

2013-2014

INTRODUCTION TO COMPUTING

CS - 01

Time - 3 Hours

Full Marks - 70

The figures in the margin indicate full marks.

Strictly specify the Group name before answering any question. All the parts of a question should be grouped together under the question number.

Group - A

1. Answer all questions. $1 \times 10 = 10$

I. What is the output of the following program ?

```
#define max 5
int main ()
{
    int i=0;
    i=max++;
    printf("%d", i++);
    return 0;
}
```

- (A) 5 (B) 6 (C) 7 (D) compiler error

II. If x is one dimensional array, then pick up the correct answer

- (A) *(x + i) is same as &x[i]
- (B) *&x[i] is same as x+i
- (C) *(x + i) is same as x[i] + 1
- (D) *(x + i) is same as *x[i]

- III. Choose the correct answer
- enum variable cannot be assigned new values
 - enum variable can be compared
 - enumeration feature increase the power of C
 - none of the above

IV. What will be the output of the following code segment, if any ?

```
myfunc ( struct test t) {
    strcpy(t.s, "world");
}

mainO {
    struct test {
        char s[10];
    } t;
}
```

```
strcpy(t.s, "Hello");
printf("%s", t.s);
myfunc(t);
printf("%s", t.s);
}
```

- Hello Hello
- world world
- Hello world
- the program will not compile

V. If a function is declared as void fn(int *p), then which of the following statements is valid to call function fn()

- fn(x) where x is defined as int x;
- fn(x) where x is defined as int *x;
- fn(&x) where x is defined as int *x;
- fn(*x) where x is defined as int *x;

VI. What is the following function computing? Assume

that both a and b are positive integers.

```
int fn( int a, int b ) {
    if (b == 0)
        return b;
    else
```

```
        return (a * fn(a, b - 1));
    }
```

- output will be 0 always
- output will always be b
- computing a^b
- computing a + b

VII. What will be output if you will compile and execute the following C code:

```
#include<stdio.h>
#include<string.h>
int main()
{
    char s1 []="Hello\n";
    char *s2="Hello\t";
    printf("%d",strcmp(s1 ,s2) && strcmp(s1 ,s2));
    return 0;
}
```

- 1
- Hello
- 1&&Hello
- none of the above
- compiler error

VIII. What will be output if you will compile and execute the following C code:

```
#include<stdio.h>
#define x 5+2
int main()
```

Group B

```
int i;  
i=x*x*x;  
printf("%d", i);  
return 0;
```

- (A) 343 (B) 27 (C) 133 (D) compiler error
(E) none of the above

- IX. What will be output if you will compile and execute the following C code:

```
#include<stdio.h>  
int main()  
{  
    int a=2;  
    if(a == 2)  
    { a = a+2<< 1;  
        printf("%d",a);  
    }  
    else  
    {break;  
    }  
    return 0;  
}
```

- (A) print nothing (B) -3 (C) -2 (D) 1 (E) compiler error

- X. What will be output if you will compile and execute the following C code:

```
#include<stdio.h>  
#include<string.h>  
main()  
{char str[ ]="Hello world";  
printf("%s",str+ 1);  
}
```

- (A) garbage output (B) e (C) Hello world (D) ello world
(E) compilation error

#Answer any three questions : 5×3=15

2. (a) Write down the basic differences between 1's complement and 2's complement.
(b) How to use 2's complement number system to calculate $(31)_{10} - (17)_{10}$ in binary ? 2+3

3. (a) Compare the use of switch statement with the use of nested if-else statements. Which is more convenient?
(b) Write a C program to find largest among three numbers, using ternary operator.
2+3

4. (a) Draw a flow chart to print first n terms in a Fibonacci series.
(b) What's the difference between a null pointer, a NULL macro, the ASCII NUL character and null string ? 3+2

5. Write a C program to print the following pattern. 5

1
1 2 1
1 3 3 1
1 4 6 4 1

6. (a) When char a[] and char *a are treated as same by the compiler ?
(b) What are the main characteristics of a union ? 2+3

Group-C

#Answer any three questions : 15×3=45

7. (a) What is recursion? What advantages are there in its use?
(b) Write a C program to determine whether a given number is positive or negative without using relational and conditional operator.

- (c) Write a C program that accepts an array of integers and return a pointer to the largest element using the dynamic memory allocation,

- (d) Perform the following operations:

- I. Convert $(10010011)_2$ to $(?)_8$
- II. Convert $(420)_6$ to $(?)_4$
- III. Convert $(225.26)_{10}$ to $(?)_{16}$

8. (a) How can a one dimensional array of pointers be used to represent a collection of strings?
(b) Differentiate between function pointer and pointer to function with suitable example.

