

11-18

Shahjalal University of Science & Technology

Course No: CSE-203Q Course Title: Structured Programming Language Credit: 2.0

Term Test: 2

Full Marks: 20

Time: 25 Minutes

1. a) What are the differences between *while* and *do-while* loop? 2

- b) Rewrite the following while statement using for and do-while loop. 3

```
int i = 1;
While(i<20) {
    printf("%d ", i*i);
    i += 2;
}
```

2. Write the output of the following code segment (Show all steps): 5

```
int i = 0, x = 0;
for (i = 1; i <= 10; ++i) {
    if (i % 2 == 1) x += i;
    else x--;
    printf("%d ", x);
    continue;
}
printf ("\nx = %d", x);
```

3. Write a program that calculates and prints the sum of the integers which are divisible by 3 from 10 to 89. 5

4. Write a switch statement that will examine the value of a char-type variable called color and print one of the following messages, depending on the character assigned to color. 5

- RED, if either r or R is assigned to color,
- GREEN, if either g or G is assigned to color,
- BLUE, if either b or B is assigned to color,
- YELLOW, if either y or Y is assigned to color,
- BLACK, if color is assigned any other character

[Answer any 4 (four) from the following 5 (five) questions]

1. Write a program that will reverse the elements of the following array: 5

```
int arr[] = {1,20,3,40,5,60,7,80,9,100};
```
2. Write a program that reads a string and determines whether it is a palindrome or not. 5
(Note: A palindrome is a word, phrase, number, or other sequence of characters which reads the same backward or forward i.e. "radar", "level")
3. Write a recursive function named 'Calculate' which will calculate the sum of first N natural numbers. 5
(Note: Positive integers are known as natural number i.e. 1, 2, 3....N)
4. a) What are the benefits of pointers over the use of arrays? 1
b) Write the output generated by the following program:

```
#include<stdio.h>
int main(){
    int x = 5, y;
    int *px, *py;
    px = &x;
    y = *px * 10;  $y = 5 \times 10$ 
    py = &y;
    printf("%d %d\n", y, *px);
    printf("%d %d\n", x, *py);
    return 0;
}
```

5. Write the outputs of the following code segments: 5

```
#include<stdio.h>
int main(){
    int a[10] = {0,1,2,3,4,5,6,7,8,9};
    int i;
    for(i=0;i<10;i++)
        a[i] = 9-i;
    for(i=0;i<10;i++)
        printf("%d\n", a[i]);
    return 0;
}
```

```
#include<stdio.h>
int p[10]={0,1,2,3,4,5,6,7,8,9};
int main(){
    int i, n = 0;
    for(int i=0;i<10;++i)
        { if ((p[i]%2)==0) n += p[i]; }
        printf("%d", n);
    return 0;
}
```

Shahjalal University of Science & Technology

Department of Computer Science & Engineering

1st Year 1st Semester Final Examination – June 2016 (EEE 2015 Batch)

Course No: CSE-203Q Course Title: Introduction to Computer Language

Credits: 2.0 Full Marks: 50 Time: 2 Hours

(Answer four questions taking any two from each group)

Group - A

1. a) What are the rules for naming an identifier in C? Determine which of the following identifiers are valid.

If invalid explain why.

FOR,while, \$tax_rate, printf, my-name, 1x,c2

- b) Given a student record containing the fields described as follow:

```
char name[80];  
int regNo;  
float marks;
```

How many bytes are required to store the data for 100 students?

- c) Write appropriate statements to read and write the above variables.

- d) Explain the expressions $x++$, $++x$ and $x+=5$ with examples.

2. a) Write the following program using if-else statements

```
#include<stdio.h>  
void main()  
{  
    int a,b,c;  
    printf("Enter two numbers: ");  
    scanf("%d%d", &a, &b);  
    c=a>b ? a : b;  
    printf("%d", c);  
}
```

What will the output of the code for $a=10, b=3$ and $a=25, b=20$?

- b) Write a program that calculates and prints the sum of the integers from 13 to 95 which are divisible by 3

4

- c) Write a program to exchange the content of two variables.

2.5

- d) Write the functionality of #include and #define directives in C.

2

3. a) What are the advantages of structured programming?

2

- b) What will be the output of the following program?

3

<pre>main() { int x; x = func(6); printf("%d", x); }</pre>	<pre>int func(int n) { if (n==1) return 1; else return n*func(n-1); }</pre>
--	---

- c) Identify the actual and formal arguments from the above program.

3

- d) Define local and global variable. How are they declared?

3

- e) What is the purpose of void in a function?

1.5

Group-B

4+2.5

4. a) Write the output of the following code segment (Show all steps):

```

i) main() {
    int i = 0, x = 0;
    for (i = 1; i <= 10; ++i) {
        if (i % 2 == 1) x += i;
        else x--;
        printf("%d ", x);
        continue;
    }
    printf ("\nx = %d", x);
}

```

```

ii) void main() {
    int i=0;
    for ( ; ; ) {
        printf("%d", i);
        i++;
    }
}

```

- b) Write a program that reads a string and determines whether it is a palindrome or not. 5
 (Note: A palindrome is a word, phrase, number, or other sequence of characters which reads the same backward or forward i.e. "radar", "level")
- c) What do the getchar() and putchar() functions do? 1

5. a) Following program is written to print the average of 3 integers. Change the program so that it works correctly. 2.5

```

#include<stdio.h>
int main()
{
    int a,b,c;
    scanf("%d %d %d", &a, &b, &c);
    int avg = (a+b+c)/3;
    printf("%d\n", avg);
    return 0;
}

```

- b) Define explicit type casting? What is the difference between == and = in C? 2
- c) Distinguish between library function and keyword. Give Examples. 3
- d) Write a recursive function named 'Calculate' which will calculate the sum of first N natural numbers. 5
 (Note: Positive integers are known as natural number i.e. 1, 2, 3....N)

6. a) What are the benefits of pointers over the use of arrays? 1.5

- b) Write the output generated by the following program: 4

```

#include<stdio.h>
int main()
{
    int x = 5, y;
    int *px, *py;
    px = &x;
    y = *px * 10;
    py = &y;
    printf("%d %d\n", y, *px)
    printf("%d %d\n", x, *py);
    return 0;
}

```

- c) Define a structure consisting of two floating point members, called real and imaginary. Include the tag complex within the definition. 3
- d) Write down the primary advantage to use a data file. What are the purposes of fopen and fclose function? 1+3
 Give example.

1st Year 1st Semester Examination

Session : 2015-2016

Course Title : English Language

Course Code : ENG 101 (EEE) Credit : 2

Marks : 50

Exam Duration : 2 hours

Department of English

Shahjalal University of Science and Technology

Q1. Read the passage below and answer the questions that follow.

