L-4/T-1/MME **Date : 01/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **IPE 491** (Engineering Management)

Full Marks: 210 Time : 3 Hours

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The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

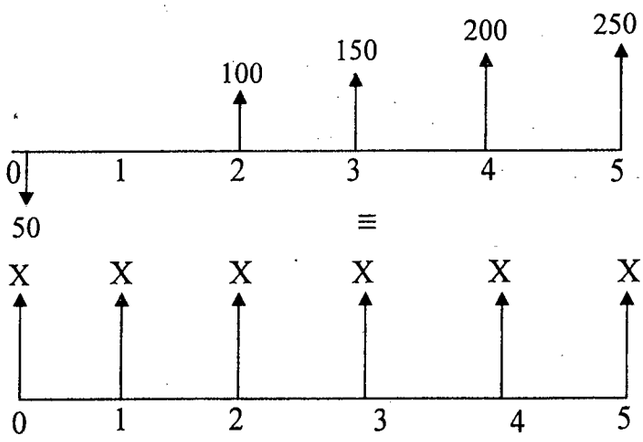
SECTION – A

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

Symbols indicate their usual meaning.

1. (a) What are the traditional or systematic performance appraisal methods? Describe any three of them. **(15)**

   (b) Find the equivalent equal payment series(X) such that two cash flows shown in the diagram are equivalent at 10% compounded annually. **(20)**



2. (a) Discuss the common errors of traditional rating. **(10)**

   (b) What are the disadvantages of payback period? **(5)**

   (c) Consider the following investment projects **(20)**

	Net cash flow	
n	Project A	Project B
0	–$120,000	–$100,000
1	20,000	15,000
2	20,000	15,000
3	30,000	130,000
4	100,000	0

Assuming MARR = 15%, determine the IRR for each investment. Which project would be acceptable based on IRR and MARR?

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3. (a) A company produces both interior and exterior paints from two raw materials M1 and M2. Data are given in following table. **(12)**

	Tons of raw material per tons of		Maximum daily availability (ton)
	Exterior Paint	Interior Paint	
Raw material, M1	6	4	24
Raw material, M2	1	2	6
Profit per ton ($1000)	5	4	

A market survey restricts the maximum daily demand of interior paint to 2 tons. Additionally the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. Formulate a Linear Programming model for this problem.

(b) What are the assumptions of linear programming? **(8)**

(c) What is TQM? What are the seven basic tools of TQM? Describe them. **(15)**

4. (a) Define 'quality'. What are the costs of quality? Discuss them. **(15)**

(b) Consider the following LP model **(20)**

Maximize $Z = 2x_1 + 3x_2$

Subject to $x_1 + 3x_2 \leq 6$

$3x_1 + 2x_2 \leq 6$

$x_1 \geq 0, x_2 \geq 0$

Solve the problem using simplex method.

SECTION – B

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

5. (a) Describe the management process with appropriate figure. **(15)**

(b) What are the four building block of an organization? Describe them briefly. **(15)**

(c) Why do different levels of management need different types of skills? **(5)**

6. (a) Describe Maslow's need theory and differentiate with ERG theory. **(15)**

(b) How does the style of effective leadership vary with the situation? Explain with Fiedler model to leadership. **(15)**

(c) "Leaders are made not born." Do you agree with this statement? Justify your answer. **(5)**

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7. (a) Differentiate classical view and acceptance view of authority. **(15)**

(b) In which situation, does matrix organization perform better? Explain this organization with advantages and limitations. **(15)**

(c) Why are managers reluctant to delegate authority? **(5)**

8. (a) A company makes three finishing lures in its manufacturing facility. Data concerning these products appear below: **(10)**

	Frog	Minnow	Worm
Normal annual sales volume	100,000	200,000	300,000
Unit selling price	$2.00	$1.40	$0.80
Variable cost per unit	$1.20	$0.80	$0.50

Total fixed expenses for the entire company are $282,000 per year.

All three products are sold in highly competitive markets, so the company is unable to raise its prices without losing unacceptable numbers of customers.

The company has no work in process or finished goods inventories due to an extremely effective just-in-time manufacturing system.

Required:

(i) What is the company's overall break-even in total sales dollars?