- (c) Use recursive function calls to evaluate the following series

$$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

- (d) What are the basic data types used in C ?

9. (a) What do you mean by scope and visibility of variables?

- (b) Write a short note on different storage classes in C.
(c) Write a C function to determine frequency of letters A Z or a...z in a given string, considering both cases.

2+6+7

10. (a) Explain “call by value” and “call by address” mechanism for passing arguments into a general function call.
(b) Write a C program that accepts two *one dimensional* sorted arrays and merge them to obtain a sorted array.

- (c) Does mentioning the array name gives the base address in all the contexts ? Explain.

11. (a) Write down the differences between `calloc()` and `malloc()`.

- (b) Define a structure to store the marks obtained by the students in three subjects. Write a C program using that structure to read the data and determine the following:

- (1) Total marks obtained by each student.
(2) The highest mark in each subject and the roll no. of the student who scored it.
(3) The roll no. of the student who obtained the highest total marks.

- (c) What are the differences between compiler and interpreter ?

4+8+3

2013-2014

INTRODUCTION TO COMPUTING

CSE - 01

Time - Three Hours

Full Marks - 70

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Group - A

1. Answer all questions : $1 \times 10 = 10$

I. # define sqr(x) (x * x)

int main()

{

int a ,b=3;

a=sqr(b+2);

printf("%d",a);

}

A. 25 B. 11 C. Garbage value D. None of above

II. The keyword used to transfer control from a function back to the calling function is
A. switch B. goto C. return D. go back

III. Choose the correct output(s) of the following program.

```
int sum(int n)
{
    if (n<1) return n;
    else return (n+sum(n-1));
}

main()
{
    printf("%d",sum(5));
}
```

A. 10 B. 16 C. 14 D. 15 E. None of above
IV. Choose the correct output(s) of the following program.

```
void mainO()
{
    switch(6) {
        case 6.0f:printf("Sangakkara");
        break;
        case 6.0: printf("Sehwag");
        break;
        case 6.0L: printf("Steyn");
        break;
        default: printf("Smith");
    }
}
```

A) Sangakkara

B) Sehwag

C) Steyn

D) Smith

E) Compilation error

V. What will be output when you will execute following c code ?

```
void main()
{
    int arr[ ]{1,2,5,6,9,10};
    int *b=&arr;
    printf("%d ", b[+3]);
}
```

A. 9 B. 6 C. 2 D. Compilation error E. None of the above

VI. Choose the correct output(s) of the following program.

```
int main()
{
    int a = 320; char *ptr;
    ptr=( char *)&a;
    printf("%d ", *ptr);
    return 0;
}
```

A. 9 B. 6 C. 2 D. Compilation error E. None of the above

VII.What can be said of the following ?

```
struct Node {
    char *word;
    int count;
    struct Node left;
    struct Node right;
}
```

A) Sangakkara

B) Sehwag

C) Steyn

D) Smith

E) Compilation error

A) Incorrect definition B. Structures cannot refer to other structures C. Structures can refer to themselves. Hence the statement is correct D. Structure can refer to maximum of one other structure

VIII. Which of the following is not derived data type in c?

A. Function B. Enumeration C. Pointers D. Structure

IX. Choose the correct output(s) of the following program.

```
int main()
{
    int a[5] {5, 1, 15, 20, 25};
    int i, j, m;
    i= ++a[1];
    j = a[1]++;
    m=a[i++];
    printf("%d, %d, %d", i, j, m);
    return 0;
}
```

A. 2 115 B. 1 25 C. 3 2 1 5 D. 2 3 2 0 E. None of above

X. Choose the correct output(s) of the following program.

```
main()
{
    int x=0;
    for (i=0; i<x; i+=3)
    {
        printf("start");
        continue;
        printf("end");
    }
    return 0;
}
```

A. end end end B. start start start C. start end start D. start start start start E. Compilation error

Group B

#Answer any three questions

3×5=15

2. (a) What should malloc(0) do? Return a null pointer or pointer to 0 bytes ? Justify.

(b) Using macro definition, write a program in C to check whether entered character is digit or not. 2+3

3. (a) Under what condition a pointer variable can be subtracted from another? How will these difference be interpreted?

(b) What is the difference between const char* p and char const* p? Explain with example. 2+3

4. (a) What are the differences between realloc() and calloc() functions?

(b) Write a program in C to perform addition of two 2-dimensional array using dynamic memory allocation. 2+3

5. (a) Write down the advantages and disadvantages of recursion. When a program containing recursive function calls are executed, how are the local variables within the recursive function interpreted?

(b) Perform the following operations:

(i) $(3AC)_{15} = (?)_{11}$ (ii) $(536)_8 = (?)_{16}$

3+2

Group C

#Answer any three questions $3 \times 15 = 45$

6. (a) How is a member of a union variable assigned an initial value? In what way does the initialization of union variable differ from initialization of a structure variable?

