

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2016
Department of Computer Science and Engineering
CHEM 1207
Chemistry

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define σ and π bonds. Show the electronic distribution in the structural formula of the following molecules (write the Lewis structure) (09)
i) POCl_3 ii) N_2O_4 iii) HClO_3 iv) HClO_4
b) Indicate the different types of bond that are present in the following compounds: (06)
i) NaCl ii) $(\text{H}_2\text{O})_x$ iii) $\text{Cu}(\text{NH}_3)_4\text{Cl}_2$
c) Draw the molecular orbital diagram of NO^- . Illustrate the geometry and nature of hybridization of following molecules: (12)
i) PCl_5 ii) SF_6 iii) HgCl_2
d) Discuss about the superiority of MOT over VBT on explaining the paramagnetic property of O_2 molecule? (08)
2. a) Write down the principle and mechanism of Li-ion battery (with diagram). (09)
b) Define e.m.f. Deduce Nernst equation. Draw and explain electrolytic cell. (13)
c) Write short notes on- (06)
i) Transport number ii) Electrical double layer
d) The e.m.f. of the following cell at 298K is 0.5V (07)
 $\text{Pt, H}_2 (1 \text{ atm}) \mid \text{H}^+ \parallel \text{KCl (Sat-)} \mid \text{Hg}_2\text{Cl}_2 \mid \text{Hg}$
Calculate the pH of the unknown solution, $E_{\text{cell}} = 0.2415\text{V}$.
3. a) Define crystal system. Illustrate with examples unit cells of Hexagonal and Rhombohedral crystal systems. (08)
b) "Parallel planes of a crystal have the same Miller Indices", explain. Why is it important to know Miller Indices in material sciences? (09)
c) Consider a metal with FCC structure and atomic weight of 92.9. When monochromatic X-radiation having a wave length of 0.1028 nm is focused on the crystal, the angle of diffraction (2θ) for the (311) set of planes in this metal occurs at 71.2 degrees for the first order reflection $n = 1$. Calculate - (08)
i) the inter-planar spacing for this set of planes
ii) lattice parameters for this metal
iii) density of the metal (g/cm^3)
d) Write short notes on- (10)
i) Schottky and Frenkel defects
ii) Structure and properties of Si
4. a) Define overlap zone, forbidden zone, conduction band and non conduction band. (10)
b) How can you calculate the IR drop in an electrolytic cell? (07)
c) Discuss the bonding character of the elements N and P with special reference to their positions in the periodic table. (08)
d) What is non-stoichiometric defect? Explain with examples. Draw a crystal structure of Ge. (10)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What is conducting polymer? Distinguish among electron-conducting polymers, proton-conducting polymers and ion-conducting polymers. (12)
b) Describe the conduction mechanism of conducting polymers based on soliton. (10)
c) Discuss the free radical mechanism of polymerization with suitable examples. (08)
d) How can you prepare regioregular poly (thiophene)? (05)

6. a) What do you mean by oligomer and polymer? Describe the structural differences relating to thermo-setting and thermo-plastic properties of polymer. (12)
- b) Classify the polymers mechanically according to their T_g and T_m value. (08)
- c) Explain the basic principle and instrumentations of spectroscopic technique. (10)
- d) Calculate the vibrations frequency, ν_{\max} (in cm^{-1}) for $-\text{C}=\text{O}$ and $-\text{C}\equiv\text{N}$ groups. (05)
7. a) Define singlet state and triplet state. (06)
- b) From Jablonski energy diagrams explain fluorescence and phosphorescence. (12)
- c) Describe the photosensitized formation of formaldehyde from H_2 and CO in the presence of trace amounts of mercury vapor. (10)
- $$\begin{array}{c} \text{O} \quad \text{O} \\ \parallel \quad \parallel \\ \text{H}-\text{C}-\text{C}-\text{H} \end{array}$$
- Some $\text{H}-\text{C}-\text{C}-\text{H}$ is formed during the reaction. Explain how.
- d) What do you mean by wave number and quantization of energy? Calculate the energy associated with a radiation having wave length 5000 \AA . (07)
8. a) Why does a change in dipole moment during vibration of a molecule necessary for a molecule to be IR active? (04)
- b) Explain why symmetric stretching of CO_2 is IR inactive. (03)
- c) Determine the vibrational degrees of freedom for nonlinear C_6H_6 molecule. (04)
- d) Define fundamental bands, first overtone and second overtone. Among these, fundamental bands are the most intense peaks. Explain this by Boltzman distribution law? (15)
- e) Determine which atoms are NMR active among ^1_1H , ^2_1H , $^{12}_6\text{C}$, $^{13}_6\text{C}$, $^{17}_8\text{O}$, $^{19}_9\text{F}$. Why is external magnetic field necessary for NMR spectroscopy? (09)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2016
Department of Computer Science and Engineering
CSE 1201

