BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **MME 401** (Physical Metallurgy of Ferrous Alloys)

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 **Question No. 1** and any other **Two** from the rest.

1. (a) During austenitizing, sites of austenite nuclei formation in various types of steels depends on their prehistory, alloy contents and microstructures. Explain. In what microstructural situation the austenite grain size will be the finest? **(10)**

   (b) The target of cryogenic treatment is beyond the conversion of retained austenite to martensite and/or bainite to optimize various service related mechanical as well as chemical properties of any as quenched steel component-explain.
   In a particular shrink fitting operation of an AISI 1065 steel shaft of outer diameter 200 mm into a central hole (198 mm diameter) of a power transmission gear as shown in **Figure for Question No.1(b)**. Find out the hardening and appropriate sub-zero treatment temperatures. Also design the full heat treatment schedule for the fitting purposes? See **Table for Question No.1(b)** for necessary data. Assume reasonable value for any missing data. **(25)**

2. (a) Forging creates characteristic cracking in copper added steel. What is the most important solution for this problem? Explain the underlying mechanisms. **(10)**

   (b) With necessary sketches explain how addition of molybdenum improves the following properties of steels: **(25)**

   (i) hardenability, (ii) pitting corrosion resistance in chloride containing environment (iii) elevated temperature strength and (iv) wear resistance of tool steels.

3. (a) Although the ultimate target of process annealing and stress relieving annealing of steel products is the same, the application requirements are controlled by completely different and complex scenarios. Explain the statement with necessary diagrams and sketches. **(10)**

   (b) The practical tempering behaviour of an AISI 1070 steel and the approximate theoretical relationship between hardness versus carbon content of steel are shown in **Figure for Question No.3(b)**. Quantitatively show which austenitizing temperature shows better agreement with the theoretical hardness values after tempering. Explain possible reasons related to deviation if there is any. **(25)**

Contd P/2

MME 401

4. (a) High strength limits the deep drawability of steel sheet. Do you agree with this statement? Explain with necessary crystallographic structures. **(10)**

(b) Two important limitations of plain carbon steel are: (a) high ductile brittle transition temperature and (b) difficulty in throughout hardening of large section. What are the practical impacts of these behaviour of plain carbon steel? Suggest suitable alloying elements to overcome these limitations and explain their effects with neat sketches. **(25)**

SECTION – B

There are **FOUR** questions in this section. Answer **Question No. 5** and any other **Two** questions.

5. Assume you work as the head of materials engineering and design department in a ferrous plant. The plant has some mini plants based on material type: plain low-carbon steel parts, high-carbon steel parts, cast iron products, and tool steel products. Your plant yields (produces) sheet metals, plates, gears, tools, pipes, welding electrodes, and ten more items. You work in each mini plant for three months per year. Your current job scope for the last three years is to identify sustainable methods for product manufacturing. In the fiscal year 2022-2023, you have identified the following issues warranting extra attention and review. The problems are stated below. This year, you have been asked to explain why you recognise these as the subject of product process line change evaluation. Propose your explanation and probable solutions (if needed). **(40)**

(a) A plain carbon steel part was produced by the case hardening carburizing method at 950°C. However, the dimensional accuracy is not very good. You are thinking of changing the surface treatment process to nitriding. However, the corrosion resistance of the product would be low. This product's increased corrosion resistance is essential to change the surface treatment process to nitriding.

(b) In the tool steel mill section, the fatigue behaviour of the W-grade tool steels is poor. There are a few complaints from clients. Without changing composition, manufacturing process modification is needed for greater fatigue strength.

(c) Martensitic stainless steel (without heat treatment) is used in one mill for regular valves and surgical instruments. You are thinking of changing the material to precipitation hardenable stainless steel.

(d) In the cast iron mill section, one pipe product has many carbides (the material is nodular cast iron). You need to reduce the number of carbides by hear treatment.

