

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **PHY 121** (Waves and Oscillations, Optics and Thermal Physics)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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

1. (a) What are Lissajous figures? On what factors does it depend? (5)
- (b) If the mass of a spring m_s is not negligible but small compared to the mass m of the object suspended from it, then show that the time period of the simple harmonically oscillating spring is $T = 2\pi\sqrt{\frac{m + m_s/3}{K}}$ where the symbols have their usual meanings.
- Form the above equation, mention the effect of spring mass in the oscillation. (20)
- (c) An ideal spring has force constant k , and a mass m is suspended from it. The spring is cut in half and the same mass is suspended from one of the halves. Is the frequency of the vibration the same before and after the spring is cut? How are the frequencies related? (10)
2. (a) Write down the differential equation of a damped oscillation. Solve it to obtain an expression for the displacement in the case of a damped oscillatory motion. Discuss about the effect of damping on the frequency of oscillation. (20)
- (b) Which type of damping motion should be set in door closer? Justify your answer. (5)
- (c) The initial displacement of a damped harmonic oscillator of mass 2 kg and damping constant 2.5 kg/s is 0.02 m. Find the time taken for the amplitude reduced to 10% of its initial value. Calculate the mean life time of the oscillation. (10)
3. (a) What is phase velocity? Find the relation between group velocity and phase velocity. When does the group velocity become equal to the phase velocity? (5)
- (b) Show that in the case of a stationary wave, no energy is transferred across any section of the medium. (20)
- (c) A string vibrates according to the equation $y = 5\cos\left(\frac{\pi}{4}x\right)\sin(30\pi t)$, where x and y are in centimeters and t is in seconds.
- (i) What is the amplitude and velocity of the component waves whose superposition can give rise this vibrations?
- (ii) What is the distance between consecutive nodes? (10)

PHY 121

4. (a) What is spherical aberration of a lens? How spherical aberration can be minimized? (8)
- (b) Draw schematically the arrangement of Fresnel's biprism experiment. Explain how the wavelength of light can be determined by the help of Fresnel's biprism. (20)
- (c) In a biprism experiment, the eye-piece is placed at a distance of 1.2 m from the source. The distance between the virtual sources was found to be 7.5×10^{-4} m. Find wavelength of the light, if the eye-piece is to be moved transversely through a distance of 1.888 cm for 20 fringes. (7)

SECTION – B

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

5. (a) What do you mean by diffraction of light? Write down the equation for diffraction grating by mentioning each term. (10)
- (b) Discuss how the Fraunhofer class of diffraction due to a single slit depends on the dimension of the wavelength of light being used relative to the width of the slit. (15)
- (c) Show that the smallest detail that can be resolved in an optical microscope is about the same size as the wavelength of light being used. (10)
6. (a) Distinguish between unpolarized and polarized light. State Brewster's law for the plane polarized light. (12)
- (b) Describe double refraction phenomena in a calcite crystal. Show how Nicol prism can be used as a polarizer as well as an analyzer. (15)
- (c) A 20 cm long tube containing sugar solution rotates the plane of polarization by 11° . If the specific rotation of sugar is 66° , calculate the strength of the solution. (8)
7. (a) Explain the term entropy. Describe graphical notation of entropy. (11)
- (b) Show that the charge of entropy between any two states is independent of the path chosen for the transformation. (12)
- (c) Show that when a substance of mass m having a constant specific heat c is heated from T_1 to T_2 degrees the change in entropy is $S_2 - S_1 = mc \ln \frac{T_2}{T_1}$ where the symbols have their usual meaning. (12)
8. (a) What do you know about thermodynamic functions? Classify and describe them. Derive two Maxwell's relation with one from which Clausius – Clapeyron equation can be deducted. (15)
- (b) Derive Clausius-Clapeyron equation and explain its physical significance on melting and boiling. (12)
- (c) The specific volume of steam at 100°C and 76 cm of Hg pressure is $1670 \text{ cm}^2\text{gm}^{-1}$. Calculate the change in boiling point of water due the change in pressure of 2 cm of Hg. How much pressure is required to increase the boiling point of water by 10°C . (8)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **MATH 157** (Calculus I)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

Symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

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

1. (a) Test the continuity and differentiability of the function $f(x) = \begin{cases} \sqrt{1-x^2}, & |x| \leq 1 \\ \sin \pi x, & |x| > 1 \end{cases}$ at every point. Also sketch the graph of $f(x)$. (20)
- (b) For the function $y = \sin^5 x \cos^3 x$ find y_n . (15)
2. (a) State Leibnitz theorem. Using this theorem find $(y_n)_0$ for $y = \sin(a \sin^{-1} x)$. (12)
- (b) If $u = f\left(\frac{x}{y}\right) + yg\left(\frac{x}{y}\right)$, then show that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = 0$. (11)
- (c) Expand $y = e^{a \sin^{-1} x}$ in infinite power series of x . (12)
3. (a) Evaluate : $\lim_{x \rightarrow 0} \left(\frac{a^x + b^x}{2} \right)^{\frac{1}{x}}$. (11)
- (b) Find the dimensions of the largest rectangle which can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. (12)
- (c) Find in what intervals the function $f(x) = x^4 + x^2 - 6x^2$ is increasing, decreasing, concave up, and concave down. Also find the inflection points and hence sketch the graph. (12)
4. (a) Find the pedal equation of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. (11)
- (b) Find the equation of the circle of curvature at the point (3,1) on the curve $y = x^2 - 6x + 10$. (12)
- (c) Find all the asymptotes of the curve $x^3 + 2x^2y - 9xy^2 - 18y^3 - 4x + 8y - 1 = 0$ (12)