Structured Programming

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer ANY THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer ANY THREE questions from this section in Script A)

1. a) Define identifier and keyword. Find identifiers and keywords from the following program: (10)

```
#include<stdio.h>
void MAX(int val1, int val2)
{
    if(val1 > val2)
        printf("%d", val1);
    else
        printf("%d", val2);
}
int main()
{
    int a, b;
    scanf("%d%d", &a, &b);
    MAX(a, b);
    return 0;
}
```

- b) Why is symbolic constant necessary? How does compiler process symbolic constant? (08)
Explain with example.
- c) Suppose you have a data type myType. The size of myType is 5 bits. If the following code (10)
segment is executed then what will be the output? Explain your answer.

```
signed myType x = 20;
signed myType y = -22;
printf("%d %d", x, y);
```

- d) Why is typedef used? Explain with example. (07)

2. a) Define automatic type conversion. How does automatic type conversion work for (10)
 $x = a/b + c - b * l$, where a, b, c, l and x are double, integer, float, short int and long int
respectively.

- b) What will be the output of the following code segments? Explain. (08)

```
int x = 2, y = 0;          int a = 2, b = 7, c = 10;
int z = (y++) ? 2 : y == 1 && x;  c = a == b;
printf("%d\n", z);        printf("%d", c);
```

(i)

(ii)

- c) Write a program to calculate the sum of the following series for first n terms. (10)

$$\frac{1}{6} + \frac{1}{11} + \frac{1}{21} + \frac{1}{36} + \dots$$

- d) What is the advantage of using enum over symbolic constant? (07)

3. a) What is the basic difference between else if ladder and switch? Explain with example. (10)
b) Why is variadic function necessary? Write a program to calculate the average marks of a (13)
student based on N courses.

c) Determine the output of the following programs. Explain your answer.

(12)

```
#include<stdio.h>
int main()
{
    static int i = 0;
    jump:
    {
        int i = 5;
        printf("%d ", i);
        i++;
    }
    if(i < 7)
        i++;
    goto jump;
    return 0;
}
```

(i)

```
#include<stdio.h>
int main()
{
    int i = 2;
    for(++i; i++; ++i)
    {
        printf("%d", i);
        if(i = 3)
            break;
    }
    return 0;
}
```

(ii)

4. a) Define recursion. Explain the basic Fibonacci problem using recursion for n th position Fibonacci number. (12)
- b) Write a program that may take a number from user in *main.c* file then sends it to a user-defined function "void COMPUTE(int)" whose definition is in *compute.c* file. COMPUTE function computes the sum of the digits of the number. In *main.c* file, print the summation of the digits of the number. Also use header file for "void COMPUTE(int)". (13)
- c) Explain the purpose of using header guards with appropriate example. (10)

SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Declare and initialize a variable of "World" structure and print the member data of that variable. (08)

```
#include<stdio.h>
int main()
{
    struct Bangladesh{
        char c;
        float d;
    };
    struct World{
        int a[3];
        char b;
        struct Bangladesh Khulna;
    };
    // Declare and initialize a variable of "World" structure
    // Print the declared variable
    return 0;
}
```

- b) What are the outputs of the following programs and explain the outputs. (10)

```
#include<stdio.h>
int main()
{
    char str[25]= "ABCDEFGHJIJ";
    printf("%s\n", str+2);
    return 0;
}
```

(i)

```
double values[][3]={{1.2}, {9.2,-1.2},
                    {7.3, 7.9, 4.8}};
int i = 0, j = 0;
for( i = 0; i<= 2; i++ ){
    for( j = 0; j< 3; j++ )
        printf("%lf", values[i][j]);
    printf("\n");
}
```

(ii)

- c) Write a program to split the strings into parts by delimiters like comma, space, dollar sign, and ampersand. (09)
- d) Write down the macro definitions for the followings: (08)
- To find arithmetic mean of two numbers.
 - To convert a uppercase alphabet to lowercase.