Contd P/3

MME 401

6. (a) In cast irons, rank the following alloying elements in terms of their importance in microstructural changes: Mo, P, Mn, S, and Si. Evaluate the reasons for your ranking choice. **(16)**

   (b) The austenitic stainless steels usually present excellent corrosion resistance, ductility, toughness and weldability. Still, we must carry out the heat treatment process for improved mechanical properties. Design a heat treatment (annealing) cycle for AISI 316 grade austenitic stainless steel. How do precipitates play a crucial role in selecting the annealing temperature? **(16 ½)**

7. (a) Draw a plot showing the effects of tempering temperature on the hardness of quenched four different classes of tool steels. Constitute reasonings for modification of tempering schedules based on carbide content for tool steels. **(16)**

   (b) Why do high-speed steels have higher carbon equivalent values? Explain the softening and hardening tendency of high-speed steel during tempering. Draw necessary diagrams. **(16 ½)**

8. (a) Generate an induction hardening process design for making symmetrical parts, such as gears, shafts, axles, cam lobes, stampings, and spindles. Emphasise process parameters. **(16)**

   (b) Both pack carburizing and gas carburizing are simple processes that are popular in many industries. If the product is plain carbon steel, which process would you choose and why? Include process diagrams, carbon depth calculation, and microstructural changes that occurred. **(16 ½)**

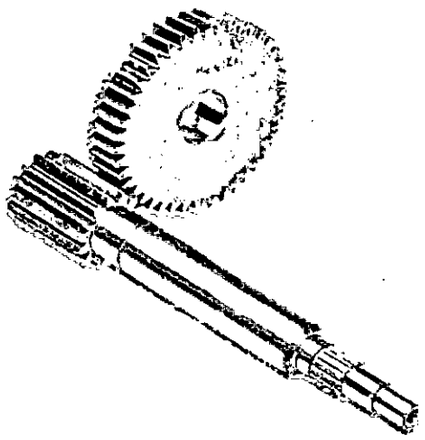

Figure for Question No.1(b).

Substance	Coefficient of Expansion Per Degree Centigrade
Aluminum	25×10^{-6}
Brass or Bronze	19×10^{-6}
Brick	9×10^{-6}
Copper	17×10^{-6}
Glass (Plate)	9×10^{-6}
Glass (Pyrex)	3×10^{-6}
Ice	51×10^{-6}
Iron or Steel	11×10^{-6}
Lead	29×10^{-6}
Quartz	0.4×10^{-6}
Silver	19×10^{-6}

Table for Question No.1(b).

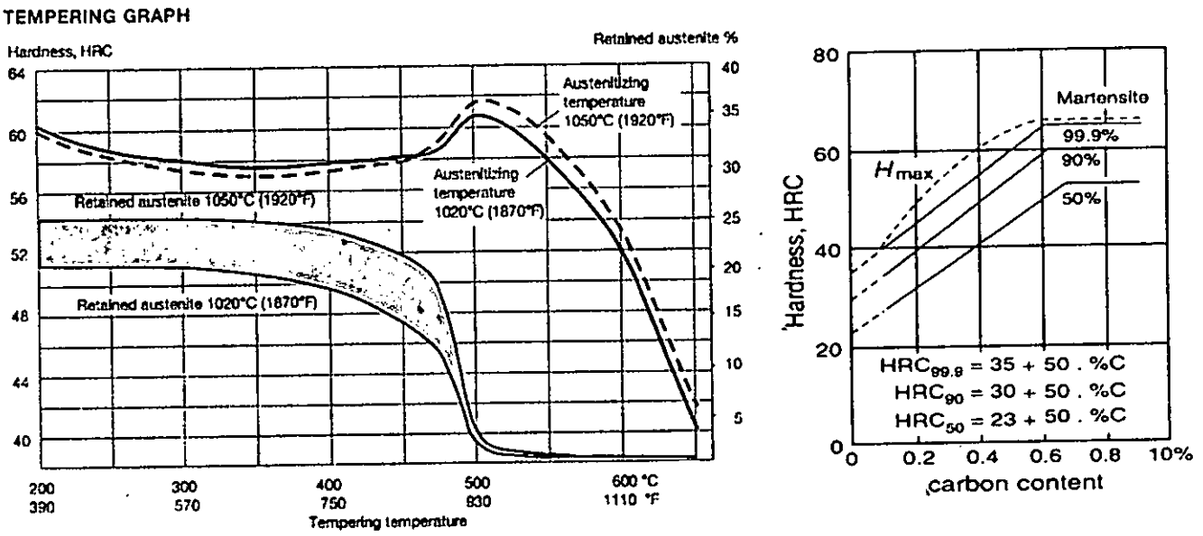

Figure for Question No.3(b).

