BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations (January 2020 Term)

Sub: **IPE 105** (Principles of Cost and Management Accounting)

Full Marks: 180   Section Marks: 90   Time: 2 Hours (Sections A + B)

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

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## SECTION – A

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

Assume reasonable values for missing data, if any

1. XYZ company produces and sells a single product, a wooden hand loom for weaving small items such as scarves. Selected cost and operating data relating to the product for two years are given below.

| Item | Cost |
|---|---|
| Selling price per unit | $60 |
| Manufacturing cost: | |
| Variable per unit produced: | |
| Direct materials | $12 |
| Direct labor | $6 |
| Variable overhead | $2 |
| Fixed per year | $120,000 |
| Selling and administrative cost: | |
| Variable per unit sold | $5 |
| Fixed per year | $70,000 |

**Inventory data:**

| | Year 1 | Year 2 |
|---|---|---|
| Units in beginning inventory | 0 | 2,000 |
| Units produced during the year | 10,000 | 6,000 |
| Units sold during the year | 8000 | 8000 |
| Units in ending inventory | 2,000 | 0 |

*Required:*

-Assume that the company uses absorption costing.

(i) Compute the unit product cost in each year.

(ii) Prepare an income statement for each year.

-Assume that the company uses variable costing.

(iii) Compute the unit product cost in each year.

(iv) Prepare an income statement for each year.

(45)

2. ABC company operates a fleet of armored cars that make scheduled pickups and deliveries in the Los Angeles area. The company is implementing an activity-based costing system that has four activity cost pools: Travel, Pickup and Delivery, Customer Service, and Other. The activity measures are miles for the Travel cost pool, number of pickups and deliveries for the Pickup and Delivery cost pool, and number of customers for the Customer Service cost pool. The Other cost pool has no activity measure. The following costs will be assigned using the activity-based costing system:

| Item | Cost |
|---|---|
| Driver and guard wages | $730,000 |
| Vehicle operating expense | $280,000 |
| Vehicle depreciation | $120,000 |
| Customer representative salaries and expenses | $170,000 |
| Office expenses | $30,000 |
| Administrative expenses | $320,000 |
| Total | $1650,000 |

(45)

The distribution of resource consumption across the activity cost pools is as follows:

|  | Travel | Pickup and Delivery | Customer Service | Other | Totals |
|---|---|---|---|---|---|
| Driver and guard wages | 50% | 35% | 10% | 5% | 100% |
| Vehicle operating expense | 70% | 5% | 0% | 25% | 100% |
| Vehicle depreciation | 60% | 15% | 0% | 25% | 100% |
| Customer representative salaries and expenses | 0% | 0% | 90% | 10% | 100% |
| Office expenses | 0% | 20% | 30% | 50% | 100% |
| Administrative expenses | 0% | 5% | 60% | 35% | 100% |

*Required:*
(i)     Carry out the first stage allocation of cost.
(ii)    Carry out the second stage allocation of cost.


3.    (a) UVX Company produces a single product. The cost of producing and selling a single unit of this product at the company's normal activity level of 60,000 units per year is:

| Item | Cost |
|---|---|
| Direct materials | $5.10 |
| Direct labor | $3.30 |
| Variable manufacturing overhead | $1.00 |
| Variable manufacturing overhead | $4.00 |
| Variable selling and administrative expense | $1.50 |
| Fixed selling and administrative expense | $2.40 |

The normal selling price is $21 per unit. The company's capacity is 75,000 units per year. An order has been received from a mail-order house for 15,000 units at a special price of $14 per unit. This order would not affect regular sales.

