KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2023
CSE 1231
(Computer Programming)

Time: 3 Hours   Total 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) Assume reasonable data if any missing.

SECTION-A

1(a) What do you mean by structured programming? Write down the types of programming 10
languages.

1(b) Explain the operators in C with examples. 10

1(c) Explain how an else-if ladder works with proper example. 05

1(d) Explain the difference between the "++x" and "x++" operators in C. Provide an example 10
where this distinction affects the output of a program.

2(a) Write a C program that counts the number of positive, negative and zero elements in an 12
array.

2(b) Write a C program to check whether two arrays are identical. If the array is identical, then 13
reverse the array. Otherwise, do not reverse the array.

2(c) Observe the following program: 10

```
void main () {
    int x=10, y=20;
    if (++x && y++) {
    x++;
    }
    printf ("x=%d, y=%d \n", x, y);
}
```

Explain the output of this program.

3(a) Explain the different types of loops in C programming. Provide examples for each type. 08

3(b) Write a program that takes an integer as input and calculates the sum of its digits. For 12
example, if the input is 1 2 3 4, the output should be 10 (1+2+3+4).

3(c) Discuss about four basic data types with proper examples. 08

3(d) How do we define and declare 1D and 2D arrays in C with examples? 07

4(a) What is pointer? How is a pointer initialized? Explain the concept of variable, value and 08
address.

4(b) Explain call by value and call by reference using pointers. 07

4(c) Write a C program to check whether an array is started in ascending or descending order. 10
Here, we have to pass the array to function using a pointer, which returns whether this
array is ascending or descending.

4(d) What is pointer arithmetic? Observe the following program. 10

```
int main () {
    int i=3, *j, **k ;                        Address of i = 64
    j = &i;                                   Address of j = 97
    k = &j;                                   Address of k = 69
    printf ("%u  %u  %u", &i, *k, &j);
    printf ("%d  %d  %d", i, *j, **k);   }
```

SECTION-B

5(a) What is null-terminating in C? Why is it important? Provide examples.   10

5(b) You have two string variables: str1 = "hello" and str2 = "world". Now write a code to join these two strings and store it in another variable str3.   12

5(c) Write a code to compare two string variables. If more than one characters mismatched, you should print "Mismatched". Otherwise print "Matched".   13

6(a) Why do we need user-defined functions? Write the differences between user-defined functions and built-in functions.   08

6(b) Write a C function that takes an array of integers as input and returns shortest and largest number.   12

6(c)
```
void main () {
        int i=0;
        if (i<10) {
        printf (" %d \n", i);
        i++;
        main ();   }
        }
```
Is there any problem in the code? If yes,
(a) What is it?
(b) Explain why the problem occurs.
(c) Solve the problem   15

7(a) Why structures are important? Explain with code.   10

7(b) Design a structure to handle complex variables. Write a function that can take two complex numbers, prints their summation result in correct format and returns the result.   13

7(c) Write another function that takes an array of complex numbers and permanently makes imaginary part=zero.   12

8(a) Why files are important in C? Write the differences between fprintf () and fputs ().   10

8(b) Write a C code that opens a text file, counts the number of words and prints the count.   13

8(c)
10	Messi
07	Ronaldo
11	Neymar
    12

This information is stored in player .txt file. The first column is jersey number, the second column is player name. Read the file and print only the name of the players whose jersey number is > = 10.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2023
HUM 1231
(Technical and Communicative English)
Time: 3 Hours   Total 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) Assume reasonable data if any is missing.

SECTION-A

1(a) Make sentence with the following structures using the words given in brackets. 14
   i. Subj. + Intransitive Verb + Adv. of Time. (Read as verb)
   ii. Subj. + Transitive Verb + Object. (Like as verb)
   iii. What + Subj. + Verb + Adv. of Manner + Verb + Adj. Complement. (Think and is as verb)
   iv. It + Verb + Adj. Complement + that + Subj. + Verb + Adv. of place. (is and succeed as verb)
   v. Since + Subj. + Verb + Adj. Complement, Subj. + Verb + Obj. (is and do as verb)
   vi. Neither + Subj. + Nor + Subj. + Subj. + Verb + Adj. Complement + Adv. of place. (Feel as verb)
   vii. Subj. + Relative Pronoun + Verb + Adv. of Manner + Verb + Adv. of Manner + Adv. of place. (Study and is as verb)

1(b) Change the following words as asked in brackets and make sentence with the changed 12
   forms.
   Crudity (into adj.), Thick (into noun), Remission (into verb), Palpation (into verb), Attain (into noun), Interruption (into verb).

