

**SECTION – A**

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

1. (a) What are the damped oscillations? Write down the differential equation of a damped oscillator. Solve it to obtain an expression for the displacement in the case of damped oscillatory motion. Discuss the effect of damping on the natural frequency of an oscillator. (4+20+3)
  
- (b) A damped oscillator having mass 200 g, force constant 80 N/m and damping constant 0.06 kg/s. In how many periods of oscillation will the mechanical energy of oscillator drop to one-half of its initial value? Calculate the mean life time of the oscillator. (8)
  
2. (a) What are the Lissajous' figures? On what factors does it depend? Explain how these figures are useful in the laboratory? (7)
  
- (b) Derive a general expression for the resultant vibration of a particle simultaneously acted upon by two initially perpendicular simple harmonic vibrations having same period but different phase and amplitude. Find out the condition for circle and straight line. (20)
  
- (c) Two ideal springs are attached to a block of mass  $M$ , free to slide on a frictionless horizontal surface, as shown in Figure 1. If the springs separately have force constants  $k_1$  and  $k_2$ , find the effective force constant  $k_{\text{eff}}$ . And hence find the frequency of oscillation of the block. (8)

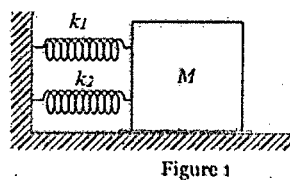


Figure 1

3. (a) Distinguish between particle velocity and wave velocity, and obtain the relation between the two. (7)
  
- (b) A plane progressive wave is propagating through a fluid medium of density  $\rho$ . Deduce the expressions for energy density and intensity of the plane progressive wave. (20)
  
- (c) A source of sound has a frequency of 800 Hz and amplitude of 4 cm. What is the flow of energy across a square cm per second, if the velocity of sound is 350 m/s and density of the medium is  $0.00129 \text{ g/cm}^3$ ? (8)

**PHY 159/ME**

4. (a) What is chromatic aberration of a lens? (5)
- (b) Deduce the condition for the achromatism of a combination of two thin coaxial lenses separated by a distance  $x$ . (20)
- (c) It is desired to make a converging achromatic lens of mean focal length 30 cm by using two lenses of materials A and B. If the dispersive power of A and B are the ratio 1:2, find the focal length of each lens. (10)

**SECTION – B**

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

5. (a) Two thin convex lenses of power  $P_1$  and  $P_2$  are placed co-axially in air at certain distance  $d$  apart. Show that their equivalent power  $P$  is given by (10)

$$P = P_1 + P_2 - dP_1P_2$$

where the symbols have their usual meaning.

- (b) Deduce an expression for the distance between the principal point of equivalent lens and the first lens, when two thin lenses are placed co-axially in air and separated by a distance  $d$ . (15)
- (c) The focal lengths of the convex lens and the concave lens are 8 cm and 4 cm, respectively. The lenses are placed at a certain distance apart. Calculate the distance between the lenses if they form an achromatic combination. (10)

6. (a) What is spherical aberration? What are the methods to minimize spherical aberration? (5)
- (b) Deduce an expression for minimum spherical aberration from the following equation.

$$\chi = \frac{h^2}{f} \left[ \frac{k^2 \mu^3 + k(\mu + 2\mu^2 - 2\mu^3) + \mu^3 - 2\mu^2 + 2}{2\mu(\mu - 1)^2(1 - k)^2} \right]$$

where the symbols have their usual meanings. (20)

- (c) Calculate the shape factor of a lens to exhibit minimum spherical aberration, when the lens material has a refractive index 1.6. (10)

**PHY 159/ME**

7. (a) What is phase space, phase point and ensemble in statistical mechanics? (8)

(b) Derive the Fermi-Dirac distribution law for a system of particles. (20)

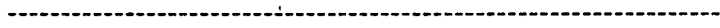
(c) In a system in thermal equilibrium at absolute temperature  $T$ , two states with energy difference  $4.83 \times 10^{-21}$  J occur with relative probability  $e^2$ . Calculate the temperature. (7)