MATH 157**SECTION – B**

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

5. Workout the following :

$$(a) \int \frac{dx}{\sin x(2 \cos^2 x - 1)} \quad (11)$$

$$(b) \int \frac{x^2 dx}{(x \sin x + \cos x)^2} \quad (12)$$

$$(c) \int \frac{xdx}{(1+x)^{1/3} - (1+x)^{1/2}} \quad (12)$$

6. (a) Find a reduction formula for $I_n = \int x^n \cos mx dx$ and hence find $\int x^3 \cos 4x dx$. (13)

(b) Evaluate : $\lim_{n \rightarrow \infty} \left[\frac{1}{\sqrt{n^2 - 1}} + \frac{1}{\sqrt{n^2 - 2^2}} + \frac{1}{\sqrt{n^2 - 3^2}} + \dots + \frac{1}{\sqrt{2n - 1}} \right]$. (10)

(c) Find the value of $\int_0^{\pi/2} \frac{\sin x \cos x dx}{a^2 \sin^2 x + b^2 \cos x}$. (12)

7. (a) Evaluate : $\int_0^{\pi} \frac{x \sin x dx}{1 + \cos^2 x}$ (11)

(b) Evaluate : $\int_1^{\infty} \frac{\sqrt{x} dx}{(1+x)^2}$ (12)

(c) Prove that (i) $\int_0^{\infty} x^4 e^{-x^2} dx = \frac{3}{8} \sqrt{\pi}$, (ii) $\beta(p+1, q) + \beta(p, q+1) = \beta(p, q)$. (6+6)

8. (a) Find the larger area enclosed by the circle $x^2 + y^2 = 64a^2$ and the parabola $y^2 = 12ax$. (13)

(b) Find the area of the loop of the curve $3ay^2 = x(x-a)^2$. (10)

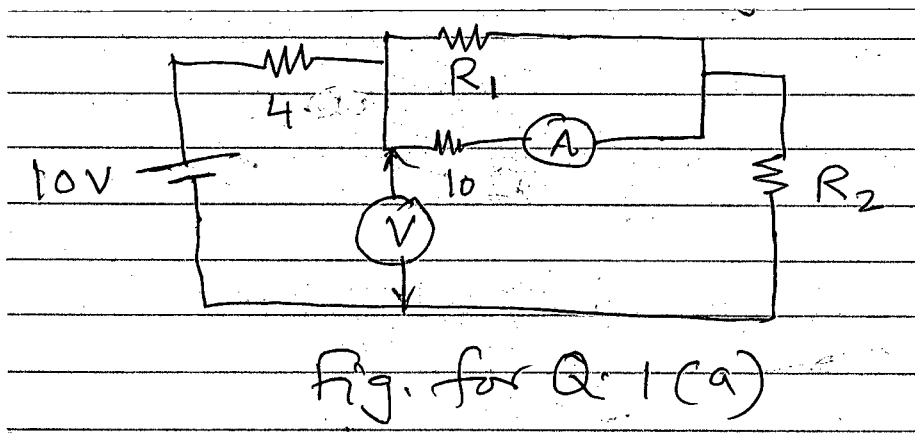
(c) Find the volume of the solid generated by revolving the cardioid $r = a(1 + \cos \theta)$ about the initial line. (12)

SECTION - A

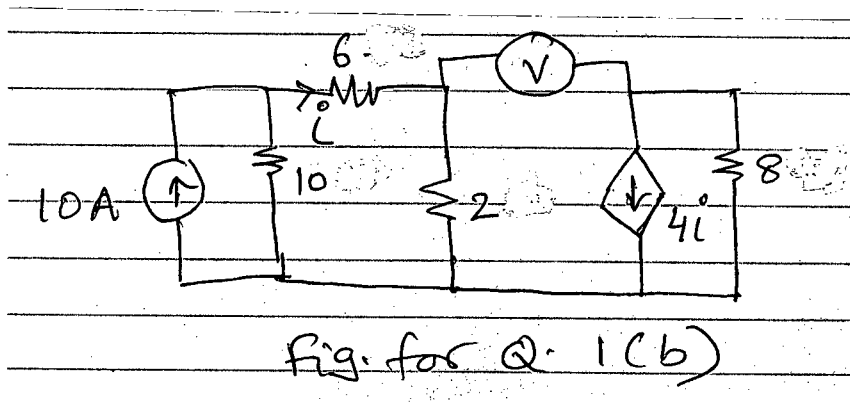
There are **FOUR** questions in this Section. Answer any **THREE** questions.

Unless otherwise specified, all resistances are in Ω .

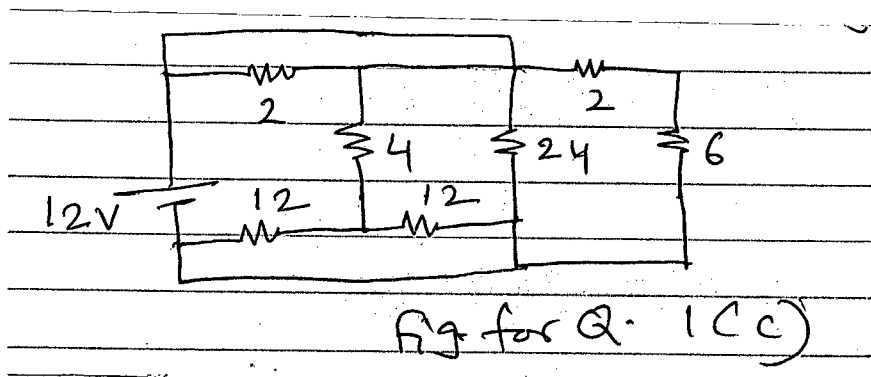
1. (a) Find the values of R_1 and R_2 in the following circuit if the voltmeter and ammeter read 6 V and 0.6 A, respectively. (12)



