

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering
1st Year 1st Semester Final Examination - 2025

Course No: MAT 05411101

Course Title: Coordinate Geometry and Linear Algebra

Time: 03 (Three) hours

Full Marks: 60

N.B. : (i) Answer any two question from each PART
each PART

(ii) Use separate answer scripts for

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----

--N/A-----

PART-A

1. (a) Transform the equation $3x^2+2xy+3y^2-18x-22y=50=0$ to $4x^2+2y^2=1$ when 05
referred to rectangular axis through the point (2,3). Find the inclination of
the later axis to the former.
- (b) Show that a homogeneous quadratic equation represents a pair of straight 05
lines passing through the origin. When are they parallel and perpendicular?
If the pair of straight lines $x^2 - 2fxy - y^2 = 0$ and $x^2 - 2gxy - y^2 = 0$
be such that each pair bisects the angle between the other pair, prove that
 $fg = -1$.
2. Define conic section. Write down a general equation of a second degree 03
(a) stating the conditions for circle, parabola, ellipse and hyperbola. Test the
nature of the conic $9x^2 - 24xy + 16y^2 - 18x - 101y + 19 = 0$.
- Obtain the equations of tangent and normal in parametric form for the 04
(b) parabola $y^2 = 4ax$. Find the equations of tangent and normal to
the ellipse $x^2 + 4y^2 = 32$ at $\theta = \pi/4$.
- A search light has parabolic reflector, forms a bowl with 40 cm wide from 03
rim to rim and 30 cm deep. The bulb is located at the focus.
- (c) (i) What is the equation of the parabola used for reflector?
(ii) How far from the vertex is the bulb to be placed so that the maximum
distance covered?
3. Define eigen values and eigen vectors of a matrix. Find all the eigen values 10
and corresponding eigen vectors of $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. Also, find an invertible
matrix P such that $P^{-1}AP$ is diagonal.

OR

State Cayley-Hamilton theorem. Find the characteristic equation of the
matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 1 \\ 3 & 1 & 1 \end{bmatrix} \text{ and verify Cayley-Hamilton theorem for it.}$$

PART-B

4. (a) Define rank and nullity of a matrix. Find rank and nullity of this matrix. 05
A system of linear equation is given

$$\begin{aligned}x_1 + 2x_2 - x_3 + x_4 &= 0 \\2x_1 + 4x_2 - 2x_3 + 2x_4 &= 0 \\3x_1 + 6x_2 - 3x_3 + 3x_4 &= 0 \\4x_1 + 8x_2 - 4x_3 + 4x_4 &= 0\end{aligned}$$

- (b) Write down an $m \times n$ system of linear equations including their consistency. Determine the values of λ so that the following linear system in three variables x, y and z has (i) a unique solution (ii) more than one solution (iii) no solution: 05

$$\left. \begin{aligned}x + y - z &= 1 \\2x + 3y + \lambda z &= 3 \\x + \lambda y + 3z &= 2\end{aligned} \right\}$$

5. (a) What do you mean by subspace of a vector space. Give an example which is not a subspace of a vector space \mathbb{R}^3 . 03

- (b) How can you define linear combination of n vectors of a vector space? Determine whether or not the vector $u = (3, 9, -4, -2)$ as a linear combination of the vectors $u_1 = (1, -2, 0, 3), u_2 = (2, 3, -1, 0)$ and $u_3 = (2, -1, 2, 1)$. 04

- (c) What is the generator of a vector space. Prove that the vectors $\{(2, -1, 3), (4, 1, 2), (8, -1, 8)\}$ does not generate the vector space \mathbb{R}^3 . 03

OR

5. (a) Define linearly dependent and linearly independent set of vectors. Prove that the zero vector of any vector space $V(F)$ is linearly dependent but $(1, 2) \in \mathbb{R}^2$ is linearly independent. 03