8. (a) What is wave function? Write down the postulates of wave function. (8)

(b) Calculate the wave function and energy of a particle trapped in a one dimensional box of length  $L$ . The potential is given by (20)

$$V(x) = \begin{cases} 0, & 0 \leq x \leq L \\ \infty, & x < 0, x > L \end{cases}$$

(c) Find the probability that a particle trapped in a box of length  $L$  can be found between  $0.46L$  and  $0.54L$  for the ground and first excited state. (7)



BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-/1T-2 B. Sc. Engineering Examinations 2016-2017

Sub : **MATH 163** (Integral Calculus and Differential Equations)

Full Marks : 280

Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

Symbols have their usual meaning.

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

1. Perform the following integrals:

$$(a) \int \frac{\cos x dx}{2 \sin x + 3 \cos x}, \quad (b) \int \frac{3x-2}{1-6x-9x^2} dx, \quad (c) \int \frac{x + \sqrt[3]{x^2} + \sqrt[6]{x}}{x(1 + \sqrt[3]{x})} dx. \quad (16+16+14\frac{2}{3})$$

$$2. (a) \text{ Evaluate: } \lim_{n \rightarrow \infty} \left[ \left(2 + \frac{1}{n^2}\right)^{1/n^2} \left(2 + \frac{2^2}{n^2}\right)^{2/n^2} \left(2 + \frac{3^2}{n^2}\right)^{3/n^2} \cdots \left(2 + \frac{n^2}{n^2}\right)^{n/n^2} \right] \quad (14\frac{2}{3})$$

$$(b) \text{ Evaluate: } \int_0^1 \cot^{-1}(1-x+x^2) dx \quad (16)$$

$$(c) \text{ Prove that, } \int_0^1 \frac{x^2 dx}{\sqrt{1-x^4}} \times \int_0^1 \frac{dx}{\sqrt{1+x^4}} = \frac{\pi}{4\sqrt{2}}. \quad (16)$$

$$3. (a) \text{ Determine the perimeter of the loop of } 3ay^2 = x^2(a-x) \quad (15)$$

$$(b) \text{ Find the intrinsic equation of } p = r \sin \alpha \quad (15)$$

$$(c) \text{ Use Trapezoidal and Simpson's } \frac{3}{8} \text{ rules to evaluate the integral of } \int_0^1 \frac{\ln(1+x^2)}{1+x^2} dx$$

$$\text{dividing the range into 9 equal part.} \quad (16\frac{2}{3})$$

$$4. (a) \text{ Find the area outside of } r = 2a \cos \theta \text{ and inside of cardioid } r = a(1 + \cos \theta) \quad (15)$$

$$(b) \text{ Find the volume of the solid formed by the revolution of the loop of the curve } y^2(a+x) = x^2(3a-x) \text{ about the x-axis.} \quad (15)$$

$$(c) \text{ Find the surface area of the solid of revolution of the lemniscate } r^2 = a^2 \cos 2\theta \text{ about the line } \theta = \frac{\pi}{2}. \quad (16\frac{2}{3})$$

**MATH 163(ME)****SECTION - B**

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

5. (a) Find the differential equation of the family of circles with fixed radius  $r$  and tangent to the  $x$ -axis. (10)

(b) Define exact differential equation and solve the IVP:

$$\cos y \, dx + (1 + e^{-x}) \sin y \, dy = 0, \quad y(0) = \frac{\pi}{4}. \quad (16\frac{2}{3})$$

(c) Write down Riccati's differential equation. Transform it to Bernuoli's differential equation and hence solve  $\frac{dy}{dx} = x^3(y-x)^2 + \frac{y}{x}$ . (20)

