient of friction is 0.25 and the groove width is 1 mm. Calculate 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. **(15)**

6. (a) Discuss the chemical tests that are carried out in testing of coated products. **(20)**

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(b) Mention which coatings are applied on the following applications. Give reasons to your answer. **(15)**

(i) Food cans,

(ii) Electrical contacts for switch,

(iii) Cutlery.

7. (a) Describe the chemical, structural and grain boundary effects on the co-efficient of sliding friction. **(18)**

(b) Draw and explain the diagram showing the influence of normal load on the friction behavior of Cu-Cu sliding in air. **(7)**

(c) Name the basic mechanisms of wear. Explain, with suitable diagram, the effect of relative hardness of abrasive medium to work piece. **(10)**

8. (a) Draw and explain the schematics of abrasive wear processes as a result of plastic deformation by three deformation modes. **(18)**

(b) Discuss how wear rate changes as a function of sliding velocity and the particle size of an abrasive paper. **(8)**

(c) State and explain the conditions under which abrasive wear takes place by means of fracture. **(9)**