6. a) Write a program to store information using structures with dynamic memory allocation. (10)

Sample Inputs:

Enter number of records: 2
 Enter name of the subject and marks respectively:
 Programming
 22
 Enter mane of the subject and marks respectively:
 Structure
 33

Sample output:

Displaying Information:
 Programming 22
 Structure 33

- b) Point out the errors, if any, and explain the outputs in the following programs (08)

<pre> struct S{ int i; struct S *p; }; int main() { struct S var1, var2; var1.i = 100; var2.i = 200; var1.p = &var2; var2.p = &var1; printf("\n%d %d", var1.p->i, var2.p->i); } </pre> <p>(i)</p>	<pre> #include<stdio.h> int main() { FILE *fp; openfile("Myfile.txt", fp); if(fp ==NULL) printf("unable to open file"); } openfile(char *fn, FILE **f){ *f = fopen(fn, "r"); } </pre> <p>(ii)</p>
---	--

- c) Write a program to carry out the following: (09)

- i) Read a text file 'INPUT.TXT'
- ii) Write each word in reverse order in a text file 'OUTPUT.TXT'

Example:

Input: THIS IS MY COUNTRY

Output: SIHT SI YM YRTNUOC

Assume that each word length is maximum of 10 characters and each word is separated by newline/blank characters.

- d) Use the "stringing" and "token-pasting" operator to define a macro called *display(s, i)* that will give output: Display → y3 = 6 where (08)

```

main(){
    int y3 = 6;
    //call display macro with proper parameters
}

```

7. a) Write the value of j and k for each statements (04)

```

double i = 4, *j, *k;           //sizeof(double) = 8
j = &i;                         //Address of i = 16 (Assume)
j = j+1;                        //j = _____?
j = j+3;                        //j = _____?
k = j+4;                        //k = _____?
k = j-3;                        //k = _____?

```

- b) Assume we have two user-defined functions: (10)

```

float *one(double *a, int b);    //Function1
float two(/* pass appropriate parameters */); //Function2

```

How to pass function "one" and character 'k' as parameters to function "two"? How to call function "one" from inside the function "two"? Give sample code of it.

- c) Describe following declaration involving pointers: (10)

- i) `int *(*k[5])(char (*a)[])`
- ii) `char (*p(double *a))[4]`

d) Write a structure declaration for the following situations. Assume a 16-bit integer word. (11)
Define three-bit fields, called a, b and c, whose widths are 8 bits, 6 bits, and 5 bits respectively. Force b to the beginning of the second word of storage. Separate b and c with 2 vacant bits.

8. a) What is a self-referential structure? Explain with example(s). (05)
b) Assume that you want to submit your solution to any online judge (UVA, Codeforces, etc.). (11)
But your solution of any problem must contain the below statements.

```
freopen("fi.txt", "r", stdin);  
freopen("fo.txt", "w", stdout);
```

But we know that when we submit a solution into any online judge, it does not permit to open a file for reading and writing. What will be the solution without comment out (//or /*....*/) or delete the above two statements? Give an example with proper explanation.

- c) The outline of C program is shown below: (12)

```
int main(int argc, char *argv[]){  
.....  
}
```

- i) Suppose the compiled object program is stored in a file called demo.exe, and the following commands are issued to initiate the execution of the program.

```
demo debug fast
```

Determine the value of argc and the non-empty elements of argv.

- ii) Suppose the command line is written as

```
demo "debug fast"
```

How will this change affect the values of argc and argv?

- d) What is the significance of EOF? Why do we close a file? (07)

OKHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 2nd Term Examination, 2016
 Department of Computer Science and Engineering
 CSE 1203
 Digital Logic Design