6. (a) A body weighing 64 pound is dropped from a height of 100 ft with an initial velocity of 10 ft/sec. Assume that the air resistance is proportional to the velocity of the body. If the limiting velocity is known to be 128 ft/sec, find (i) an expression for the velocity of the body at any time  $t$  and (ii) an expression for the position of the body at any time  $t$ . (14 $\frac{2}{3}$ )

(b) Discuss the method of variation of parameters to solve the differential equation  $a_2(x)y'' + a_1(x)y' + a_0(x)y = g(x)$  and hence solve  $y'' - 4y' + 4y = (x+1)e^{2x}$ . (18)

(c) Find the particular integral of the differential equation  $(D^2 - 1)y = xe^x \sin x$ . (14)

7. (a) Transform the differential equation  $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} - y = \ln(1+x)^2 + x - 1$  into constant coefficients and then solve it. (18 $\frac{2}{3}$ )

(b) Solve the following differential equation by the method of factorization of operator:

$$[(x+1)D^2 - (3x+4)D + 3]y = (3x+2)e^{3x}. \quad (15)$$

(c) Does the series  $\sum_{n=1}^{\infty} \frac{(n+1)!(n+2)!}{(3n)!}$  converge? (13)

8. (a) Find the orthogonal trajectories of the family  $y^2 = kx^3$ . Also sketch the graph. (16 $\frac{2}{3}$ )

(b) Solve  $x \frac{d^2y}{dx^2} - \frac{dy}{dx} = -\frac{2}{x} - \ln x$ . (15)

(c) Find the complete solution of the differential equation  $(D^2 - 9D + 18)y = e^{-3x}$ . (15)

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**L-1/T-2** B. Sc. Engineering Examinations 2016-2017Sub : **CHEM 141** (Chemistry of Engineering Materials)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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

1. (a) Pitting corrosion can be assessed neither by determining the mass loss nor by measuring released hydrogen-explain? (7)
- (b) Corrosion can be controlled via coating – explain. (12)
- (c) What is Crevice corrosion? How galvanic corrosion can be prevented? (3+5=8)
- (d) Discuss different types of defects in painting? (8)
  
2. (a) What is zeolite? Discuss the principle of softening hard water using permutit or zeolite process. Why brine is passed after a certain interval during softening of water by permutit process? (2+10+3)
- (b) Define priming. How it can be prevented? (3+5=8)
- (c) Define “available chlorine” of bleaching powder. Mention the disadvantages of this method. (3+5=8)
- (d) What do you mean by Scale and Sludge formation in boiler? (4)
  
3. (a) Classify Ceramic based on their application. (10)
- (b) Why Bioceramics are so important in medical fields? (7)
- (c) What is Porcelain material? How do the toughness and strength of a porcelain material arise? (3+5=8)
- (d) How milling is done by Attrition method? In which circumstances attrition crushing is most useful? (6+4=10)

**CHEM 141/ME**

4. (a) What are the salient features of a good lubricant? (7)
- (b) Discuss the following properties of a refractory materials (i) Porosity (ii) Thermal spalling (iii) Dimensional stability (iv) Refractoriness under load. (12)
- (c) Schematically show the flow diagram for the manufacturing process of refractory materials. (6)
- (d) What is pigment? What pigments are usually used to produce black, yellow, blue and red colored paint. (2+8=10)

**SECTION – B**

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

5. (a) What are biodegradable plastics? Describe health hazards of plastics. (8)
- (b) Write the differences between thermosetting and thermoplastics. (5)
- (c) Describe the preparation of the following plastics with reactions (any three). Mention their uses. (i) polyvinylacetal (ii) polyethylene (iii) acrylic resin (iv) polyester. (15)
- (d) Discuss the physical and thermal properties of plastics. (7)
6. (a) Give the classification of synthetic fibres. (6)
- (b) What are the differences between natural fibre and synthetic fibre? (5)
- (c) Describe the manufacturing processes of Nylon 66 with reactions and flow sheet. (12)
- (d) Write short notes on the following (any three) (12)
- (i) Acetate rayon (ii) Dynel (iii) Polyurethane (iv) Spinning Methods.
7. (a) What are the different types of Rubber? (8)
- (b) Give the chemical composition of natural rubber latex. (7)
- (c) Describe the properties of rubber. (10)
- (d) Discuss the preparation of Styrene-Butadiene Rubber (SBR) with flow sheet. (10)