- (b) For which value of k , the vectors $(k, 1, 0), (1, k, 1)$ and $(k, 1, k + 1)$ are linearly independent. 04

- (c) Define basis and dimension of a vector space. Determine whether or not the following form a basis of the vector space $\mathbb{R}^3: \{(1, 2, 0), (0, 5, 7), (-1, 1, 3)\}$. 03

6. (a) What are meant by linear transformation? Define kernel and image of a linear transformation. Determine the linear transformation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by $T(x, y, z) = (x + y - z, x - y + z, x + y + z)$ is invertible or not. If the operator is invertible, find T^{-1} . 07

- (b) Find an orthonormal basis of W of \mathbb{R}^3 spanned by $\{v_1 = (1, 1, 1), v_2 = (0, 1, 1), v_3 = (0, 0, 1)\}$. 03

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Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science & Engineering

Final Examination, 2024

1st Year 1st Semester

Course No: CSE 0541 1143

Course Title: Discrete Mathematics

Time: 03 (Three) hours

Full Marks: 60

N.B. : (i) Answer all questions from each PART

(ii) Use separate answer scripts for each PART

(iii) Marks allotted are indicated in the margin

(iv) Special Instruction (if any)-----N/A-----

PART-A

1. (a) Define Tautology. Show that $[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$ is a tautology. 03
- (b) Show that $\neg(p \vee (\neg p \wedge q))$ and $\neg p \wedge \neg q$ are logically equivalent by developing a series of logical equivalences. 05
- (c) Determine which rule of inference is used in the following arguments: 02
 If it rains today, then we will not have a barbecue today. If we do not have a barbecue today, then we will have a barbecue tomorrow.
 Therefore, if it rains today, then we will have a barbecue tomorrow.
2. (a) Define Ackermann function. From the definition of that function find $A(1,3)$. [Hins. $A(m, n)$] 05
- (b) Prove the following: i) $A \cap (A \cap B) = A$ ii) $A \cap (A \cup B) = A$ 05
3. (a) Define reflexive, symmetric and transitive relation. 03
- (b) Consider the following five relations on the set $A = \{1, 2, 3, 4\}$: 05
 $R = \{(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)\}$
 $S = \{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$
 $T = \{(1, 3), (2, 1)\}$
 $U = A \times A$, the universal relation
 $V = \emptyset$, the empty relation
 Determine whether or not each of the above relations on A is
 i) Reflexive
 ii) Symmetric
 iii) Transitive
 Define Equivalence relation with example. 02

OR

3. (a) Let $A = \{1,2,3,4,5,6\}$ and let R be the relation on the set A;
 $R = \{(x, y) \mid x \text{ divides } y\}$
 i) Write R as a set of ordered pairs. 02
 ii) Draw its directed graph. 02
- (b) Draw the graph G corresponding to the adjacency matrix: 03

$$A = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$
- (c) What is isomorphism? Draw two graphs that are isomorphic and describe briefly. 03

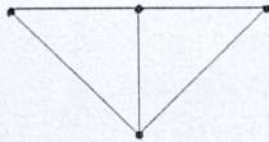
PART-B

4. (a) Find the solution to the recurrence relation: $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ 05
with the initial conditions $a_0=2, a_1=5$ and $a_2=15$

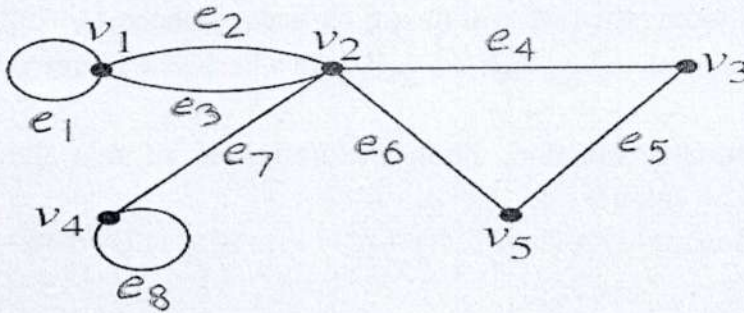
(b) Define with figure: 05
i. Regular graph
ii. Bipartite graph
iii. Complete graph

