

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2021  
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) "C is called a free form programming language" –explain with example. (05)  
b) What is the output of the following program? (10)

```
#include <stdio.h>
int main(){
    unsigned char x = -2;
    if(x+2) printf("%u\n", x);
    else printf("%u\n", x+2);
    return 0;
}
```

- c) "else if ladder block is better than switch-case block" –when and why? (10)  
d) Differentiate between logical and bitwise operators with examples. (10)
2. a) Rewrite the following code of "if/else-block" into corresponding "switch/case-block". (11)

```
#include <stdio.h>
int main(){
    int a = 2, b = 1;
    if(a==2 && b ==1) printf("Okay\n");
    else printf("Not okay\n");
    return 0;
}
```

- b) A sequence is called Bitonic if it is first increasing, then decreasing. In other words, an array  $arr[0..n-1]$  is Bitonic if there exists an index  $i$  where  $0 \leq i \leq n-1$  such that  $x_0 \leq x_1 \dots \leq x_i$  and  $x_i \geq x_{i+1} \geq \dots \geq x_{n-1}$ . Implement a user define function that checks an array is either Bitonic or not. The prototype of the function is given as follows where  $n$  is the size of array. (15)
- `int checkBitonic(int arr[], int n);`
- c) What is variadic function? Show some examples of variadic function in C programming language. (09)
3. a) Write a C program that takes a mark (0 to 100) from user keyboard. Then, find the linguistic grade of the corresponding mark. Note: you mustn't use any if/else block. (13)

Mark	Linguistic grade
$\geq 90$	Excellent
$\geq 80$ and $< 90$	Very Good
$\geq 70$ and $< 80$	Good
$\geq 60$ and $< 70$	Satisfactory
$< 60$	Unsatisfactory

- b) Is there exist any logical, syntactical or any other problem? Do the solution if exist any. (10)

```
#include <stdio.h>
int main(){
    int age=50;
    if(age<=40)
        if(age<=16)
            printf("Young\n");
    else
        printf("Old\n");
}
```

- c) Make the following user defined function recursive designing the base and recursive case so that it returns the summation between  $m$  and  $n$ . (12)

```
int summation (int m, int n){
    //Make recursive
}
```

4. a) When does stack overflow problem occur in recursion? Give example and solution. (10)  
 b) What will be the output of the following programs? Explain your answer. (14)

<pre>#include&lt;stdio.h&gt; int a, b, c = 0; void prtfun (void); int main() {     static int a = 1;     prtfun(); a += 1;     prtfun();     printf("\n %d %d ", a,b);} void prtfun(){     static int a=2;     int b=1; a += ++b;     printf("\n %d %d ",a,b);}</pre>	<pre>#include&lt;stdio.h&gt; int main() {     static int i = 0;     jump:     {         int i = 5;         printf("%d",i);         i++;     } if(i&lt;7)         i++;     goto jump;     return 0;}</pre>
---	---

- c) Write a program that converts the last character into opposite case of all words in a given string. (11)

**SECTION B**

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

5. a) "All character arrays are strings but all strings are not character arrays" – justify this statement. (05)  
 b) Write a program in C to reverse a string without using *strrev* function. No extra string should be used and the source string itself should be modified to store the reverse string. Number of exchanges should be minimum. (09)  
 c) Each line in a file named "input.txt" contains *weekday, day, month and year* in the format shown in following. There can be any number of such lines in the file. You have to find *weekday* (as a string), *day* (as an integer), *month* (as a string) and *year* (as an integer) from those lines in the "input.txt" file and print these in the output console. (11)

input.txt			
Monday,	5	December,	2022
Thursday,	29	December,	2022
Sunday,	18	December,	2022

- d) Suppose in a project you have some sensor data in the form of short (16-bit values) array named "givenData". You have to write those data in a file named "data.dat" using *fwrite* function and after that you need to read those data from "data.dat" file using *fread* and store it to "outputData" array. You need to determine the size of the "givenData" array and the "outputData" array efficiently. Write a program for it. (10)
6. a) How is a multidimensional array defined in terms of an array of pointers? How does this definition differ from a pointer to a collection of contiguous arrays of lower dimensionality? (09)  
 b) A C program contains the following declaration: (10)

```
static char *color[6]={"red", "green",
"blue", "white", "black", "yellow"};
```