19/05/2024

L-4/T-1/MME Date: ~~04/05/2024~~

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B.Sc. Engineering Examinations 2022-2023

Sub: **MME 427 (Surface Engineering and Tribology)**

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) Surface degradation by corrosion is a slow process. Select a practicable laboratory corrosion test which best resembles the long-term real service condition. Name two standard tests and explain how they are performed in laboratory to evaluate a component's real service life. **(15)**

(b) Draw the force equilibrium diagram for a body on an inclined plane and deduce the equation for expression of static co-efficient of friction. **(7)**

(c) Analyse the salient feature of coefficient 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. **(13)**

2. (a) Suggest appropriate coatings and state why they are the best suited for the following applications. **(15)**

i) Food cans

ii) Electrical contacts for switch

iii) Motor car exhaust pipe

(b) Quantify the ploughing component of the coefficient of friction for a spherical shaped wear particle is sliding in contact with a softer material surface. Draw schematic diagrams and use conventional notations. How can the ploughing component of friction be decreased? **(20)**

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

(b) Bismuth is a low melting point (271°C) metal and copper oxidizes readily. Select the qualitative sliding velocity of bismuth and copper in order to reduce friction. Show with clear diagram and give reasoning to your selection. **(13)**

(c) 'Wear resistance of pure metals is proportional to their hardness but is more complex for alloys'. – Justify with necessary diagram and examples. **(12)**

Contd..... P/2

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4. (a) What is metallurgical compatibility? How do metallurgical compatibility and grain boundary affect wear rate of materials? **(10)**

(b) 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 C steel plate under a normal load of 20 Newton and rotates about its axis at 100 rpm for 48 hours. As a result of wear during the test, the mass losses of the brass and steel are 30 mg and 2 mg, respectively. Calculate wear coefficients and wear depths for the brass and the steel. (Hardness of steel = 2.5 GPa, ρ_{steel} = 7800 kg/m^3, hardness of brass = 0.8 GPa, ρ_{brass} = 8500 kg/m^3). **(12)**

(c) Figure 1 shows schematics of wear by fracture. Mention and explain the wear mechanism, conditions under which this type of wear occurs. **(13)**

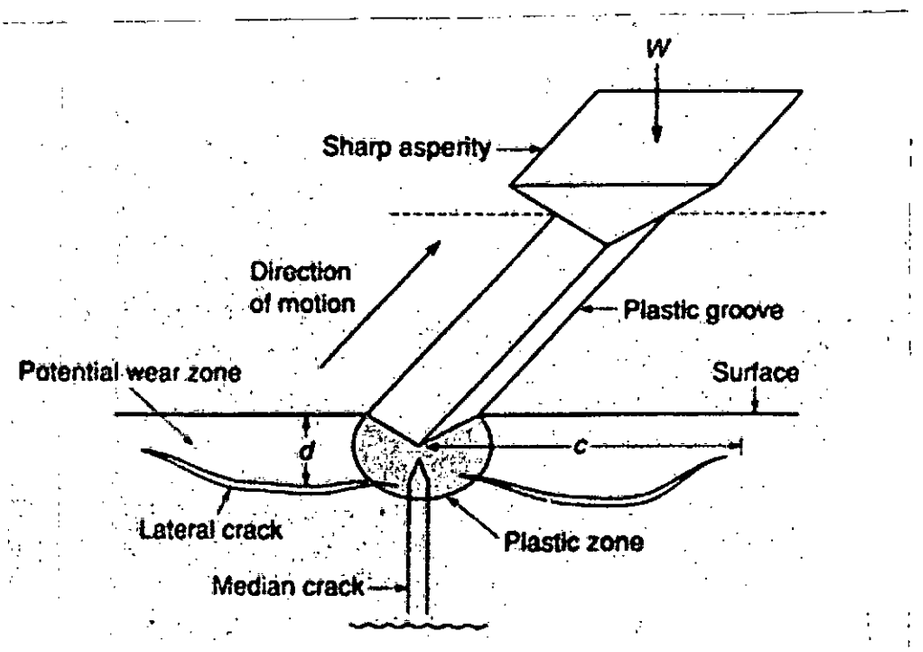


Figure 1. for question 4. (c)