5. (a) f, g, h are functions on $X = \{1, 2, 3\}$ as 04
 $f = \{(1, 2), (2, 3), (3, 1)\}$
 $g = \{(1, 2), (2, 1), (3, 3)\}$
 $h = \{(1, 1), (2, 2), (3, 1)\}$
Compute i) $f \circ g \circ h$ ii) $f \circ h \circ g$

(b) Find all spanning trees of the following graph: 04



(c) Represent the graph with an incidence matrix: 02



6. (a) Consider Universal set U and two sets A and B. Shade the following sets using Venn diagram: 04

i. $A \cap B^c$ ii. $(B/A)^c$

(b) Define the following function with example: 06
i. Bijective ii. Ceiling iii. Floor

OR

6. (a) Find the value of $A(1, 3)$ using Ackermann function. 04

(b) In a class of 80 students, 50 students know English, 55 students know French and 46 students know German language. 37 students know English and French, 28 students know French and German, 21 students know English and German, 7 students know none of the languages. How many students know all the three languages? 04

(c) Find $f(4)$ if f is defined recursively by $f(0) = -1, f(1) = 2$ and $f(n+1) = f(n)^2 f(n-1)$. 02

-X-

- (f) Find errors, if any, in each of the following segments: 3
- i. `if (x+y = z && y>0)`
`printf(" ");`
 - ii. `if (code > 1);`
`a=b+c`
`else`
`a=0`
 - iii. `if (p<0) || (q<0)`
`printf("sign is negative");`

2. (a) How would you decide the use of one of the three loops in C for a given problem? 2
- (b) Explain the operation of each of the following for loops: 3
 - i. `for(n=1;n<=5;)`
`sum=sum+n;`
 - ii. `for(n=1;n<5;n++)`
`n=n-1;`
 - iii. `for(n=5;n<=m;n-=1)`
`sum=sum+n;`
- (c) Compare, in terms of their functions, the following pairs of statements: 2+2
 - i. `break` and `continue`
 - ii. `while` and `for`
- (d) When do we use `for(; ;)` statements. What is the output of the following code? 1+1

```
int n=0, m=1;
do
{
printf(m);
m++;
}while(m<=n);
```
- (e) Explain the differences between structures and unions. 2
- (f) Describe the output of the following if `k=5, i=++k, j=k++, k++, ++k`. 2

PART-B

3. (a) What is a data structure? Why an array is called a data structure? 1+2
- (b) Define stack. Explain stack operations. 1+2
- (c) Write a recursive algorithm to print the Fibonacci series up to N terms. 2
- (d) Sort the letters of the string "COMPUTER" using the Bubble Sort algorithm. Write the total number of comparison and total number of interchanges required to sort the data. 3
- (e) What is the output of the following program? 2

```
main()
{
char string[]="Hello world";
int m;
for(m=0; string[m]!='\0'; m++)
if((m%2)==0)
printf("%c", string[m]);
}
```
- (f) Identify errors, if any, in each of the following initialization statements. 2
 - i. `int number[] = {0 ,0 ,0, 0};`
 - ii. `float item[3][2] = {0 ,1 , 2 ,3};`
 - iii. `float item[2,4] = {(0 ,1 , 2 ,3),(0 ,1 , 2 ,3)};`
 - iv. `float result[10]=0;`

OR

3. (a) What is dynamic memory allocation? 1
- (b) What is the principal difference between the functions `malloc` and `calloc`? What does the following code achieve? 1+2
 - i. `int * p;`
`p= malloc(sizeof(int));`
 - ii. `float* p;`
`p= calloc(10,sizeof(float));`