**CHEM 141/ME**

8. (a) Give the description of raw materials of glass. (10)
- (b) Write the classification of glass. Discuss the following glasses: (i) photochromic silicate glass (ii) Borosilicute glass and (iii) optical glass. (12)
- (c) Write the reactions involved in the glass furnace when soda, limestone and silica are used with respect to temperature. (6)
- (d) Describe the prospect of glass industry in Bangladesh. (7)
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The figures in the margin indicate full marks.

Symbols indicate their usual meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

**SECTION – A**

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

1. (a) What do you understand by law of demand? What are the exceptions to the law of demand? Explain in brief. (15)
- (b) How would you derive the market demand curve of a commodity? (10)
- (c) What are the main causes of shifting of the demand curve? Explain. (10)
2. (a) Define income elasticity of demand and price elasticity of demand. (10)
- (b) Show that price elasticity of demand varies from zero to infinity along any straight line demand curve. Explain graphically. (15)
- (c) From the following table, calculate elasticity of demand if you move from point A to C and explain what you understand from the result. (10)

POINT	P <sub>x</sub>	Q <sub>y</sub>
A	315	220
B	416	350
C	517	425

3. (a) What is an indifference curve? Explain the properties of an indifference curve. (15)
  - (b) Define budget line and budget set. (10)
  - (c) From the following budget line and the utility function, calculate the amount of two commodities that maximizes satisfaction. What is the maximum amount of satisfaction? (10)
- $$5000 = 45X + 55Y$$
- $$U = 500 X^{0.6}Y^{0.7}$$
4. (a) What do you understand by localization of industries? What are the causes of localization of industries? (15)
  - (b) Explain the advantages and the disadvantages of localization of industries. (15)
  - (c) What do you understand by division of labour? Explain different types of division of labour. (5)

**HUM 103/ME**

**SECTION – B**

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

5. (a) What are the components of Total Cost (TC)? Give examples. (5)  
 (b) Define average and marginal cost and complete this table of costs. (15)

Quantity	TC	TFC	TVC	AFC	AVC	AC	MC
0		200	0				
1		200	300				
2			550				
3			750				
4			1050				
5			1550				
6			2250				
7			3150				
8			4250				

- (c) Draw the figure of average cost (AC) and marginal cost (MC) from the above table (in Q. No. 5(b)) and discuss the relationship between AC and MC. (15)
6. (a) What are the characteristics of a perfectly competitive market? (5)  
 (b) Distinguish between the perfectly competitive market and monopoly with examples. (15)  
 (c) State the equilibrium condition of the perfectly competitive market. Show the equilibrium graphically and explain. (15)
7. (a) What is national income? Discuss the different measurement of national income. (8)  
 (b) Explain the concept of nominal GDP and real GDP. Which one gives more precise understanding of national income and why? (5)

Output	2015		2016		2017	
	P <sub>15</sub>	Q <sub>15</sub>	P <sub>16</sub>	Q <sub>16</sub>	P <sub>17</sub>	Q <sub>17</sub>
Shirt	50	200	60	210	40	220
Rice	10	1000	15	600	8	1200
Car	1000	25	1100	10	900	30
Laptop	300	70	400	70	200	80

- (c) From the given information, calculate nominal GDP and real GDP. (12)  
 (d) Show the relationship of inflation and unemployment and explain why such relationship exists. (10)
8. (a) What is production function? (5)  
 (b) What is diminishing marginal productivity of factors? Suppose,  $Y = 10L^{0.6}K^{0.4}$ , where Y = total output, L = Labor, K = Capital. Find the marginal product of first two labors. (20)  
 (c) Distinguish between economics profit and accounting profit. (5)  
 (d) Why does monopoly arise into the market? (5)

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## BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2016-2017

Sub : **HUM 101** (English)

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, including **Q. No. 1** as compulsory.