- (i) What is the meaning of color?, (ii) What is the meaning of (color + 2)?, (iii) What is the value of \*(color + 2)?, and (iv) Write the line of code to print "lack" from "black".  
 c) Write a complete C program, using pointer notation, that will generate a table containing the following three columns: (16)

<i>t</i>	$ae^{bt}\sin ct$	$ae^{bt}\cos ct$
----------	------------------	------------------

Structure the program in following manner: Write two special functions,  $f_1$  and  $f_2$ , where  $f_1$  evaluates the quantity  $ae^{bt}\sin ct$  and  $f_2$  evaluates  $ae^{bt}\cos ct$ . Have main function to enter the values of  $a$ ,  $b$ , and  $c$ . Then call a function, *table\_gen*, which will generate the actual table for the values of  $t$  from 1 to 60. Pass  $f_1$  and  $f_2$  to *table\_gen* as arguments. You can use *sin()*, *cos()* and *exp()* functions defined in the *math.h* header file.

7. a) What are the techniques of comparing two structure variables? Explain with example. (12)  
 b) Define a structure with Roll, Subject1, Subject2, Subject3 and total. Now take Roll and marks of the three courses for  $n$  students. Calculate the total marks of each student. Also calculate the average marks of each courses obtained by  $n$  students. (13)  
 c) Differentiate between *malloc* and *calloc* with their declarations. (10)
8. a) What is the significance of EOF? (08)  
 b) Write a C program to print the average of some numbers given through command line using the concept of command line arguments. (09)  
 c) Suppose, you have 4 files (*main.c, add.c, sub.c, calculator.h*). Write an efficient Makefile for these files using dependencies, variables and proper comments. Now consider the situation where you have run to the Makefile once and after that you have made some changes in the *add.c* file. Which commands will be executed if you re-run the Makefile? (13)  
 d) How does a *union* differ from a *structure*? (05)

TIME: 3 hours

FULL MARKS: 210

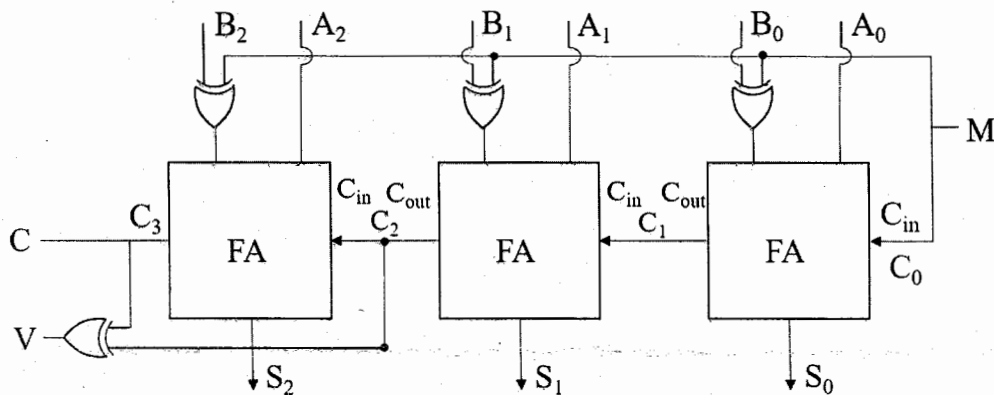
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**SECTION A**

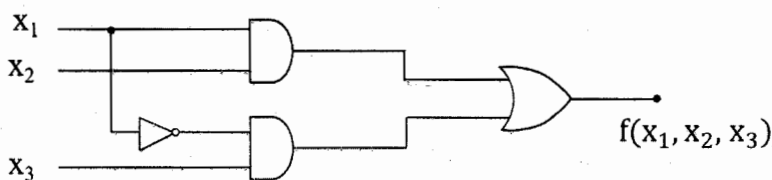
(Answer **ANY THREE** questions from this section in Script A)

1. a) The state of a 16-bit register is 1000011010100100. What is its content if it represents: (06)  
 (i) Four decimal digits in BCD, (ii) Four decimal digits in Excess-3 code, (iii) Four decimal digits in 84-2-1.
- b) Express the following function in sum of minterms and product of maxterms. (10)  

$$F = bd' + acd' + ab'c + a'c$$
- c) What are the advantages and disadvantages of 1's complement over 2's complementing system? Explain how subtraction is performed using  $r$ 's and  $(r-1)$ 's complements? (12)
- d) What do you mean by self-complementing code? Explain using Excess-3 code. (07)
2. a) Show that the dual of the Exclusive-OR is equal to its complement. (05)
- b) Initially you design the following circuit for adding and subtracting. But this performs very slow. Now modify this circuit for faster operations. (15)