(ii) Of the total fixed costs of $282,000 could be avoided if the Frog lure product were dropped, $96,000 if the Minnow lure product were dropped, and $60,000 if the Worm lure product were dropped. The remaining fixed costs of $108,000 consist of common fixed costs such as administrative salaries and rent on the factory building that could be avoided only by going out of business entirely.

What is the break-even quantity of each product?

(b) Hickey Company, a manufacturing firm, produces a single product. The following information has been taken from the company's production, sales, and cost records for the just completed year: **(25)**

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Production in units	30,000
Sales in units	?
Ending finished goods inventory in units	?
Sales in dollars	$650,000
Costs:	
Advertising	$ 50,000
Direct labor	80,000
Indirect labor	60,000
Raw materials purchased	160,000
Building rent (production uses 80% of the space; administrative and sales offices use the rest)	50,000
Utilities, factory	35,000
Royalty paid for use of production patent, $1 per unit produced	?
Maintenance, factory	25,000
Rent for special production equipment, $6,000 per year plus $0.10 per unit produced	?
Selling and administrative salaries	140,000
Other factory overhead costs	11,000
Other selling and administrative expenses	20,000

	Beginning of Year	End of Year
Inventories:		
Raw materials	$20,000	$10,000
Work in process	30,000	40,000
Finished goods	0	?

The finished goods inventory is being carried at the average unit production cost for the year. The selling price of the product is $25 per unit.

Required:

(i) Prepare a schedule of cost of goods manufactured for the year.

(ii) Compute the number of units in the finished goods inventory and cost of the units in finished goods inventory at the end of the year.

(iii) Prepare an income statement for the year.

L-4/T-1/MME **Date : 06/03/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **MME 467** (Ceramics for Advanced Applications)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **Eight** questions in this Section. Answer any **Six**.
The questions are of equal value.

1. (a) Distinguish between soft and hard magnetic materials on the basis of their hysteresis parameters. Explain the influence of temperature on the magnetic behaviour.

2. What are the desirable characteristics for advanced ceramic powders? Describe the technique of ceramic nanopowder synthesis by vapour – phase reactions..

3. Explain spinel structure and show how normal spinel differs from inverse spinel with specific example.

4. Explain superconductivity by BCS theory. What is critical field, H_c and critical temperature, T_c and how they are related to each other?

5. Discuss the role of Cu–O chains and CuO_2 planes in high temperature cupractes superconductor. Mention some salient features of high T_c ceramic superconductors from the structural point of view.

6. Describe in short the uses of advanced ceramics in radiotherapy and hyperthermia therapy of cancer.

7. Give a brief description on the suitability of using zirconia as orthopaedic implant materials. Mention few limitations of using zirconia as implant material.

8. Calculate the theoretical magnetic moments in Bohr magneton of Ni Fe_2O_4 and $ZnFe_2O_4$ and hence show that substitution of nonmagnetic Zn for magnetic Ni in Ni_{1-x} Zn_x Fe_2O_4 (x = 0.2 and 0.5) ceramic magnets enhances magnetic moment.

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MME 467

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.
The figures in the margin indicate full marks.

9. Explain the ferroelectricity. Discuss the ferroelectric behaviour of $BaTiO_3$ in terms of its structure and structural transformation. **(10+25=35)**

10. What is piezoelectricity? Using $PbZrO_3$ – $PbTiO_3$ phase diagram, explain the piezoelectric behaviour of PZT. Discuss how different types of dopants modify the properties of PZT for specific applications. **(5+15+15=35)**

11. Write short notes on the following engineering ceramics giving special reference to their structures, properties, processing and applications. **(35)**
    (a) Silicon carbide, (b) Silicon nitride.

12. (a) Discuss the principal characteristics of ceramic bearing materials. Explain the advantages and limitations of using Si_3N_4 as a bearing materials over high-carbon chrome bearing steel (SUJ2). **(5+10=15)**
    (b) What do you mean by total internal reflection along an optical fibre? Discuss how this is accomplished in designing optical fibres. List some parameters that are found detrimental to properties during the fabrication of optical fibres. **(5+10+5=20)**

L-4/T-1/MME **Date : 27/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **MME 475** (Polymers and Composites)

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) Compare and contrast addition polymerization with condensation polymerization. **(15)**