TIME: 3 hours

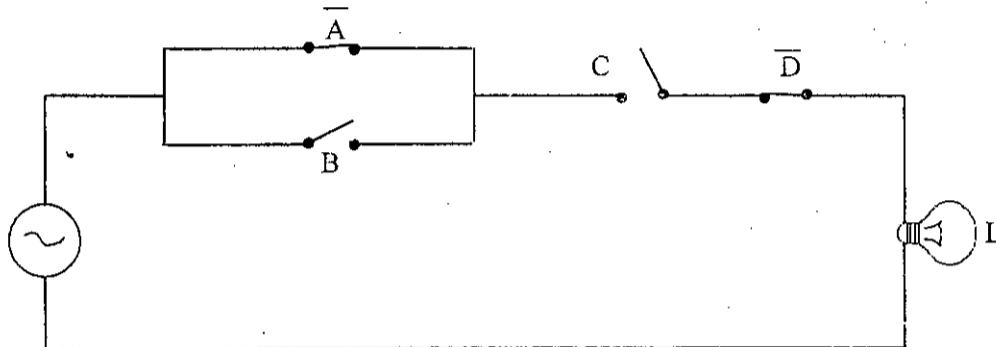
FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.

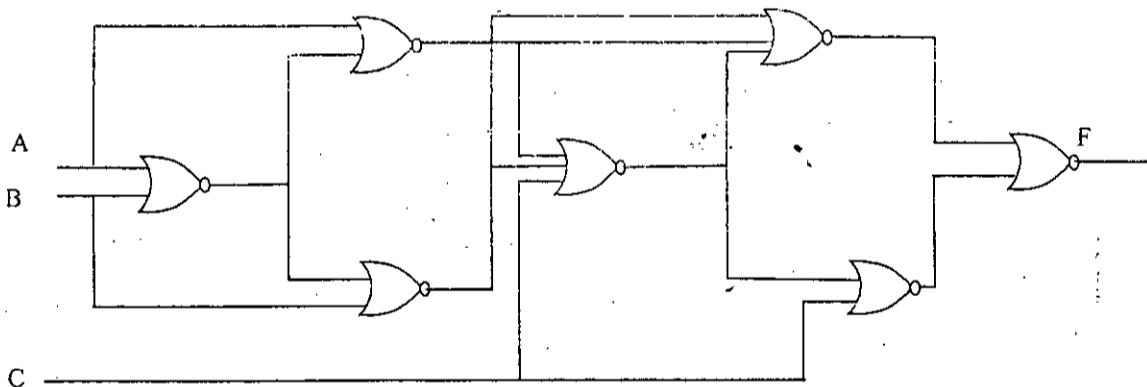
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What do you mean by Self-Complementing code? Explain it using an example. (06)
- b) Show that NOR and NAND gates are functionally complete. (09)
- c) What is a switching function? Express the following switching circuit in binary logic notation (05) in terms of L. Hence, find its truth table.



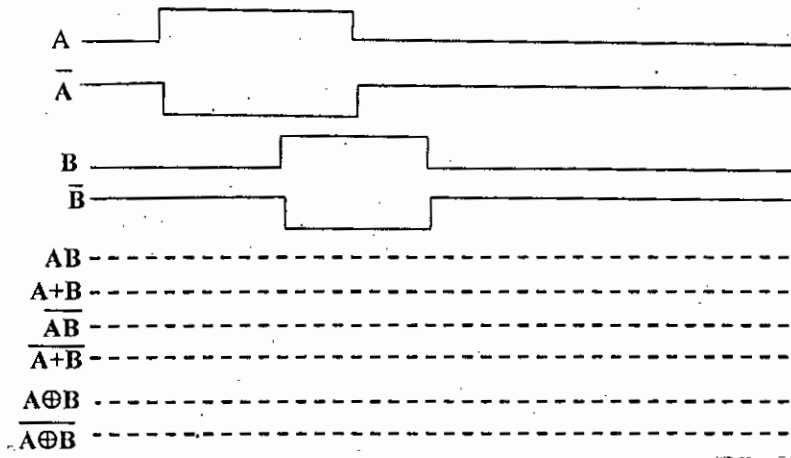
- d) Derive the circuits for a three-bit parity generator and four-bit parity checker using an odd parity bit. (10)
- e) Define a Logic gate. Derive the logic equation and its corresponding truth table for the (05) following logic diagram.