- (b) Find the reading of the voltmeter in the circuit for Q. 1 (b). (12)



- (c) Write one use of Δ -Y transformation. Find the current delivered by the source. (11)



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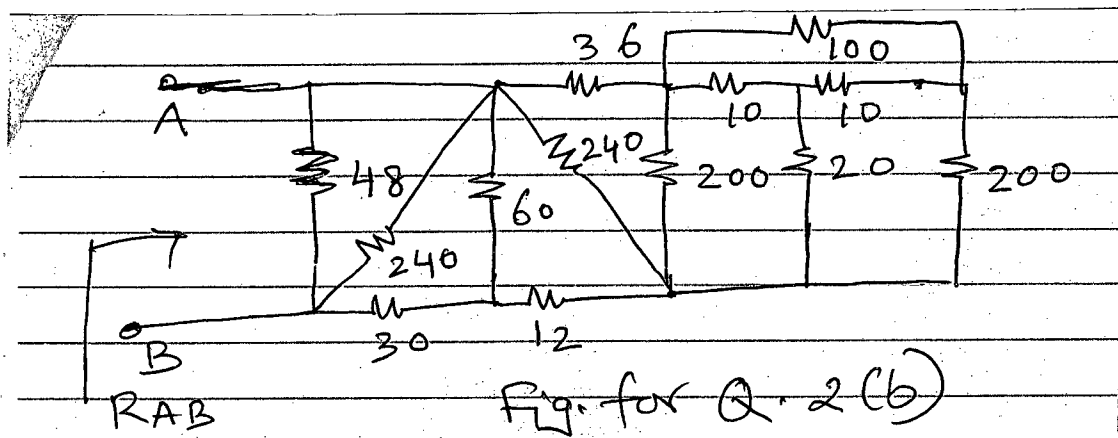
2. (a) In solving for currents using mesh analysis, the following equations are obtained.
 Draw the circuit and find the currents. (15)

$$15 i_1 - 10 i_2 = -10$$

$$10 i_1 - 22 i_2 + 10 i_3 = 0$$

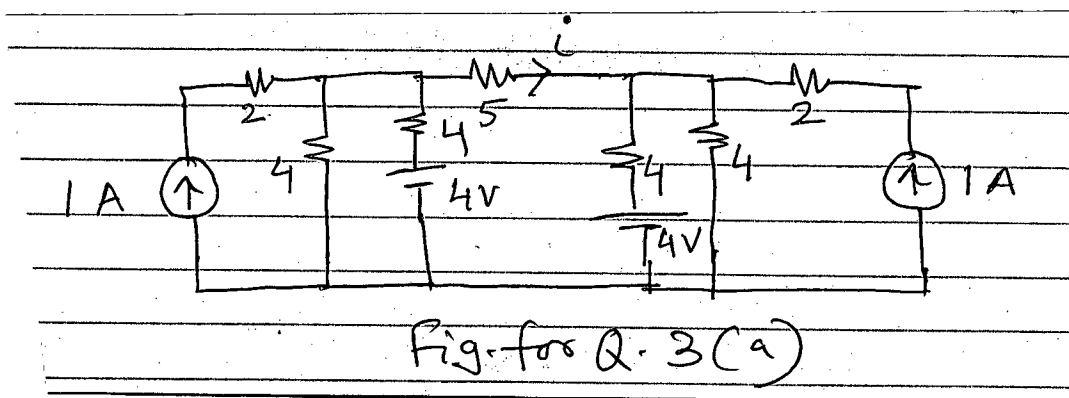
$$10 i_2 - 15 i_3 = 12$$

- (b) Find the equivalent resistance R_{AB} of the network shown. Show all the steps of circuit simplification. (15)

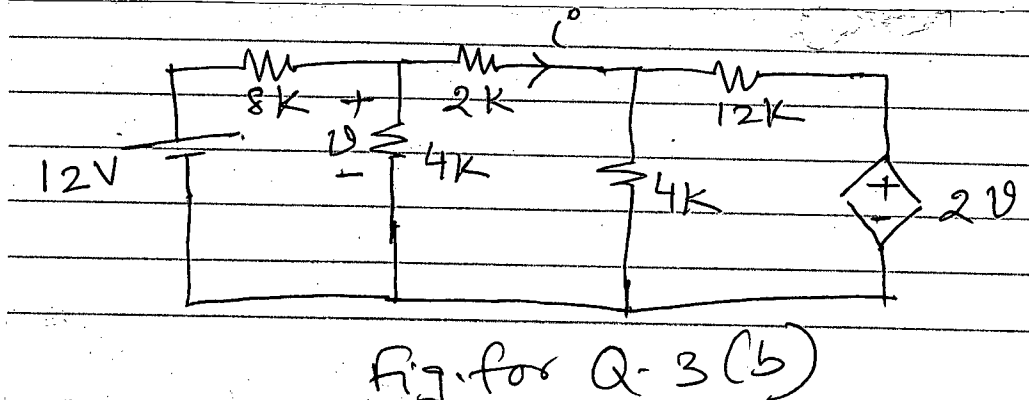


- (c) Find the condition for maximum DC power supply to a load. Explain where we use maximum power condition. (5)

3. (a) Find current i using Source Conversion- (17)

