SECTION-A

1(a) Write short notes on: 12
  (i)   Machine Language
  (ii)   Assembly Language
  (iii) Structured Programming
  (iv)   Compiler & Interpreter

1(b) What are the parts of a C program? Give an example & identify each parts.   10

1(c) Write a C program to solve the following algebraic equation   08
$$x = (a + b)^3 + \left(\frac{c}{d}\right) \% e$$

1(d) Write a C program to find the size of a variable. [N.B: All types of data type must be   05
considered and also provide the output of the program]

2(a) Write down the pseudocode and detailed algorithm to input electricity unit charges and   12
calculate total electricity bill according to given conditions:
For first 50 units, Tk 2.00/unit
For next 100 units, Tk 2.50/unit
For next 100 units, Tk 3.00/unit
For unit above 250 units, Tk 4.00/unit
An additional surcharge of 20% is added to the bill.

2(b) Draw the flowchart of if…else and else…if.   08

2(c) Write a program to make such a pattern like a pyramid with numbers   15

```
        1
      2   3
    4   5   6
  7   8   9   10
```

3(a) How a function can be categorized? Explain each of the type with an example.   10

3(b) What is recursion? Write a program to solve GCD problem.   09

3(c) Compare call by value & call by references with necessary examples.   08

3(d) What are the basic file operations in C? Explain with appropriate examples.   08

4(a) How can you initialize a 2-dimensional array of size 4 by 3? Give an example & write a   12
program to find the transpose of the matrix by using the above example.

4(b) Write a C program to merge two files and write them to another file.

4(c) What are the characteristics of OOP? Briefly explain them with examples.   1[

4(d) Write down the basic structure of a class and mention how to create an object of that class.   05

SECTION-B

5(a) Briefly discuss the following operators: 12
      i)   Comma separated operator
      ii)   Conditional operator
      iii)   Bitwise operator

5(b) Write the output of the following code segment   05

```
main () {
        int n;
        for (n=12; n>=3/5; n--){
        printf ("n=%d", (n--)%3); }}
```

5(c) Write a C program to find the first and last digit of any number.   14

5(d) What is Automatic type conversion? How can you perform the casting operation of a   04
variable?

6(a) Which operations are not valid in String data using normal operators? How can you   10
perform these operations?

6(b) Write a C program to find the total number of alphabets, digits or special characters in a   12
string.

6(c) Write the output of the following code segment   08

```
char *name="Harry Potter";
printf ("%c", *name);
printf ("%c", *(name+6));
printf ("%c", *(name++));
printf ("%c", *name++);
```

6(d) Why string data are so important?   05

7(a) What is the array of pointers? Write the importance of using pointers.   20

7(b) Write a C program to copy one array to another using pointer.   10

7(c) Write the output of the following   05

```
int main () {
int arr [5] = {10, 50, 30, 40, 60, 70, 80};
int *ptr = &arr[2];
while ( ptr <= &arr[4]) {
*ptr++;
printf ("%d",*ptr); }}
```

8(a) What are the techniques of passing structure variable as arguments? Write the basic differences between struct and union with examples. 15

8(b) Suppose a Book has the following attributes 12
ISSN, Book_name, Author_name, Copy, Price
Write a program using struct to take inputs of n number of books and display their information.

8(c) Write the differences of the following with examples. 08
i) String and Array
ii) Struct and Array

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
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 missing.

SECTION-A

1(a) Make sentence with the following structures using the words given in brackets.   14
    i.   Subj. + Linking verb + Adj. Complement. (Appear as verb)
    ii.   Subj. + Intransitive verb + Adv. of Manner. (Study as verb)
    iii.   Subj. + Transitive verb + Object. (Read as verb)
    iv.   That + Subj. + Verb + Adv. of Manner + Verb + Adj. Complement. (Speak and is as verb)
    v.   Since + Subj. + Verb + Adj. Complement, Subj + Verb + Adv. of place. (is and prosper as verb)
    vi.   Subj. + Verb + Adv. of Manner, but + Verb + Adj. Complement. (Labor and is as verb)
    vii.   Subj. + Relative pronoun + Verb + Adv. of place, + Verb + Noun Complement. (Live and is as verb)

1(b) Change the following words as asked in brackets and make sentences with the changed forms: 12
Solvency (into adj.), false (into noun), height (into adj.), delusion (into verb), criminal (into verb), cage (into verb).