2. a) What is a combinational logic circuit? Explain the combinational circuit design procedure (09) using an example.
- b) A hardware engineer has been asked to design an alarm circuit which will be operated as follows: (06)
 "The alarm will ring if and only if the alarm switch is turned on and the door is not closed, or it is after 6p.m and the window is not closed". *Design it*
- c) What is "minterm" and "maxterm"? Find the minterm and maxterm expressions of the (10) following function $f(a, b, c, d) = \bar{a}(\bar{b} + d) + ac\bar{d}$.
- d) Implement the following Boolean function using tabulation method. (10)
 $F(A, B, C, D) = \sum(0, 1, 2, 8, 10, 11, 14, 15)$
3. a) What is a full-adder? Show how a full-adder can be converted to a full subtractor with the (08) addition of one inverter circuit.
- b) Design a combinational circuit that multiplies 2 unsigned 4 bit numbers. Use AND gates and (11) binary adders.

c) Complete the following timing diagram.

(06)



d) What is a look-ahead carry generator? Design a look-ahead carry generator circuit for a 4-bit parallel adder. (10)

4. a) What is a multiplexer circuit? Explain how a full-adder circuit can be implemented using multiplexers. (10)

b) Implement the following Boolean functions using PAL. (10)

i) $X(A, B, C) = \Sigma(2, 3, 5, 7)$

ii) $Y(A, B, C) = \Sigma(0, 1, 5)$

iii) $Z(A, B, C) = \Sigma(0, 2, 3, 5)$

c) Given a 64×8 ROM chip with an enable input, show the external connection necessary to construct a 256×8 ROM with four chips and a decoder. (07)

d) Specify the size of a ROM (number of words and number of bits per word) that will accommodate the truth table for the following combinational circuit components. (08)

i) A binary multiplier that multiplies two 4-bit numbers.

ii) A 4-bit adder-subtractor

iii) A quadruple 2 to 1 line MUX with common select and enable inputs.

iv) A BCD to seven segment decoder with an enable input.

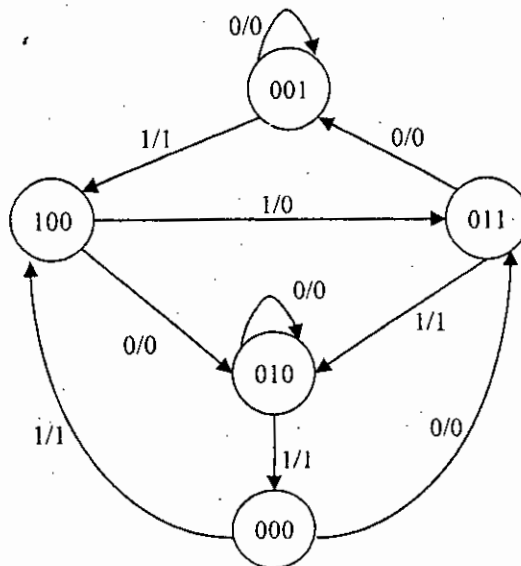
SECTION B

(Answer ANY THREE questions from this section in Script B)

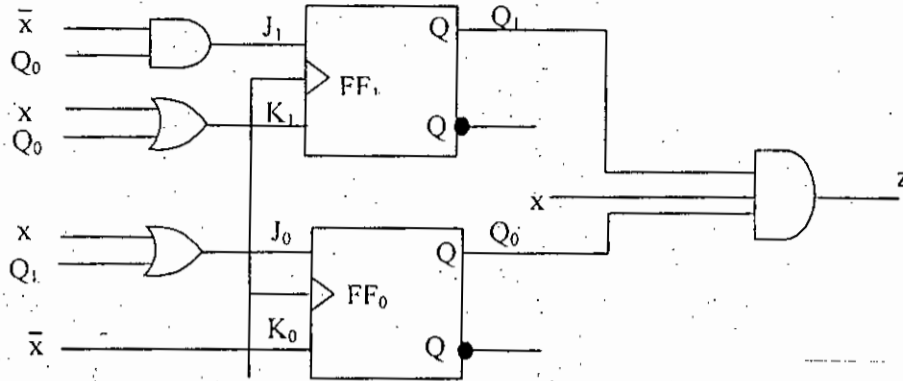
5. a) What is a sequential circuit? Explain different kind of sequential circuit models using example(s). (12)

b) What is a flip-flop? Discuss how a clocked JK flip-flop can be constructed using logic gates. Hence, derive its characteristic equation. (09)

c) For the following state-diagram, design a Mealy-machine using T-flip-flops. The circuit will have one input and one output. (14)



6. a) Why do you need to analyze a sequential circuit? Analyze the following circuit in terms of (13) the followings:
- Input and output equations.
 - State Table.
 - State diagram.



