Bangladesh Open University
School of Science and Technology
B. Sc in Computer Science and Engineering Program
152 Term (1st Year 2nd Semester)
Final Examination
Course Code & Title: MAT1231 Linear Algebra and Differential Equation

Time: 3 hours | Total Marks(5x14): 70

[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1. (a) Define differential equation. Show that the differential equation of circle touch the x-axis at the origin is 1+4

$$(x^2 - y^2)\,dy - 2xy\,dx = 0.$$

(b) Solve any three of the following equations: 9

(i) $\int dy = (y^2 - 1)\,dx$;

(ii) $\frac{dy}{dx} = 1 + e^{x-y}$;

(iii) $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$;

(iv) $(x^2 + y^2)\,dy = xy\,dx$.

2. (a) Prove that the differential equation $M\,dx + N\,dy = 0$ is exact if and on'y if $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$, where M and N both are functions of x, y. 6

(b) Solve 8

(i) $(x^3 + 3xy^2)\,dx + (3x^2y + y^3)\,dy = 0$;

(ii) $(1 + xy)y\,dx + (1 - xy)x\,dy = 0$.

3. (a) Find the general solution of $2y'' - 7y' + 3y = 0$. 4

(b) It is evident that $y_p = 3x$ is a particular solution of the equation $y'' + 4y = 12x$, and that $y_c(x) = c_1 cos2x + c_2 sin2x$ is its complementary solution. Find a solution of this differential equation that satisfies the initial conditions $y(0) = 5, y'(0) = 7$. 6

(c) Show that in a mass-spring-dashpot system, the equation $mx'' + cx' + kx = 0$, where m is mass, c is dashpot constant and k is spring constant; has a unique solution for $t \geq 0$ satisfying given initial conditions $x(0) = x_0, x'(0) = v_0$. 4

4. (a) If $A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 3 & -1 \\ -3 & 1 & 2 \end{bmatrix}$, then find the value of $A^2 - 3A + 9I_3$. 4

(b) Find the matrix X, such that $\begin{bmatrix} 1 & -4 \\ 3 & -2 \end{bmatrix} X = \begin{bmatrix} -16 & -6 \\ 7 & 2 \end{bmatrix}$. 5

(c) Solve the following system: 5

$$x + y + z = 7$$
$$x + 2y + 3z = 16$$
$$x + 3y + 4z = 22.$$

5. (a) Transform the following differential equation into an equivalent system of first-order differential equations. 7

$$x'' + 3x' + 7x = t^2.$$

(b) Find the general solution of the system 7

$$x' = y;$$
$$y' = 2x + y.$$

6. (a) Show whether the following vectors are a basis of $\mathbb{R}^3$ or not. 7

$(1, 2, 1), (2, 1, 0), (1, -1, 2)$.

(b) Find a basis and the dimension of the solution space W of the following homogeneous system: 4

$$x + 2y + z - 2t = 0$$
$$2x + 4y + 4z - 3t = 0$$
$$3x + 6y + 7z - 4t = 0.$$

(c) Define row space, column space and null space of a matrix. 3

7. (a) Find the eigen values of the matrix $A = \begin{bmatrix} 2 & 1 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$. 5

(b) Find a matrix P that diagonalizes the matrix $A = \begin{bmatrix} 0 & 0 & -2 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$. 9

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Final Examination

Course Code & Title: CSE1235 Digital Logic Design

Time: 3 hours | Total Marks: 70

[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1. (a) A technician testing a logic circuit sees that the output of a particular INVERTER is stuck LOW while its input is pulsing. List as many possible reasons as you can for this faulty operation. 2

(b) Four large tanks at a chemical plant contain different liquids being heated. Liquid-level sensors are being used to detect whenever the level in tank A or tank B rises above a predetermined level. Temperature sensors in tanks C and D detect when the temperature in either of these tanks drops below a prescribed temperature limit. Assume that the liquid-level sensor outputs A and B are LOW when the level is satisfactory and HIGH when the level is too high. Also, the temperature-sensor outputs C and D are LOW when the temperature is satisfactory and HIGH when the temperature is too low. Design a logic circuit that will detect whenever the level in tank A or tank B is too high at the same time that the temperature in either tank C or tank D is too low. 4

(c) Simplify the following expressions using Boolean algebra: 4

(i) $x = \bar{A}\bar{B}\bar{C} + \bar{A}BC + AB\bar{C} + A\bar{B}\bar{C} + A\bar{B}C$

(ii) $y = \overline{(C + D)} + \bar{A}C\bar{D} + A\bar{B}\bar{C} + \bar{A}\bar{B}CD + AC\bar{D}$

(d) Simplify the following Boolean functions using K-maps and draw the logic circuit for the simplified expression: 4