1(c) Make new word with the following suffix and prefix, then use them in sentence: 09
   Homo_____, De_____, _____ation, ____ism, ____scape, Il_____.

2(a) Transform the following sentences as asked in brackets. 14
   i. Raju, who lives in London, is a doctor. (Simple)
   ii. That Saju obeys his parents is praiseworthy. (Simple)
   iii. Since Mim studies regularly, he can progress knowledge. (Compound)
   iv. Shova uses time properly, but can't develop in life. (Complex)
   v. Labu not only does social activities but also works for own family. (Simple)
   vi. Till you work hard, we will not help you. (Simple)
   vii. Liza is as lovely as her sisters. (Comparative)

2(b) Make use of the following words in sentence as asked in brackets. 12
   Face (as verb), Above (as noun), Race (as verb), Spy (as verb), Close (as adv.), Deep (as adv.)

2(c) Write one antonym and one synonym for each of the following words and use the 09
   antonyms and synonyms in sentence.
   Calm, Nice, Punctual.

3(a) Make WH-questions on the underlined portions of the following sentences by assuming 14
   them missing.
   i. Lina is a bad live performer.
   ii. Only 8-12 pilots can make a successful landing Paro.
   iii. Khulna is the third largest city in Bangladesh.
   iv. People show who they really are in their last moment.
   v. Old lions breed young ones.
   vi. She felt better with her family.
   vii. Failing exam is not an option.

3(b) Complete the sentences with subordinate clauses.
i. The boy went out to play _____ (adv. clause)
ii. He went away by the train _____ (adj. clause)
iii. _____ is a well-known fact (noun clause)
iv. _____ living was cheaper. (adv. clause)
v. Mary had a little lamb _____ (adj. clause)
vi. I earn _____ (noun clause)

3(c) Make sentences expressing the following notions/emotions.   09
i. Express happiness, ii. Anger, iii. Ask to advice, iv. Express obligation, v. Seek permission, vi. Express moral attitude.

4(a) Correct the following sentences: 14
i. A water needs to be pure for drinking.
ii. V.C. will inaugurate the ceremony.
iii. This pen cost me fifty money.
iv. The prisoner was put in iron.
v. Cattles are grazing in the field.
vi. Many a men attended in the meeting.
vii. The machineries is out of order.

4(b) Make sentence using the following modals as instructed.   12
i. May (To ask for permission)
ii. Must (To order)
iii. Can (To give instruction)
iv. Had better (To express duty at present)
v. Should (To express priority)
vi. Might have been (To indicate past possibility)

4(c) Make sentences with the following idioms and phrases.   09
Round the bend, Barrel of laugh, In the doghouse, Bell the cat, Ants in your pants, Beyond the pale.

SECTION-B

5(a) Make a precis on the following passage.   15
The Matrix presents a version of an old philosophical fable: the brain in a vat. A disembodied brain is floating in a vat, inside a scientist's laboratory. The scientist has arranged that the brain will be stimulated with the same sort of inputs that a normal embodied brain receives. To do this, the brain is connected to a giant computer simulation of a world. The simulation determines which inputs the brain receives. When the brain produces outputs, these are fed back into the simulation. The internal state of the brain is just like that of a normal brain, despite the fact that it lacks a body. From the brain's point of view, things seem very much as they seem to you and me.
The brain is massively deluded, it seems. It has all sorts of false beliefs about the world. It believes that it has a body, but it has no body. It believes that it is walking outside in the sunlight, but in fact it is inside a dark lab. Neo's situation at the beginning of the Matrix is something like this. He thinks that he lives in a city, he thinks that he has hair, he thinks it is 1999, and he thinks it is sunny outside.
In reality, he is floating in space, he has no hair, the year is around 2199, and the world has been darkened by war. There are a few small differences from the vat scenario above. Neo's brain is located in a body, and the computer simulation is controlled by machines rather than by a scientist. But, the essential details are much the same. In effect, Neo is a brain in a vat.

5(b) Evaluate critically with reference of 'The gift of the Magi' by O'Henry why the life of   10
Jim and Della is represented in sacrifice.