SECTION – B

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

5. (a) Compare between old and modern techniques of coating. **(5)**

(b) Evaluate the role of polarization in electrodeposition. **(15)**

(c) A work is to be coated with Zn thickness of 20 μm. The dimension of the work dipped in the bath is 250 cm × 25 cm × 2.0 cm. The current is supplied in the tank with 90% current efficiency for 10 min. Calculate the current required for the Zn deposition on the work. **(15)**

Contd..... P/3

MME 427

6. (a) Select and explain a method for producing adherent, insoluble and protective coating on metallic alloy. **(12)**

(b) A metallic component requires good corrosion and wear resistance. How will you modify the surface of the component? **(13)**

(c) You can deposit a coating using both the PVD and CVD techniques. Which one will you choose for your industry? Justify your answer. **(10)**

7. (a) Propose a method for depositing a plastic coating on sheet/foil and also justify your choice. **(15)**

(b) Compare different types of plating techniques. **(5)**

(c) In plating a continuous strip 100 cm wide with Sn from an acid solution (valence change 2), the desired strip speed 1000 cm/sec, current efficiency 95% and the thickness of Sn is to be 0.5 μm (each side) at a current density 4500 A/m^2. How long must the plate be, assuming that the strip passes straight through the tank with no return bends? (ρ_{sn} = 7.31 g/cc, A_{sn} = 118.7) **(15)**

8. (a) You need to modify the surface of a product with heat resistance refractory materials. Critically explain the steps to be followed to modify the surface. **(15)**

(b) Analyse the role of static potentials in the electrodeposition of alloys. **(15)**

(c) How does rate of surface adsorption vary with the concentration of absorbent? **(5)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **MME 435** (Advanced Ceramics)

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

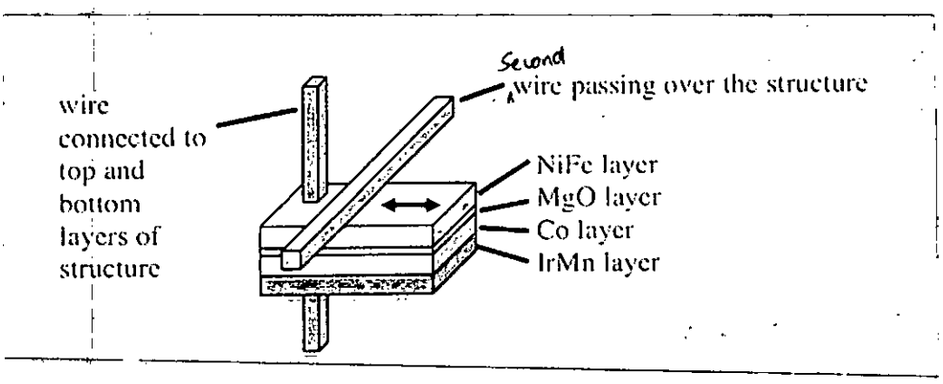
There are **FOUR** questions in this section. Answer any **THREE** questions.

(Important physical constants have been provided at the end.
Assume reasonable value for any missing data)

1. (a) An oxide thin film is subject to a biaxial tensile stress in the xy plane (i.e. $\sigma_z = 0$) which leads to a strain such that $e_{xx} = e_{yy} = 0.01$. The material has cubic symmetry with $c_{11} = 3\times10^{11}$ J/m^3, $c_{12} = 1\times10^{11}$ J/m^3, and $B_1 = 3\times10^6$ J/m^3. What magnetoelastic anisotropy does this produce? Necessary equations are provided at the end. **(20)**

   (b) Consider a case where you have a Li-garnet that contains predominantly oxygen vacancies at low P_{O2} and oxygen interstitials at high P_{O2}. In the intermediate region, the oxide is stoichiometric and may have anti-Frenkel disorder. If you are asked to design a Li-ion battery using this oxide, precisely explain which P_{O2} region you would operate in and why. **(15)**

2. A device called a MRAM (magnetic random-access memory) is made of a small structure as shown below. Each structure stores one bit of information. Wires are connected to the structure so a current can be passed through it perpendicular to the layers. The second wire passes over the structure but is not connected to it. The NiFe and Co layers both have easy axes in plane along the direction marked by the arrow.