$F(A, B, C, D) = \sum(0, 1, 2, 4, 5, 7, 11, 15)$

2. (a) Distinguish between sequential circuit and combinational circuit. 2

(b) Design and describe a 4-bit adder subtractor circuit with example. 6

(c) What do you mean by BCD adder? Design and describe a BCD adder circuit with truth table. 2+4

3. (a) Construct logic diagram for the following Boolean function with multiplexer. Consider D as input. 4

$$F(X, Y, Z, W) = \sum(1, 3, 4, 11, 12, 13, 14, 15)$$

(b) What is the problem of S-R Flip-Flop? How do you solve this problem? 1+1

(c) What is J-K Flip-Flop? Design and describe the operation of a J-K Flip-Flop circuit. 1+4

(d) Write HDL code for D Flip-Flop and T Flip-Flop. 3

4. (a) What is Hamming code? Given the 8 bit data word 11000100, generate the 12 bit composite word for the Hamming code. Now, 2+6

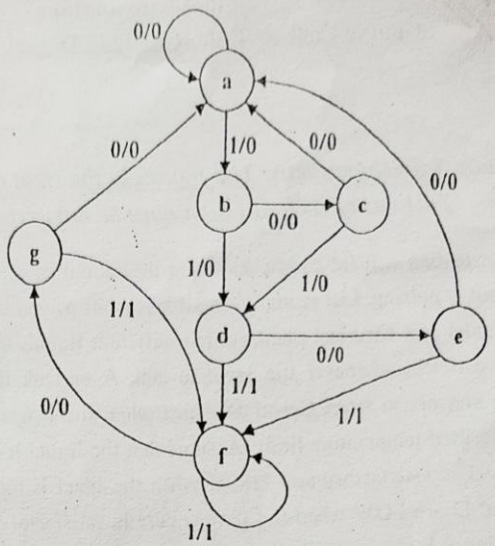
(i) What will be the 12-bit composite word that stored in memory?

(ii) Explain the error detection procedure using Hamming code technique, when the 12 bits are read from memory.

(b) The statement "Hamming code can be used to correct a single error and detect double errors"- Justify your answer. 2

(c) Design a combinational circuit using a ROM. The circuit accepts 3-bit number and generates an output binary number equal to the square of the input number. 4

5. (a) Consider the following state diagram that accepts the input sequence 01010110100 starting from the initial state 'a'. Each input of 0 or 1 produces an output of 0 or 1 and causes the circuit to go to the next state. 6



Now,

(i) Draw state table and reducing state table.

(ii) Draw reduced state table and reduced state diagram.

(iii) Draw reduced state table with binary assignment.

(b) List out the procedure for designing synchronous sequential circuit. 2

(c) Design a logic circuit that detects three or more consecutive 1's in a string of bits coming through an input line. Show all the possible steps. 6

6. (a) What do you mean by shift register? Draw and describe the 4-bit serial transfer register circuit with an example. 1+4

(b) Draw and explain 4-bit synchronous binary counter. 5

(c) What do you mean by memory unit? Design a 4×4 RAM. 4

7. (a) Consider the following Boolean functions: 8

$$w(A,B,C,D) = \sum(2,12,13)$$

$$x(A,B,C,D) = \sum(7,8,9,10,11,12,13,14,15)$$

$$y(A,B,C,D) = \sum(0,2,3,4,5,6,7,8,10,11,15)$$

$$z(A,B,C,D) = \sum(1,2,8,12,13)$$

Now,

(i) Simplifying the four functions to a minimum numbers of terms.

(ii) Design a PAL programming table.

(iii) Design PAL logic circuit.

(b) Given the following function $F(A,B,C) = \sum(1,5,6,7)$. Is this function Hazard free or not? If yes, design a hazard free circuit, otherwise why explain. 3

(c) Design a block diagram of an asynchronous sequential circuit. 3

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Course Code & Title: CSE1237 Structured Programming Language

Time: 3 hours | Total Marks (5x14): 70

[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1. (a) Write briefly about the following terms: 4
(i)Program (ii) Algorithm (iii) Flowchart (iv) Compiler.

(b) Write an algorithm to find largest number among three numbers. Also draw a flowchart for the written algorithm. 2+2

(c) State some applications of C programming language. 2

(d) Identify the syntax errors from the following program. After corrections what will be the output would you expect when you execute it? 2+2

```
#define PI 3.14
int main()
{
int radious;
        float perimeter, area
        radius = 5
        perimeter = 2.0 * PI * radius;
        area = PI * radius * radius;
printf ("%f","%f",&perimeter, & area)
        return 0;
}
```

2. (a) What is data type? Explain different data types in C giving an example to each. 1+5

(b) Differentiate between *else-if* ladder and *switch* statement. 3

(c) Briefly explain variable and constants in C. 3

(d) Write a C program to check whether a given number is even or odd. 2

3. (a) What is loop? Explain with example where *for* loop is suitable and where *do-while* loop is suitable. 1+4