(b) Define a structure for a student having name, roll number, marks obtained in six subjects. Write a C program to input the details for 20 students and print the details of the

(c) What is the difference between break and exit statement? Illustrate with suitable example

- (d) Write a C program that accepts any of the four pair of characters: O, { }, [], < > and prints the name of the corresponding pair of characters as Parentheses, Curly braces, Square brackets and Angular brackets.

7. (a) Explain the salient features of `typedef`

- (b) Write a complete C program that includes a recursive function to determine the value x^n where n is positive number and n is greater than 1.

(c) What is necessity of declaration of a function?
How can you calculate size of a function?

- (d) Write a program in C to replace all occurrences of a substring within a string by a user specified string.

8. (a) Write a program in C to convert Binary to Decimal using user defined function.

(b) Compare and contrast the different features of the available storage classes of a variable in C.

- (c) What precaution should be taken while returning a pointer from a function ? Justify your answer with suitable examples.

9. (a) What is the significance of arithmetic logical unit (ALU) and control unit (CU) in digital computer system? How do you use 2's complement to perform $(24)_{10} - (45)_{10}$ in binary?

- (b) Write a C code to add two numbers without using binary arithmetic operator.

(c) Given the coordinates of three points (x_1, y_1) , (x_2, y_2) and (x_3, y_3) , write a C program to determine whether they are collinear or not.

- (d) In what way is the initialization of an external variable more restricted than the initialization of an automatic variable? Explain.

10. (a) Consider a 2-D array storing the marks of 4 different subjects of 5 students. Show the memory map of this 2-D array. What are the possible restrictions for initializing this 2-D array dimensions of its declaration?

- (b) Define an array of pointers and a pointer to an array. Illustrate with suitable example.

(c) What is macro? How is it different from preprocessor directive? Differentiate between #define directive and #include directive.

- (d) Write a program in C to find all the prime divisors for a given integer number.

Roll No.
< D >

B.Tech/Even Sem/Reg/2013-14

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```
int main()
{
    int a = 320; char *ptr;
    ptr =(char *)&a;
    printf("%d ", *ptr);
    return 0;
}
```

A. 2 B. 64 C. 320 D. Compilation error

VII.What can be said of the following ?

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    m=a[i++];
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    return 0;
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X. Choose the correct output(s) of the following program.

```
main()
{
    int x=0; i;
    for (i=0; i<x; i+=3)
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        printf("end");
    }
    return 0;
}
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A. end end end B. start start start C. start end start D. start
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- (c) What is the difference between **break** and **exit** statement? Illustrate with suitable example.

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2013-2014

ENGINEERING CHEMISTRY

CY- 01

Time - Three Hours

Full Marks - 70

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Answer any five questions (at least one from each group)

Group - A

1. (a) What are the physical significances of entropy change?

(b) Efficiency (η) of any engine must be less than $1(\eta < 1)$. Prove it by considering the Carnot cycle taking one mole of an ideal gas.

(c) An ideal heat engine operating between 100°C and 25°C absorbs 1000 J of heat from high temperature reservoir. How much heat is rejected to low temperature reservoir ?

4+6+4

2. (a) Internal energy (U) remains constant in every isothermal process in a closed system — true or false ? — explain.

(b) Latent heat of evaporation for H_2O is 540 cal/gm at 100°C . At what temperature will water boil at 800 mm of Hg?

(c) Prove that in the chain reaction $\text{H}_2 + \text{Br}_2 \rightarrow 2 \text{ HBr}$, the rate of HBr production $(dC_{\text{HBr}} / dt) \propto C_{\text{H}_2}$.

2+4+8

3. (a) What is the difference between consecutive and opposing reactions?

(b) Why pH of the medium is considered to be important during the estimation of Fe^{+2} ion by KMnO_4 in aqueous solution?

(c) A drug is known to be ineffective when it has decomposed to the extent of 30%. The original concentration of the sample is 500 units/ml. When analysed 20 months later, the concentration was found to be 420 units/ml. Assuming that the decomposition is first order, what will be the expiration time of the sample?

(d) Represent and explain the variation of rate constant with pH for an acid-base catalysed reaction.

Group B

4. (a) Derive the Schrödinger wave equation $H\Psi = E\Psi$ and mention the characteristics of an eigen function.

(b) Show the radial probability distribution curves of the following orbitals and mention the number of nodal point(s) in each case: $3s$, $3p$, $3d$ and $5d$.

(c) For simplifying the mathematical solution of a wave function Ψ , how the Cartesian coordinate of a point $A(x, y, z)$ can be transformed to a polar coordinate (r, θ, φ) ?