1(c) Make new word with each of the following suffix and prefix. Use them in sentences.   09
_____ive, _____wise, Ultra_____, For_____, _____ly, Be_____.

2(a) Transform the following sentences as asked in brackets.   14
    i.   Liza, who is a banker, works sincerely in office. (Simple)
    ii.   Soma walking everyday at morning is healthy. (Complex)
    iii.   What you recite sweetly is nice to enjoy. (Simple)
    iv.   He cannot exercise regularly because of his laziness. (Complex)
    v.   In spite of being punctual he is unfortunate in life. (Complex)
    vi.   Besides living peacefully, he helps the poor. (Compound)
    vii.   Habib is the most hardworking boy in the village. (Positive)

2(b) Make use of the following words in sentence as asked in brackets.   12
Bed (as verb), Back (as adj.), Back (as verb), About (as adv.), Advance (as adj.), Baby (as verb)

2(c) Write one synonym for each of the following words and use them in sentence.   09
Engineer, Born, Holy, Fringe, Wreck, Luxury.

3(a) Make wh question with the underlined word(s) of the following sentences.   14
    i.   I would like chocolate once.
    ii.   Mim has been suffering from fever for three days.
    iii.   Karim's pen has gone lost.
    iv.   Shova reads hard to gather knowledge.
    v.   Shila weighs 60 kgs.
    vi.   Mim called you to his party.
    vii.   The pond is waist deep.

3(b) Complete the sentences with subordinate clauses:
   i) The boy welt 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 sentence with the following modals as asked in brackets.   09
   i) Can (to express an offer to somebody else)
   ii) Should + have + past participle of verb (to express a past action, not discharged)
   iii) Must (to express certainty)
   iv) Should (to express obligation)
   v) Will (to express determination)
   vi) Would (to express a polite request)

4(a) Correct the following sentences.   14
   i. Chairman will suppose to preside over the meeting.
   ii. My brother is M.A.
   iii. He wants some blotting.
   iv. The clock struck six O'clock.
   v. When he is lame, he can't walk a long path.
   vi. Quote the poem from heart.
   vii. The book cost him fifty money.

4(b) Express the following notions and functions in sentence.   12
   i. Command, ii. Willingness, iii. Cheerfulness, iv. Tension, v. Dislike, vi. Honesty.

4(c) Make sentences with the following idioms and phrases.   09
   Spill the beans, face the music, cut to the chase, bear down, to go from rags to riches, a piece of cake.

SECTION-B

5(a) Make a precis of the following passage.   20
   Many times we listen to-'honesty is the best policy', but reality focuses before us the view that honesty is the best policy having no importance in the achievement of the attractions of life in the world. What we, realistic human beings crave for attractions refers to economic excellences such as post, position, business, a lot of assets, etc. But the best method to gain better these things doesn't effect honesty as the prime concern. Around us whatever posts we experience, nurtures much flattery. If someone flatters the authority of the big posts, the authority choose him/her for the post. Likewise position in anywhere requires a clever path not based on the easy considerations as an honest man does; the same view comes of business. Frequently it is found telling a lie, cheating consumers etc. in business. Even assets' accumulation follow the path of unfairness many times as no transparent ways of justice either in achieving or contributing is followed in the accumulation. Frustration rests in our heart in such a material world where there is only the assessment of compettion in following the way of goal-no matter what honesty prescribes. It so nourishes only and deep the depth of spiritual peace and thereby harmony in the rhythm of life. So Warren Buffet, an American philanthropist', says 'Honesty is the very expensive gift. Don't expect it from cheap people.'

5(b) What are Francis Bacon's suggestion on study?   10

5(c) Reflect the importance of sacrifice with the light of the character of Jim and Della in The Gift of The Magi.   10

6(a) Write a paragraph on "Arts and Humanities for Engineers".   15

6(b) Write a CV with a cover letter for the post of automation engineer of Tesla.   20

7(a) Amplify the following idea –   20
      "Life can only be understood backwards, but it must be lived forwards".