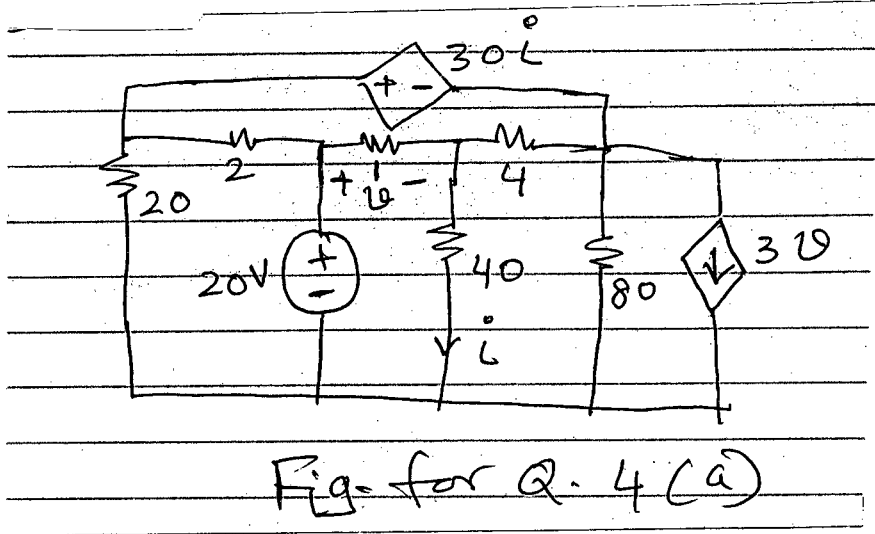


- (b) Use Thevenin's Theorem to find current i . (18)

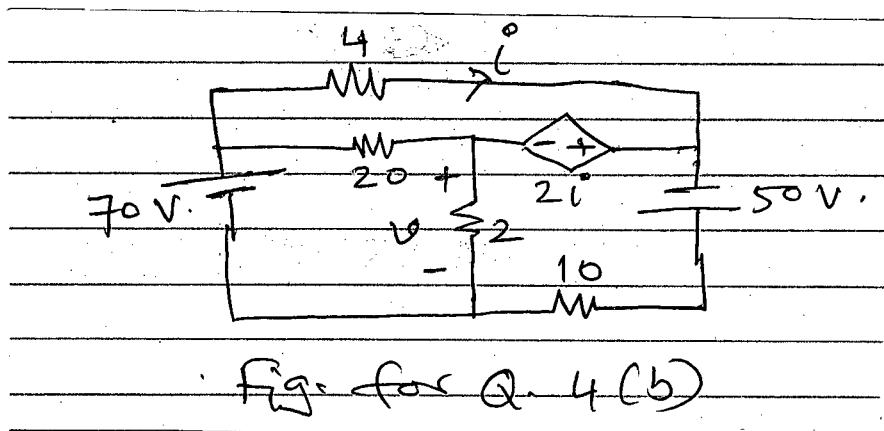


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4. (a) Use node-voltage method to find the power delivered by the 20 V source. (15)



(b) Explain the usability of Superposition principle. Using this principle, find the voltage v in the circuit shown. (15)

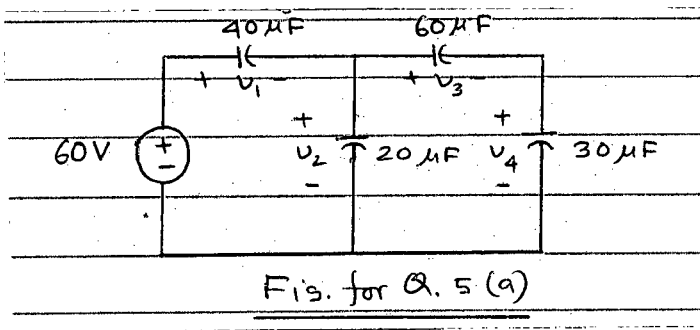


(c) Define Supermesh and Supernode. (5)

SECTION - B

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

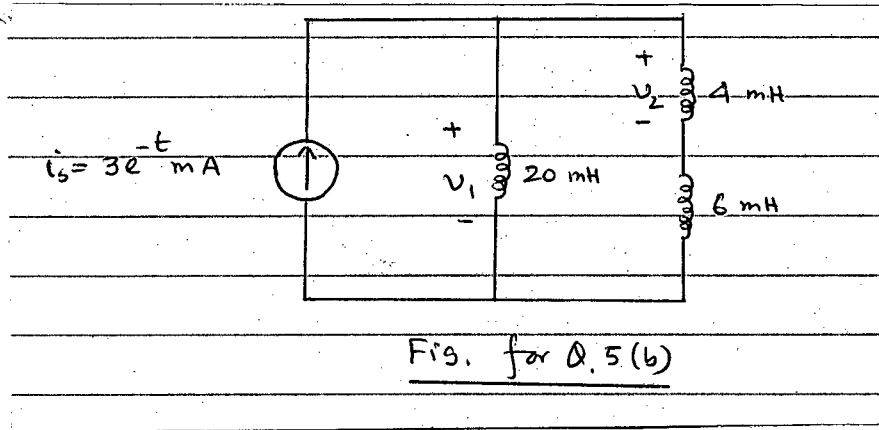
5. (a) Find the voltage v_1, v_2, v_3 and v_4 in the circuit shown in Fig. for Q. 5(a). (17)



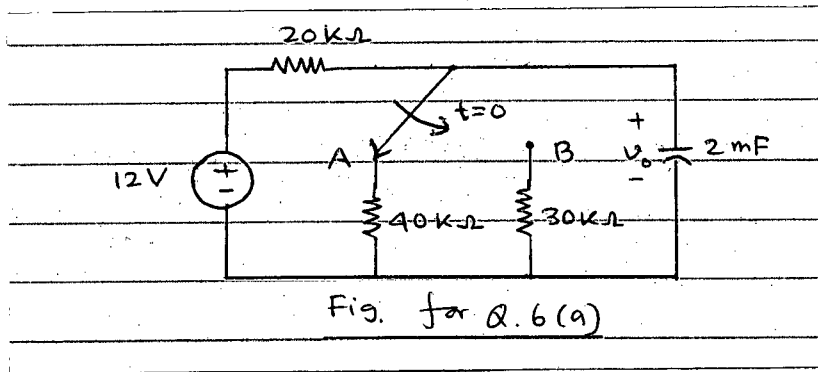
(b) For the circuit shown in Fig. for Q. 5(b), find the v_1 , and v_2 and energy stored in the 20 mH inductor at $t = 1$ sec. (18)