5(c) Critically comment on the character of Emily Grienson from Faulkner's "A Rose for   10
Emily".

6(a)   Write a paragraph on dream in life.   15

6(b)   Write a CV for the post of a lecturer at KUET.   20

7(a)   Write a report on coaching centre you observe in your country.   20

7(b)   Write an e-mail to Professor 'X' requesting her to supervise your MSc thesis. 15

8.   Write a free composition on the following   35
       "The Role of Culture in Developing a Nation's Life."

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2023
Math 1231
(Vector, Matrix and Ordinary Differential Equations)
Time: 3 Hours   Total 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) Assume reasonable data if any missing.

SECTION-A

1(a) A particle moves along the curve $\vec{r} = (t^3 - 4t)\hat{\imath} + (t^2 + 4t)\hat{\jmath} + (8t^2 - 3t^3)\hat{k}$, where t is the time. Find the magnitude of the tangential components of its acceleration at $t = 2$. 08

1(b) If $\vec{A} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k}$ and $\vec{B} = \hat{\imath} - 2\hat{\jmath} + \hat{k}$, find a vector of magnitude 5 perpendicular to both $\vec{A}$ and $\vec{B}$. 07

1(c) A vector field $\vec{F} = (2x^2 + 8xy^2)\hat{\imath} + (3x^3y - 3xy)\hat{\jmath} - (4y^2z^2 + 2x^3z)\hat{k}$ is given. Prove that $\vec{F}$ is not solenoidal but $\vec{G} = xyz^2 . \vec{F}$ is solenoidal. 08

1(d) If $\varphi = 2xyz^2$, $\vec{F} = xy\hat{\imath} - z\hat{\jmath} + x^2\hat{k}$ and C is the curve $x = t^2$, $y = 2t$, $z = t^3$ from $t = 0$ to $t = 1$. Evaluate the line integral (i) $\int_C \varphi d\vec{p}$ and (ii) $\int_C \vec{F} \times d\vec{p}$ 12

2(a) Determine whether the line integral $\int 2xyz^2 dx + (x^2z^2 + z\cos yz)dy + (2x^2yz + y\cos yz)dz$ is independent of the path of integration? If so, then evaluate it from $(1, 0, 1)$ to $(0, \frac{\pi}{2}, 1)$. 13

2(b) If $\vec{F} = 4xz\hat{\imath} - y^2\hat{\jmath} + yz\hat{k}$, evaluate $\iint_S \vec{F}.\hat{\eta}ds$, where S is the surface of the cube bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$ and $z = 1$. 12

2(c) Evaluate $\oint_C \vec{F}.d\vec{r}$ by Stokes' theorem, where $\vec{F} = (x^2 + y^2)\hat{\imath} - 2xy\hat{\jmath}$ and C is the boundary of the rectangle $x = \pm a$, $y = 0$ and $y = b$. 10

3(a) Find a, b, c such that the matrix 10
$$\begin{pmatrix} a & 1/\sqrt{2} & -1/\sqrt{2} \\ b & 1/\sqrt{6} & 1/\sqrt{6} \\ c & 1/\sqrt{3} & 1/\sqrt{3} \end{pmatrix} \text{ is orthogonal.}$$

3(b) Let $A = \begin{pmatrix} 1 & \lambda & 0 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$, (i) Determine the value of λ for which A is invertible, (ii) For those values found in part (i) find the inverse of A. 12

3(c) Define rank of a matrix. Reduce the matrix A to normal form and find its rank. 13
$$A = \begin{pmatrix} 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \\ 4 & 5 & 6 & 7 \\ 9 & 10 & 11 & 12 \end{pmatrix}$$

4(a) Determine the current I_1, I_2 and I_3 for the electrical network from the following figure:
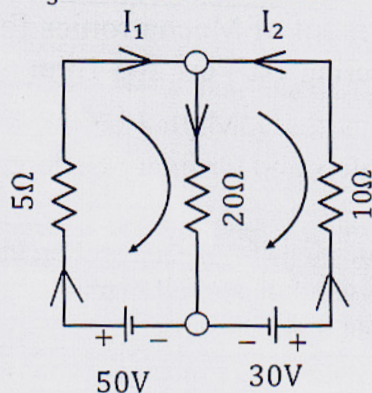
4(b) Define characteristic polynomial, eigen value and eigen vector.   06