7(b) Write an e-mail to your professor 'X' requesting her to supervise your thesis paper on   15
      thermodynamics.

8(a) Write a free composition on the following –   35
      The healthy youths: The development of a Country.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
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) 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 $\vec{B}$.   12

1(b) A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction of $\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$.   12

1(c) Show that $\vec{\nabla}\phi$ is a vector perpendicular to the surface $\phi(x, y, z) = c$, where c is a constant. Hence find the unit normal to the surface $x^2y + 2xz = 4$ at the point (2,-2,3).   11

2(a) Find the work done in moving a particle once around a circle C in the xy-plane, if the circle has center at the origin and radius 3 and if the force field is given by $\vec{F} = (2x - y + z)\hat{\imath} + (x + y - z^2)\hat{\jmath} + (3x - 2y + 4z)\hat{k}$.   11

2(b) What is meant by conservative vector field? Prove that $\vec{F} = (y^2\cos x + z^3)\hat{\imath} + (2y\sin x - 4)\hat{\jmath} + (3xz^2 + 2)\hat{k}$ is a conservative force field. Also find the scalar potential of the force field $\vec{F}$.   12

2(c) Verify Green's theorem in the plane for $\oint_C (xy + y^2)dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.   12

3(a) Write the matrix $A = \begin{bmatrix} 3 & 2 & -1 \\ 1 & 4 & 5 \\ -2 & 0 & 6 \end{bmatrix}$ as the sum of a symmetric and skew-symmetric matrices.   10

3(b) If possible, find the inverse of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 0 \\ 0 & 1 & 2 \end{bmatrix}$ by elementary transformations.   12

3(c) Reduce the matrix $A = \begin{bmatrix} 2 & -1 & 0 & 3 \\ 1 & 0 & 4 & -3 \\ -4 & 1 & 5 & 0 \end{bmatrix}$ to echelon form, then to canonical form and then to normal form. Also find its rank.   13

4(a) If A is involuntary, then show that $\frac{1}{2}(I + A)$ and $\frac{1}{2}(I - A)$ are idempotent.   08

4(b) Determine the values of a so that the following system
$x + y - z = 1$
$2x + 3y + az = 3$
$x + ay + 3z = 2$
has (i) no solution, (ii) infinite solution, (iii) a unique solution.   12

4(c) Find the characteristic roots, characteristic vectors for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence verify Cayley Hamilton theorem.   15

SECTION-B

5(a) Explain linearity and nonlinearity of a differential equation with examples. Find the differential equation corresponding to the equation $y = ae^x + be^{2x} + ce^{-3x}$, where a, b, and c are arbitrary constants. **13**

5(b) Show that the differential equation $x\cos\left(\frac{y}{x}\right)\frac{dy}{dx} = y\cos\left(\frac{y}{x}\right) + x$ is homogeneous and solve it. **11**

5(c) Find the general solution of the differential equation $(12y + 4y^3 + 6x^2)dx + 3(x + xy^2)dy = 0$. **11**

6(a) Find the particular solution of the differential equation $\frac{dy}{dx} + y\cot x = 2x + x^2\cot x \ (x \neq 0)$ given that $y = 0$ when $x = \frac{\pi}{2}$. **11**

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

6(c) Set up the initial-value problem that will give the velocity of a 60 kg sky diver that jumps out of a plane with no initial velocity and an air resistance of $0.8|v|$. for this example, assume that the positive direction is upward. **13**

7(a) Solve $(D^4 - 5D^3 + 6D^2 + 4D - 8)y = 0; D = \frac{d}{dx}$. **10**

7(b) Solve $\frac{d^2y}{dx^2} + 4y = x\sin x$. **12**

7(c) Solve $y'' + y = \sec x$. **13**

8(a) Find the general solution of the differential equation $(D - 1)^2(D + 1)^2 = \sin^2\frac{x}{2} + e^x + x$. **12**