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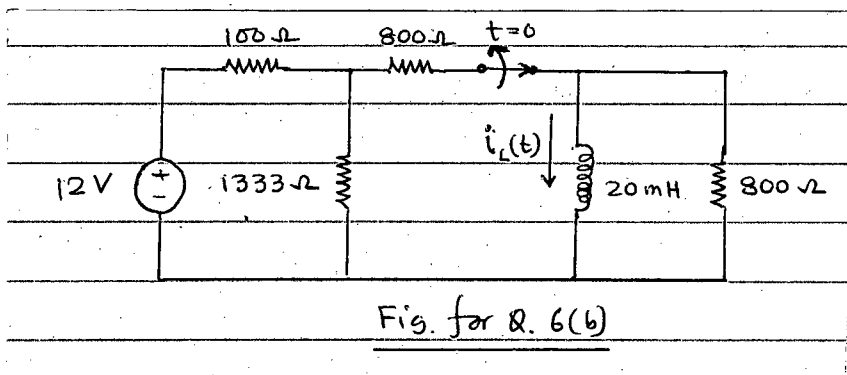
Contd ... Q. No. 5(b)



6. (a) Assuming that the switch in Fig. for Q. 6(a) has been in position A for a long time and is moved to position B at $t = 0$, find $v_0(t)$ for $t \geq 0$. (18)



- (b) In Fig. for Q. 6(b), the 12 V source has been applied for a long time before the switch opens at $t = 0$. Find $i_L(t)$ for $t > 0$. (17)



7. (a) A resistance of 10Ω is connected in series with a $303 \mu\text{F}$ capacitor. If the voltage drop across the capacitor is $150\sin(220t - 60^\circ)$ volts, find the expression of the impressed voltage across the entire series circuit. Also find the expression of the current flowing through the circuit. (17)

- (b) Find the average and effective value of the waveform shown in Fig. for Q. 7(b). (18)

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Contd ... Q. No. 7(b)

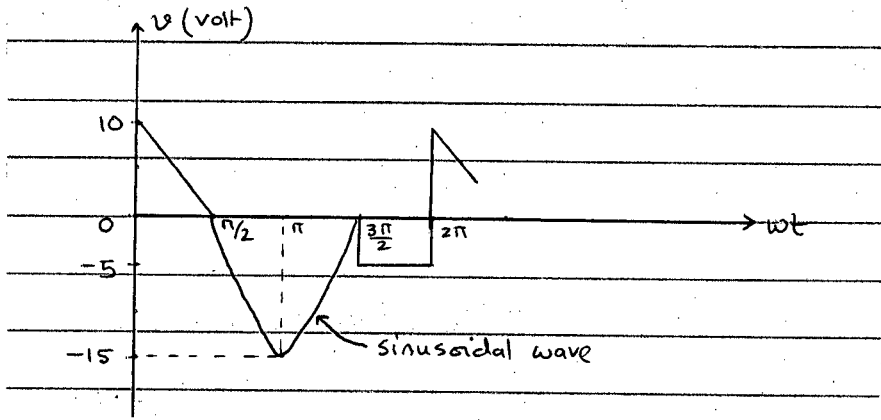


Fig. for Q. 7(b)

8. (a) Find the average power absorbed by the 10Ω resistor in circuit shown in Fig. for Q.

8(a).

(17)

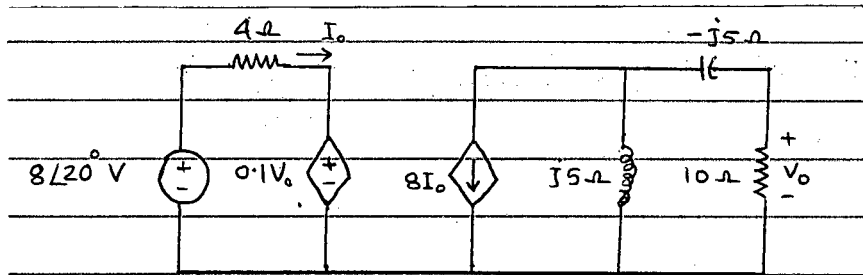


Fig. for Q. 8(a)

(b) Obtain the Norton equivalent circuit at terminals a-b for the circuit shown in Fig. for

Q. 8(b).

(18)

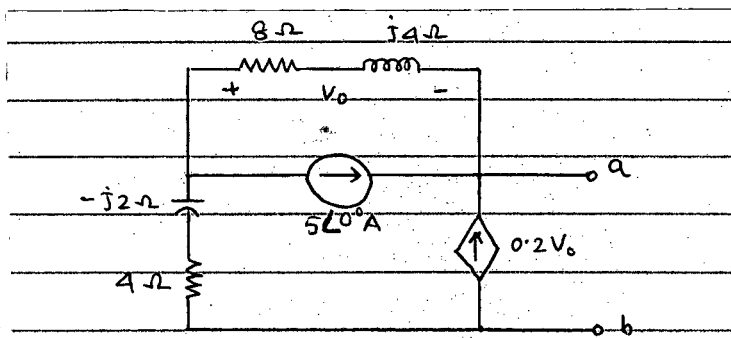


Fig. for Q. 8(b)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **HUM 135** (English)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – AThere are **FOUR** questions in this Section. Answer Q No. 1 and any **TWO** from the rest.