3X 5 = 15

Exploitation in the world today is a major problem with there being a few different types of exploitation. Trafficking, sweatshop working, and slavery are the three major types of exploitation. Money is the biggest reason why there is exploitation in the world today. The only way for exploitation in the world today to end is for poverty and greed to end. I will further more talk about all of these topics to show just how bad exploitation is and how there aren't many ways for it to be stopped.

Trafficking and sweatshop working are the most common forms of exploitation in the United States today. Trafficking occurs when a poor individual is offered job opportunities to make money and persuaded that these opportunities are good jobs. Then the poor individual agrees to work and then is forced to work as a prostitute, abused laborer or a servant. Sweatshop working occurs in the corporate environment today and is when the average businessman works around the clock for his company and doesn't receive career advancements or raises but the CEO is becoming richer and richer. In both of these cases of exploitation, there is a person who is getting rich or making a lot of money off of someone else who is doing all the work. Trafficking is a problem for the world because it is not only doing nothing to help poverty in the world but it is making it worse. These poor people who are trying to make a living and work out of being poor are having their money taken from them or are not even making enough money to get out of poverty which is keeping poverty rates low. Corporate sweatshop working is also just as bad for the world because the economy is not being boosted by having the CEO's of companies becoming richer. The economy would be so much stronger if the millions that these CEO's are making is divided and dispersed to the employees who are doing all the work. The economy suffers from both trafficking and corporate sweatshop working.

Slavery is the other type of exploitation the world is encountering today. Although, every country in the world today has made it illegal to own and exercise total control over another human being, slavery is still a major problem in the world. Slavery today isn't like the slavery that used to take place. Today slavery is even worse. Before slave owners would give security and benefits of somewhat in shelter, and food. In today's slavery people are being smuggled back and forth across country lines and forced into what is basically slavery. People today are forced into jobs that they don't want to do and are abused into doing them. Once they are not "working" as they are supposed to they are just dumped on to the streets. This is a crime and a huge problem in

you have
written

the world because first of all in most cases these people are kidnapped and secondly these people are not being paid and if they are it's the smallest of wages.) This ruins the economy because jobs are being taken and completed with very few wages being paid out. This keeps the poor from making money and it takes them away from being able to get a good job or jobs are taken for other people to have.

I will take 2 hours
to go to station

Money is the biggest reason for exploitation in the world today. People just want to make money whether they are rich or poor they always want money. The poor people continue to go after job opportunities and the rich keep using the poor to make more money. So therefore, as long as there is poverty and greed in the world there will be exploitation because the poor will continue to look for money and the greedy will continue to make money anyway possible.

- How does an individual fall victim to trafficking?
- How do the corporate farms exploit the workers?
- In what way can the economy be better?
- What is the form of modern slavery?
- How can we stop exploitation?

2. Change the parts of speech of the following words as directed and make one sentence with each of the new words.

5

home (adj.), curious (noun), peace (adj.), book(adj.) autonomous (noun)

3. Write five sentences using five modals.

5

4. Put punctuation marks where necessary.

5

It was a bitter cold rainy day, later that month when she was working in the men's surgical ward one afternoon to fill in for someone else, when heard two of the men talking both were British: one an officer, the other a sergeant.

5

5. Write the names of the tenses that are used in the following sentences.

- I have finished my part of the work.
- We had been talking simultaneously when she shouted for us to stop.
- Your paper submission date is over.
- I am planning to visit my grandmother next week.
- It had struck me before that the man was a criminal.

5

6. Make 'wh' questions with the following words.

how long, when, why, whose, where

10

7. Write a paragraph of 160-170 words on any one of the following topics.

- Happiness
- Democracy in Bangladesh

Term Test-I, MAT 103K
 Differential and Integral Calculus
 Marks: 10, Time: 30 min.

Q.1 Justify your answer about the (continuity) of the given function $f(x)$ where $f(x) = \begin{cases} x-2, & x \geq 2 \\ 2-x, & x < 2 \end{cases}$ at $x=2$.
 Also, test the differentiability at $x=2$.

Q.2 If $y = \tan^{-1}(x/a)$ then find y_n .

Q.3 If $y = e^{asinx}$
 prove that (i) $(1-x^2)y_2 - xy_1 - a^2y = 0$
 (ii) $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (x^2+a^2)y_n = 0$
 and hence, bind the value of y_n when $x=0$.

Term: Session II

MAT 103E, Time: 20 min

Differential and Integral Calculus

Marks: 10, Answer all questions

Q.1 Evaluate $\int \sqrt{\tan x} dx$. [08]

Show that $\int_0^{\pi/2} \frac{\sin^2 x dx}{\sin x + \cos x} = \frac{1}{\sqrt{2}} \log(\sqrt{2}+1)$

Q.2 Find the reduction formula of $\int \cos^n x \sin mx dx$. [08]

Prove that $I_n = -x^{n-1} \frac{(4-x^2)^{3/2}}{n+2} + \frac{4(n-1)}{n+2} I_{n-2}$, where

$$I_n = \int x^n (4-x^2)^{1/2}$$

Instructions: Answer 05 (five) questions taking at least 02 (two) from each group of the following.

GFG.JP-A

1.(a) Define domain and range of a function. Find the domain and range of the following functions . 4

(i) $f(x) = \sqrt{x^2 - 9}$, (ii) $f(x) = \frac{2x}{x-4}$, hence sketch the graph.

(b) Evaluate $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$.

(c) Test the continuity and differentiability of the following function $f(x)$ at $x = \pi/2$ where 7

$$f(x) = \begin{cases} 2 - \left(x - \frac{\pi}{2}\right)^2, & x \geq \frac{\pi}{2} \\ 1 + \sin x, & x < \frac{\pi}{2} \end{cases}$$

$$\begin{aligned} & \approx 2 \neq 0 \\ & \approx 2 \neq 2 \end{aligned}$$

(d) From the first principle, find the differential coefficient of $x^{\sin x}$. 5

(e) Differentiate $\log\left(\frac{1+\sqrt{x}}{1-\sqrt{x}}\right)$ with respect to $\sqrt{x^3}$. 4

(f) Expand $\log(1+e^x)$ in ascending powers of x as far as the term containing x^4 . 5

3.(a) If $y = \tan^{-1}\left(\frac{x}{a}\right)$ then find y_n . ✓ 5

(b) Give the statement of Libnitz theorem. If $y = \cos\{m \sin^{-1}(ax+b)\}$, then prove that 5

$$\{1 - (ax+b)^2\}y_{n+2} - (2n+1)a(ax+b)y_{n+1} + (n^2 - n^2)a^2 y_n = 0.$$

(c) At what point, is the tangent to the curve $y = x^3$ parallel to the chord joining the points $(1,1)$ to $(2,8)$? 4

4.(a) What is meant by homogeneous function ? If $u = \log r$ and $r^2 = x^2 + y^2 + z^2$, then prove that 5

$$r^2 \left(\frac{d^2 u}{dx^2} + \frac{d^2 u}{dy^2} + \frac{d^2 u}{dz^2} \right) = 1. \quad \frac{\partial}{\partial x} \rightarrow \frac{\partial}{\partial r}$$