1. (a) Explain with reference to the context any **TWO** of the following: (15)
- (i) “All I knew was that I was stuck between my hatred of the empire I served and my rage against the evil-spirited, little beasts who tried to make my job impossible.”
- (ii) “I thought that I had the blood of a man on my hands all these years.”
- (iii) “You only get them in big countries, like Africa and India.”
- (b) Answer any **ONE** of the following: (15)
- (i) Explain Orwell’s ambivalence as a police officer in Burma in the story “Shooting an Elephant”.
- (ii) “Ralph and Jack represent opposing forces of human instincts.” Discuss with reference to “Fire on the Mountain”.
- (c) Answer any **Three** of the following: (15)
- (i) What were strategies employed by the astrologer to resolve the problems of his customers?
- (ii) Why was the writer compelled to shoot the elephant?
- (iii) Why was a peculiar ‘restlessness’ in the household of the family as described in the story “The Rocking – Horse Winner”?
- (iv) How was the island as depicted by the writer in the “Fire on the Mountain”?
2. (a) Recast and correct any **TEN** of the following sentences: (15)
- (i) Bangladesh is facing soring unemployment problem.
- (ii) The house beside the pond is their’s.
- (iii) Laura is an alumnus of the Oxford.
- (iv) I met him sometimes in last summer.
- (v) Has is not as tall as his father.
- (vi) I have other books beside this.
- (vii) Young men dream glory and riches.
- (viii) The music created an allusion that it was coming from the next room.
- (ix) Rabindranath occupies a most unique place in literature.

**HUM 101/ME**

**Contd ... Q. No. 2(a)**

- (x) The story has no morale.
- (xi) Fifteen minutes are allowed to each speaker.
- (xii) The committee is divided in their opinions.

(b) Give the meaning and make sentences with any TEN of the following words: **(15)**

Accomplice, Disseminate, Jeopardy, Laud, Mend, Oblivion, Penetrate, Quell, Sagacity, Sever, Taciturn, Unanimous.

3. Amplify the idea in any ONE of the following: **(30)**

- (a) "Truth is hard  
I came to love its hardness,  
It never deceives."
- (b) "... if winter comes, can spring be far behind?"

4. Write a précis of the following passage with a suitable title: **(30)**

As what geographers have estimated, about twenty percent of the earth's surface is occupied by deserts. A majority of us view deserts as one unique kind of landscape – areas with little or no rainfalls. In actual fact, there are differences between the deserts, though in varying degrees. While it is common for laymen like us to see deserts as rocky or covered with gravel or pebbles, there are some where large sand dunes inhabit. Despite the fact that rainfall is minimal, temperatures do change in deserts, ranging from seasonal ones to daily changes where extreme hotness and coldness are experienced in the day and night. Unfavorable conditions in the deserts, especially the lack of water, have discouraged many living things from inhabiting these landscapes. Nevertheless, there are exceptionally surviving ones which through their superb tactics, have managed to live through and are still going strong. One such kind is the specialist annual plants which overcome seasonal temperature changes with their extremely short, active life cycles. In events of sudden rain, the plant seeds pullulate and grow very quickly to make full use of the rain water. Their flowers bloom and set seeds that ripen quickly in the hot sun too. Once the water runs dry, the mother plant dies, leaving behind the drought-resistant seeds, waiting patiently for the next rainy season to arrive.

**SECTION – B**

There are **FOUR** questions in this section. Answer any **THREE** questions, including **Q. No. 5 as compulsory.**

5. Read the passage and answer the questions that follow: **(45)**

The United States was founded by immigrants and has grown due to immigration from around the world. Large numbers of immigrants entered the United States during three periods in American history. Many new settlers arrived in the colonies in the early days. Another heavy period was in the early 1800's. The third period was between 1880-1920.