4(c) State Cayley-Hamilton theorem. Verify Cayley-Hamilton theorem for the matrix   14
$$A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & -1 & 1 \\ 3 & 1 & 1 \end{pmatrix}.$$

SECTION-B

5(a) Define order and degree of a differential equation. Find the differential equation corresponding to the equation $xy = ae^x + be^{-x} + x^2$, where a and b are arbitrary constants.   13

5(b) Find the particular solution of the initial value problem $\frac{dy}{dx} = (4x + y + 1)^2$, $y(0) = 1$.   10

5(c) Find the general solution of the differential equation   12
$(x + 2y - 3)dx - (2x + y - 3)dy = 0$

6(a) Solve the differential equation   11
$(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$.

6(b) Solve the initial value problem $3\frac{dy}{dx} + 3\frac{y}{x} = 2x^4y^4$, $y(1) = 1$.   11

6(c) A body of temperature 80 °F is placed in a room of constant temperature 50 °F at time $t = 0$. At the end of 5 minutes, the body has cooled to a temperature of 70 °F. (a) Find the temperature of the body at the end of 10 minutes. (b) When will the temperature of the body be 60 °F? (c) After how many minutes the temperature of the body be within 1 °F of the constant 50 °F temperature of the room.   13

7(a) Find the general solution of the differential equation $(D^8 + 6D^6 - 32D^2)y = 0$. $D = \frac{d}{dx}$ 09

7(b) Solve $\frac{d^2y}{dx^2} + a^2y = x\cos ax$.   12

7(c) Convert the differential equation $2y'' + 5y' - 3y = 0$ into a system, solve the system, and use the calculated solution to get the solution of the original differential equation.   14

8(a) Find the complete solution of the differential equation   12
$(D^2 - 4D + 3)y = 2xe^{2x} + 3e^x\cos2x$.

8(b) Solve the differential equation $(D^2 + 4)y = 4\tan2x$ by the method of variation of parameters.   12

8(b) Find the general solution of the Cauchy Euler differential equation   11
$(x^2D^2 + xD + 1)y = \sin(\log x^2)$.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2023
ME 1231
(Manufacturing Processes)

Time: 3 Hours   Total 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) Assume reasonable data if any missing.

SECTION-A

1(a)	Define manufacturing process. Describe the importance of studying manufacturing processes.	10
1(b)	Draw the components of a sand mould and label it.	08
1(c)	What is pattern? Describe different patterns based on their structure.	10
1(d)	Explain shrinkage allowance and draft allowance with the help of necessary sketches.	07
2(a)	With the help of necessary sketches, briefly explain lost wax casting method. Also write down the advantages and limitations of centrifugal casting.	15
2(b)	Which centrifugal casting process would you choose to manufacture a motorcycle rim? Justify your answer.	08
2(c)	Explain the common defects that are likely to be found in casting and their remedies. Also mention different methods to detect casting defects.	12
3(a)	Define welding. Mention various types of welding joints. Differentiate welding with soldering and brazing.	12
3(b)	Describe oxyacetylene gas welding with different types of flame formation during the process.	10
3(c)	Compare and contrast TIG and MIG welding.	06
3(d)	Enumerate the advantages and limitations of thermit welding with application.	07
4(a)	Write down the significance of recrystallization temperature in metal forming process. What are the purposes of metal forming process?	10
4(b)	Differentiate between hot working and cold working process. Write down the names of five operations that may involve both hot working and cold working process.	10
4(c)	Describe how a tooth paste tube can be manufactured.	09
4(d)	Explain the following operations: i) Blanking ii) Forging iii) Rolling	06

SECTION-B

5(a) Draw a single point cutting tool and show its different angles and elements. 1

5(b) Explain metal cutting mechanism with neat sketches. 10

5(c) Define feed and depth of cut. Write down the assumptions of Merchant theory 07

5(d) Write down the properties and functions of cutting fluid. 08

6(a) Name and describe the major parts of a lathe machine, mentioning their functions with neat sketches. 15

6(b) Explain the quick return mechanism of shaper machine with necessary sketches. 08

6(c) Differentiate drilling, boring and reaming from each other. 07

6(c) List eight operations that can be performed in a lathe machine. 05

7(a) Why milling machine is called most versatile of all machine tools? Explain. Also differentiate between conventional milling and climb milling. 10

7(b) What is meant by automation? How it can be done in manufacturing process. 07