   (b) What is crazing? How does crazing control fracture of a plastic? **(10)**

   (c)The density of two polypropylene materials are 0.904 g/cm^3 and 0.895 g/cm^3 respectively, while the associated percent crystalline of those two materials are 62.8 and 54.4 respectively. Calculate (i) densities of totally crystalline and totally amorphous polypropylene and (ii) density of a specimen having 74.6% crystallinity. **(6+4=10)**

2. (a) Sketch and describe different stages during deformation of a semicrystalline polymer. **(18)**

   (b) Mention the importance of localized strengthening during tensile loading of a polymer. **(5)**

   (c) What are polymer additives? Mention the roles of any three additives in plastics. **(12)**

3. (a) Select and describe a manufacturing process for hollow plastic article production. **(20)**

   (b) Explain the importance of reciprocating screw type injection moulding machine. **(9)**

   (c) What is the function of a gauge filter in an extruder? **(6)**

4. (a) Differentiate between vacuum forming process and pressure forming process. **(14)**

   (b) Briefly describe reaction injection moulding process. **(10)**

   (c)Why is structural foam injection moulding preferred for plastic production? **(7)**

   (d) Which type of nozzle is used for high viscosity plastic production? **(4)**

SECTION – B

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

5. (a) Discuss the different fracture modes of composites with suitable examples. **(25)**

   (b) Write the advantages of hybrid composites over conventional composites. **(5)**

   (c) Calculate the debonding interfacial force of a single fiber – reinforced composite. The fiber length and diameter are 10 mm and 1 mm respectively. The fracture stress of fiber is 115 MPa. **(5)**

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MME 475

6. (a) Differentiate between ceramic fiber and organic fiber in terms of structure, properties, and application. **(10)**

   (b) Describe the production process of silicon carbide fiber from polymer. Give some important applications of silicon carbide fiber in composites. **(20)**

   (c) Name the different manufacturing methods that are used for the production of reinforced thermoplastics and reinforced thermosets. **(5)**

7. (a) Suggest and briefly describe the fabrication method of the composite that will be used as aircraft door and floor. **(14)**

   (b) Narrate the processing technique of carbon fiber reinforced carbon matrix composite. **(16)**

   (c) What is the effect of ultraviolet radiation on polymer composite? **(5)**

8. (a) What is In situ metal matrix composites (MMC)? Briefly discuss the fabrication process of In Situ composite. **(15)**

   (b) What type of MMCs manufacturing method provides the best combination of properties? Why? **(5)**

   (c) Mention the factors that increase the toughness of ceramic matrix composites (CMCs). Discuss the fiber-matrix interfacial characteristics of CMCs. **(15)**

L-4/T-1/MME **Date : 22/02/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **MME 411** (Principles of Materials characterization)

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**.
The questions are of equal value.

1. In the following equation all symbols have their usual meanings. Mention the parameters in the equation that directly contribute for the quantitative analysis of various elements by mass spectroscopy and also discuss the underlying reasons.

$$r = \frac{mv}{ZB}$$

2. What do you understand by the term "Electronic Spectroscopy"? Is it possible to analyze materials by electronic spectroscopy with the photon energy level of visible light? Explain why UV light with wavelength lower than 200 nm is not frequently used in materials characterization.

3. 'All materials having co-valent bonds are possible to characterize by IR spectroscopy' — Why? Discuss the reasons that enable IR spectroscopy to distinguish similar bonds in different molecules.

4. Mention the basic types of IR spectrometers with their special features. With a neat flow diagram discuss the working principle of dispersive type IR spectrometer.

5. Define reversing and non-reversing thermal events of materials with suitable examples. Explain why TMDSC is capable to separate reversing and non-reversing thermal events in materials.

6. Distinguish between prism and grating type monochromators. With some practical examples explain he comment that "OES has provided the maximum benefits to metallurgists."

7. In TEM a very high level of vacuum is essential — why? Discuss the diffraction contrast imaging technique in the TEM.

8. Discuss the working principle of XRF spectroscopy. Compared to WDS or EDS, XRF spectroscopy needs relatively higher operating voltage — why?