1. Read the passage carefully and answer the questions those below:

(45)

Police department in the United States and Canada see it as central to their role that they respond to calls for help as quickly as possible. This ability to react fast has been greatly improved with the aid of technology. The telephone and police radio, already long in use assist greatly in reduction of police response time. In more recent time there has been the introduction of the '911' emergency system, which assists police in planning patrols and assigning emergency requests to the people officers nearest to the scene of the emergency.

An important part of police strategy, rapid police response, is seen by police officers and the public alike as offering tremendous benefits. The more obvious one are the ability of police to apply first-aid lifesaving techniques quickly and in greater possibility of arresting people who may have participated in a crime. It aids in identifying those who witness an emergency or crime, as well as in collecting evidence. The overall reputation of a police department, too, is enhanced if rapid response is consistent, and this in itself promotes the prevention of crime. Needless to say, rapid response offers the public some degree of satisfaction in its police force.

While these may be the desired consequences of rapid police response, actual research has not shown it to be quite so beneficial. When response times increase to 3-4 minutes-still quite a rapid response-the possibility of arrest is substantially reduced. Similarly, in identifying witness to emergency or crimes, police are far more likely to be successful if they arrive at the scene no more than four minutes on average, after receiving a call for help. Yet both police officers and the public define 'rapid response' as responding up to 10-12 minutes after calling the police for help.

Should police assume all the responsibility for ensuring a rapid response? Studies have shown that people tend to delay after an incident occurs before contacting the police. A crime victim may be injured and thus unable to call for help, for example, no telephone may be available at the scene of the incident. Often, however, there is no such physical barrier to calling the police. Indeed, it is very common for crime victims to call their parents, their minister, or even their insurance company first. When the police are finally called in such cases the effectiveness of even the most rapid of response is greatly diminished.

Contd P/2

HUM 135

Contd ... Q. No. 1

The effectiveness of rapid response also needs to be seen in light of the nature of the crime. For example, when someone rings the police after discovering their television set has been stolen from their home, there is little point, in terms of identifying those responsible for the crime, in ensuring a very rapid response. It is common in such burglary or theft cases that the victim discovers the crime, however, as in the case of robbery, rapid response, provided the victim was quickly able to connect the police, is more likely to be advantageous. Based on statistics comparing crimes that are discovered and those in which the victim is directly involved. Spelman and Brown (1981) suggest that three in four calls to police need not be met with rapid response.

It becomes clear that the importance of response time in collecting evidence or catching criminals after a crime must be weighted against a variety of factors. Yet because police department officials assume the public strongly demands rapid response they believe that every call to the police should be met with it. Thus, rather than emphasizing rapid response, the focus of energies should be to on establishing realistic expectations in the caller and making every attempt to meet them.

Questions:

- (i) What do you understand by “police response time”?
 - (ii) What are the latest technological developments that reduce police response time?
 - (iii) How can police succeed in identifying witness to emergencies or to crime?
 - (iv) Do you think physical barriers are great cause of delay in contacting police?
 - (v) Provide an appropriate title for the passage above and give reasons to substantiate that.
2. (a) “Every business letter, in principle, is a sales letter.” Discuss the qualities of a sales letter in light of this statement. **(10)**
- (b) Suppose you are the chief engineer of a firm. You have purchased some equipment for your organization. After receiving the equipment you find some pieces of equipment are sub-standard. Now write a letter of complaint to the supply of those products. **(10)**
- (c) Write phonetic transcriptions of the following words: (any five): **(10)**
Abstract, Everybody, Basic, English, Stone, Shout.
3. (a) What is index of a report? **(5)**
- (b) Write a composition on any one of the following: **(15)**
- (i) Internet: Connects People or Alienates Them
 - (ii) What is More Important: Our Privacy or National Security?
 - (iii) Leisure Time Activities

HUM 135

Contd ... Q. No. 3

- (c) Write a dialogue between two students of your Department about the necessary of English courses offered by the Dept. of Humanities, BUET. (10)
4. (a) Transform the following sentences as directed (any five): (10)
- (i) Turn the right turn and you will find the house of your friend (Simple)
 - (ii) Can you tell me when he will arrive? (Complex)
 - (iii) The fog being very dense, the steamer sailed at less than half speed. (Compound)
 - (iv) This is the vase in which we arrange flowers. (Simple)
 - (v) Speak low to prevent our being overhead. (Complex)
 - (vi) He was rewarded for his outstanding performance. (Compound)
- (b) What are the characteristic features of an order letter? (5)
- (c) Write short notes on any three of the following: (15)
- (i) Topic Sentence
 - (ii) Annual Confidential Report
 - (iii) Indented Style
 - (iv) Discourse
 - (v) Phoneme

SECTION – B

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

5. (a) Explain with reference to the context any two of the following: (15)
- (i) “A bird in the hand is worth two in the bush, laddie!”
 - (ii) They were watching me as they would watch a conjurer about to perform a trick.
 - (iii) “More wood! All of you get more wood!”
- (b) Answer any one of the following: (15)
- (i) What do you know about imperialism? What adverse effects of imperialism are found in the story “Shooting an Elephant”.
 - (ii) Give reasons for your likings/dislikings of the story “An Astrologer’s Day”.
- (c) Answer any three of the following: (15)
- (i) Comment on the title of the story “The Rocking-Horse Winner”.
 - (ii) What is the symbolic significance of the death of the elephant?
 - (iii) How does the astrologer deceive his innocent customers?
 - (iv) How do the children form a society on the desert island?
 - (v) What alternative could the writer adopt instead of shooting the elephant?