7(c) Write down the advantages of CNC machine tool. Also write a short note on CNC lathe machine. 08

7(d) What is indexing? What are the common methods of indexing? Explain any one of them. 10

8(a) Why non-conventional methods of machining are very essential? Explain. 08

8(b) Explain the working principle of ECM. Write down the functions and properties of dielectric fluid in EDM. 12

8(c) Describe the working procedure of USM with necessary sketches. Also mention its advantages and disadvantages 09

8(d) What does PCB mean? Describe the necessity of PCB and PCB fabrication process with real life examples. 06

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2023
Ph 1231
(Physics)

Time: 3 Hours   Total 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) Assume reasonable data if any missing.

SECTION-A

1(a) What is an electric dipole moment? Calculate the electrical field due to an electric dipole at a point on the perpendicular bisector of the dipole. **12**

1(b) Applying Gauss's theorem to find the electric field due to volume distribution of charges in a sphere at $r < R$, $r = R$ and $r > R$. **13**

1(c) Four equal point charges $+4mC$ are placed at the four corners of a square that is 40cm on a side. Find the force on any one of the charges. **10**

2(a) State and explain Biot-Savart law. Under what condition Biot-Savart law becomes more useful than Ampere's law. **10**

2(b) Use Biot-Savart law to find B due to a current 'i' in a long straight wire at a point outside the straight wire. **13**

2(c) Describe the hysteresis loop of a material. Discuss the magnetic properties those we found from the hysteresis loop. **12**

3(a) Define magnetic moments, magnetic field intensity, intensity of magnetization, magnetomotive force, and magnetic susceptibility. **10**

3(b) State Kirchhoff's current and voltage laws. Apply the laws to a Wheatstone bridge and find the conditional for bridge balance. **15**

3(c) What is time constant of a RC circuit? After how many time constants will the energy stored in a capacitor reach one-fourth its equilibrium value. **10**

4(a) State Ampere's law. Write some general application of these law. **08**

4(b) What is Zener voltage? Discuss the behavior of a p-n junction under forward and reverse biasing. **10**

4(c) What is rectifier? Discuss the construction and working principle of a full wave rectifier. **12**

4(d) The magnetic field in the interior of a certain solenoid has the value 6.0×10^{-4} T when the solenoid is empty. When it is filled with iron, the field becomes 2.7 T. Find the relative permeability under these conditions. **05**

SECTION-B

5(a) What is simple Harmonic motion? Show that the simple Harmonic motion is an oscillatory motion in terms of displacement velocity and acceleration and show also these graphically.   12

5(b) Calculate the average kinetic energy and the total energy of a body executing simple Harmonic motion. Show that, the principle of conservation of energy is obeyed by a harmonic oscillator.   13

5(c) The force and displacement of a simple dynamic system undergoing sinusoidal excitation are given by the equations $F = 11 sin\left(\frac{\pi t}{6}\right)$ N, and $Y = 2 sin\left(\frac{\pi t}{6} - \frac{\pi}{4}\right)$ meters. Calculate the work done by the excitation force in (i) 24 seconds and (ii) 5 days.   10

6(a) Show that there is no transference of energy across any section of the medium in the case of a stationary wave.   12

6(b) What are beats? How are they produced? Analytically discuss the formation of beats and show that the number of beats per second is equal to the difference in frequency of the two notes.   13

6(c) A car sounding a horn producing a note of 300 Hz approaches and then passes a stationary observer at a steady speed of 20 m/s. What are the frequencies apparent to the observer when the car is (i) approaching and (ii) receding? What is the interval between these two notes? (Velocity of sound = 320 m/s).   10

7(a) What is telephoto lens? Discuss the importance of a telephoto lens?   08

7(b) Discuss the construction and working principles of a compound microscope. Derive the expression for the magnifying power of a compound microscope.   17

7(c) Derive the expression for magnification when the telescope with the final image at a near point.   10

8(a) What is population inversion? When does the material act as an amplifier? Show that the two-level laser system is not suitable for producing lasers.   12

8(b) Discuss the constructional details and working principle of a semiconductor LASER.   13

8(c) A Ruby laser emits light of wavelength 694.4nm. If a laser pulse is emitted for 1.2×10^{-11}s and the energy released per pulse is 0.15 J, (i) what is the length of the pulse and (ii) how many photons are there in each pulse?   10

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