(b) If $U = \frac{y}{z} + \frac{z}{x} + \frac{x}{y}$, prove that $x \frac{dU}{dx} + y \frac{dU}{dy} + z \frac{dU}{dz} = 0$. 3

(c) State Euler's Theorem. If $u(x, y) = \tan^{-1} \frac{x^3 + y^3}{x^2 - y^2}$, then show that $x \frac{du}{dx} + y \frac{du}{dy} = \sin 2u$. 6

GROUP-B

5.(a) Evaluate the following integrals: (any three)

(i) $\int \frac{\cos x \, dx}{(a + \sin x)(a - \sin x)}$, (ii) $\int \frac{x^3 + 1}{x(x^2 + 1)^2} \, dx$, (iii) $\int \frac{dx}{3 + 2 \sin x + \cos x}$, (iv) $\int \frac{dx}{a + b \cos x}$, ($a > b$). 14

6.(a) State and prove the fundamental theorem of integral calculus. 5

(b) What is definite integral ? Prove that $\int_0^{2a} f(x) \, dx = \int_0^a f(x) \, dx + \int_0^a f(2a-x) \, dx$ and hence evaluate $\int_0^1 \frac{\ln(1+x)}{1+x^2} \, dx$. 5

(c) Define integral as the limit of sum. Show that $\int_0^a \left[\frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \dots + \frac{1}{8n} \right] = \frac{3}{8}$. 4

7.(a) Prove that $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} \, dx = \frac{\pi^2}{4}$. 4

(b) Give the statement of Wallis formulae. Using Wallis formulae, determine the limit of which the following series tends, as n tends to infinity $\frac{1}{n} \sum_{k=1}^n \sin^2 \frac{\pi k}{2n}$. 5

(c) Obtain the reduction formula for $\int \sec^n x \, dx$, hence deduce the value of $\int_0^{\pi/4} \sec^3 x \, dx$. 5

8.(a) Define Gamma and Beta function. Obtain the value of $\Gamma\left(\frac{1}{2}\right)$. 4

(b) Evaluate the following improper integral: $\int_0^{\infty} \frac{x \, dx}{x^4 + 1}$. 5

(c) Find the area, common to the two curves $y^2 = x$, $x^2 + y^2 = 4ax$. 5

Instructions: Answer 05 (five) questions taking at least 02 (two) from each group of the following.

GFG/JP-A

1.(a) Define domain and range of a function. Find the domain and range of the following functions. 4

(i) $f(x) = \sqrt{x^2 - 9}$, (ii) $f(x) = \frac{2x}{x-4}$, hence sketch the graph.

(b) Evaluate $\lim_{x \rightarrow \pi/2} (\sin x)^{\tan x}$. 3

(c) Test the continuity and differentiability of the following function $f(x)$ at $x = \pi/2$ where 7

$$f(x) = \begin{cases} 2 - \left(x - \frac{\pi}{2}\right)^2, & x \geq \frac{\pi}{2} \\ 1 + \sin x, & x < \frac{\pi}{2} \end{cases}$$

$$\lim_{n \rightarrow \infty} (n^{-2})^{x^n}$$

$$= 2 \neq 0$$

$$= 2 \neq 2$$

2.(a) From the first principle, find the differential coefficient of $x^{\sin x}$. 5

(b) Differentiate $\log\left(\frac{1+\sqrt{x}}{1-\sqrt{x}}\right)$ with respect to $\sqrt{x^3}$. 4

(c) Expand $\log(1+e^x)$ in ascending powers of x as far as the term containing x^4 . 5

3.(a) If $y = \tan^{-1}(x/a)$ then find y_n . 5

(b) Give the statement of Leibnitz theorem. If $y = \cos\{m \sin^{-1}(ax+b)\}$, then prove that 5

$$\{1 - (ax+b)^2\}y_{n+2} - (2n+1)a(ax+b)y_{n+1} + (n^2 - n^2)a^2y_n = 0.$$

(c) At what point, is the tangent to the curve $y = x^5$ parallel to the chord joining the points (1,1) to (2,8)? 4

4.(a) What is meant by homogeneous function? If $u = \log r$ and $r^2 = x^2 + y^2 + z^2$, then prove that 5

$$r^2 \left(\frac{d^2 u}{dx^2} + \frac{d^2 u}{dy^2} + \frac{d^2 u}{dz^2} \right) = 1. \quad \frac{\partial}{\partial x} \rightarrow \frac{\partial}{\partial x}$$

(b) If $U = \frac{y}{z} + \frac{z}{x} + \frac{x}{y}$, prove that $x \frac{dU}{dx} + y \frac{dU}{dy} + z \frac{dU}{dz} = 0$. 3

(c) State Euler's Theorem. If $u(x, y) = \tan^{-1} \frac{x^3 + y^3}{x - y}$, then show that $x \frac{du}{dx} + y \frac{du}{dy} = \sin 2u$. 6

GROUP-B

14

5.(a) Evaluate the following integrals: (any three)

(i) $\int \frac{\cos x dx}{(a + \sin x)(a - \sin x)}$, (ii) $\int \frac{x^3 + 1}{x(x^2 + 1)^2} dx$, (iii) $\int \frac{dx}{3 + 2\sin x + \cos x}$, (iv) $\int \frac{dx}{a + b \cos x}$, ($a > b$). 5

6.(a) State and prove the fundamental theorem of integral calculus. 5

(b) What is definite integral? Prove that $\int_0^{2a} f(x) dx = \int_0^a f(x) dx + \int_0^a f(2a-x) dx$ and hence evaluate $\int_0^1 \frac{\ln(1+x)}{1+x^2} dx$. 5

(c) Define integral as the limit of sum. Show that $\lim_{n \rightarrow \infty} \left[\frac{1}{n} + \frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \dots + \frac{1}{8n} \right] = \frac{3}{8}$. 4

7.(a) Prove that $\int_0^{\pi} \frac{\cos x}{1 + \cos^2 x} dx = \frac{\pi^2}{4}$. 4

(b) Give the statement of Wallis formulae. Using Wallis formulae, determine the limit of which the following series tends, as n tends to infinity $\frac{1}{n} \sum_{k=1}^n \sin^{2k} \frac{\pi k}{2n}$. 5

(c) Obtain the reduction formula for $\int \sec^n x dx$, hence deduce the value of $\int_0^{\pi/4} \sec^3 x dx$. 5

8.(a) Define Gamma and Beta function. Obtain the value of $\Gamma\left(\frac{1}{2}\right)$. 4

(b) Evaluate the following improper integral: $\int_0^\infty \frac{x dx}{x^4 + 1}$. 5

(c) Find the area, common to the two curves $y^2 = 4x$, $x^2 + y^2 = 4ax$. 5

QE END

Department of Physics
Shahjalal University of Science and Technology

Course Code: PHY 103 (EEE)