- (c) Find errors, if any, in the following memory management statements: 2
- i. `*ptr = (int *)malloc(m, sizeof(int));`
 - ii. `table = (float *)calloc(100);`
 - iii. `node = free(ptr);`
- (d) Comparing the working of the following functions: 2+2
- i. `strcpy` and `strncpy`;
 - ii. `strcmp` and `strncmp`
- (e) What will be the output of the following code? 1
- ```
char s1[]="ANIL KUMAR GUPTA";
char s2[]="KUMAR";
printf(strstr(s1,s2));
```
- (f) Why must the array be sorted before applying binary search? Write an algorithm to search an element using binary search in a sorted array. 1+3
4. (a) Describe the two ways of passing parameters to functions. When do you prefer to use each of them? 1+1
- (b) A function to divide two floating point numbers is as follows: 2
- ```
divide ( float x, float y)
{
    return (x/y);
}
```
- What will be the value of the following function calls"
- i. `divide(10,2)` iii. `divide(4.5,1.5)`
 - ii. `divide(9,2)` iv. `divide(2.0,3.0)`
- (c) When do we use the following? 2
- i. Unions
 - ii. Bit fields
 - iii. typedef keyword
 - iv. The sizeof operator
- (d) How is a pointer initialized? Explain the effects of the following statements: 1+2
- i. `int a, *b = &a;` iii. `char *s;`
 - ii. `int p, *p;` iv. `a = (float *) &x;`
- (e) What is wrong with the following code? 2
- i. `int **p1, *p2;`
`p2 = &p1;`
 - ii. `int m;`
`int **x = &m;`
- (f) How does an append mode differ from a write mode? What does the following statement do? 2+2
- i. `while (c=getchar() != EOF)`
`putc(c, f1);`
 - ii. `for(i=1;i<=5;i++)`
{
`fscanf(stdin, "%s", name);`
`fprintf(fp, "%s", name);`
}

Sylhet Engineering College, Sylhet
 (Shahjalal University of Science & Technology)
 Department of Computer Science and Engineering
 1st year 1st semester final Exam 2025

Course No: EEE 0713 1109

Course Title: Introduction to Electrical Engineering

Time: 03 (Three) hours

Full Marks: 60

N.B. : (i) Answer any three question from each PART
 (iii) Marks allotted are indicated in the margin

(ii) Use separate answer scripts for each PART
 (iv) Special Instruction (if any)-----N/A----

PART-A

1. (a) What is the differences between Super Node & Node? 02
 (b) Calculate the equivalent resistance R_{eq} in the circuit in Fig. 1(b). 03

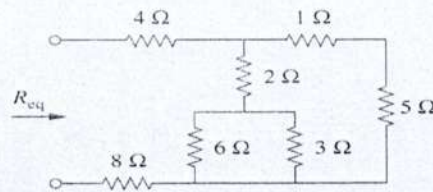


Figure 1(b)

- (c) Obtain the equivalent resistance R_{ab} for the circuit in Fig. 1(c) and use it to find current i . 05

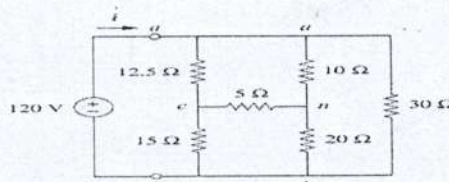


Figure 1(c)

OR

1. (a) Define the following terms used in electrical circuit analysis: Node, Branch and Loop. 02
 (b) Compare the advantages and disadvantages of series and parallel circuits in household wiring. 03
 (c) Convert the Δ network in Fig. 1.1(c) to an equivalent Y network: 05

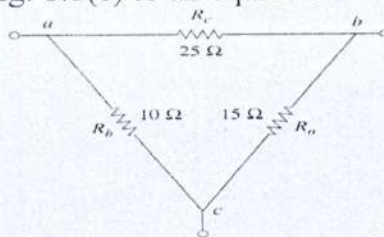


Figure 1.1(c)