## HUM 101/ME

### Contd ... Q. No. 5

In the early colonial days, some people came to find economic opportunity. Some wanted freedom of religion. However, about one-half of European immigrants came as indentured servants because the cost of travel was so high. They could work off the cost of their trip after they arrived in the United States. Another group of immigrants brought to the United States by force were African Americans. It is thought that between the 17<sup>th</sup> and 19<sup>th</sup> centuries 5000,000-750,000 slaves were brought to America.

From 1816-1865, many Irish people immigrated to America due to great poverty caused by the potato famine in Ireland. They usually settled near the coast where they landed. Also, many German farmers, about 5 million people, arrived in America and settled in the Midwest and started farms. Many Asians came to the west coast of the United States, perhaps after hearing about the gold rush. The number is said to be 25,000.

For most of the 1800's, the federal government left the matter of immigration up to the states. However, in 1890, President Benjamin Harrison set up an immigration station on Ellis Island in New York harbor near the Statue of Liberty. From 1890-1954, 12 million immigrants came through this station.

The immigrants would be taken off the ships on which they traveled and went by barge to Ellis Island. They wore tags from the ship which told where they came from. On Ellis Island, they would go through long lines and undergo medical inspection to see if they were healthy enough to stay in the United States. Many, of course, spoke no English and had a difficult time.

During the 1890's most of the immigrants came from central, southern, and eastern Europe. By 1920, more than 4 million Italians had come to America. From 1890-1920 over 2 million Jews immigrated to America to avoid religious persecution.

In 1924, Congress passed the Immigration Act. It set quotas for how many people could enter the United States from any given country. The limit would be 2% of the number of people from that country already living in America. The number was based on the 1890 census of the population. Unfortunately, this act favored Europeans and discriminated against Asians.

Immigration slowed greatly during periods of poor economic times in the United States. During the depression of the 1870's, many fewer people came to the United States. World War I caused a falling off of the numbers also. The depression of the 1930's and World War II continued this falling off.

After World War II, refugees from Europe and the Soviet Union could enter the United States, as well as after the Cuban Revolution in 1959. In 1965, the Immigration and Nationality Act was passed. It did away with quotas. Americans could sponsor people from their home countries. Its purpose was to reunite families. Other laws followed. In recent years, most of the immigrants to America do not come from Europe. Many come from Latin America.

#### **Questions:**

- (a) Why and when did immigration decrease in the United States?
- (b) What were the impacts of 1928 Immigration Act on Asians?

**HUM 101/ME**

**Contd ... Q. No. 5**

- (c) From which European countries, as mentioned in the passage, did immigrants settle in the USA? When did they enter the United States?
- (d) Why was an immigration station set up on Ellis Island?
- (e) What is the passage about?
- (f) Write down the meanings of the following words as used in the passage:  
Indenture, discriminate, take off, depression, persecution.
6. (a) What is a business letter? Write down the different parts of a business letter. (10)
- (b) Suppose you bought 500 books from Unique Publishers Ltd. Dhaka. But you found the pages of some books torn. Write a letter claiming compensation of the damaged books. (10)
- (c) Write phonetic transcriptions of the following words: (Any five) (10)  
University, engineer, ocean, moustache, firm, civilization.
7. (a) Discuss the fundamental principles of report writing. (10)
- (b) Write a short essay on any ONE of the following topics: (10)
- (i) Domestic Violence.
- (ii) Benefits and Troubles of Travelling Alone.
- (iii) Social Media and its Impacts.
- (c) Suppose last week you happened to meet a cricketer of Bangladesh Cricket Team and talked to him for some time. Write your conversation in the form of a dialogue. (10)
8. (a) Transform the following as directed: (Any five) (10)
- (i) All that glitters is not gold. (Simple)
- (ii) A poor man is not always unhappy. (Complex)
- (iii) A man who is dishonest cannot win the respect of others. (Simple)
- (iv) You need not have bought that book. (Compound)
- (v) He did not submit his assignments even though the date of submission was extended. (Compound)
- (vi) After many a time I had requested him, he agreed to help her. (Simple)
- (b) Write the salient features of a tender notice. (5)
- (c) Write short notes on any THREE of the following: (15)
- (i) Differences between vowels and consonants.
- (ii) Memo.
- (iii) Follow-up letter.
- (iv) The four parts of a paragraph: paragraph introducers, paragraph developers, context modulators, and paragraph terminators.
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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2016-2017

Sub: **ME 171** (Computer Programming Language)

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**.