*Required:*
If the order is accepted, by how much will annual profits be increased or decreased? (The order will

not change the company's total fixed costs.)                                                                                   (25)

(b) How does a master budget help industrial manager of an organization in business decision-

making? Can you relate the components of a master budget to the balanced scorecard approach to

performance measurement of an organization? Justify your answer.                                           (20)

## SECTION – B

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

4. (a) Visic Corporation, a manufacturing company, produces a single product. The    (45)
following information has been taken from the company's production, sales, and
cost records for the just completed year:

| | |
|---|---|
| Production in units | 29,000 |
| Sales in units | ? |
| Ending finished goods inventory in units | ? |
| Sales in dollars | $1,300,000 |
| Costs: | |
| Advertising | $105,000 |
| Entertainment and travel | $40,000 |
| Direct labor | $90,000 |
| Indirect labor | $85,000 |
| Raw materials purchased | $480,00 |
| Building rent (production uses 80% of the space; administrative and sales offices use the rest) | $40,000 |
| Utilities, factory | $108,000 |
| Royalty paid for use of production patent, $1.50 per unit produced | ? |
| Maintenance, factory | $9,000 |
| Rent for special production equipment, $7,000 per year plus $0.30 per unit produced | ? |
| Selling and administrative salaries . . . . . . . . . . | $210,000 |
| Other factory overhead costs | $6,800 |
| Other selling and administrative expenses | $17,000 |

| | Beginning of yr | Ending of yr |
|---|---|---|
| Inventories | | |
| Raw material | $20,000 | $30,000 |
| Work-in-process | $50,00 | $40,000 |
| Finished goods . | ? | ? |

The finished goods inventory is being carried at the average unit production cost
for the year. The selling price of the product is $50 per unit.

### Required:
1. Prepare a schedule of cost of goods manufactured for the year.
2. Compute the following:
a. The number of units in the finished goods inventory at the end of the year.
b. The cost of the units in the finished goods inventory at the end of the year.
3. Prepare an income statement for the year.

5. (a) Film Specialties, Inc., operates a small production studio in which advertising films are    (45)
made for TV and other uses. The company uses a job-order costing system to accumulate
costs for each film produced. The company's trial balance as of May 1, the start of its fiscal
year, is given as follows:

| | |
|---|---|
| Cash | $ 60,000 |
| Accounts Receivable | 210,000 |
| Materials and Supplies | 130,000 |
| Films in Process | 75,000 |
| Finished Films | 860,000 |
| Prepaid Insurance | 90,000 |
| Studio and Equipment | 5,200,000 |

| | | |
|---|---:|---:|
| Accumulated Depreciation | | $1,990,000 |
| Accounts Payable | | 700,000 |
| Salaries and Wages Payable | | 35,000 |
| Capital Stock | | 2,500,000 |
| Retained Earnings | | 1,400,000 |
| Total | $6,625,000 | $6,625,000 |

Film Specialties, Inc., uses a Production Overhead account to record all transactions relating to overhead costs and applies overhead costs to jobs on the basis of camera-hours. For the current year, the company estimated that it would incur $1,350,000 in production overhead costs, and film 15,000 camera-hours. During the year, the following transactions were completed:

a. Materials and supplies purchased on account, $690,000.

b. Materials and supplies issued from the storeroom for use in production of various films, $700,000 (80% direct to the films and 20% indirect).

c. Utility costs incurred in the production studio, $90,000.

d. Costs for employee salaries and wages were incurred as follows:

| | |
|---|---:|
| Actors, directors, and camera crew | $1,300,000 |
| Indirect labour costs of support workers | $230,000 |
| Marketing and administrative salaries | $650,000 |

e. Advertising costs incurred, $800,000.

f. Prepaid insurance expired during the year, $70,000. Of this amount, $60,000 related to the operation of the production studio, and the remaining $10,000 related to the company's marketing and administrative activities.

g. Depreciation recorded for the year, $650,000 (80% represented depreciation of the production studio, cameras, and other production equipment; the remaining 20% represented depreciation of facilities and equipment used in marketing and administrative activities).

h. Rental costs incurred on various facilities and equipment used in production of films, $360,000; and rental costs incurred on equipment used in marketing and administrative activities, $40,000.

i. Production overhead was applied to jobs filmed during the year. The company recorded 16,500 camera-hours.

j. Films that cost $3,400,000 to produce according to their job cost sheets were completed during the year. The films were transferred to the finished films storeroom to await delivery to customers.

k. Sales of films for the year (all on account) totalled $6,000,000. The total cost to produce these films was $4,000,000 according to their job cost sheets.

l. Collections on account from customers during the year, $5,400,000.

m. Cash payments made during the year; to creditors on account, $2,500,000; and to employees for salaries and wages, $2,200,000.