Time: 30 min

Total Marks: 10

Answer all the following questions

- The magnitude of the acceleration of uniform circular motion is given by,

$$a = \lim_{\Delta t \rightarrow 0} \frac{\Delta v}{\Delta t} = \frac{v^2}{r}$$
 1.0
 How can you show its direction of the acceleration?
- Define the following arena of Physics: i) Kinematics, ii) Dynamics, and iii) Classical Mechanics. 1.5
- Define Force and Mass from Newton's laws of motion. 2.0
- Figure 1 shows a weight of 50 N hung by strings. Consider the knot at the junction of the three strings to be 'the body'. The body remains at rest under the action of the three forces shown in Figure 2. Find the magnitude of F_A and F_B . 2.5

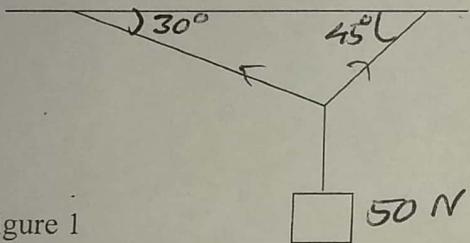


Figure 1

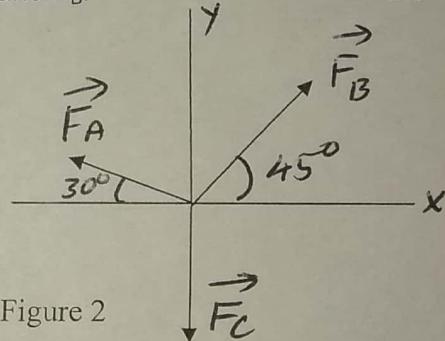


Figure 2

- Sketch how an impulsive force $F(t)$ may vary with time during a collision starting at time t_i and ending at t_f . Then define the impulse J of the force. Define J when the force is constant over time. 3

$$\begin{aligned} J &= m(v-u) \\ &= F \Delta t \end{aligned}$$

Department of Physics
Shahjalal University of Science and Technology

Course Code: PHY 103 (EEE)

Time: 30 min

Total Marks: 10

Answer all the following questions

- ✓ 1. The magnitude of the acceleration of uniform circular motion is given by,

$$a = \lim_{\Delta t \rightarrow 0} \frac{\Delta v}{\Delta t} = \frac{v^2}{r}$$
 How can you show its direction of the acceleration? 1.0
- ✓ 2. Define the following arena of Physics: i) Kinematics, ii) Dynamics, and iii) Classical Mechanics. 1.5
- ✓ 3. Define Force and Mass from Newton's laws of motion. 2.0
4. Figure 1 shows a weight of 50 N hung by strings. Consider the knot at the junction of the three strings to be 'the body'. The body remains at rest under the action of the three forces shown in Figure 2. Find the magnitude of F_A and F_B . 2.5

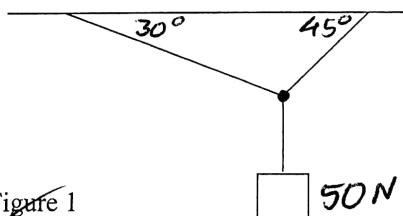


Figure 1

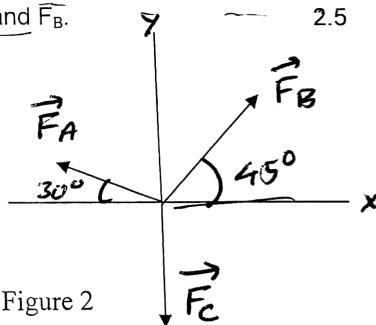


Figure 2

- ✓ 5. Sketch how an impulsive force $F(t)$ may vary with time during a collision starting at time t_i and ending at t_f . Then define the impulse J of the force. Define J when the force is constant over time. 3

Department of Physics
Shahjalal University of Science and Technology

Course Code: PHY 103 (EEE)

Time: 30 min

Total Marks: 10

$$\omega = 2\pi f \quad \omega = \frac{2\pi}{T}$$

Answer all the following questions

1. Write down the differential equation for simple, forced and damped harmonic motion. 3.0
2. Give one example for each of infrasonic, ultrasonic and audible sound. 1.5 ✓
3. The pressure in a travelling sound wave is given by the equation $p = 1.5 \sin \pi (x - 330t)$, where x is in meters, t in seconds and p in N/m^2 . Find the pressure amplitude, frequency, wavelength and speed of the wave.

What quantity, if any, for transverse wave in a string corresponds to the pressure amplitude for longitudinal waves in a tube? 2+1

4. Distinguish between traveling and standing sound wave. 2.5

Shahjalal University of Science & Technology, Sylhet

Department of Physics

B. Sc. (Hons.) 1st Year 1st Semester Examination-2016 (Held in July, 2016)

Course: PHY103 (Mechanics, Waves, Heat and Thermodynamics) for EEE

Full Marks: 70, Credit: 3, Time: 3 hours.

Answer any five questions

[The figures on the right margin indicate full marks]

1. (a) Show that the trajectory of a projectile is parabolic.



[6]

- (b) A stone is thrown from the ground with an initial velocity $\vec{v}_o = (4.9\hat{i} + 9.8\hat{j})$ m/s. Find the magnitude of its velocity (i) at the highest point and (ii) at $t = 0.5$ s.

[3]

- (c) A plane flying horizontally with a speed of 80 m/s releases a projectile. The horizontal distance traveled by the projectile is 900 m when it hits the ground. Find its time of flight and the altitude of the plane.

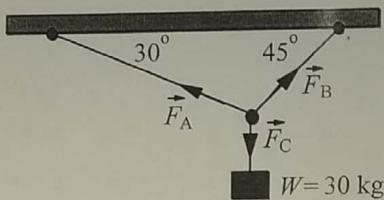
[5]

2. (a) Define mass from Newton's second law of motion. Distinguish between mass and weight of a body.

[3+3]

- (b) The following figure shows a weight $W=30$ kg hung by strings. Consider the knot at the junction of the three strings to be 'the body'. The body remains at rest under the action of the three forces. Find the magnitude of the forces F_A and F_B .

[8]



3. (a) What is a collision? Give three examples.

[1+1
+6]

Show that momentum is conserved during collision.

- (b) A 2.0 kg ball drops vertically onto the floor with a speed of 25 m/s. It rebounds with an initial speed of 10 m/s. (i) What impulse acts on the ball during contact? (ii) If the ball is in contact for 0.02 s, what is the average force exerted on the floor?

[6]

4. (a) Define rigid body. Find a relation between the torque applied to the rigid body and the angular acceleration of this body.

[1+7]

- (b) Mention the 'breakthroughs' by Copernicus, Brahe, Kepler and Newton in motion of the bodies in the solar system.

[4]

- (c) Define gravitational field strength and gravitational potential energy.

[2]

5. (a) What is Doppler effect? Find the frequency received by a detector of sound when the detector and the source both are moving.