HUM 135

6. (a) Recast and correct any ten of the following sentences: (15)

- (i) Soup and salad are too light a dinner.
- (ii) The students became angered, annoyed and enraged.
- (iii) Mili doesn't want none of that dress.
- (iv) Hasan is speaking in regards to the matter we discussed.
- (v) Rana is seldom ever on time for his work.
- (vi) Ms. Raisa won't be able to make that conference in July.
- (vii) Mamun came as fast as e coas possibly able.
- (viii) There were four 90s in the scores.
- (ix) The fisherman put the boat up under the dock.
- (x) When I saw the lights coming toward the house, I begin to get afraid.
- (xi) The average man of thirty years can undergo this exercise.
- (xii) The help given us was not adequate enough for our purpose.

(b) Give meanings of and make sentences with any ten of the following words: (15)

Abate, bar, cabal, conversion, discern, expound, feeble, forbearance, imply, impromptu, lustrous, promulgate.

7. (a) Amplify the idea in any one of the following: (30)

- (i) However mean your life is, meet it and live it; do not shun it and call it hard names.
- (ii) The things you take for granted, someone else is praying for.

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

Tension is so common a term but so difficult to define. It means mental strain or excitement or condition when feelings are tense, when relation between persons, groups, states etc. are strained. As regards an individual's tension, it saps his energy, destroys his power of imagination, deadens his sensibility and creativity and eats into the vitals of life. No medicine has yet been invented to cure this disease, as it is no disease at all, yet it is the greatest one. It springs from many a factor, from the unfulfilment of desire and from the frustration in life. A man of gigantic figure, tremendous physical strength, endless wealth and vast knowledge can be a victim of tension, but it never meets a man who has indomitable courage, strong will force, unyielding spirit and who can think man is born to brave the theories of life and sweet are the uses of adversity. He can smile away grief, shake off cares and anxieties, always take positive steps, welcome sorrow and sufferings and bear the brunt of life with fortitude and forbearance, calm and composure and prudence and sagacity. Hence, the man who harbours optimistic attitude to life, cherishes hopes and aspirations even in the midst of a sea of troubles and nourishes steadfastness and singleness of spirit and as purpose never yields to tension. And as regards tension between persons or groups or states, it can be overcome when the problems creating this condition are problems creating this condition are freely discussed.

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-1 B. Sc. Engineering Examinations 2015-2016

Sub : **CSE 109** (Computer Programming)

Full Marks : 210

Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

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

Do not use variable length array in any of your answers. Also, read the constraints/ notes mentioned in each question carefully. You **must** adhere to the constraints in answering the respective question.

1. (a) Write a program to compute the speed of a car. The input to the program is 2 real numbers. The first number represents the radius of each wheel of the car in meters. The second real number represents the RPM (Rotation per Minute) of each wheel. Your program should output a single real number (print 2 digits after the decimal point) that represents the speed of the car in kilometers per hour. (10)

(b) Write a program that can whether a point is inside or outside a circle. The input contains five real numbers. The first number represents the radius of the circle. The next 2 numbers represent the (x, y) coordinates of its center. The next 2 numbers represent the (x, y) coordinates of the query point. Print "Inside the circle" if the query point is inside or on the circle. Otherwise print "Outside the circle". (10)

(c) Carefully analyze the code in figure# 1 and write down in output. (10)

```
#include<stdio.h>

int a, b;
void swap(int a, int b) {
    int temp = a; a = b; b = temp;
    printf("swap: %d %d\n", a, b);
}
int run(int a) {
    b += 1; a += b;
    printf("run: %d %d\n", a, b);
    return a;
}
int main(){
    int a, b;
    a = 2; b = 3;
    a += run(b);
    printf("main: %d %d\n", a, b);
    swap(a, b);
    run(a);
    printf("main: %d %d\n", a, b);
    return 0;
}
```

Figure# 1: Program listing for question 1(c)

CSE 109

Contd ... Q. No. 1

(d) Assuming the variables are defined, write necessary statement to perform the following printing operations. (5)

- (i) Print the value of integer variable *myInt*, right justified within 7 spots and with no leading zeros.
- (ii) Print the value of *myInt* (defined above) in hexadecimal representation. Use small letters for a-f.
- (iii) Print the value of float variables *myFloat*; print 5 digits after the decimal point.
- (iv) Print the value of double variable *myDouble*.
- (v) Print the value of char variable *myChar*.

2. (a) Write a program to sort a set of integers in non-decreasing order. You can use any sort algorithm. The first line of input contains *n* – the number of integers to sort. The maximum value of *n* can be 128. The next line contains the *n* integers, separated by space. Output the sorted integers in a single line, separated by space. (10)

(b) For the sort algorithm you have implemented in 2(a), show the state of the following array after each iteration of the outer loop: {10, 90, 20, 80, 30, 70, 40, 60, 50, 85, 15} (10)

(c) The prime factorization of a positive integer is a list of the integer's prime factors, together with their multiplicities. In this problem, your input will be an integer *n* ($1 < n < 100001$). You need to output the prime factorization of the integer. To complete this task, you must implement the following functions (design appropriate parameters and return type): (15)

- (i) PrimeFactorize - Computes and prints out the prime factorization of a positive integer. The integer is a parameter to this function.
- (ii) isPrime – detects whether an integer (parameter) is prime or not.
- (iii) main – Reads the input integer; calls primeFactorize with it.

Refer to the following table for better understanding of the problem and exact formatting of input/output.