- c) The following Boolean expression:  $B + C'D + A'D$  is a simplified version of the expression:  $A'B'D + A'BC'D' + ABD' + ABC + B'CD$ . Are there any don't-care conditions? If so, what are they? (10)
- d) What are the steps of combinational circuit design procedure? (05)
3. a) Define decoder and multiplexer. Construct a  $5 \times 32$  decoder with four  $3 \times 8$  decoder/demultiplexers and a  $2 \times 4$  decoder. Use block diagram only. (10)
- b) A logic circuit is given below. Does this circuit contain any hazard? If there is hazard, explain how a hazard free circuit is designed? (12)



- c) What is a demultiplexer circuit? Implement the following function with a multiplexer. (13)  

$$F(a, b, c, d) = \sum m(0, 1, 2, 5, 7, 9, 11, 14, 15)$$
4. a) Simplify the following function  $F$  using Quine-McCluskey method. (13)  

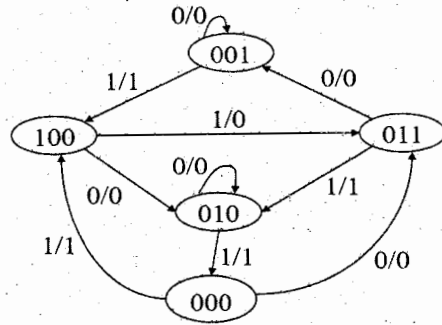
$$F(A, B, C, D) = \sum(1, 4, 6, 7, 8, 9, 10, 11, 15)$$
- b) What are the types of ROM? Design a 2048-bit ROM which word size is 8 bits. (10)
- c) What is carry propagation delay in a full adder circuit? Show that carry propagation problem can be eliminated by designing a carry-look ahead generator. (12)

**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) "Circuit design with JK flip-flop gives more don't-care options with respect to other flip-flop" – justify the statement with flip-flop excitation table. (10)

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



6. a) Differentiate between a register and a latch. (05)  
 b) What is an asynchronous counter? Design a decade binary asynchronous counter with JK flip-flops. (10)  
 c) Design a synchronous counter that count 1 → 6 → 7 → 0 → 3 → 6 → 1 using T FFs. (10)  
 d) What is a register? Draw the 4-bit parallel load register with a load line using D flip-flops and explain its operation. (10)
7. a) Draw the logic diagram for the following state equation, where DA and DB are the flip-flop input functions for D flip-flop, A & B respectively. (10)  

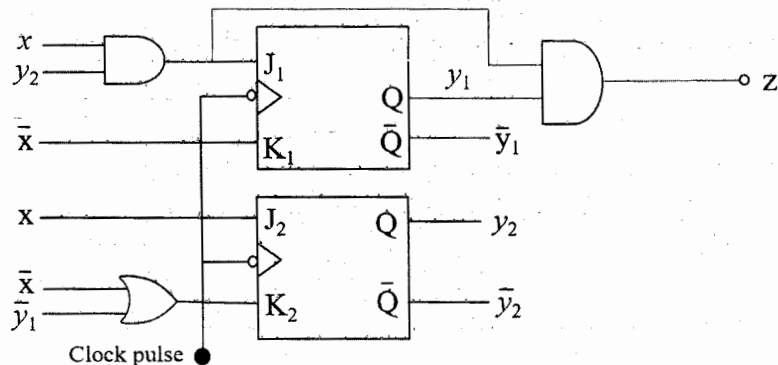
$$A(t + 1) = DA(A, B, x) = \Sigma(2, 5, 6)$$

$$B(t + 1) = DB(A, B, x) = \Sigma(2, 4, 5, 7)$$
- b) An engineer has been asked to design a synchronous sequence detector circuit. The detector circuit has one input ( $x$ ) and one output ( $z$ ). The circuit examines group of four consecutive inputs and produces an output  $z = 1$  if the input sequence 0101 or 1001 occurs. The circuit resets after four inputs. Now, you have to design the sequence detector circuit as an engineer using D flip-flops only. (15)
- c) What do you mean by state reduction and state assignment? Reduce the number of states in the following state table to its minimum. Hence, give an optimal state assignment. (10)