- Design a 3-bit Gray code synchronous counter using T-flip-flops. (10)
 - "Circuit design with JK flip-flop gives more don't care options with respect to other flip-flop" (06) –justify the statement with flip-flop excitation tables.
 - Draw the circuit diagram of a 4-bit up-down Asynchronous counter and explain its operation. (06)
7. a) The content of a 4-bit shift register is initially 1101. The register is shifted six times to the (06) right with the serial input 101101. What is the content of the register after each shift?
- b) Why do you need to reduce the number of states? Reduce the number of states in the (10) following state table and tabulate the reduced state table.

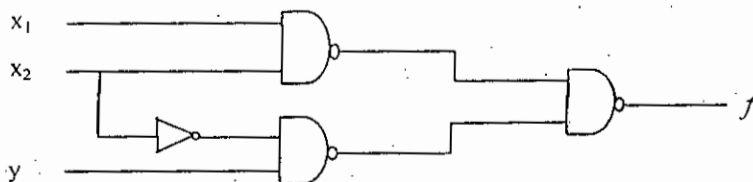
Present State	Next State		Output	
	x = 0	x = 1	x = 0	x = 1
a	f	b	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

- Construct a T-flip-flop using JK flip-flops and other gates (if necessary). (06)
- A hardware engineer has been asked to design a sequence detector which has one input, x and (13) one output, z. The proposed detector will examine a string of 0's and 1's applied to the x input and generates an output z=1 only when a prescribed input sequence occurs. It is assumed that the input x can only change between clock pulses. A typical input and the corresponding output sequence are given below.

x	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	0
z	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0
time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Now, design the sequence detector using D-flip-flops.

- What is state assignment? List the three guidelines which are useful in making state (10) assignments, and apply these guidelines for a particular state table.
- What is the difference between serial and parallel transfer? Which types of register is used in (08) each case? Explain.
- Explain the different kind of hazards that may present in combinational networks. Identify the (12) kind of hazards present in the following circuit. Explain how to remove it from the circuit.



- Differentiate between a register and a latch. (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 2nd Term Examination, 2016
 Department of Computer Science and Engineering
 EEE1217
 Analog Electronics

TIME: 3 hours

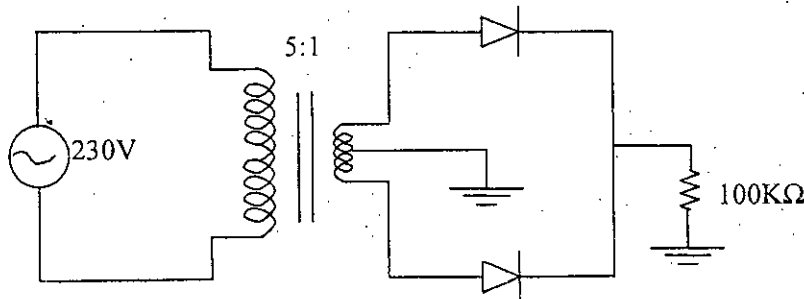
FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.
 iii) Graph paper will be provided if required.

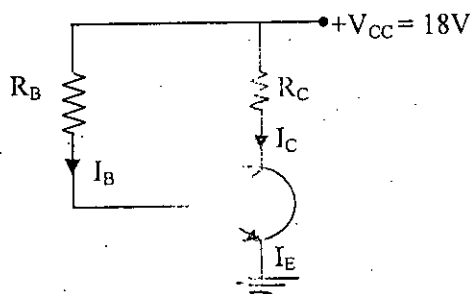
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) How depletion layer is formed in a p-n junction? Explain the p-n diode at different biasing (14)
 condition.
 b) In the centre-tap circuit shown below, the diodes are assumed to be ideal. (10)
 Find (i) d.c. output voltage, (ii) peak inverse voltage, (iii) rectification efficiency