Input	Output
85000	$2^3 \times 5^4 \times 17^1$
234	$2^1 \times 3^2 \times 13^1$
7	7^1

3. (a) In this problem, you are given a 2D square matrix as follows: The first line of input contains a single integer *n* ($1 \leq n \leq 20$), representing the number of rows and columns in the matrix. Then the elements of the matrix are given in row major order. (Meaning, the next line contains *n* space separated integers representing the first row of the matrix; the next line represents the second row of the matrix and so on). Store the matrix in a 2D array. Then compute and print the sum of elements in both diagonals combined. In the example below, your output should: - 11. (15)

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Contd ... Q. No. 3(a)

-1	-3	-7	0
9	2	-6	2
4	2	-4	1
-1	7	0	-5

(b) A subsequence is a sequence that can be derived from another sequence by deleting some elements without changing the order of the remaining elements. For example, “bdg” is a subsequence of “abcdefgh”. Also, an empty sequence is a subsequence of any other sequence. Give 2 input strings S and S' , you have to determine whether S' is a subsequence of S . The input contains S in line 1 and S' in line 2. (Note that the strings may contain space characters). In the output, print “YES” if S' is a subsequence of S ; “NO” otherwise.

(15)

(c) Implement the *strcat* library function.

(5)

4. (a) Write a recursive method of print an unsigned integer in binary. The prototype of the method should be:

(10)

```
void printBinary(unsigned int x);
```

Your solution must adhere to the following constraints:

- There should be no leading zeroes in the printed bit pattern.
- If the integer is 0, the bit pattern should just be 0.
- You cannot use bitwise operators in your solution.

(b) Define a *Student* structure to contain the following information about a student:

(5+20)

- First name (no spaces) – The maximum length is 20 characters
- Roll number – Integer. Unique identifier of a student.
- Scores (real numbers) in Physics, Chemistry and Math.

Create an array of Student structure to read information about students from different input text files. Following information is stored in the different input files:

- **stdInfo.txt:** Line # 1 contains the total number of students, n ($1 \leq n \leq 20$), Each of next n lines contains first name (no spaces) and roll number (integer) of a student. The information stored in this file is in increasing order of roll number. (Meeting, the roll number of student specified in line 2 is lower than that in line 3 and so on.)

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Contd ... Q. No. 4(b)

- **{phy.txt, chem.txt, math.txt}**: Each of these files contains n lines. Each line contains roll number and score (real number) in the respective subject (as indicated by the filename) for each student. The roll and score in each line is separated by a single space. The data in these files is not stored in roll number order.

Your output should be another text file as described below:

- **stdScores.txt**: This file should contain student information in increasing order of roll number. For each student, a line contains roll number, followed by first name, followed by scores in physics, chemistry and math respectively.

SECTION – B

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

5. (a) Sketch a suitable diagram illustrating the structure of a computer system according to Von Neumann Computer Architecture. (7)
- (b) What is the advantage of using 2's complement subtraction instead of 1's complement subtraction? Perform the subtraction $75_{10} - 10_{10}$ using 2's complement method showing all the steps. (3+9=12)
- (c) State two uses of enumerations. Write the general form to define an enumeration. Define an enumeration of the primary colors (red, green and blue) and declare a variable p-cd as a variable of this type of enumeration. (3+4+5=12)
- (d) Write the output of the following C program. (4)

```
# include <stdio.h>
void sf( )
{
    static int C = 0;
    C++;
    printf ("%d\n", C);
}
void main ( )
{
    int j;
    for (j=0; j<4;j++)    sf();
}
```

6. (a) Write the output of the following C program. (10)

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Contd ... Q. No. 6(a)

```
#include <stdio.h>
void main ()
{
    int i, *pc;
    int y[] = { 10, 20, 30, 40, 50};
    pc = y;
    for (i = 0; i < 5; i++)
    {
        *pc * = 3;
        (*pc) ++;
        printf ("%dt", *pc++);
    }
}
```

(b) "Pointer subtraction can be utilized to find the length of a string" – demonstrate this by writing a function strlen (char *s) that takes as argument a string s and returns the length of the string. (11)

(c) Write the output of the following C++ program. (9)

```
#include <stdio.h>
void demo (int w, int x , int *y, int &z)
{
    *y = *y + 3;
    z = 4 + z;
    w = w *x +z - 10;
    x = z*w - 5;
}
int main ()
{
    int a = 5, b = 10, c = 12, d = 16;
    demo (a, b, & c, d);
    print ("%d %d %d %d", a, b, c, d);
}
```

(d) Show how to make x a new name for double and define a variable height using x. (3+2=5)

7. (a) Assume that the size of an integer is 2 bytes. Now write a C program that swaps the lower byte and upper byte of an integer using union. (11)

(b) Using ternary operator write a macro ISDIGIT (CH) that returns 1 if CH is a digit and 0 otherwise. (9)

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Contd ... Q. No. 7

(c) Create a function called minm that returns the smaller of the two arguments used to call the function. Overload minm so that it accepts integers, string representation of integers and characters. Consider the following calls to minm for example. **(15)**

```
minm(10, 40); // returns 10
minm("10", "40"); // returns 10
minm('A', 'p'); /* returns 'A'. The arguments are treated case insensitive */
```

You can use library defined functions such as atoi.

8. (a)

```
# include <string.h>
class demo {
    char * p;
public:
    demo ( char *q)
    {
        p = new char [strlen(q)+1];
        strcpy (p,q);
    }
    ~demo ()
    {
        delete [ ] p;
    }
    ...
};
int main ()
{
    demo a (" I like"), b("C++");
    demo c = b;
    ...
    return 0;
}
```

(7+8=15)

Point out and element the problem in the above C++ program. You are not allowed to modify the main function and the destructor of the class demo.

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Contd ... Q. No. 8

(b)

```
class samp {  
    public: int x, y;  
};  
void fn (samp *ob, int *px)  
{  
    *px = ob ->x;  
    ob->x = ob->y;  
    ob->y = *px;  
}
```

(8)

Rewrite function for using reference parameters instead of pointer parameters preserving the functionality of fn.

(c) State two advantages of using new over malloc function. Using new show how to allocate a double and give it an initial value of - 100.57.

(3+5=8)

(d) Mention the restriction that apply to inline functions.

(4)