(d) Which information one will get from the radial and angular part of a total wave function Ψ ? $5+4+3+2$

5. (a) What is called lattice, lattice point and lattice energy? Derive Born-Landé equation for calculating the lattice energy of an ionic crystal.

(b) Describe with a schematic diagram and show the arrangement of lattice points (considering lattice points as hard spheres of same size) while constructing the hexagonal close packing (hcp) and cubic close packing (ccp) structures. From there show the positions of octahedral (Oh) and tetrahedral (Td) sites.

(c) Calculate percentage space occupation in case of hexagonal close packing structure.

6. (a) What is Valence Bond Theory (VBT)? How it differs from Crystal Field Theory (CFT)? According to VBT which ' d ' orbitals will be in use for hybridization to adopt square planar, trigonal bipyramidal, square pyramidal and outer orbital octahedral geometries in case of inorganic complexes?

(b) Show the splitting of ' d ' orbitals in an octahedral stereochemistry and therefrom show that CFSE for each electron occupation in t_{2g} and e_g set of orbitals are $+4 Dq$ and $-6 Dq$ respectively when the crystal field splitting parameter $\Delta = 10 Dq$.

(c) For a metal ion which d^n systems may prefer both high and low spin states? Taking any d^n ion show that when (i) $\Delta > p$ then low spin state and when (ii) $\Delta < p$ then high spin state is energetically stable (p is pairing energy, Δ is crystal field splitting parameter). $6+4+4$

Group - C

7. (a) Write short notes on

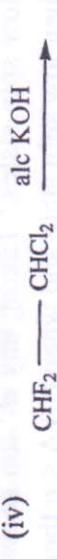
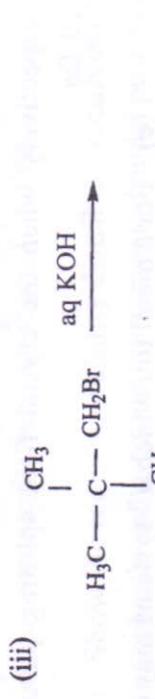
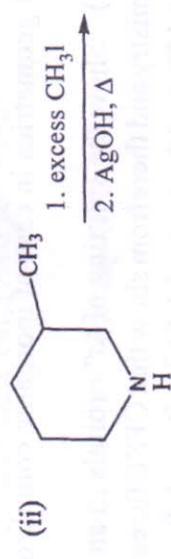
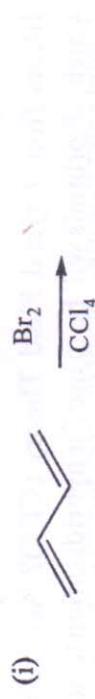
(i) Aldol condensation, (ii) Claisen condensation (iii) Electrophilic substitution.

(b) What are the necessary conditions for resonance to occur? $3 \times 4 + 2$

8. (a) How would you synthesise: (i) SBR, (ii) Nylon 6,6
 (iii) Dacron?

- (b) Describe the method of separation of water, sulphur containing compounds from crude oil.
- (c) Describe octane number and cetane number
- (d) Name three biopolymers and indicate their monomeric units. $6+3+3+2$

9. (a) Predict the products with plausible mechanism:



- (b) State the differences between polymerisation and condensation. $4 \times 3+2$
-

2013-2014

ENGINEERING CHEMISTRY**CY- 01****Time - Three Hours****Full Marks - 70***The figures in the margin indicate full marks.***Answer any five questions (at least one from each group)****Group - A**

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(b) Efficiency (η) of any engine must be less than 1 ($\eta < 1$). Prove it by considering the Carnot cycle taking one mole of an ideal gas.

(c) An ideal heat engine operating between 100°C and 25°C absorbs 1000 J of heat from high temperature reservoir. How much heat is rejected to low temperature reservoir ?

4+6+4

2. (a) Internal energy (U) remains constant in every isothermal process in a closed system — true or false ? — explain.

(b) Latent heat of evaporation for H₂O is 540 cal/gm at 100°C. At what temperature will water boil at 800 mm of Hg?

(c) Prove that in the chain reaction H₂ + Br₂ → 2 HBr,
the rate of HBr production $(dC_{HBr} / dt) \propto C_{H_2}$;
2+4+8

P.T.O.

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4. (a) Derive the Schrödinger wave equation $H\psi = E\psi$ and mention the characteristics of an eigen function.

(b) Show the radial probability distribution curves of the following orbitals and mention the number of nodal point(s) in each case: $3s$, $3p$, $3d$ and $5d$.

(c) For simplifying the mathematical solution of a wave function ψ , how the Cartesian coordinate of a point $A(x, y, z)$ can be transformed to a polar coordinate (r, θ, ϕ) ?