### Required:

1. Prepare journal entries to record the year's transactions.

2. Prepare a T-account for each account in the company's trial balance and enter the opening balances given above. Post your journal entries to the T-accounts. Prepare new T-accounts as needed. Compute the ending balance in each account.

3. Is production overhead underapplied or overapplied for the year? Prepare the necessary journal entry to close the balance in Production Overhead to Cost of Films Sold.

4. Prepare an income statement for the year. (Do not prepare a schedule of cost of goods manufactured; all of the information needed for the income statement is available in the T-accounts.)

6.  (a) Outback Outfitters sells recreational equipment. One of the company's products, a small    (22)
camp stove, sells for $50 per unit. Variable expenses are $32 per stove, and fixed expenses
associated with the stove total $108,000 per month.

### Required:

1. Compute the break-even point in number of stoves and in total sales dollars.

2. If the variable expenses per stove increase as a percentage of the selling price, will it result in a higher or a lower break-even point? Why? (Assume that the fixed expenses remain unchanged.)

3. At present, the company is selling 8,000 stoves per month. The sales manager is convinced that a 10% reduction in the selling price would result in a 25% increase in monthly sales of stoves. Prepare two contribution income statements, one under present operating conditions, and one as operations would appear after the proposed changes. Show both total and per unit data on your statements.

4. Refer to the data in (3) above. How many stoves would have to be sold at the new selling price to yield a minimum net operating income of $35,000 per month?

(b) Menlo Company manufactures and sells a single product. The company's sales and       **(23)**
expenses for last quarter follow:

|                         | Total      | Per Unit |
|-------------------------|------------|----------|
| Sales                   | $450,000   | $30      |
| Less variable expenses  | 180,000    | 12       |
| Contribution margin     | $270,000   | $18      |
| Less fixed expenses     | 216,000    |          |
| Net operating income    | $ 54,000   |          |

_**Required:**_

1. What is the quarterly break-even point in units sold and in sales dollars?

2. Without resorting to computations, what is the total contribution margin at the break-even point?

3. How many units would have to be sold each quarter to earn a target profit of $90,000? Use the contribution margin method. Verify your answer by preparing a contribution format income statement at the target sales level.

4. Refer to the original data. Compute the company's margin of safety in both dollar and percentage terms.

5. What is the company's CM ratio? If sales increase by $50,000 per quarter and there is no change in fixed expenses, by how much would you expect quarterly net operating income to increase?

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
B. Sc. Engineering Examinations January 2020
Sub: **PHY 117** (Structure of Matter, Electricity & Magnetism and Modern Physics)
Full Marks: 180                                                    Time: 2 Hours
The figures in the margin indicate full marks. Symbols have their usual meaning.
**USE SEPARATE SCRIPTS FOR EACH SECTION**

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## SECTION-A

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

1. (a) Show that the mass of a body moving at the speed, $u$, relative to an observer is larger than its mass when at rest relative to the observer by the factor $1/\sqrt{1-u^2/c^2}$, where $c$ is the speed of light in vacuum. Graphically show the variation of mass and kinetic energy of the body with the increase of $u$.                    [15]

   (b) Why the universe is believed to be expanding? If the frequencies of the spectral lines in light from a distant galaxy are found to be two-third as great as those of the same lines in light from nearby stars, find the recession speed of the distant galaxy.    [15]

2. (a) What is quantization of electromagnetic waves inside an experimental black body? How does quantum theory explain the black body radiation spectrum removing the classical ultraviolet catastrophe?                    [15]

   (b) (i) Draw and explain the dependence of photocurrent on frequency and intensity of the incident light in photoelectric effect. (ii) An iron surface is irradiated by ultra-violet light and no photoelectrons are ejected until the wavelength of the incident light falls below 288 nm. What will be the maximum kinetic energy of the emitted electron when the iron is illuminated with light of wavelength 140 nm?        [15]