   (a) Explain precisely how the structure could store one bit of information, and how it could be read out. How could you write a data bit? **(15)**

   (b) What role does the MgO play, and what thickness should it have? What is the purpose of the IrMn layer? **(15)**

   (c) One of your classmates suggested that a hard magnet could be used instead of IrMn. Explain briefly whether you think this is a good or bad idea. **(5)**

Contd P/2

MME 435

3. (a) We want to make a magnetic recording tape made up of small particles of barium ferrite with $K_u = 5\times10^6$ J/m^3. What is the minimum diameter of the particles you can use? Explain what assumptions are needed for this calculation. **(15)**

   (b) With the help of a sketch, explain the dependence of coercivity vs. particle size and label its various regimes of behavior. Also draw the M-H loops for the various regimes. **(15)**

   (c) The switching field of small particles is usually much less than the predictions of the Stoner-Wohlfarth model. Briefly explain why. **(5)**

4. (a) Single phase Zirconia is not known to have good fracture toughness. Explain with the help of sketches and phase diagrams how you can design zirconia ceramics with enhanced fracture toughness. **(15)**

   (b) You are given a substrate of $Gd_3Ga_5O_{12}$ with orientation (110) that has a lattice parameter of 12.376 Å. With the help of the lattice parameters and the strain data in table provided below, design a rare earth (RE) iron garnet thin film that is the most likely to have out-of-plane magnetic anisotropy. **(20)**

RE Element	Lattice parameter Å	λ_{100}@ 300K, 10^{-6}	λ_{111}@ 300K, 10^{-6}
Y	12.376	-1.25	-2.73
Sm	12.530	+21	-8.5
Eu	12.498	+21	+1.8
Gd	12.470	+0.2	-2.9
Tb	12.436	-3.3	+12
Dy	12.405	-12.5	-5.9
Ho	12.375	-4.0	-3.4
Er	12.349	+2	-4.9
Tm	12.325	+1.4	-5.2
Yb	12.302	+1.4	-4.5
Lu	12.283		

Contd P/3

MME 435

SECTION – B

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

5. (a) Differentiate between the conditions for different growth modes for epitaxial film formation. **(15)**

   (b) Illuminate the dependence of epitaxial film formation on substrate temperature and deposition rate. **(10)**

   (c) Schematically show the emitted fluxes for types of sources during evaporation. **(10)**

6. (a) Interpret the powder characteristics for manufacturing advance ceramics. **(12)**

   (b) Mention two important applications of piezoelectric SiO_2 and pyroelectric $LaTiO_3$. **(10)**

   (c) Explain the effect of temperature and frequency of applied electric field on the dielectric constant of a material. **(13)**

7. (a) Which parameters control the dielectric constant of $BaTiO_3$? Also describe the effect of grain size on the dielectric properties of $BaTiO_3$. **(18)**

   (b) Calculate the equilibrium number of vacancies formed in MgO at 1000 K for which the enthalpy for defect formation is 2 eV. The vibrational frequencies of normal atoms and vacancies are 1.6×10^{-15} Hz and 0.6×10^{-15} Hz respectively. In that case, the coordination number of vacancies is four (4). Given that 1eV = 1.6×10^{-19} J and Boltzmann's constant (k) = 1.38×10^{-23} J/K. **(17)**

8. (a) Write the defect reactions for following events: **(12)**

   (i) Dissolution of MgO in Al_2O_3

   (ii) Doping BaO with $BiFeO_3$

   (b) 'Meissner effect is responsible for magnetic levitation'- Explain the assertion by taking magnetic levitated train as an example. **(11)**

   (c) "BCS theory of superconductivity is not applicable for high-temperature superconductors" – explain the statement. **(12)**

Magnetoelasticity: strain e: $e = \frac{3}{2}\lambda_s\left(\cos^2\theta - \frac{1}{3}\right)$ $\lambda_s = \frac{2}{3}\left(\varepsilon_{\parallel} - \varepsilon_{\perp}\right)$

Total energy as a function of α, the direction cosines of M, for cubic material

$$u = u_a + u_{me} + u_{el}$$

$$= \frac{U_0}{V_0} + K_1\left(\alpha_1^2\alpha_2^2 + \alpha_2^2\alpha_3^2 + \alpha_3^2\alpha_1^2\right) + K_2\alpha_1^2\alpha_2^2\alpha_3^2 \ldots$$

$$+B_1\left(\alpha_1^2 e_{xx} + \alpha_2^2 e_{yy} + \alpha_3^2 e_{zz}\right) + B_2\left(\alpha_1\alpha_2 e_{xy} + \alpha_2\alpha_3 e_{yz} + \alpha_3\alpha_1 e_{zx}\right)$$

$$+\frac{1}{2}c_{11}\left(e_{xx}^2 + e_{yy}^2 + e_{zz}^2\right) + c_{12}\left(e_{xx}e_{yy} + e_{yy}e_{zz} + e_{zz}e_{xx}\right)$$

$$+\frac{1}{2}c_{44}\left(e_{xy}^2 + e_{yz}^2 + e_{zx}^2\right) - \frac{1}{3}B_1 e_{ij}$$