2. (a) Define Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL). 02
 (b) Compare the applications of KCL and KVL in circuit analysis, providing examples where each law is most useful. 03
 (c) Find currents and voltages in the circuit shown in Fig. 2(c). 05

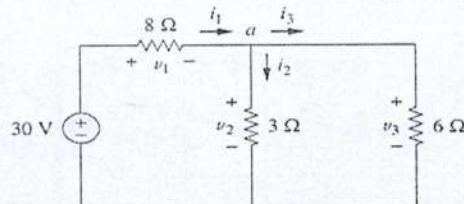
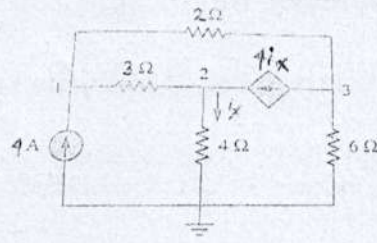


Figure 2(c)

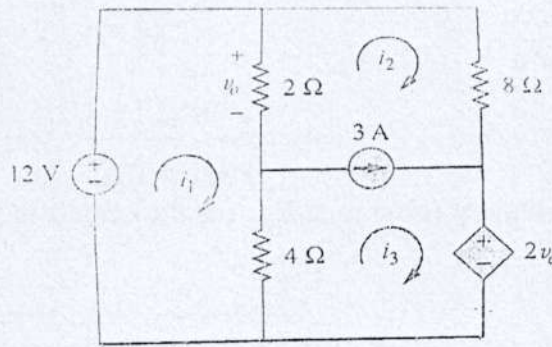
3. (a) Find the voltages at the three nonreference nodes in the circuit of fig. 3(a)



05

fig. 3(a)

- (b) Use mesh analysis to find i_1 , i_2 and i_3 in the circuit of fig. 3(b)



05

fig. 3(b)

PART-B

4. (a) Explain why methods of analysis are required in electrical circuit analysis, highlighting their importance in simplifying complex circuits and obtaining accurate electrical quantities. 02
- (b) Draw and explain all the phasors of pure resistive circuit, pure inductive circuit and pure capacitive circuit. Do you know in which circuit, voltage is leading and in which, it is lagging? 03
- (c) Determine the current through a $200\mu F$ capacitor whose voltage is shown in Fig. 4(c). 05

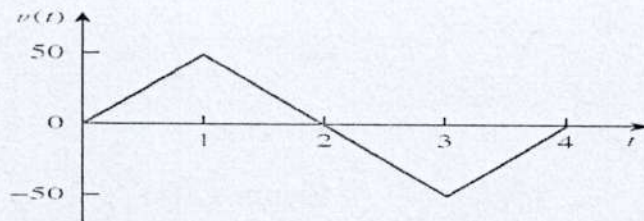


Figure 4(c)

OR

4. (a) Define Sinusoids, Phasors and Frequency. 02
- (b) Calculate the equivalent inductance for the inductive ladder network in Fig. 4.1(b) 03

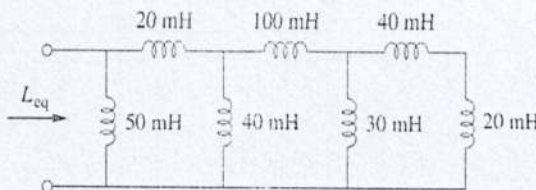


Figure 4.1(b)

- (c) Evaluate these complex numbers: 05

(a) $(40\angle 50^\circ + 20\angle -30^\circ)^{1/2}$

(b) $\frac{10\angle -30^\circ + (3 - j4)}{(2 + j4)(3 - j5)^*}$

5. (a) Find the Thevenin equivalent circuit of the circuit shown in **Fig. 5(a)**, to the left of the terminals a-b. Then find the current through $R_L = 6\Omega$, 16Ω , and 36Ω . 05