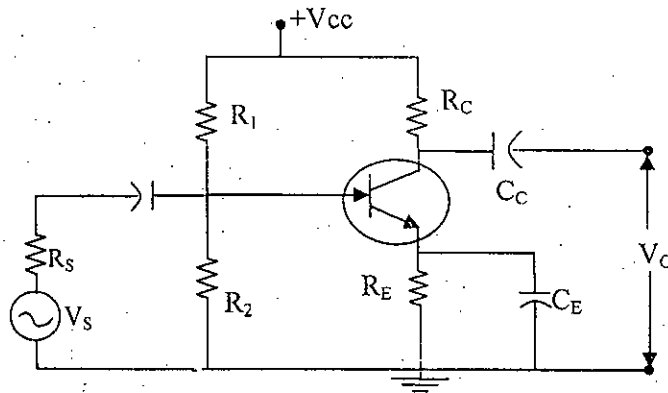


- c) Differentiate between avalanche and zener breakdown of a diode. (06)
 d) Mention the effects of temperature on semiconductor devices. (05)
2. a) Describe the construction and working principle of a n-p-n transistor. (10)
 b) Show that (i) $I_C = \frac{\alpha}{1-\alpha} I_B + \frac{I_{CBO}}{1-\alpha}$, (ii) $\beta = \frac{\alpha}{1-\alpha}$, and (iii) $S = \frac{\beta+1}{1-\beta \frac{dI_B}{dI_C}}$, where the (12)
 symbols have their usual meanings.
 c) What is faithful amplification? Mention the conditions for faithful amplification. (07)
 d) Write short notes on operating point. (06)
3. a) What do you mean by hybrid parameters? Why is it called so? Show that, the voltage gain of (10)
 a common emitter amplifier is, $A_v = \frac{-h_{fe}}{z_{in} \left(h_{oe} + \frac{1}{r_L} \right)}$
 b) What is thermal runaway? Briefly explain. (05)
 c) "CMOS act as an inverter"- justify this statement. (08)
 d) Design base resistor bias circuit for a CE amplifier such that operating point is $V_{CE} = 8V$, and (12)
 $I_C = 2mA$. If the supplied DC voltage is 15 volt and $\beta = 50$, calculate the value of load
 resistance that would be employed for the following circuit.

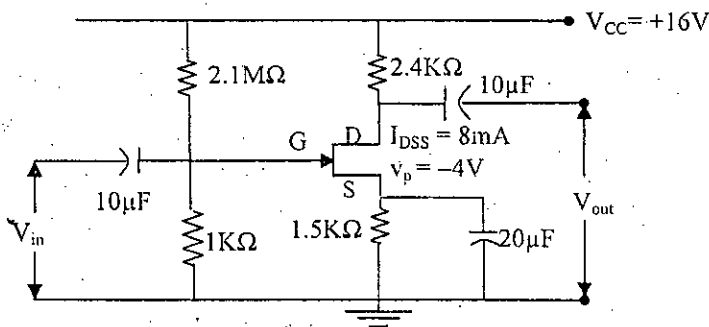


4. a) Classify FET with examples. Explain the operation of a n-channel JFET. (12)
 b) Explain the operation of Darlington pair circuit and show that, $\beta = \sqrt{\beta_1 \times \beta_2}$ (07)

- c) Draw an ac equivalent circuit of the transistor amplifier configuration as shown in the following figure. (07)



- d) Determine the followings for the circuit as shown below (09)
 (i) V_D , (ii) V_S , (iii) V_{DS} and (iv) V_{DG}



SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Draw the two transistor model of an SCR. Explain SCR characteristics with indicating holding current, forward and reverse blocking regions. (09)
 b) With neat sketch, explain the working principle of SCR half-wave rectifier. Also derive the expression of output voltage and current. (09)
 c) A UJT has 10V between bases. If the intrinsic stand off ratio is 0.65, find the value of stand off voltage. If forward voltage drop in the p-n junction is 0.7V, find peak point voltage. (07)
 d) For UJT relaxation oscillator, show that $f \cong \frac{1}{R_1 C \ln \left[\frac{1}{1-\eta} \right]}$, where the symbols have their usual meanings. (10)
6. a) Define electronic oscillator. What are the essential parts of an oscillator? Explain the operation of a tank circuit. (10)
 b) How an undamped oscillation can be provided? Describe the principle of operation of a Hartley oscillator. (12)
 c) Draw the block diagram of UPS and describe in brief. (07)
 d) What is regulated power supply? Why is it necessary? (06)
7. a) What is op-amp? Write down the salient feature of an op-amp. (06)
 b) Draw differential amplifier and instrumentation amplifier and find the expression of overall gain. (12)
 c) Define CMRR, slew rate and virtual ground. (06)
 d) A $v = 10 \sin 1000\pi t$ is applied to the input of an op-amp integrator for which $R = 100k\Omega$ and $C = 1\mu F$ Find the output voltage at $t = 0$ sec and $t = 5$ sec. (11)
8. a) Define IC. What is scale of integration? Classify IC by structure and component density. (08)
 b) How monolithic ICs are made? Differentiate between triac and diac. (14)
 c) What is feedback circuit? Explain positive and negative feedback circuit. (07)
 d) An ac voltage $v = 240 \cos 314t$ is applied to an SCR. If the SCR has a forward breakdown voltage of 180V, find the time during when SCR remains off. (06)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 2nd Term Examination, 2016
Department of Computer Science and Engineering
MATH 1207