Strain along a direction with direction cosines β:

$$\frac{\partial l}{l} = -\frac{B_1}{c_{11} - c_{12}}\left(\alpha_1^2\beta_1^2 + \alpha_2^2\beta_2^2 + \alpha_3^2\beta_3^2 - \frac{1}{3}\right) - \frac{B_2}{c_{44}}\left(\alpha_1\alpha_2\beta_1\beta_2 + \alpha_2\alpha_3\beta_2\beta_3 + \alpha_3\alpha_1\beta_3\beta_1\right)$$

Magnetostriction constants: $\lambda_{100} = -\frac{2}{3}\frac{B_1}{c_{11} - c_{12}}$ and $\lambda_{111} = -\frac{1}{3}\frac{B_2}{c_{44}}$

Elasticity: cubic material $\sigma_i = c_{11}e_{ii} + c_{12}(e_{jj} + e_{kk})$

$$\lambda_{110} = (1/4)\,\lambda_{100} + (3/4)\,\lambda_{111}$$

Physical Constants, Conversions, and Useful Combinations

Physical Constants	
Avogadro constant	$N_A = 6.022 \times 10^{23}$ particles/mole
Boltzmann constant	$k = 8.617 \times 10^{-5}$ eV/K $= 1.38 \times 10^{-23}$ J/K
Elementary charge	$e = 1.602 \times 10^{-19}$ coulomb
Planck constant	$h = 4.136 \times 10^{-15}$ eV · s
	$= 6.626 \times 10^{-34}$ joule · s
Speed of light	$c = 2.998 \times 10^{10}$ cm/s
Permittivity (free space)	$\epsilon_0 = 8.85 \times 10^{-14}$ farad/cm
Electron mass	$m = 9.1095 \times 10^{-31}$ kg
Coulomb constant	$k_c = 8.988 \times 10^{9}$ newton-m^2/(coulomb)^2
Atomic mass unit	$u = 1.6606 \times 10^{-27}$ kg
Permeability of space	$\mu_o = 4\pi\ 10^{-7}$ Henry/m
Useful Combinations	1 μ_B (Bohr magneton) = 9.27 10^{-24} Am^2
Thermal energy (300 K)	$kT = 0.0258$ eV $\simeq 1$ eV/40
Photon energy	$E = 1.24$ eV at $\lambda = 1$ μm
Coulomb constant	$k_c e^2 = 1.44$ eV · nm
Permittivity (Si)	$\epsilon = \epsilon_r\epsilon_0 = 1.05 \times 10^{-12}$ farad/cm
Permittivity (free space)	$\epsilon_0 = 55.3e$/V · μm

Periodic Table, with the Outer Electron Configurations of Neutral Atoms in Their Ground States

The notation used to describe the electronic configuration of atoms and ions is discussed in all textbooks of introductory atomic physics. The letters *s*, *p*, *d*, . . . signify electrons having orbital angular momentum 0, 1, 2, . . . in units $\hbar$; the number to the left of the letter denotes the principal quantum number of one orbit, and the superscript to the right denotes the number of electrons in the orbit.