Assume any data if necessary. Symbols used have their usual meanings.

1. (a) What are the hardware modules that must be assembled together to build a working computer? How does a multi-core CPU differ from a single-core CPU? What is firmware? (12)
- (b) Give six examples of modern computing platforms. Based on your examples, explain why the knowledge of computing platform is necessary for a programmer. (11)
- (c) Briefly describe the main programming components that a computer programmer has to learn in order to solve a computational problem by programming. Which components remain unchanged, (i) when the programmer switches to a different programming language to solve the same problem and (ii) the programmer seeks to solve a different problem with the same programming language? (12)
2. (a) Classify computer programming languages (with examples) according to their:
  - (i) evolution (generation), (ii) purpose (use) and (iii) implementation (logical design). (9)
  - (b) Illustrate with examples 'function call by value' and 'function call by reference'. (8)
  - (c) Write a C user-defined function '**sort()**' with appropriate prototype declaration, which being called from another function, can sort in descending order, a local array of n integer elements of the calling function.  
Then, in the function '**main()**', initialize an array with 10 integers sequentially as 77, 66, 54, 45, 81, 70, 55, 40, 85, and 90. Call '**sort()**' and print the sorted array from '**main()**'. (18)
3. (a) Given the following declaration: (12)

```
int p[2][3][2]={1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12};
```

The first element of the array is located at address '12040'. If an integer is represented by 2 bytes, then list all the elements (variables) of the array with proper indices along with their values and addresses in memory.

  - (b) Write a C program that will take an English letter as input from keyboard in upper case, if it gets lower case letter, then convert it to upper case and then prints to the display an upper case letter following five alphabets after it. [For example, if 'A' is the input, prints 'G', if 'z' is the input, prints 'F'] (10)
  - (c) Write a C program which prints 10 random integer numbers from 100 to 1000. (10)

**ME 171**

4. (a) Write a C user-defined function 'newword()' which returns a character-type pointer. Upon calling, the function should randomly select a country name from among five country names hard-coded inside it as strings and returns. The calling function 'main()' stores the returned country name into its local string, counts the length of the local string and prints the string with its length. (12)

(b) Find the output of the following C code segments: (10)

```
(i)
char c[] = "ME-BUET-2018";
char *p = c;
printf("%s", c+3);
printf("%c%c%s", *p, *(p+1), (c+7));

(ii)
char str1[20] = "Computer ";
char str2[20] = "Programming";
strcat(str1, str2);
sprintf(str1, "%s\n", str2);
printf("%s", str1);
```

(c) Write a C program which reads five of your friends' bodyweights in kilograms and heights in centimeters from a file 'data.txt', calculates their body-mass indices (BMIs) and then prints the BMIs in another file 'bmi.txt'. Show a sample input file and your expected output file. (13)

$$\left[ \text{BMI} = \frac{\text{bodyweight in kg}}{(\text{height in cm})^2} \right]$$

**SECTION - B**

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

5. (a) How is a word, like "Computer", stored in a computer memory? How many float type variables can be stored in a one terabyte memory? (10)

(b) Why is C language called a General Purpose Language? Write down the basic structure of a typical C programming language. (10)

(c) The following is a portion of a C source code:

```
int A = 6, int B = 12, C;
C = A + B;
```

How does the hardware of a CPU find out the above summation? (10)

(d) Write the output of the following C source code. (5)