(d) Which information one will get from the radial and angular part of a total wave function ψ ?

5. (a) What is called lattice, lattice point and lattice energy ? Derive Born-Landé equation for calculating the lattice energy of an ionic crystal.

(b) Describe with a schematic diagram and show the arrangement of lattice points (considering lattice points as hard spheres of same size) while constructing the hexagonal close packing (hcp) and cubic close packing (ccp) structures. From there show the positions of octahedral (O_h) and tetrahedral (T_d) sites.

(c) Calculate percentage space occupation in case of hexagonal close packing structure.

6. (a) What is Valence Bond Theory (VBT)? How it differs from Crystal Field Theory (CFT)? According to VBT which ' d ' orbitals will be in use for hybridization to adopt square planar, trigonal bipyramidal, square pyramidal and outer orbital octahedral geometries in case of inorganic complexes ?

(b) Show the splitting of ' d' orbitals in an octahedral stereochemistry and therefrom show that CFSE for each electron occupation in t_{2g} and e_g set of orbitals are $+4 Dq$ and $-6 Dq$ respectively when the crystal field splitting parameter $\Delta = 10 Dq$.

(c) For a metal ion which d^n systems may prefer both high and low spin states? Taking any d^n ion show that when (i) $\Delta > p$ then low spin state and when (ii) $\Delta < p$ then high spin state is energetically stable (p is pairing energy, Δ is crystal field splitting parameter).

Group - C

7. (a) Write short notes on

- (i) Aldol condensation, (ii) Claisen condensation
- (iii) Electrophilic substitution.
- (b) What are the necessary conditions for resonance to occur ?

2013-14**BASIC ELECTRONICS****EC - 01****Full Marks : 70****Time : Three Hours***The figures in the margin indicate full marks.*Answer any **five** questions.

1. (a) Explain the difference in metal, semiconductor and insulator using energy band diagram.
 - (b) What will happen to the number of electrons in the conduction band of the semiconductors as the temperature of the semiconductors is increased?
 - (c) Explain why the temperature coefficient of resistance of semiconductor is negative?
 - (d) A sample of Si is doped with As to level of 5×10^{16} atoms/cm³. Find the concentrations of electrons and holes of the doped semiconductor. Also determine its resistivity. (Given : $n_i = 1.5 \times 10^{10} / \text{cm}^3$, $\mu_n = 1350 \text{ cm}^2/\text{v-s}$; $\mu_p = 480 \text{ cm}^2/\text{v-s}$).
2. (a) Explain how the majority carriers flow at the moment when the P and N type semiconductors are brought together. Will this flow of majority carriers continue? — If not, explain.
 - (b) Write the expression for the I-V relation of PN junction diode. Compare the I-V characteristics of ideal and practical PN junction diode.
 - (c) A PN junction Ge diode has a reverse saturation current of $1.5 \mu\text{A}$ at 300 K. Obtain the static and the dynamic resistances of the

P.T.O.

(2)

B/9/41-460

diode at that temperature for an applied forward bias voltage of 0.3V.
 (Given: The Boltzmann constant, $k_B = 1.38 \times 10^{-23} \text{ J/K.}$) $(3+3)+4+4$

3. (a) Draw the circuit diagram of bridge rectifier using PN junction diodes and explain its working principle. What is "peak inverse voltage (PIV)" of a rectifier and what is its value for this rectifier?

(b) Explain why bridge rectifier is preferred over a centre-tap rectifier?

(c) Turn ratio of a transformer at the input stage of a bridge rectifier is 12 : 1. The primary is connected to 230 V 50 Hz A.C supply. Compute DC voltage across load, PIV of each diode and if the same DC voltage is obtained using center tapped rectifier what will be the PIV.

 $8+2+4$

4. (a) With a neat circuit diagram of a CE transistor configuration discuss about amplification operation. Why CE configuration is widely used?

(b) Derive the relationship between α and β of transistor.

(c) An n-p-n transistor with $\alpha = 0.98$ is operating in CE configuration. If the base current (I_B) is $100 \mu\text{A}$, calculate collector current, I_C .

5. (a) Discuss briefly the need for transistor biasing.

(b) Draw and explain a potential divider biasing circuit in CE configuration having an emitter resistance.

(c) Calculate the value of V_{CE} in a fixed biased CE configuration npn transistor having the following circuit parameters.
 $R_B = 200k\Omega$, $R_C = 1k\Omega$, $V_{CC} = 10V$ and $\beta = 100$.

6. (a) Draw the circuit of non-inverting amplifier using op-amp. Derive the expression for the voltage gain and explain how a stable gain is achieved in the circuit.

(b) Explain the summing operation using OP-AMP. $10+4$

(3)

7. (a) State the merits and demerits of negative feedback in amplifier.