H^{1} $1s$																	He^{2} $1s^2$
Li^{3} $2s$	Be^{4} $2s^2$											B^{5} $2s^22p$	C^{6} $2s^22p^2$	N^{7} $2s^22p^3$	O^{8} $2s^22p^4$	F^{9} $2s^22p^5$	Ne^{10} $2s^22p^6$
Na^{11} $3s$	Mg^{12} $3s^2$											Al^{13} $3s^23p$	Si^{14} $3s^23p^2$	P^{15} $3s^23p^3$	S^{16} $3s^23p^4$	Cl^{17} $3s^23p^5$	Ar^{18} $3s^23p^6$
K^{19} $4s$	Ca^{20} $4s^2$	Sc^{21} $3d$ $4s^2$	Ti^{22} $3d^2$ $4s^2$	V^{23} $3d^3$ $4s^2$	Cr^{24} $3d^5$ $4s$	Mn^{25} $3d^5$ $4s^2$	Fe^{26} $3d^6$ $4s^2$	Co^{27} $3d^7$ $4s^2$	Ni^{28} $3d^8$ $4s^2$	Cu^{29} $3d^{10}$ $4s$	Zn^{30} $3d^{10}$ $4s^2$	Ga^{31} $4s^24p$	Ge^{32} $4s^24p^2$	As^{33} $4s^24p^3$	Se^{34} $4s^24p^4$	Br^{35} $4s^24p^5$	Kr^{36} $4s^24p^6$
Rb^{37} $5s$	Sr^{38} $5s^2$	Y^{39} $4d$ $5s^2$	Zr^{40} $4d^2$ $5s^2$	Nb^{41} $4d^4$ $5s$	Mo^{42} $4d^5$ $5s$	Tc^{43} $4d^6$ $5s$	Ru^{44} $4d^7$ $5s$	Rh^{45} $4d^8$ $5s$	Pd^{46} $4d^{10}$ –	Ag^{47} $4d^{10}$ $5s$	Cd^{48} $4d^{10}$ $5s^2$	In^{49} $5s^25p$	Sn^{50} $5s^25p^2$	Sb^{51} $5s^25p^3$	Te^{52} $5s^25p^4$	I^{53} $5s^25p^5$	Xe^{54} $5s^25p^6$
Cs^{55} $6s$	Ba^{56} $6s^2$	La^{57} $5d$ $6s^2$	Hf^{72} $4f^{14}$ $5d^2$ $6s^2$	Ta^{73} $5d^3$ $6s^2$	W^{74} $5d^4$ $6s^2$	Re^{75} $5d^5$ $6s^2$	Os^{76} $5d^6$ $6s^2$	Ir^{77} $5d^9$ –	Pt^{78} $5d^9$ $6s$	Au^{79} $5d^{10}$ $6s$	Hg^{80} $5d^{10}$ $6s^2$	Tl^{81} $6s^26p$	Pb^{82} $6s^26p^2$	Bi^{83} $6s^26p^3$	Po^{84} $6s^26p^4$	At^{85} $6s^26p^5$	Rn^{86} $6s^26p^6$
Fr^{87} $7s$	Ra^{88} $7s^2$	Ac^{89} $6d$ $7s^2$															

Ce^{58} $4f^2$ $6s^2$	Pr^{59} $4f^3$ $6s^2$	Nd^{60} $4f^4$ $6s^2$	Pm^{61} $4f^5$ $6s^2$	Sm^{62} $4f^6$ $6s^2$	Eu^{63} $4f^7$ $6s^2$	Gd^{64} $4f^7$ $5d$ $6s^2$	Tb^{65} $4f^8$ $5d$ $6s^2$	Dy^{66} $4f^{10}$ $6s^2$	Ho^{67} $4f^{11}$ $6s^2$	Er^{68} $4f^{12}$ $6s^2$	Tm^{69} $4f^{13}$ $6s^2$	Yb^{70} $4f^{14}$ $6s^2$	Lu^{71} $4f^{14}$ $5d$ $6s^2$
Th^{90} – $6d^2$ $7s^2$	Pa^{91} $5f^2$ $6d$ $7s^2$	U^{92} $5f^3$ $6d$ $7s^2$	Np^{93} $5f^4$ $7s^2$	Pu^{94} $5f^6$ $7s^2$	Am^{95} $5f^7$ $7s^2$	Cm^{96} $5f^7$ $6d$ $7s^2$	Bk^{97}	Cf^{98}	Es^{99}	Fm^{100}	Md^{101}	No^{102}	Lr^{103}

L-4/T-1/MME **Date: 28/04/2024**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub: **HUM 405** (Economics of Development and Planning)

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) What do you mean by economic development? Can you give hypothetical or real examples of situations in which a country may be developing economically but may still be underdeveloped? **(15)**

   (b) Explain and justify the development of Bangladesh economy showing the trends of 'Gross Domestic Product (GDP) growth rate' and 'poverty rate' over the last 15 years. **(20)**