[1+8]

- (b) A train blowing its whistle approaches a stationary observer and then leaves him behind. The observer measures a frequency of 219 Hz as the train approaches and a frequency of 184 Hz as the train leaves. The speed of sound is 340 m/s. Find the speed of the train.

[5]

6. (a) State the first and second laws of thermodynamics.

[4]

- (b) Show that, for an ideal gas undergoing a reversible adiabatic process, $PV^\gamma = \text{constant}$, where γ is the ratio, C_p / C_V of the principal heat capacities.

[6]

- (c) Find expressions for the work done by an ideal gas in (i) a reversible isothermal process and in (ii) a reversible adiabatic process.

[4]

7. (a) Define ideal gas from microscopic point of view.

[3]

- (b) Calculate the pressure of an ideal gas from kinetic theory.

[6]

- (c) Sketch a Carnot cycle for an ideal gas. Briefly explain the steps.

[1+3]

Define the efficiency of a heat engine.

+1]

8. (a) What is ultraviolet catastrophe? How did Max Plank correct the formula for spectral energy density?

[2+4]

- (b) Obtain Wien's displacement law. What does this law express?

[4+1]

- (c) How many photons are present in 1.00 cm^3 of radiation in thermal equilibrium of 1000 K?

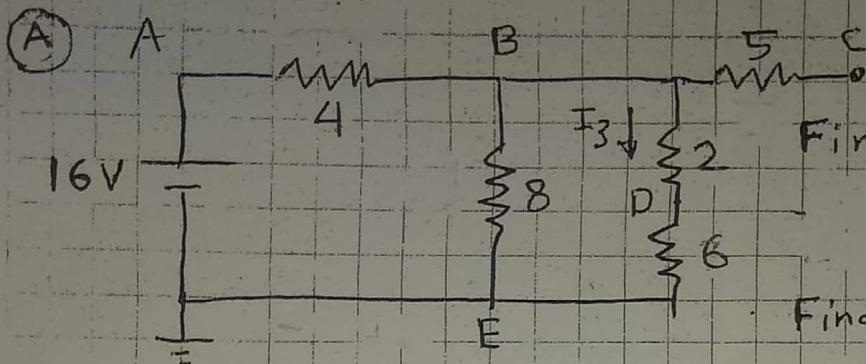
[3]

NAME

REG. NO.

Voltages in V
currents in A
Resistances in Ω
Capacitors in F
Inductors in H

Q2



Find Voltage at C

$$\underline{1} \quad 0$$

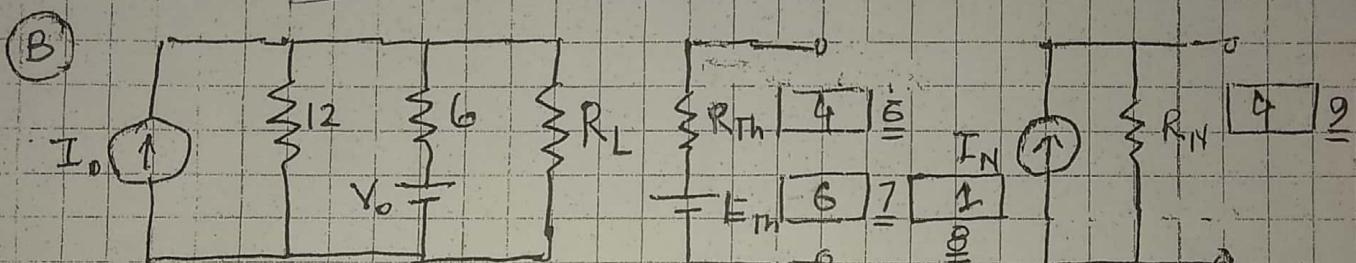
Find current I3

$$I_3$$

$$\underline{2} \quad 0.5$$

If the ground is connected at point D

Find voltages at:-



$$(use I_o = 3) \quad (use I_o = 6)$$

$$V_o = 6$$

$$V_o = 18$$

(C) Calculate the current through

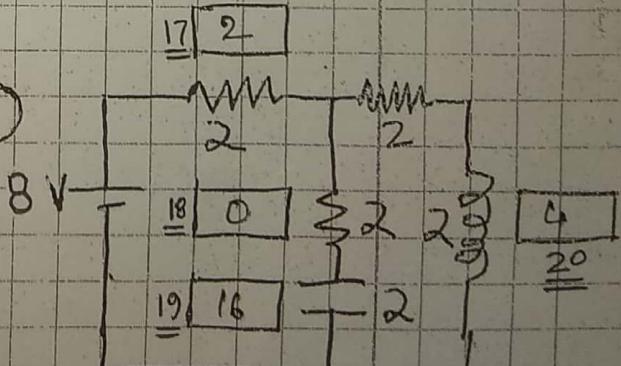
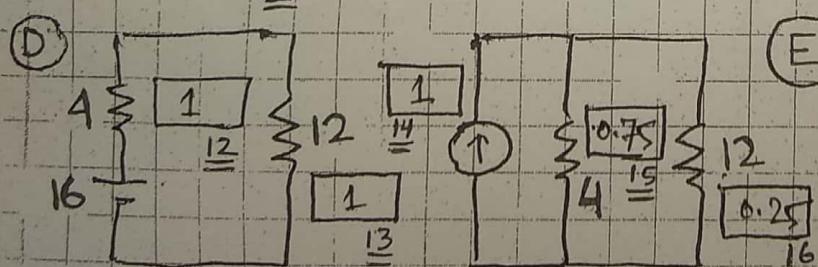
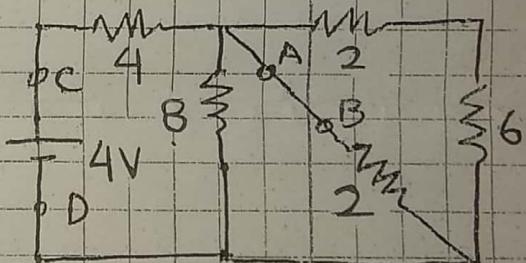
The location AB [] Now replace

The voltage source at CD with short

and place the voltage source at AB.

Calculate the current at short

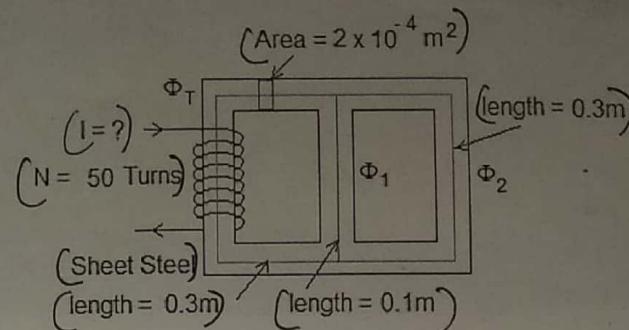
CD [].



The voltage source at left is converted into current source in right. Find currents through the resistors.