Coordinate Geometry and Differential Equations

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Find the angle through which the axes must be rotated to remove xy -term from the equation (10)
 $7x^2 - 6\sqrt{3}xy + 13y^2 = 16$. Also find the transformed equation.
b) Write down the general equation of conic. Find nature and the centre of the conic (11)
 $6x^2 + 5xy - 6y^2 - 4x + 7y + 11 = 0$.
c) The direction cosines l, m, n of two lines are connected by the relations $l + m + n = 0$ and (14)
 $2lm + 2ln - mn = 0$. Find them and also find the angle between the lines.

2. a) Find the rectangular and spherical polar coordinates for a point, whose cylindrical polar (12)
coordinates are $\left(4\sqrt{5}, \tan^{-1}\left(-\frac{1}{2}\right), 1\right)$.
b) Find the equation of a plane that passes through the point $(2, -3, 1)$ and perpendicular to the (11)
line joining the points $(3, 4, -1)$ and $(2, -1, 5)$.
c) Find the distance of the point $(2, -4, 5)$ from the plane $2x + 5y + 6z = 11$, measured parallel (12)
to the line $\frac{x}{2} = \frac{y}{1} = \frac{z}{-2}$.

3. a) Find the locus of a 3-dimensional point, whose x -coordinate is 2 and y -coordinate is 4. (10)
b) Find the equation of cone whose vertex at $(1, 1, 1)$ and which passes through the guiding (12)
curve $x^2 + y^2 = 4, z = 2$.
c) Find the length and the equation of the shortest distance between the lines (13)
 $\frac{x-3}{3} = \frac{y-8}{-1} = \frac{z-3}{1}$ and $\frac{x+3}{-3} = \frac{y+7}{2} = \frac{z-6}{4}$. Also find the points where it intersects the
lines.

4. a) Define great circle. Find the equation of the sphere, which touches the plane (17)
 $3x + 2y - z + 2 = 0$ at the point $(1, -2, 1)$ and cuts orthogonally the sphere
 $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$.
b) Reduce the equation of conic $x^2 - 5xy + y^2 + 8x - 20y + 15 = 0$ to the standard form and find (18)
its vertex, equations of the axes and latus rectum.

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define order of a differential equation with example. Find the differential equation for which (09)
 $xy = Ae^x + Be^{-x}$ is a solution, where A and B are arbitrary constants.
b) Solve the partial differential equation $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} + 2 \frac{\partial^2 z}{\partial y^2} = (y-1)e^x$. (16)
c) Solve $\frac{\partial u}{\partial t} = 4 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables. (10)

6. Solve any three of the followings:

(35)

(i) $(x^3 + y^2\sqrt{x^2 + y^2})dx - (xy\sqrt{x^2 + y^2})dy = 0.$

(ii) $(1 + x^2)\frac{dy}{dx} + y = \tan^{-1}x.$

(iii) $(6x - 4y + 1)dy = (3x - 2y + 1)dx.$

(iv) $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right)y = e^{-2x}.$

7. Solve any three of the followings:

(35)

(i) $\frac{d^2y}{dx^2} - y = \left(1 + \frac{1}{e^x}\right)^2.$

(ii) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$

(iii) $\frac{d^2y}{dx^2} - 9\frac{dy}{dx} + 18y = e^{e^{-3x}}.$

(iv) $\frac{d^3y}{dx^3} + 8y = x^4 + 2x + 1.$

8. a) Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 2y = x \log x.$

(16)

b) Define ordinary point and regular singular point of a differential equation. Find the indicial (19)

roots and recurrence relation of the differential equation $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - 1)y = 0.$