(b) What is the use of break and continue statement in C language? 3

(c) Write a program to reverse the digits of a given integer number. For Example reverse of given number 3578 is 8753. 4

(d) What is the output for the following C code 2

```
value = 1;
switch (value)
{
Case 1:printf("Good");
Case 2:printf("Morning");
Case 3:printf("Cprogram")
}
```

4. (a) What is an array? How is it declared? 2+2

(b) Write a program to read the marks of 5 subjects for each of the 10 students of a class and display the average marks for each of the students. 5

(c) Write a program for appending a string with another string. Do not use built in functions. 5

5. (a) What do you about pointer? Define the asterisk (*) and ampersand (&) operator in terms of pointer. What will be the output of the following program?

```
int main()
{
    int a,b *ptr;
    a = 30;
    ptr = &a;
    b = *ptr;
    printf("a :%d\n",a++);
    printf("b :%d\n",b++);
    printf("value :%d\n",*ptr);
    return 0;
}
```

(b) How does a structure differ from an array? Define a structure named BOUCSE02, which contains, std_name,std_id, and std_cgpa. Using this structure, write a program to read information of a student from keyboard and save in a file named student.txt. 2+2+4

6. (a) What is function? What are advantages of using function in a program? 2+2

(b) Describe the approaches of passing arguments to a function with example. 5

(c) What is recursion? Write a recursive function to calculate the factorial of a given integer number. 2+3

7. (a) What is file mode? State the purpose of various file modes to open a file. 1+2

(b) Write the purpose of the following file handling functions: 5
(i) fseek() (ii) getw() (iii) feof() (iv) fscan() (v) rewind().

(d) A file named 'data.txt' contains a series of integer numbers. Write a C program to read these numbers and then write all the positive numbers to a file named 'positive.txt'. 6

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Course Code & Title: EEE1233 Electronic Devices and Circuit

Time: 3 hours | Total Marks (5x14): 70

[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1. (a) Draw and explain the V-I characteristics of a PN junction. 7

   (b) Compare between clipper and clampers. 3

   (c) A silicon diode dissipates 3W for a forward DC current of 2A. Calculate the forward voltage drop across the diode and its bulk resistance. 4

2. (a) Define impedance, reactance. Ripple and cut-off frequency. 8

   (b) Define feedback, bandwidth, open-loop and closed loop. 6

3. (a) Define the threshold voltage for MOSFET. Discuss about construction and operation of n-channel enhancement type MOSFET.. 7

   (b) Explain the V-I characteristics of n-channel depletion. 5

   (c) What are advantages of negative feedback? 2

4. (a) What is the difference between BJT and FET? 3

   (b) Describe static characteristics of a JFET. 7

   (c) Explain the operation of JFET for the following condition: 4

   $V_{GS} = 0V$ and V_{DS} some possible value.

5. (a) Describe working principle of NPN transistor. 6

   (b) When does LED emit no light? 2

   (c) Find output of a summing amplifier circuit where $R_{in1} = 1K\Omega$, $R_{in2} = 2\ K\Omega$, $R_1 = 10\ K\Omega$, $V_{in1} = 2mV$, $V_{in2} = 5mV$. 6

6. (a) Classify amplifier according to the 6

   (i) Use; (ii) frequency capacity; (iii) mode operation.

   (b) Derive the expression of voltage gain A_v and current gain Ai of a transistor amplifier. 8

7. (a) Compare between analog to digital and digital to analog converter. 5

   (b) Describe the first order high pass filer. 4

   (c) What do you mean by filter? Mention some uses of filter. 2 + 3

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152 Term (1st Year 2nd Semester)

Final Examination

Course Code & Title: HUM1222 Bangladesh Studies

Time: 3 hours

Total Marks (5x14): 7

[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1.	(a)	What is society? Write some features of society.	7
	(b)	Write the importance of family in our life.	7
2.	(a)	What are the factors influence the culture?	7
	(b)	Show the impact of satellite culture on our own culture.	7
3.	(a)	Why should we give more emphasis on our own culture?	7
	(b)	Distinguish between Micro and Macro economics.	7
4.	(a)	What are the features of Bangladesh economy?	7
	(b)	Write some challenges of sustainable development of Bangladesh-"Human Resource Development" sector.	7
5.	(a)	Differentiate between the Mughal and Nawab Rules.	7
	(b)	Write Socio-Economic and Cultural changes from Muslim to British Rules.	7
6.	(a)	What are the importances of Bengali language in our life?	7
	(b)	Write short notes on "International Mother Language Day".	7
7.	(a)	What do you know about six point movement?	6
	(b)	Write the contribution of Father of the Nation Bangabandhu Sheikh Mujibur Rahman in the independence of Bangladesh.	8