3. (a) Why radioactivity is considered as a time dependent property of the nucleus? Explain the importance of half-life and mean-life describing a radioactive specimen? If an old wooden piece has 25.6% of radioactive carbon as compared to ordinary wood find its age, where half-life of the carbon is 5760 years.                    [20]

   (b) Why critical condition need to be maintained in a nuclear fission reactor? Between fission or fusion reactor which one is safe and viable, and why?            [10]

4. (a) Distinguish between the bonds that exists in NaCl and in Ge crystals.        ·    [15]

   (b) The Madelung constant of NaCl structure is 1.748 and the ions of opposite signs are separated by a distance of 2.82Å. If the ionization energy of Na is 5.14eV, electron affinity of Cl is 3.61eV and $n = 9$, calculate the cohesive energy of a NaCl crystal.
   [15]

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

5. (a) Distinguish between the coordination number and the number of atoms per unit cell. Find both these numbers for i) a simple cubic lattice; ii) a body centered cubic lattice; and iii) a face centered cubic lattice. [22]

(b) Lithium is cubic having lattice constant 3.50 Å and with two of its atoms in the unit cube at (0,0,0) and $(\frac{1}{2}, \frac{1}{2}, \frac{1}{2})$. How many nearest neighbours does each atom have in lithium and how far away are they? [08]

6. (a) What is primitive cell? How can you draw the Wingner-Seitz primitive cell? Determine what portion of fcc lattice is occupied by atoms. [22]

(b) The density of bcc iron is $7.9 \times 10^3$ kg/m$^3$ and the atomic weight is 56. Calculate the size of the unit cell. [08]

7. (a) What is an electric dipole? How we get the dipole moment and its direction. Show that the torque of a dipole in an external electric field is

$$\vec{\tau} = \vec{p} \times \vec{E}$$

and potential energy

$$U = -\vec{p}.\vec{E} .$$ [15]

(b) (i) Show that the electric field at a long distance along the axis of an electric dipole is

$$E = \frac{1}{2\pi\epsilon_0} \frac{p}{R^3} ;$$

where, $R$ is the distance from the center of the dipole to that point. (ii) Calculate the electric field $E$ at a distance of 5 cm from an infinite positive line charge having charge per unit length $3 \times 10^{-7}$ C/m. [15]

8. (a) From the consideration of conservation of energy obtain the differential equation for an LC circuit. Hence find an expression for the frequency of the LC oscillator. Describe briefly how oscillation is sustained in the LC oscillator. [15]

(b) What is the importance of the Hall experiment? What is Hall potential? A parallel plate air capacitor has a capacitance of 100 pf. What is the stored positive charge on the plate, and stored energy if the applied potential difference is 50 V? [15]

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-1  B. Sc. Engineering Examination 2020
Sub: CHEM 119 (Chemistry- I)
Full Marks: 180          Time: 2 Hours
The figures in the margin indicate full marks.
USE SEPARATE SCRIPTS FOR EACH SECTION AND UPLOAD IN THE LMS SYSTEM SEPARATELY
*Symbols used here bear usual meaning. Assume reasonable values for any missing data*

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

1(a)   Rationalize the following:                                                         10
      (i) The half-life of a first order reaction is independent of initial concentration.
      (ii) Under certain conditions, the rate of a reaction and specific reaction rate become identical.

(b)   Explain how you can determine the order of a reaction by half-life method.        12

(c)   For a certain first order reaction $t_{1/2}$ is 100 sec. How long will it take for the reaction to go to     8
      75% completion?

2(a)   Explain the terms 'heat of reaction at constant pressure' and 'heat of reaction at constant      10
      volume.' How are they related?

(b)   Explain the effect of pressure and addition of an inert gas on the equilibrium of the      12
      following reaction:
$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

(c)   At a certain temperature, $K$ for the reaction $3C_2H_2(g) \rightleftharpoons C_6H_6(g)$ is 4. If the equilibrium      8
      concentration of $C_2H_2$ is 0.5 mol $L^{-1}$, what is the concentration of $C_6H_6(g)$?