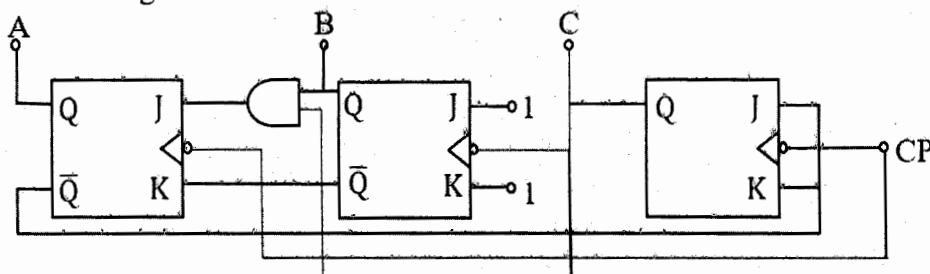
Present state	Next state		Output	
	$x = 0$	$x = 1$	$x = 0$	$x = 1$
a	a	b	0	0
b	c	d	0	0
c	a	d	0	0
d	e	f	0	1
e	a	f	0	1
f	g	f	0	1
g	a	f	0	1

8. a) Why do you need to analyze the sequential circuits? Analyze the following sequential circuit in terms of the followings: (15)

(i) Input and output equations, (ii) State table, (iii) State diagram.



- b) What is the difference between serial and parallel transfer? What type of register is used in each case? Explain. (10)
- c) A ripple counter is shown in the following figure. Determine the count sequence of the counter. Is the counter self-starting? (10)



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**SECTION A**

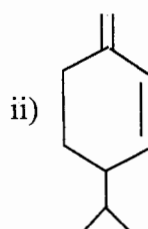
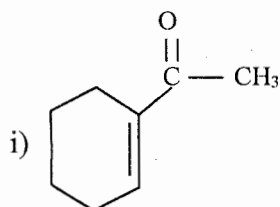
(Answer **ANY THREE** questions from this section in Script A)

1. a) Define lattice and bravis. Mention various crystal systems and show the characteristics features with diagrams. (10)  
b) What is meant by defects in crystal? Discuss about point defects and grain defects. (10)  
c) What are miller indices? Calculate the separation of (1 2 3) planes of an orthorhombic unit cell with  $a = 0.82$  nm,  $b = 0.94$  nm and  $c = 0.75$  nm. (07)  
d) Draw crystalline structure of Si. Discuss a comparative study between Si and Ge. (08)
2. a) "N<sub>2</sub> molecule is diatomic, but He is mono-atomic" – Explain with MOT. (10)  
b) "Metals are good conductor of heat and electricity" – Explain. (10)  
c) "Resonance structures are not actual structures of molecules or ions, they exist only in theory" – Explain with the help of carbonate ion (CO<sub>3</sub><sup>2-</sup>). (07)  
d) Draw the crystal structure of PCl<sub>5</sub> along with its hybridization. (08)
3. a) What is electromotive force (EMF)? Derive the Nernst equation for determination of EMF. (10)  
b) Discuss the principle of determination of p<sup>H</sup> of a solution with the help of a standard Hydrogen electrode. (10)  
c) 0.5 Normal solution of a salt placed between two platinum electrodes 20 cm apart and area of cross-section 4.0 cm<sup>2</sup> with a resistance of 25 ohms. Calculate the equivalent conductance of the solution. (07)  
d) Mention the models of electrical double layer at the solid liquid interface. (08)
4. a) What is solid electrolyte interface (SEI) layer? Why is SEI layer negative in charge? (10)  
b) Draw a thematic diagram of lithium ion battery and explain its reaction mechanism at discharge state. (10)  
c) Mention the advantages and disadvantages of Nickel cadmium battery. (08)  
d) "SiCl<sub>4</sub> is very reactive but CCl<sub>4</sub> is inert" – Explain. (07)

**SECTION B**

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

5. a) Define primary and secondary reactions with examples. (08)  
b) State and explain the laws of photochemistry. (10)  
c) What is photosensitized reaction? Explain. (10)  
d) Calculate the quantum yield of a reaction where one mole photons are absorbed giving 100 mole products. [ $\lambda = 5054$  Å] (07)
6. a) Define *p*-doped and *n*-doped conducting polymers with examples. (08)  
b) Discuss the conduction mechanism of conducting polymer and metal wire copper. (10)  
c) Outline the free radical mechanism of polymer synthesis. (10)  
d) What do you mean by thermoplastic and thermo setting polymers? Explain. (07)
7. a) What is electronic spectroscopy? Explain the Beer-lambert's law which governs the UV-visible spectroscopy. (08)  
b) What do you mean by chromophore and auxochromes? Explain. (10)  
c) Why are absorption bands formed in UV-Spectrum instead of-sharp peaks? (10)  
d) Calculate  $\lambda_{\max}$  of UV absorption for the following compounds using Woodward-Fieser rules. (07)