8(b) Solve $(D^2 - 2D + 1)y = xe^x\cos x$. **12**

8(c) Find the complete solution of $(x^2D^2 - 4xD + 6)y = x^4\sin x$. **11**

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
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 and explain its significance. Classify manufacturing process with examples. | 10

1(b) Explain the parameters that one must use to evaluate the quality of molding sand. Differentiate between backing sand, parting sand and facing sand. | 10

1(c) Define pattern and pattern allowance. Suggest the most suitable type of pattern for casting a wheel rim. Provide draft allowance to the pattern shown in Fig. 1 after providing the machining allowance. The draft angle is 0.75^0 for external details and 1^0 for internal details. | 10
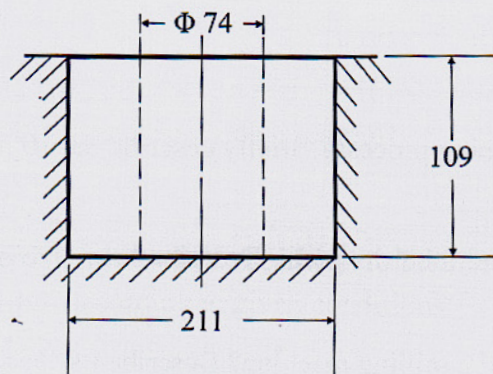

Fig. 1

1(d) What are the functions of riser and sprue? | 05

2(a) Define casting. Describe its classification with necessary diagram. | 08

2(b) How cold chamber die casting differ from hot chamber die casting? | 05

2(c) What does precision investment casting mean? Explain the most used casting method for manufacturing pipe fittings, step by step with neat sketch. Mention some advantages of this method. | 12

2(d) What is die casting? List out the advantages and limitations of die casting. | 10

3(a) Explain the functions of flux coating used in arc welding. Differentiate between welding, brazing, and soldering. | 08

3(b) Describe the essential conditions that must be fulfilled for successful welding operations. Explain the terms: weld bead, weld metal, HAZ. | 08

3(c) What is electrode? Explain about the ingredients of electrode. | 08

3(d) Describe the flames used in oxy-acetylene welding with necessary sketches. Present a comparative analysis between GTAW and GMAW. | 11

4(a) What is meant by metal forming process? Explain the choice of heating temperature in metal forming process.

4(b) Describe the following forging processes with neat sketch: 08
(i) Upsetting, (ii) heating

4(c) Draw neat sketches of different mills used for hot rolling with necessary labeling. Explain hot extrusion principle. Compare backward extrusion process with direct extrusion. 12

4(d) Briefly discuss the cold working process used for making medals. Explain the processes: 09
   i) Blanking and punching
   ii) V-bending and wiping bending
   iii) Drawing

SECTION-B

5(a) Why metal removal processes are important in manufacturing? What are the factors affecting metal cutting? 10

5(b) Prove that, $\tan\varphi = \frac{r\cos\alpha}{1-r\sin\alpha}$, where φ is the shear angle, r is the cutting ratio and α is the rake angle. 08

5(c) Sketch a Merchant circle. How can you calculate the cutting force from Merchant circle? 12

5(d) What is cutting fluid? Why it is used? 05

6(a) What is meant by machining process? Briefly describe the 10 machining operations with neat sketch. 10

6(b) Draw an engine lathe and label its parts. Describe how size of a lathe machine can be specified. 10

6(c) What are the functions of a milling machine? Describe its classification. 08

6(d) Explain the working principle and necessity of quick return mechanism with neat sketches. Mention the difference between shaper and planer machine. 07

7(a) What is meant by automation? How it can be done in manufacturing process? 08

7(b) What is meant by non-conventional machining? 05

7(c) Describe the ECM process with neat sketch and explain how it differs from the EDM process. 12

7(d) What are the advantages and disadvantages of laser beam machining? What are the areas of its applications? 10

8(a) What is meant by CNC machine tool? Explain which systems are necessary in a CNC machine. 10

8(b) Describe extrusion process for plastic products with neat sketch. 07

8(c) Explain the codes of CNC machining operation. 05

8(d) What does PCB mean? Describe the necessity of PCB and PCB fabrication process with real life examples. Briefly discuss the general PCB fabrication process. 13