3(a)   Rationalize the following:                                                         10
      (i) Equimolar solutions of sucrose and sodium chloride are not isotonic.
      (ii) Addition of a non-volatile non-electrolyte solute elevate the boiling point of solvent.

(b)   Explain how you can determine the molar mass of a solute from the measurement of      12
      lowering of vapour pressure.

(c)   The vapour pressure of ether (molar mass = 74 g/mol) is 442 mm Hg at 293 K. If 3g of a      8
      compound are dissolved in 50 g of ether at this temperature, the vapour pressure falls to
      426 mm Hg. Calculate the molecular mass of the compound.

4(a)   What are the conditions that govern the reversibility of a cell?                   10

(b)   What is the standard hydrogen electrode? What are the roles of platinum used in the      12
      hydrogen electrode?

(c)   Calculate the emf of the cell: $Zn \mid Zn^{2+} \parallel Ag^+(0.1M) \mid Ag$.          8
      The standard oxidation potential of $Ag \mid Ag^+$ is $-0.80$ V and $Zn \mid Zn^{2+}$ is $+0.76$ V.

5(a) Which of the following orbitals are not possible? Why?  6
3d, 4s, 3f, 1p

(b) How does Cr contradict the Aufbau principle?  4

(c) How did Rutherford summarise his results of gold foil experiment?  10

(d) Which of the following are valid sets of quantum numbers? For a set that is invalid, explain briefly  10
why it is not valid.
(i) $n = 3, l = 1, m = 0$  (ii) $n = 2, l = 1, m = 0$  (iii) $n = 6, l = 5, m = -1$  (iv) $n = 4, l = 3, m = 4$.

6(a) Be and Al belong to different groups and periods, but they show similarity in properties – why?  10

(b) Arrange the following sets of ions in increasing order of their size, and explain.  10
(i) $Na^+$, $F^-$, $O^{2-}$, $K^+$
(ii) $P^{3-}$, $Cl^-$, $S^{2-}$

(c) Which of the following ions requires maximum energy to form? Why?  10
$Na^+$, $Ca^{2+}$, $K^{2+}$

7(a) Draw the MO diagram for $O_2$ molecule. Discuss the magnetic properties and bond order of the  10
following species: $O_2$, $O_2^-$, $O_2^+$

(b) Use VSEPR theory to predict the geometry and hybridization in the following molecules:
(i) $ICl_2$  (ii) $OF_2$  (iii) $SiH_4$  (iv) $IF_5$

(c) How covalent character is introduced in ionic bond? Which one of the following pairs is more  10
covalent in nature? Explain.
(i) $MgCl_2$ and $MgI_2$ (ii) $BaCl_2$ and $BeCl_2$ (iii) $SnCl_2$ and $SnCl_4$

8(a) Which one of the following pairs will be more paramagnetic in nature? Show by drawing crystal  10
field splitting of $d$ orbitals.
(i) $Mn(H_2O)]^{2+}$ and $[Mn(CN)_6]^{4-}$
(ii) $[Fe(H_2O)]^{2+}$ and $[Fe(CN)_6]^{4-}$

(b) Transition elements show variable oxidation states – explain.  10

(c) Discuss briefly the isomerism in coordination compounds.  10

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA
L-1/T-1  B. Sc. Engineering Examinations 2019-2020
Sub: **MATH 191**  (Differential Calculus and Integral Calculus)
Full Marks: 240                   Time: 2 Hours
USE SEPARATE SCRIPTS FOR EACH SECTION
The figures in the margin indicate full marks.
Symbols used have their usual meaning.

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## SECTION-A

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

1.  (a)  Test the continuity and differentiability of the function $f(x) = |x| + |x-1|$ at   **(25)**
         the point $x = 0$ and $x = 1$, also sketch the graph of the function.