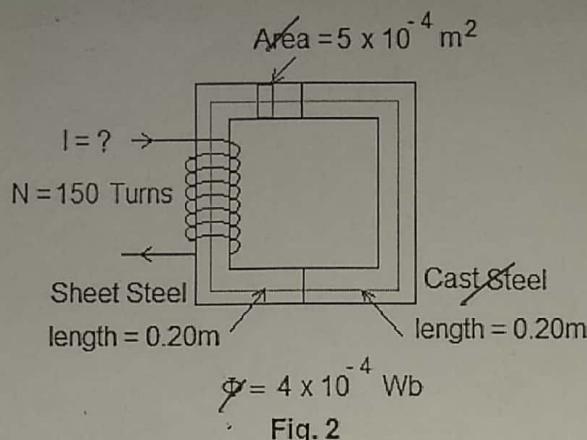
Find the energy stored at the capacitor and inductor and power dissipating at resistors.

1. Determine the current for Fig. 1. [10]



$$(\Phi_1 = 3 \times 10^{-4} \text{ Wb}) \quad \Phi_1 = 1 \times 10^{-4} \text{ Wb}$$

Fig. 1



$$\Phi = 4 \times 10^{-4} \text{ Wb}$$

Fig. 2

2. Determine the current for Fig. 2. [20]

$$A \propto \frac{1}{B}$$

$$B = 4 \text{ T}$$

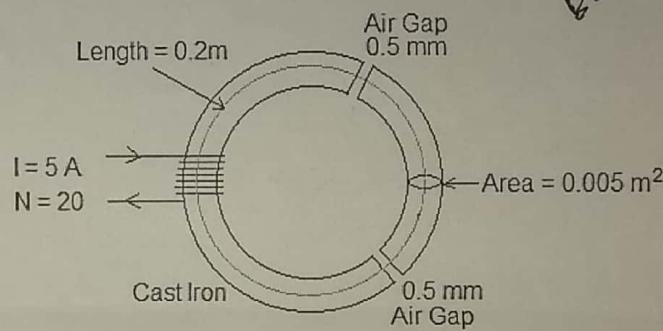
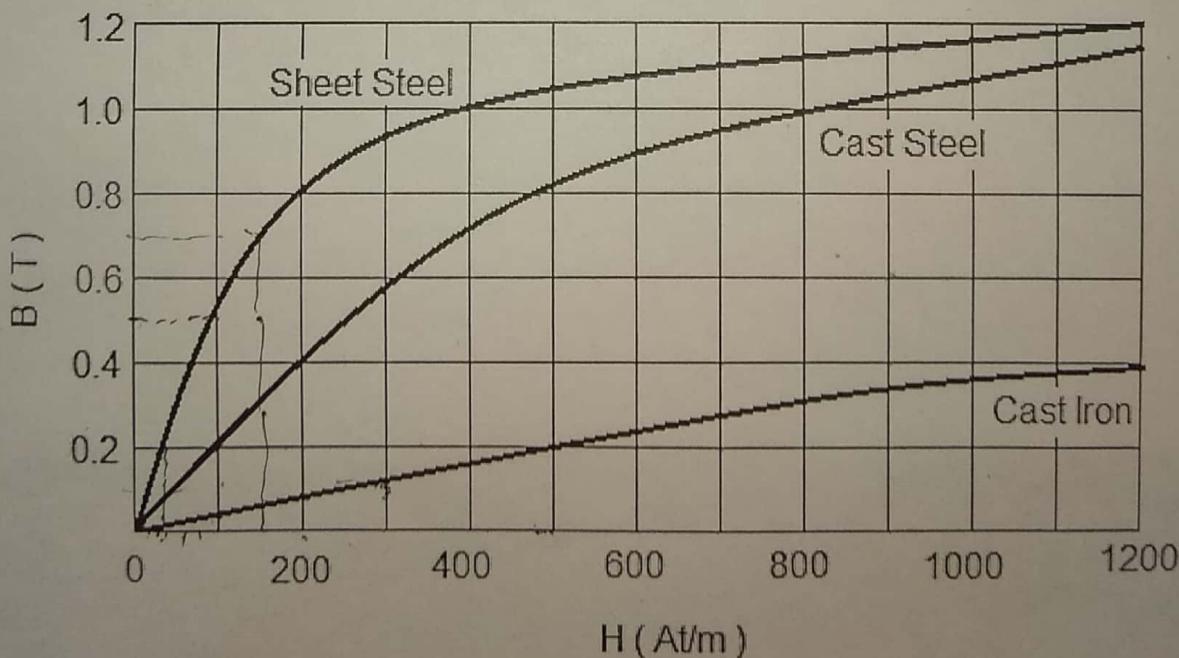


Fig. 3



$$\mu = \frac{B}{H}$$

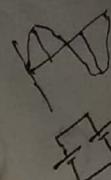
$$= \frac{T}{A} \cdot \frac{m}{A} = \frac{T}{A} = \frac{Wb/m}{A}$$

Shahjalal University of Science and Technology
Dept. of Electrical and Electronics Engineering
EEE 121: Electrical Circuits I

1st Year 1st Semester Examination Jun. 2016 (Session 2015-16)

Full marks: 100 Time: 3 Hours

(Answer every question)



Group A

1. Answer any 15 questions in 1 line or less. [15 x 1]

- (a) Find effective voltage of a sinusoidal voltage of amplitude 169.7 V.
- (b) True or False: voltage sources cannot be connected in series.
- (c) If E is connected to ground, from the circuit shown in the Fig. 1 find I_1 and V_A .
- (d) If E is connected to ground, from the circuit shown in the Fig. 1 find power in the 10Ω resistor between B and E.
- (e) If E is connected to ground, from the circuit shown in the Fig. 1 find I_2 and V_C .
- (f) What is the energy stored in an inductor of inductance $5H$ when $2A$ current is flowing through it?
- (g) what is the energy stored in a resistor?
- (h) During discharging in a RC circuit of time constant 2 ms , after what time will the voltage be 50% of its initial value?
- (i) What is the dimension of I^2R^2C ?
- (j) Why one should not disconnect an inductor from a current flowing circuit?
- (k) Net capacitance of two capacitors in series is 10 nF , if one of them is 25 nF what is the capacitance of the other?
- (l) What happens if an ammeter is not of negligible resistance?
- (m) How do you convert a voltage source into current source?
- (n) How do you convert a current source into voltage source?
- (o) True or False: Superposition theorem does not work for power calculation.
- (p) What is B, H and Φ called in magnetic circuit?
- (q) What is power factor?

2. Answer any three questions. [3 x 5]

- (a) Stating from the expression $V = L \frac{dI}{dt}$ for a simple LR circuit set up a differential equation to find the voltage and current across the inductor during connecting phase.

- (b) If the voltage across a capacitor is shown in the Fig. 2, sketch the current through the capacitor. If the given voltage is across an inductor sketch current through the inductor.