(b) An amplifier with negative feedback has gain of 100. It is found that without feedback an input signal of 20mV is required to produce a given output, whereas with feedback, the input signal must be 0.5 V for the same output. Find the values of amplifier gain and feedback fraction.

(c) Explain positive clamping using diode. $4+5+5$

8. (a) (i) Prove the De Morgan's theorems.

(ii) Simplify the Boolean expression $\overline{\overline{AB} + \overline{A} + AB}$. $5+2$

(b) Write short notes on any one :

- (i) Breakdown mechanisms in PN junction diodes.
- (ii) CRO

(iii) Positive clipper using junction diode.

7

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2013-14

BASIC ELECTRONICS

EC - 01

Full Marks : 70 Time : 3 hours

The figures in the margin indicate full marks.

Answer any five questions.

1. (a) Discuss the formation of p-type and n-type semiconductors with neat diagrams.
(b) State the mass-action law for extrinsic semiconductor.
(c) Explain under what circumstance semiconductor will behave as insulator.
(d) Find the intrinsic carrier concentration of Ge if the intrinsic resistivity at 300°K is $0.47 \Omega\cdot\text{m}$. It is given that the electron charge is $1.6 \times 10^{-19} \text{ C}$ and electron and hole mobility at 300°K are 0.39 and $0.19 \text{ m}^2/\text{volt}\cdot\text{s}$.
(e) Explain depletion layer in P-N junction and how its width changes with different biasing conditions.
3 + 2 + 4 + 2 + 3 = 14
2. (a) Explain the ideal characteristics of a P-N junction diode and how it can be used as switch.
(b) With the help of neat sketch explain the operation of a full-wave centre-tapped rectifier.
(c) A full-wave centre-tapped rectifier with diodes of forward resistance 200Ω is used to rectify a sinusoidal signal of RMS voltage 220 volt with the load resistance of $1 \text{ K } \Omega$. Determine

(2)

- (i) the dc load current,
- (ii) dc load voltage,
- (iii) the dc voltage across the diode,
- (iv) the total input power

- (iv) total dc out-put power at the load resistance.
 $3 + 6 + 5 = 14$

3. (a) Discuss the operation of a Zener diode as a voltage regulator.

- (b) With the help of a suitable circuit diagram explain the principle of operation of a positive diode clumper circuit.

$$6 + 8 = 14$$

4. (a) Draw the circuit diagram of a transistor operating in common base configuration and explain its input and output characteristics. Also briefly discuss about the three regions in the output characteristics.

- (b) Derive the relationship between α and β of transistor.

- (c) An n-p-n transistor with $\alpha = 0.98$ is operating in CE configuration. If the base current (I_B) is $100 \mu\text{A}$, calculate collector current I_C .
 $10 + 2 + 2 = 14$

5. (a) Why suitable biasing is required in a transistor?

- (b) Discuss thermal run-away effects in transistor.

- (c) Show the different biasing circuits.

- (d) Explain fixed-biasing of transistor.
 $3 + 3 + 4 + 4 = 14$

6. (a) Briefly explain the construction, operation and characteristics of a JFET.

- (b) State the characteristics of an ideal Op-AMP.
 $10 + 4 = 14$

(3)

7. (a) Draw the circuit of non-inverting amplifier using op-amp. Derive the expression for the voltage gain and explain how a stable gain is achieved in the circuit.

- (b) Explain the summing operation using OP-AMP.
 $10 + 4 = 14$

8. (a) Prove the following Boolean identities

(i) $x + y z = (x + y)(x + z)$

(ii) $x(x' + y) = xy$

- (b) Realize OR and NOR logic gates using NAND gate.

- (c) Write short notes on any one :

- (i) Wien-Bridge oscillator

- (ii) CRT

- (iii) CE amplifier.
 $(2 + 2) + 3 + 7 = 14$

Time - 3 Hours Full Marks - 70

The figures in the margin indicate full marks

Question No. 1 is compulsory and answer any five questions from the rest.

(All parts of any question should be answered at one place)

1. Attempt any ten : $10 \times 1 = 10$

- (i) State Kirchhoff's Voltage Law.
 - (ii) What do you mean by passive network ?
 - (iii) A coil has 400 turns. What is the induced emf, if the flux changes from 0.2 mWb to 1 mWb in 0.2 sec ?
 - (iv) What is the unit of reluctance ?
 - (v) What is called (1/reactance) ?
 - (vi) What is the periodic time of an alternating quantity with a frequency of 50 Hz ?
 - (vii) What do you mean by power factor of an A.C. circuit ?
 - (viii) What do you mean by phase and phase difference of an alternating quantity ?
 - (ix) What is the time constant of R-L series circuit ?
 - (x) Write Q-factor in terms of circuit parameters.
 - (xi) A coil has an inductance of 25 mH and negligible resistance. What will be the reactance at 50 Hz ?
 - (xii) What is the form factor of half wave rectified alternating current ?