8. a) What is quantum yield? Explain the reasons of low quantum yield. (08)  
b) Synthesize nylon-6 polymer. Why does this polymer show high strength? Explain. (10)  
c) What is latex? Discuss the differences of natural and vulcanized rubber. (10)  
d) Define homoannular and heteroannular dienes with examples. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2021  
 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.  
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**SECTION A**

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

1. a) Find the transformed equation of  $4xy - 3y^2 = 5$ , when the rectangular axes are rotated by an angle  $\tan^{-1}(2)$ . (11)
- b) Determine the angle through which the axes must be rotated to remove  $xy$  term in the equation  $4x^2 + 2\sqrt{3}xy + 2y^2 - 1 = 0$  and find the transformed equation. (10)
- c) Identify the curve,  $x^2 + 2xy + y^2 - 6x - 2y + 4 = 0$  and hence reduce it to the standard form. (14)
  
2. a) Find the rectangular coordinates and spherical polar coordinates, whose cylindrical polar coordinate is  $(2\sqrt{3}, \frac{\pi}{3}, 6)$ . (10)
- b) Determine the direction cosines of a line which makes equal angles with the rectangular axes and passes through the origin. Determine also the perpendicular distance from a point  $(3, 4, 5)$  to this line. (12)
- c) Suppose, the coordinates of  $P$  and  $Q$  are  $(2, 3, 6)$  and  $(-1, -1, 1)$ , respectively and  $O$  is the origin. Find the angle between the lines  $OP$  &  $OQ$ . Find also the projection of the line segment  $PQ$  on the  $y$ -axis. (13)
  
3. a) Find the equation of a plane which is parallel to the  $z$ -axis and passes through the points  $(1, -1, 3)$  and  $(2, 3, -4)$ . (11)
- b) Find the equation of the line passing through the point  $(1, -2, -3)$  and parallel to the line  $2x + 3y - 3z + 2 = 0 = 3x - 4y + 2z - 4$ . (11)
- c) Find the length of shortest distance (S.D) between two lines  $\frac{x-1}{4} = \frac{y-2}{3} = \frac{z-1}{-5}$  and  $\frac{x+1}{2} = \frac{y-3}{3} = \frac{z-4}{-4}$ . (13)
  
4. a) What is great circle? Find the equation of a sphere in which the following is a great circle  $x^2 + y^2 + z^2 - 2x + 4y - 6z + 22 = 0, 4x - 2y + 10z = 0$ . (12)
- b) Define right circular cone. Find the equation of the right circular cone whose vertex is the origin, its axis is the line  $\frac{x}{2} = \frac{y}{3} = \frac{z}{4}$  and semi-vertical angle is  $45^\circ$ . (11)
- c) Find the center and nature of the surface represented by  $3x^2 + 4y^2 + z^2 - 12x - 16y + 4z - 4 = 0$ . (12)

**SECTION B**

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

5. a) Define order of an ordinary differential equation with example. Find the differential equation for which  $xy = Ae^{2x} + Be^{-2x} + x^2$  is a solution, where  $A$  and  $B$  are arbitrary constants. (11)
- b) Solve  $(2x - 6y + 3)dx - (x - 3y - 1)dy = 0$ . (12)
- c) Solve  $(xy + 2x + y + 2)dx + (x^2 + 2x)dy = 0$ . (12)
  
6. a) Solve  $xdy - ydx = \sqrt{x^2 - y^2}dx$ . (10)
- b) Determine the general solution of  $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ . (11)
- c) Solve  $(D^2 + 6D + 9)y = \frac{e^{-3x}}{x^3}$  by using the method of variation of parameter. (14)
  
7. a) Find the general solution of  $\frac{d^2y}{dx^2} - y = x\sin x + (x^2 + 1)e^x$ . (12)
- b) Solve  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^x$ ;  $y(0) = 3$  and  $y'(0) = -5$ . (11)
- c) Solve  $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 2\log x$ . (12)