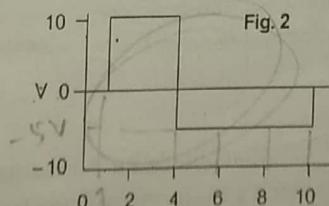


Fig. 2

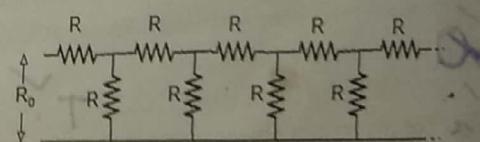
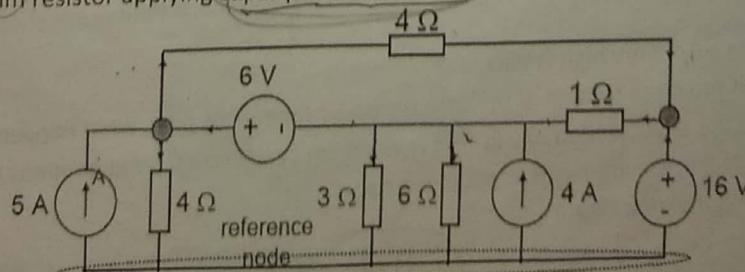


Fig. 3

- (c) Find the equivalent resistance R_0 of the infinitely long resistor network as shown in the Fig. 3 if every resistor has the same value R .

- (d) Find voltage across 6Ω resistor applying super position theorem in following figure



$$i_{0.15} = e^{-t/C} = -t/C$$

$$I = C \frac{dV}{dt}$$

$$C = L \frac{dI}{dt}$$

$$V = L \frac{dI}{dt}$$

3. Answer any two questions. [2 x 10]

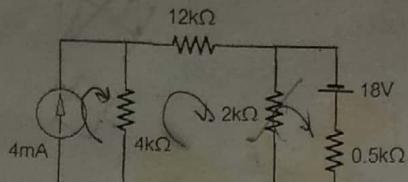


Fig. 4

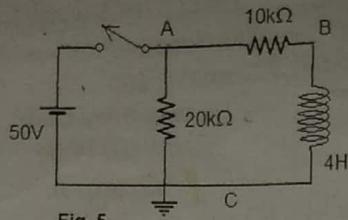


Fig. 5

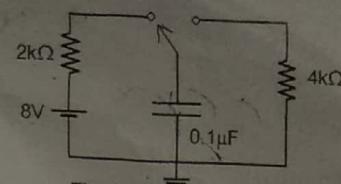


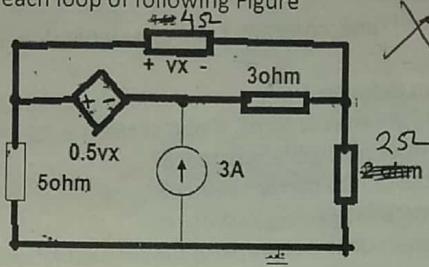
Fig. 6

D (a) (i) Find the current through the $2\text{k}\Omega$ resistor as shown in Fig. 4 by converting the current source into Voltage source and using Mesh analysis. (ii) Do the same keeping the current source as it is using Mesh analysis.

(b) (i) Find V_L , I_L and voltages V_1 and V_2 across the resistors $R_1 = 10\text{k}\Omega$ and $R_2 = 20\text{k}\Omega$ as shown in Fig. 5, as function of time after connection and disconnection. (ii) Find the voltages at A, B and C right after connection and disconnection.

(c) Calculate and sketch the capacitor voltages and currents through the two resistors as shown in Fig. 6 during charging and discharging phase by flipping the switch from one side to the other. Make sure you show the direction of current properly.

(d) Apply Mesh analysis to find current in each loop of following Figure



Group B

4. Answer any 15 questions in 1 line or less. [15 x 1]

P (a) If D is connected to ground, from the circuit shown in the Fig. 1 find voltages at B, D and E.

P (b) If D is connected to ground, from the circuit shown in the Fig. 1 find power in the $10\text{ }\Omega$ resistor between A and B.

P (c) If D is connected to ground, from the circuit shown in the Fig. 1 find I_2 and V_C .

P (d) True or False: Current sources cannot be connected in series.

P (e) What is the power dissipation in a capacitor, inductor and resistor?

P (f) What is the energy stored in a capacitor, inductor and resistor?

P (g) What is the value of μ_0 ? ✓

P (h) What is the Dimension of LC? T ✓

P (i) For maximum power transfer through load resistor what should be the resistance of the network as seen by the load?

P (j) True or False: One cannot find Norton current source and Norton resistor from Thevenin voltage source and Thevenin resistor of a network.

P (k) Sketch the voltage across a capacitor if you try to charge and discharge in a time much shorter compared to the RC time constant.

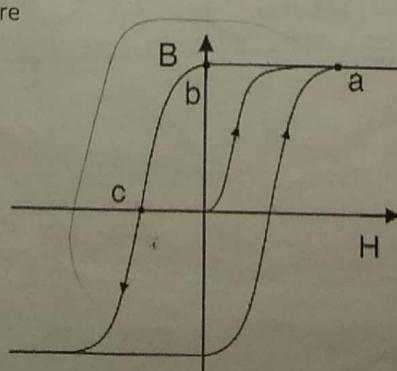
P (l) Why should a voltmeter be of very high resistance?

m In a magnetic circuit if the cross section of the core is smaller for certain part, what happens to Φ at that part?

n In a magnetic circuit if the cross section of the core is wider for certain part, what happens to B at that part?

o True or False: Magnetic flux is continuous in magnetic circuit.

p What is represented in following Figure



(q) How we can come back to origin of the curve in Figure 4 using a ferromagnetic material?

5. Answer any three questions. [3 x 5]

- (a) Stating from the expression $Q = CV$ for a simple RC circuit, setup a differential equation and solve it to find the voltage and the current across the capacitor during charging phase.
- (b) Sketch the current I and voltage V for a capacitor during charging and plot $V \times I$ which shows the power supplied to the capacitor. What happens to this power? What happens during discharging?
- (c) (i) For a ring-shaped circular magnetic core with a tiny air gap discuss the nature and continuity of H , B and Φ along the ring. (ii) What happens to H , B and Φ if the air gap is large?
- 936 (d) Show that $C = C_1 + C_2$ for parallel connection and $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$ for series connection of two capacitors. What is total L for two inductors L_1 and L_2 when connected in series and in parallel?

6. Answer any two questions. [2 x 10]

- (a) (i) Find the Thevenin equivalent Circuit for network shown in Fig.

assuming the $2\text{k}\Omega$ as the load resistor. (ii) Find the Norton equivalent Circuit for the same case following the procedure of finding Norton equivalent circuit. (iii) Convert the Thevenin voltage circuit into a current source and show that it is the Norton equivalent circuit.