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MME 411

SECTION – B

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

9. (a) What is plane polarized light? Explain the working principle of polarized light microscopy. **(15)**

   (b) Compare the characteristics of secondary electron and backscattered electron images of a scanning electron microscope (SEM). What types of information can be obtained from the secondary electron mode and backscattered electron mode during SEM operation. **(12)**

   (c) How would you obtain compositional image of a specimen by SEM? **(8)**

10. (a) What are the effects of beam current and probe size on the resolution of SEM image? **(8)**

    (b) Explain how x-ray beam is produced in a typical x-ray tube. **(10)**

    (c) Calculate the structure factor of the face-centered cubic cell having four atoms located at 000, $\frac{1}{2}\ \frac{1}{2}0$, $\frac{1}{2}0\ \frac{1}{2}$, and $0\ \frac{1}{2}\ \frac{1}{2}$ and define the possible planes from which diffracted beams would be obtained. **(17)**

11. (a) Differentiate between the characteristic radiation and continuous radiation. **(5)**

    (b) Derive Bragg's law of x-ray diffraction. **(10)**

    (c) Explain how diffraction occurs from a powdered specimen using monochromatic x-ray beam. **(20)**

12. (a) Does on atom of atomic number z (atom contain z electrons) scatter a wave whose amplitude is z times the amplitude of the wave scattered by a single electron? Justify your answer. **(10)**

    (b) Discuss the factors affecting the relative intensity of the diffraction lines on a powder pattern. **(25)**

L-4/T-1/MME Date : 15/02/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-4/T-1 B. Sc. Engineering Examinations 2010-2011

Sub : **MME 443** (Physical Metallurgy of Steels and Heat Treatment.)

Full Marks : 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

The figures in the margin indicate full marks.

1. (a) What is meant by the term 'controlled rolling'? Explain briefly the role of controlled rolling in grain size refinement and dispersion strengthening of high-strength, low-alloy structural steels. **(27)**

   (b) Write a note on ausforming. **(8)**

2. (a) What is the purpose of carburization? Describe briefly how a mild steel shaft is carburized by the process of gas carburization. Discuss briefly the factors that control the flow of carbon from the surface to the interior of the shaft during carburization. **(23)**

   (b) Suggest a suitable heat-treatment process with a neat sketch for the gas carburized shaft. Explain the process with detailed microstructural changes and hardness. **(12)**

3. (a) Distinguish between nitriding and carbonitriding. Mention the advantages and limitations of each. **(10)**

   (b) With reference to the iron-nitrogen equilibrium diagram explain how a nitrided case is formed. **(20)**

   (c) Mention the effect of alloying elements on the hardnes of the nitrided case. **(5)**

4. Answer any <u>two</u> of the following: **(17 ½ ×2)**

   (a) Distinguish between ferritic malleable cast iron and pearlitic malleable cast iron. Explain with a typical heat-treatment cycle how parlitic malleable cast iron is produced from white cast iron.

   (b) What type of heat-treatment is generally applied to ductile cast iron? Discuss briefly.

   (c) Discuss the structure-property relationship of plain low carbon-manganese steel and martensitic stainless steel.

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MME 443

SECTION – B

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

The questions are of equal value.

5. Mention various mechanisms by which iron can be strengthened. Discuss the roles of interstitial elements carbon and nitrogen on the yield behaviour of iron.

6. With the increase in pearlite content in plain carbon steel, the toughness and ductile-brittle transition temperature are drastically changed – why? Draw the transition curves of carbon steel having 0.1, 0.5 and 0.8% C.

7. Distinguish between hardening and hardenability. Discuss the effect of heating rate (from room temperature to austenite temperature range) on the structure and properties of quenched steel.

8. During quenching of a component, the cooling rate changes with time – why? Draw a typical cooling curve for a quenched component and discuss its various stages in details.

9. With necessary diagrams, discuss the effects of the scale thickness on the cooling behaviour of a steel component during quenching. Discuss various methods to minimize the formation of scale on the steel component to be hardened.

10. A heavily cold worked 0.2% carbon steel component is full annealed and process annealed. Draw the microstructures of the component after these two different heat treatments and discuss the associated tensile properties.

11. Due to faulty heat treatment practice following defects have been associated in the heat treated products.

    (a) grain boundary burning
    (b) black fracture
    (c) decarburization

    Discuss the possible reasons for these heat treatment related defects and suggest for their possible remedies.

12. Calculate the tensile strengths and relative amount of structural constituents present in furnace cooled plain carbon steels having (a) 0.3%, (b) 0.8% and (c) 1.5% C. Explain why the tensile strength of normalized plain carbon steel increases up to 1.2% C and then gradually decreases.