P.T.O.

2. (a) Write the node voltage equations and determine the currents in each branch for the network shown in figure 1.

- (b) Determine the Thevenin's equivalent circuit across terminal AB for the circuit shown in figure 2

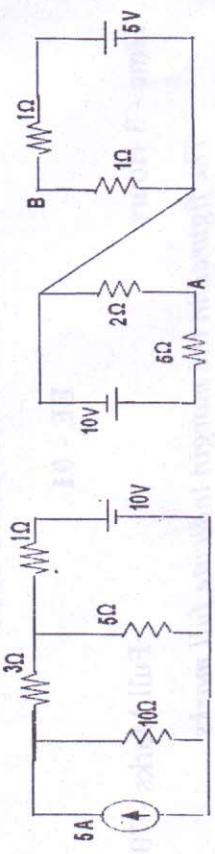
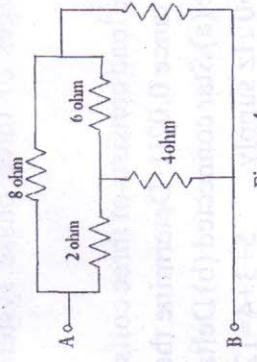


Figure: 1

3. (a) State and explain Reciprocity theorem.

- (b) Calculate the current in each branch of the network shown in figure 3 by the Superposition theorem.

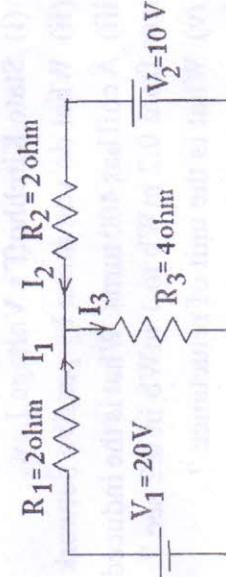


Figure: 3

$$5+7=12$$

4. (a) Use Delta-Star transformation to determine the resistance between the terminals A and B of the network, shown in figure 4.

- (b) Find the value of R for maximum power transfer and also find the value of the maximum power for the circuit shown in figure 5.

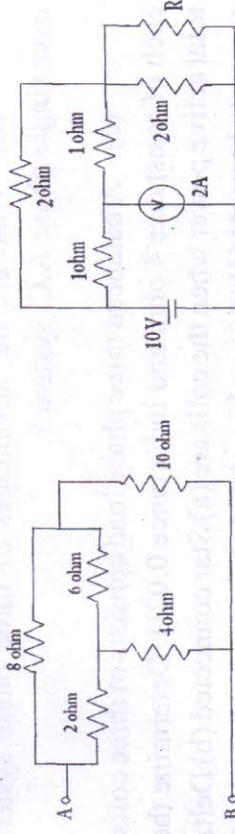


Figure: 4

$$6+6=12$$

Figure: 5

$$6+6=12$$

5. (a) What do you mean by self and mutual inductance? Enumerate the analogies between magnetic circuit and electrical circuit.

- (b) Two coils having 100 and 150 turns respectively are wound side by side on a closed magnetic circuit of cross section 125cm^2 and mean length 200cm. The relative permeability of the magnetic circuit is 2000. Calculate (i) The mutual inductance between the coils (ii) the voltage induced in the second coil if the current changes from 0 to 5 A in the first coil in 0.02 sec.

6. (a) Prove that amount of energy stored in an inductor equal to $(L_1^2)/2$.

$$5+7=12$$

- (b) A coil is wound with 300 turns over a steel ring of relative permeability 900 having a mean circumference of 400 mm and cross sectional area of 500 mm^2 . If a current of 25 A is passed through the coil, find (i) m.m.f (ii) reluctance (iii) flux (iv) flux density

7. (a) Obtain the relationship between the line voltage and phase voltage and line current and phase current for balanced three phase star connected system.

(b) What are the advantages of three phase system over single phase A.C. system ?

(c) A balanced three phase load consists of three coils, each of resistance 4 ohm and inductance 0.02H. Determine the total active power when the coils are (a) Star connected (b) Delta connected to a 415V, three phase 50 Hz supply. $5+3+4=12$

8. (a) The power factor of a circuit is 0.866 lagging. If the input power is 600 W at a voltage $v = 110 \sin(377t + 100)$ V, what is the instantaneous current ?

(b) Two elements series circuit consumes 700 W and has a power factor of 0.707 leading. If the applied voltage is $v = 141 \sin(314t + 30^\circ)$, find the circuit elements.