8. a) Find the general solution of  $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 2 \frac{\partial^2 z}{\partial y^2} = \sqrt{2x + y}$ . (10)
- b) Solve the boundary value problem  $\frac{\partial u}{\partial t} = 3 \frac{\partial u}{\partial x}$  with  $u(x, 0) = 8e^{-2x}$  by using the method of separation of variables. (12)
- c) Determine the indicial roots and recurrence relation of  $2x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + (1 - x^2)y = 0$ . (13)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
 B.Sc. Engineering 1<sup>st</sup> Year 2<sup>nd</sup> Term Examination, 2021  
 Department of Computer Science and Engineering  
 EEE 1217  
 Analog Electronics

TIME: 3 hours

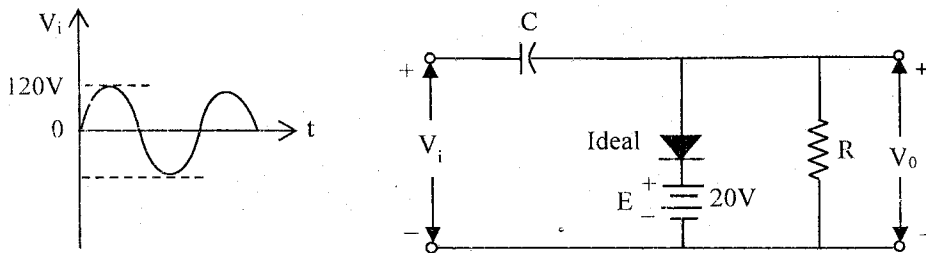
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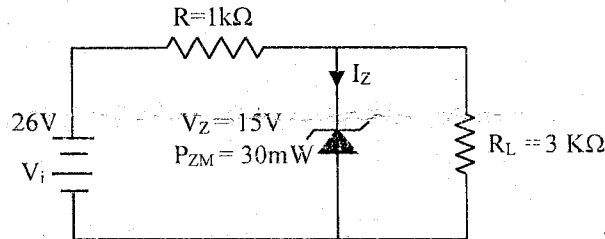
**SECTION A**

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

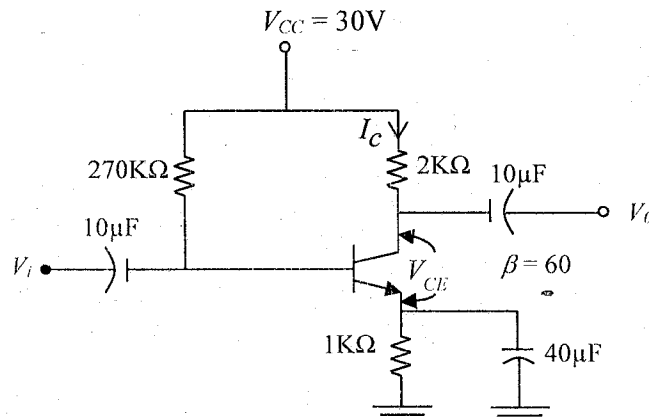
1. a) Explain the formation of depletion layer in a p-n junction. Also explain the different biasing conditions of a p-n junction with energy band diagram. (10)
- b) What are the reasons for rectification? Briefly explain different types of rectifier with proper illustrations. (10)
- c) Clearly state the function of clamper circuit. For the circuit shown in the following figure, sketch the output voltage wave  $V_o$  for the input  $V_i$ . (07)



- d) Mention the basic differences between rectifier diode and Zener diode. For the Zener diode network shown in the following figure, determine  $V_L$ ,  $V_R$ ,  $I_Z$ , and  $P_Z$ . (08)

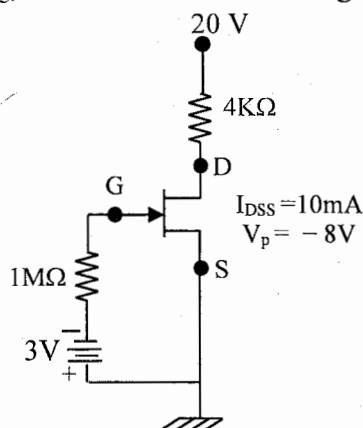


2. a) Why is transistor biasing necessary? Explain the different operating region of a transistor with the help of output characteristics curve of common base configuration. (10)
- b) Draw a Darlington pair circuit. Show that for a Darlington pair, the overall gain is  $\beta^2 = \beta_1 \times \beta_2$ ; where the symbols have their usual meanings. (10)
- c) Define stabilization of a transistor. Why this is needed? Write down the significance of stability factor. (07)
- d) For the following network, determine the value  $I_C$  and  $V_{CE}$ . (08)