2. (a) Explain how New Human Development Index (NHDI) is calculated. If you are asked to design the HDI, what might you do differently, and why? **(15)**

   (b) Compare the trends of economic variables 'Gross Domestic Product (GDP) per capita income' and 'inflation rate' with any two South Asian Countries. **(20)**

3. (a) Explain different stages of project evaluation. Mention four benefit-cost criteria used to evaluate a project. Which criterion of project evaluation is the best and why? **(15)**

   (b) Define Net Present Value (NPV), Benefits to Cost Ratio (BCR) and Internal Rate of Return (IRR). How do you interpret the following values of NPV, BCR, and IRR of a Development project? **(20)**

   NPV (Lakh taka): 1092,651.30

   BCR: 1.893

   IRR: 23.38%

4. (a) Derive the fundamental equation of Solow Model with population growth. **(15)**

   (b) Consider the production function, $Y = K^{1/4} L^{3/4}$, where Y denotes output, K capital and L labor. The parameters of the model are given by $s = 0.3$ (savings rate) and $\delta = 0.06$ (depreciation rate). Let "k" denote capital per worker; "y" output per worker; "c" consumption per worker; "i" investment per worker. Rewrite production function in per-worker terms and find the steady-state level of the capital stock. **(20)**

Contd P/2

HUM 405

SECTION – B

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

5. (a) Explain the prospects of industrialization in Bangladesh. What are the challenges of industrialization in Bangladesh? **(15)**

(b) What are the differences between 'theory of balanced growth', 'theory of unbalanced growth' and 'big push theory' in the context of Bangladesh economy? **(20)**

6. (a) Bangladesh is set to graduate out of the group of least developed countries (LDCs) on November 24, 2026, about 50 years after it first became a member of this cohort of developing countries in December 1975. Explain the current status of Bangladesh based on the criteria to graduate out of the group of LDCs. **(15)**

(b) What is planning? Explain different steps of planning with a real life example. **(20)**

7. (a) Do you believe that Bangladesh will be able to attain the Sustainable Development Goals (SDGs) as a result of the construction of the "Metro Rail" and the "Padma Bridge"? If so, what are the goals and how will they be achieved? Explain. **(15)**

(b) What kinds of dependence do developing countries have on developed nations? Which ways does the opposite hold true? **(20)**

8. (a) Using a Lorenz curve and a Gini coefficient, how can inequality be measured? Take into consideration that Bangladesh's economy has a more equitable distribution of income than that of the United States (US). For the economies of Bangladesh and the US, draw and compare the Lorenz curves. **(15)**

(b) The majority of countries have gradually switched from grants to loans and from untied to tied grants and loans. What are the main drawbacks of tied aid, particularly when it takes the form of interest-bearing loans? **(20)**

L-4/T-1/MME Date : 18/04/2024

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2022-2023

Sub : **HUM 419** (Introduction to E-Governance)

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) What is government? Make a difference between state and government. **(15)**
   (b) How do you define constitution? Discuss the qualities of a good constitution. **(20)**

2. (a) Define democracy. Critically discuss the limitations of democratic system. **(15)**
   (b) What is e-governance? Explain the legal and ethical issues of e-governance. **(20)**

3. (a) What is leadership? Describe the role of leadership in good governance and development of a country. **(15)**
   (b) Define local governance. Analyze the problems and challenges of local governance. **(20)**

4. (a) Write an analytical note on e-governance and public service delivery. **(15)**
   (b) What is citizen engagement? Discuss the ways of citizen engagement in e-governance. **(20)**

SECTION – B

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

5. (a) What is governance? Discuss good governance indicators endorsed by the UNDP (United Nations Development Programme) in 1997. **(15)**
   (b) Who are bureaucrats? Analyze the role of bureaucrats in ensuring good governance. **(20)**

6. (a) What are the different kinds of executive? Discuss the functions of executive in a state. **(15)**
   (b) Define corporate governance. Discuss the principles of corporate governance. **(20)**

7. (a) Make a discussion on the legal rights of a citizen in a state. **(15)**
   (b) What are the actors of e-governance? Discuss briefly the e-governance implementation factors. **(20)**

8. (a) What is the E-Governance Development Index (EGDI)? Describe various components of EGDI index. **(15)**
   (b) Discuss the challenges of implementing ICT policy and e-governance in Bangladesh. **(20)**