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechatronics Engineering
B. Sc. Engineering 1st Year 2nd Term Examination, 2022
Phy 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? Prove that $E = \frac{1}{2\pi\epsilon_0} \frac{p}{z^3}$ where the symbols have their usual meanings.   10

1(b) Derive an expression for the electric field due to a charged disk at a point on its central axis. Hence discuss the advantage of Gauss law in the limiting cases.   15

1(c) Two metal spheres are 3.5cm in radius and carry charges of $+1.0 \times 10^{-8}$ Coul and -3.0×10^{-8} Coul respectively, assumed to be uniformly distributed. If their center are 2.0m apart, calculate (a) the potential of the point halfway between their centers and (b) the potential of each sphere.   10

2(a) What is electric potential? Derive an expression for the potential due to a point charge.   10

2(b) Discuss the uses of a capacitor.   05

2(c) What is the capacitance of a cylindrical capacitor of length L formed by two coaxial cylinders of radii a and b?   10

2(d) The inner and outer cylinder conductors of a long coaxial cable used to transmit TV signals have diameters 0.15mm and 2.1mm. What is the capacitance of 10m of this cable?   10

3(a) What are the Kirchhoff's two laws? Using these two laws derive Wheatstone principle.   12

3(b) What is inductance of an inductor? Derive an expression for mutual inductance of two coils placed coaxially near each other.   13

3(c) Two coils are at fixed locations. When coil 1 has no current and the current in coil 2 increases at the rate 15.0 A/s, the emf in coil 1 is 25.0 mV. What is their mutual inductance?   10

4(a) What is magnetic moment? Derive a relation between the orbital magnetic moment of an electron and its orbital angular moment.   10

4(b) What is the drawback of a simple microscope? Show that the magnifying power of a compound microscope is $M = \frac{D(L - f_0 - f_e) + f_e(L - f_0)}{f_e f_0}$ where the symbols have their usual meanings.   15

4(c) A person has his near point at 15cm and a range of distinct vision of 85cm. What are his ranges of distinct vision when he wears a close fitting spectacle having a power of -0.4 diopters?   10

SECTION-B

5(a) What is Simple Harmonic Motion? Show that simple harmonic motion is an oscillatory motion in terms of displacement, velocity, and acceleration. Show all these parameters with schematic diagram.   10

5(b) Show that the superposition principle is valid only in case of linear homogeneous equation.   10

5(c) Derive an expression for time period when the body oscillates between two springs.   05

5(d) A simple harmonic motion is represented by $y = 12\sin(6t - \frac{\pi}{3})$ where y is measured in meters, t in seconds, and the phase angle in radians. Calculate the (i) frequency, (ii) epoch, (iii) maximum velocity and acceleration, and (iv) displacement at t=0 and t=6 seconds.   10

6(a) Explain oscillatory behavior of simple harmonic motion by calculating velocity and acceleration at different displacements.   10

6(b) Discuss analytically the formation of stationary waves due to reflection (i) at a rigid boundary and (ii) at a free boundary.   15

6(c) Calculate the velocity of which a source of frequency 10^4 per second should approach the observer at rest in order to produce Doppler' shift of 450 per second (velocity of sound=340m/s)   10

7(a) What is meant by Zener diode? Draw a full wave bridge rectifier.   10

7(b) Show that a full wave rectifier is twice as effective as half wave rectifier.   15

7(c) The four diodes used in a bridge rectifier circuit have forward resistances of 1Ω and have infinite reverse resistances. The ac supply voltage is 220V and load resistance is 450 Ω. Calculate mean load current and power dissipation in each diode.   10

8(a) Discuss the generation of coherent radiation. What are the applications of LASER?   10

8(b) What is population inversion? Discuss the constructional details and working principle of a semiconductor LASER.   15

8(c) A LASER beam has a power of 50MW. It has an aperture of 5×10^{-3}m and it emits light of wavelength 7240Å. The beam is focused with a lens of focal length 1cm. Calculate the area and intensity of the image.   10

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