    (b)  If $\sin^{-1} y = m\left(\sin^{-1} x\right)$ then show that   **(15)**

    $$\left(1 - x^2\right) y_{n+2} - (2n+1) x y_{n+1} + \left(m^2 - n^2\right) y_n = 0.$$

2.  (a)  If  $z = f(x, y)$  and  $x = e^u + e^{-v}$, $y = e^{-u} - e^v$  then  show  that   **(20)**
         $\dfrac{\partial z}{\partial u} - \dfrac{\partial z}{\partial v} = x \dfrac{\partial z}{\partial x} - y \dfrac{\partial z}{\partial y}.$

    (b)  Verify Rolle's theorem for $f(x) = x(x-1)^2$ in the interval $[0, 1]$.   **(20)**

3.  (a)  Find the area of the triangle formed by the axes and the tangent to the curve   **(20)**
         $x^{\frac{2}{3}} + y^{\frac{2}{3}} = b^{\frac{2}{3}}$.

    (b)  Show that, $f(x) = \left(\dfrac{1}{x}\right)^x$ has a maximum value which is $e^{\frac{1}{e}}$.   **(20)**

4.  (a)  Find the center of curvature at $(x, y)$ of the curve $x = 2at$, $y = at^2$.   **(20)**

    (b)  Find the asymptotes of the curve,   **(20)**
         $y^3 - 5xy^2 + 8x^2 y - 4x^3 - 4y^2 + 12xy - 8x^2 + 3y - 3x + 2 = 0.$

# MATH 191(IPE)

## SECTION -B

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

5. Evaluate the following: (20+20)

    (a) $\int \frac{x^2+1}{x^4+1} dx$      (b) $\int \frac{4\cos x + 5\sin x}{7\cos x + 6\sin x} dx$

6.

    (a) Evaluate: $\int_0^{\frac{\pi}{2}} \frac{\sin^2 x}{\sin x + \cos x} dx$. (20)

    (b) Find out where the following limit converges (20)
$$\lim_{n\to\infty} \left[ \frac{1}{nb} + \frac{1}{nb+1} + \frac{1}{nb+2} + \cdots + \frac{1}{na} \right]$$

7.

    (a) Calculate the value of the improper integral (20)
$$\int_0^1 \frac{x^2}{\sqrt{(1-x^3)}} dx.$$

    (b) How much area can be covered by the enclosure of two curves (20)
$y^2 = 12x + 36$ and $y^2 = 100 - 20x$ ?

8.     (a) Determine the total length of the curve $b^2x^2 - x^4 = 8b^2y^2$. (20)

    (b) To develop a bowl facing upward, revolve the parametric curve (20)
$x = 7(t + \sin t)$, $y = 7(1 - \cos t)$ about the vertical line. Now
what is the volume of liquid this bowl can hold?

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B.Sc. Engineering Examination- January 2020

## Sub: HUM 211 (Sociology)

Full Marks: 120                         Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 02 page(s) in this question paper.

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## SECTION – A

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

1. (a) What do you understand by social stratification? Explain caste system and (10) class system of social stratification.

   (b) Discuss vertical mobility and horizontal mobility with suitable examples. (10)

2. (a) What is deviance? Explain the 'social stigma' process of deviance. (10)

   (b) Briefly discuss different social views about technology and deviant (10) behavior.

3. (a) Illustrate the contribution of Karl Marx to the field of sociology. (10)

   (b) Briefly explain functional theoretical perspective of sociology. (10)

4. Write short notes on any two of the following: (20)

   a) Ascribed status and achieved status.
   b) Social norms.
   c) Mead's theory of socialization.

## SECTION – B

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

5.  (a) Discuss the characteristics of pre-industrial societies, industrial societies and    (10)
    post-industrial societies.

    (b) How do you define deindustrialization and industrialization? Describe the    (10)
    social consequences of industrial revolution.

6.  (a) Define environment and environmental justice.    (10)

    (b) How can we save the environment? Name five green industries in    (10)
    Bangladesh.

7.  (a) Explain how technological developments have changed our social and    (10)
    economic life.

    (b) Describe the characteristics of social change.    (10)

8.  (a) Write down the factors that influence a city's growth.    (10)

    (b) Briefly discuss the positive and negative consequences of capitalism.    (10)