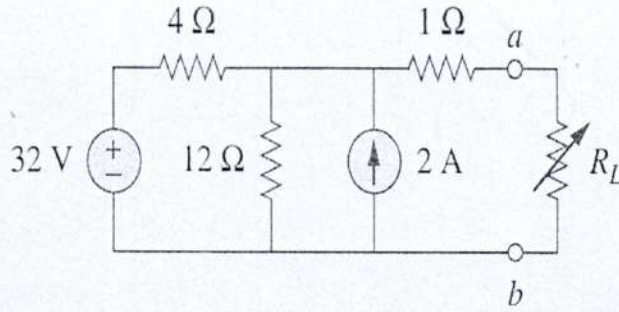


Figure 5(a)

- (b) Find the Norton equivalent circuit of the circuit in **Fig. 5(b)** at terminals a-b. 05

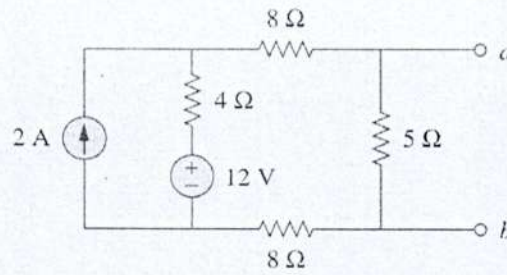


Figure 5(b)

6. (a) Explain the concepts of instantaneous power and average power in an AC circuit. 02
 (b) Find $v(t)$ and $i(t)$ in the circuit shown in **Fig. 6(b)** 03

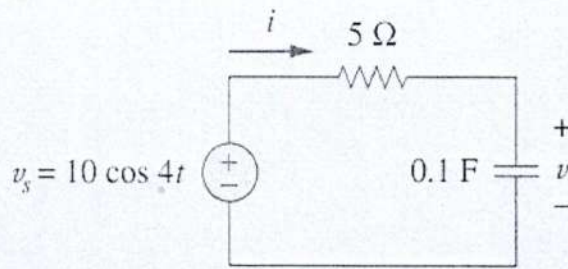


Figure 6(b)

- (c) Calculate V_x in the circuit of **Fig. 6(c)** using the method of source transformation 05

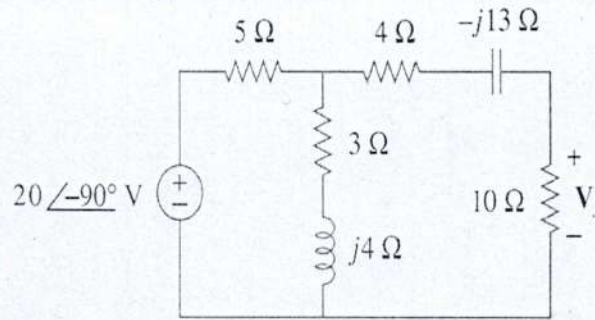


Figure 6(c)

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Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering
1st year 1st semester final Exam 2025

Course No: PHY 0533 1103

Course Title: Physics

Time: 03 (Three) hours

Full Marks: 60

N.B. : (i) Answer any three question from each PART
 (iii) Marks allotted are indicated in the margin

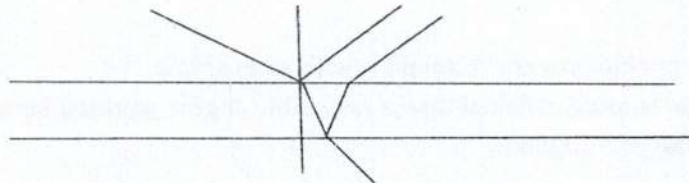
(ii) Use separate answer scripts for each PART
 (iv) Special Instruction (if any)-----N/A----