3. a) "A zener diode can act as a voltage stabilizer" – Justify your answer with necessary diagrams. (08)
- b) For small signal analysis for common emitter fixed bias configuration obtain the expression of  $Z_i$ ,  $Z_o$ , and  $A_v$  without using any approximation. (12)
- c) Mention the basic differences between BJT and JFET. (05)
- d) Given that  $I_E = 4.5\text{mA}$ ,  $h_{fe} = 150$ ,  $h_{oe} = 20 \mu\text{s}$ , and  $h_{ob} = 0.8\mu\text{s}$ . Sketch (i) Common emitter hybrid equivalent circuit, and (ii) Common-base  $r_e$  model. (10)

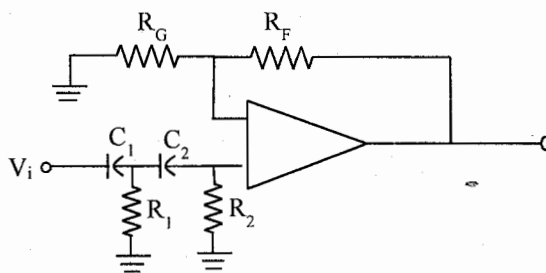
4. a) Explain the construction and operating principle at different biasing level of JFET. (12)  
 b) Design a CMOS circuit which can act as a logic inverter. Write down the major differences between depletion type MOSFET and enhancement type MOSFET. (13)  
 c) Determine the value of  $V_{GSQ}$ ,  $I_{DQ}$ , and  $V_{DS}$  for the following circuit diagram. (10)



### SECTION B

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

5. a) Differentiate between TRIAC and DIAC. Construct a lamp dimmer circuit using TRIAC and DIAC. (07)  
 b) Draw the two transistor model of SCR and explain the characteristic curves of SCR indicating all significant points. (08)  
 c) Sketch the UJT relaxation oscillator. For this oscillator prove that the oscillating frequency,  $f = \frac{1}{R.C \ln\left(\frac{1}{1-\eta}\right)}$ , where the symbols bear usual meaning. (11)  
 d) Define the negative resistance region from UJT characteristics curve. A UJT has 10V between the bases. The intrinsic stand-off ratio is 0.65 and the interbase resistance is 10KΩ. Find, (i) the values of  $R_{B1}$  and  $R_{B2}$ , (ii) the stand-off voltage, and (iii) the peak-point voltage. (09)
6. a) Write short notes on: (i) Virtual ground, (ii) Slew Rate (SR), (iii) Unity Follower. What is the maximum frequency of an op-amp if,  $SR = 0.062 \text{ v}/\mu\text{s}$  and peak voltage,  $V_p = 20\text{V}$ . (06)  
 b) Design an inverting and non-inverting amplifier circuit using op-amp. Also derive the equation of output voltage for both circuits. (10)  
 c) Explain active filter. Design and explain a second order high pass active filter with neat sketch. (08)  
 d) Design op-amp circuits to provide the following output voltages: (i)  $V_0 = -5V_1 + 3V_2$  (11)  
 (ii)  $V_0 = 2 \frac{dv_1}{dt} + 5sv_2 dt$ .
7. a) Why crystal oscillator is needed? Draw the equivalent circuit of a crystal oscillator. (08)  
 b) Define sinusoidal oscillator. What are the essential parts of an oscillator? Explain the operation of Tank circuit. (10)  
 c) Mention the limitations of LC and RC oscillators. How these can be overcome? (07)  
 d) Differentiate between active filter and passive filter. Calculate the cut-off frequency of a second order high pass filter for the following figure; where  $R_1 = R_2 = 2.1\text{K}\Omega$ ,  $c_1 = c_2 = 0.05\mu\text{F}$ ;  $R_G = 10\text{K}\Omega$  and  $R_F = 50\text{K}\Omega$ .



8. a) Mention the limitations of ordinary DC power supply. Draw and explain the operation of capacitor input filter. (12)  
 b) What do you mean by UPS? Explain three different types of UPS with appropriate block diagrams. (12)  
 c) Describe damped and undamped oscillation. Explain the principle of operation of a Colpitt's oscillator. (11)