**ME 171**

**Contd ... Q. No. 5(d)**

```
#include<stdio.h>
int main(){
int a=5;
{
a-=5;
int a=5;
a+=5;
printf("\t%d\t",a);
}
printf("%d",a);
return 0;}
```

6. (a) Find and describe the errors in the following program and debug them. (10)

```
#include<stdio.h>
#include<math.h>

extern int a;
int main(){
int q=65;
float M_PI=3.1416;
float pi=3.14;
a=100;
printf("%d",&a);
printf("%f %c %d", pi, A, Q);
printf("%s", To err is human.);
return 0;}
```

(b) Write and explain the output of the following C program. (15)

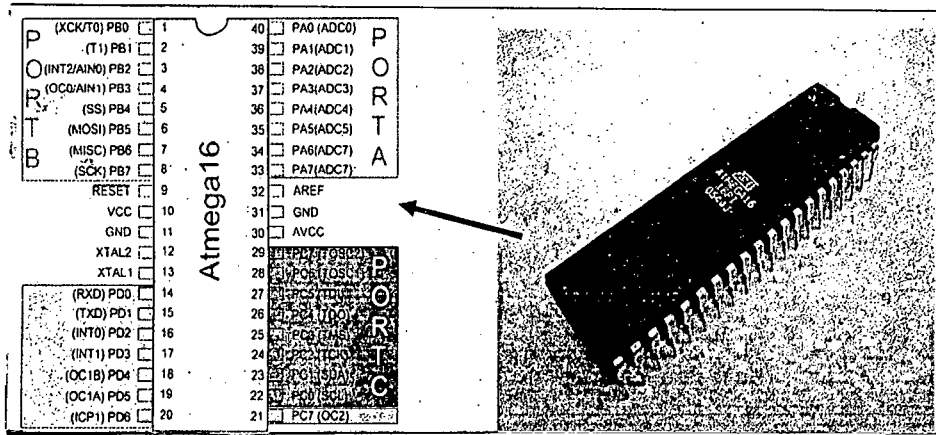
```
#include<stdio.h>
int main()
{
float age = 27.5; int BIRTH_YEAR = 1990, year;
year = (int)age + BIRTH_YEAR;
printf("28 years have almost gone, I am now %0.1f in %d.", age++, ++year);
printf("\nActually I am %d year(s) %d month(s) old.", (int)age,
(int)(age*10)%10);
return 0;}
```

(c) In the following figure, the pin arrangement of an AVR microcontroller (ATMEGA 16) is shown. Suppose, eight LEDs are connected with each of the eight pins of PORT B (pin 1 to 8). If any pin gets a signal of 3-5 volt (input 1), the corresponding LED will light, otherwise, for 0 volt voltage signal (input 0), the corresponding LED will be OFF. Find the sequence of ON and OFF LED for the following cases: (10)

**ME 171**

**Contd ... Q. No. 6(c)**

- (i) PB = 01010101 << 4;
- (ii) PB = 01010101 >> 4;
- (iii) PB = 39 & 103;
- (iv) PB = 40 || 3;
- (v) PB = 4-1<=4 && -1 ==!(0+1);



- 7. (a) When should a break statement be used? Give a practical example with C source code. (5)
- (b) Write a C source code that will find the travelling distance of an ant starting from (0,0) position. The code will ask for the distance in North, South, East and West direction and find the end position (x, y) of the ant. (15)
- (c) Discuss briefly, the various sort algorithms. (5)
- (d) Explain the importance of bit field in C programming. Mention its limitation. (10)
  
- 8. (a) What is the advantage of using Union instead of Structure in C programming? (5)
- (b) Make a database of 5 students in C language using array of Structure. Your source code should take the name, the roll no., and the mark of 5 individual students from the operator as input and print the database. (10)
- (c) Write a C program to reverse the digits of a number given as input. (10)
- (d) Write a C program that can estimate (up to five significant digits) the value of PI using the following equation. (10)

$$\pi = 4 + \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1}$$

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