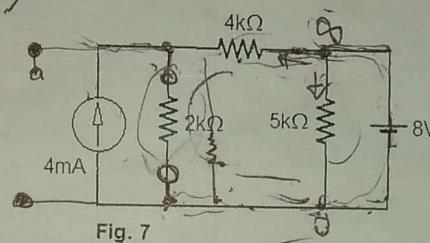


Fig. 7

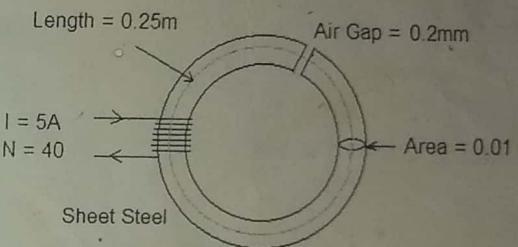


Fig. 8

(b) Using Superposition Theorem find the current through $2\text{k}\Omega$ resistor for the network in Fig. 7

Determine the magnetic flux for the Sheet steel ring with a tiny air gap shown in Fig. 8. (use B-H curve of Fig 9)

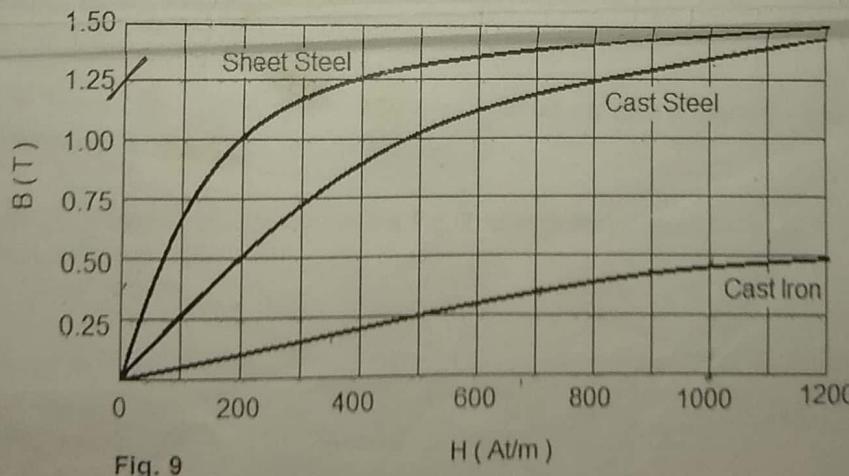


Fig. 9

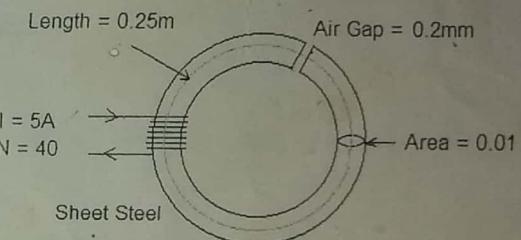
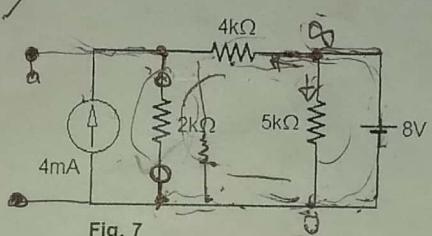
5. Answer any three questions. [3 x 5]

- (a) Stating from the expression $Q = CV$ for a simple RC circuit, setup a differential equation and solve it to find the voltage and the current across the capacitor during charging phase.
- (b) Sketch the current I and voltage V for a capacitor during charging and plot $V \times I$ which shows the power supplied to the capacitor. What happens to this power? What happens during discharging?
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- Q36 (d) Show that $C = C_1 + C_2$ for parallel connection and $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2}$ for series connection of two capacitors. What is total L for two inductors L_1 and L_2 when connected in series and in parallel?

6. Answer any two questions. [2 x 10]

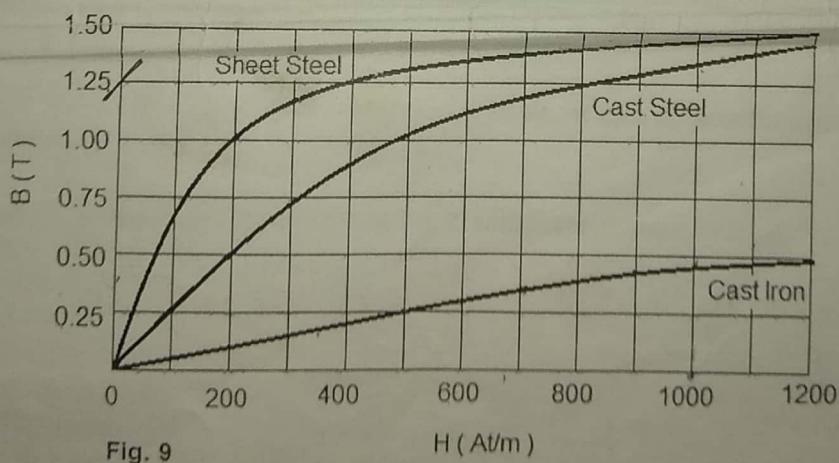
(a) (i) Find the Thevenin equivalent Circuit for network shown in Fig.

assuming the $2\text{k}\Omega$ as the load resistor. (ii) Find the Norton equivalent Circuit for the same case following the procedure of finding Norton equivalent circuit. (iii) Convert the Thevenin voltage circuit into a current source and show that it is the Norton equivalent circuit.



(b) Using Superposition Theorem find the current through $2\text{k}\Omega$ resistor for the network in Fig. 7

(c) Determine the magnetic flux for the Sheet steel ring with a tiny air gap shown in Fig. 8. (use B-H curve of Fig 9)



May 17, 2016
1:00 to 5:00 pm

A

$$\textcircled{*} V = 100 \text{ Ohms} \cdot \frac{1}{T} : T = \frac{1}{1000} \text{ s} = 1\text{mV}$$

$$\textcircled{*} V = 2V$$

$R = 7.53 \text{ k}\Omega$
 $C = 10 \mu\text{F}$
 $0.02 \mu\text{F}$

EEE 122 Lab Exam in 10 easy steps!

(Total time: 30 minutes maximum.)

You will use the lab equipment only during steps 5, 6, 7 and 8)

1. Draw a simple RC or RL Circuit (your choice!).
2. Draw the input and output signals you expect to see.
3. If you apply sinusoidal signal as input instead of square wave, what do you expect to see? Draw on your script.
4. Get your exam paper signed by the teacher at this point.
5. Make a simple RC or RL circuit with the supplied components.
6. Show the traces of input voltage signal in channel(1) and V_C (or V_L for RL circuit) in channel(2) of the oscilloscope. Make sure the setting is right.
7. Change the input signal from square wave to sinusoidal wave. How does it look?
Sketch it on your script.
8. Go to x-y setting. How does it look? Sketch on the script.
9. From the measured values calculate time constant (RC or L/R) and estimate the value of C or L. What is your percentage of error?
10. Go to your teacher with all the previously signed reports to have fun with the viva!