PART-A

1. (a) What is wave front? Suppose wave of light whose velocity is c traveling through space. Where will the light after time t ? Explain your answer. 1+2
- (b) Show that width of fringe in interference is proportional to wavelength. 04
- (c) In Young's double slit experiment, the separations between the sources are 0.18mm. The fringes are observed on a screen 90 cm away. If with certain monochromatic source of light, the third bright fringe is situated at a distance of 8.1 mm from the central bright fringes. Find the wave length of light. 03

OR

1. (a) What is Fresnel's Biprism? 02
- (b) Derive the equation of path difference for the following thin film: 04



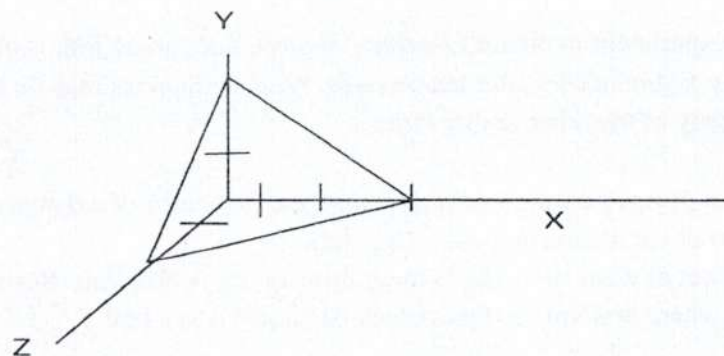
- (c) A beam of parallel rays is incident at an angle of 30° with the normal on a plane parallel film of thickness 4×10^{-5} cm and refractive index 1.50. show that the reflected light whose wavelength is 7.539×10^{-5} cm, will be strengthened by reinforcement. 04
2. (a) Write the characteristics of simple harmonic motion. 03
- (b) Show that total energy of a vibrating particle is constant. 04
- (c) Find angular frequency and time period of a mass of .5kg between two spring S_1 and S_2 oscillates in Simple Harmonic Motion by resultant force 13N .the distance between two spring is 100cm and maximum displacement by S_1 is $x=75$ cm. 03
3. (a) In an experiment to obtain Lissajous' figures, one tuning fork is of 256 Hz and a circular figure occurs after ten seconds. What deductions may be made about the frequency of the other tuning fork? 02
- (b) What is damped oscillation? Prove that, the frequency of a damped oscillation will be zero or oscillation stop when $b^2=4mk$ 04
- (c) An object of mass $m=0.2$ kg is hung from spring ($k=80$ N/m). Resistive force $-vb$ is exists where $b=4$ Nm⁻¹ S. Does block oscillate? If yes find T. 04

PART-B

4. (a) What is degree of freedom? 02
(b) Given Avogadro's number 6.02×10^{23} and Boltzman's constant 1.37×10^{-23} J/K. 03
Calculate K.E. of translation per molecule, total K.E. per molecule and total K.E. per mole.
(c) Write the reasons of modification of gas equation by Van Der Walls . 02
(d) Calculate the molecular diameter of Nitrogen molecules if $n = 2.7 \times 10^{25}$ molecules per m^3 and mean free path is 8×10^{-8} m. 03

OR

4. (a) What do you mean by thermodynamic equilibrium? 02
(b) Discuss the following process by the 1st law of thermodynamics. 04
i) Adiabatic
ii) Isobaric
(c) What is Entropy? When 5gm water is heated from 10°C to 90°C , how much entropy change? 1+3
5. (a) What is reversible process? Explain it with an example. 03
(b) "No engine is more efficient than a reversible engine working between the same two temperature"- Explain. 04
(c) A 10 K-W engine is operating between 217°C and 17°C . Calculate 03
(i) the amount of heat absorbed
(ii) the amount of heat rejected
(iii) the efficiency of the engine
6. (a) What is unit cell? Discuss simple, body centered and face centered cubic crystal . 04
(b) Find the packing fraction of simple and face centered cubic crystal . 04
(d) Write the Miller indices of the following figure: 02



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