(c) A 240 V, single phase induction motor delivers 15 kW at full load. The efficiency of the motor at this load is 82 % and p.f. is 0.8 lagging. Calculate (a) the input current of the motor (b) the kW and (iii) kVA. $3+4+5=12$

9. (a) Discuss the principle of operation of a single phase transformer and also distinguish between core type and shell type transformer.

(b) Derive the emf equation of a dc generator.

(c) A 1000 kVA transformer has primary and secondary turns of 400 and 100 respectively and induced voltage in the secondary is 1000 volts. Find (i) primary voltage (ii) secondary full load current (iii) the secondary current when 10 kW load at 0.8 power factor is connected at the output. $(3+1) + 4+4 = 12$

2013-14

ELECTRICAL TECHNOLOGY**EE 01****Full Marks : 70****Time : 3 Hours***The figures in the margin indicate full marks.*Answer any **five** questions from the following

(Parts of each question should be answered at one place).

1. (a) What do you mean by passive circuit.
 - (b) State and explain Superposition theorem.
 - (c) Find the current through the resistance R and the voltage across it when connected as shown in figure 1 by Thevenin Theorem.
- $1 + 6 + 7 = 14$

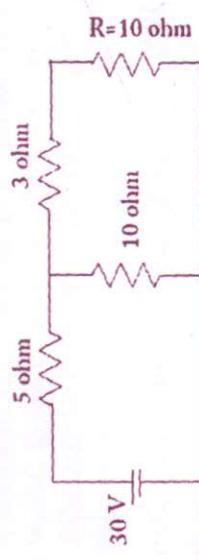


Figure 1

2. (a) Using node voltage method, find the current through the 3 ohm resistor of the network shown in figure 2.

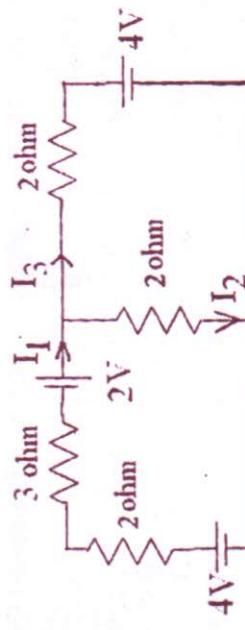


Figure 2

(2)

- (b) Determine the current I in the circuit shown in figure 3 using Norton's Theorem.

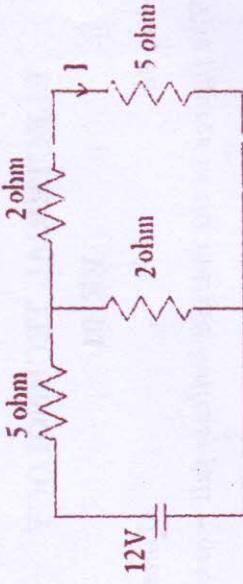


Figure 3

3. (a) Find the value of the load resistance (R_L) to give maximum power transfer for the network shown in figure 4, find also the power delivered to the load.

- (b) A coil consists of 750 turns and current of 10 Amperes in the coil gives rise to a magnetic flux of 1200 μ wb. Calculate (i) mmf (ii) Energy stored when the current is reversed in 0.01 second.

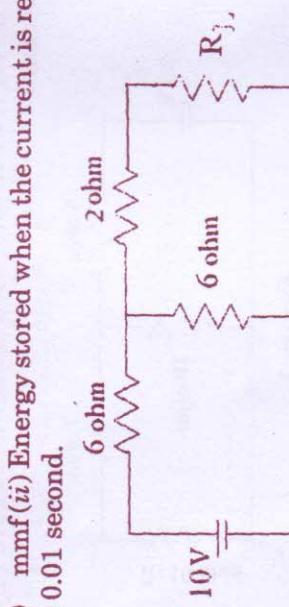


Figure 4

4. (a) What do you mean by self and mutual inductance ? Differentiate between magnetic Circuit and Electrical Circuit.
 (b) A circuit has 1000 turns enclosing a magnetic circuit with a cross section of m^2 . The flux density is 1 Wb/m² with a current of 4 ampere and 1.4 Wb/m² with a current of 9 Ampere. Find the value of inductance between these current limits and the induced electromotive force if the current fall uniformly from 9A to 4A in 0.05 sec.

$(3 + 4) + 7 = 14$

(3)

5. (a) In an electrical circuit two parallel impedances draw currents I_1 and I_2 when $I_1 = 40 \angle 200^\circ$ A, $I_2 = 30 \angle -650^\circ$ A. If the supply voltage be $100 \angle 0^\circ$ V, obtain the values of line current and power factor. What is the input power ?
 (b) By r.m.s. we imply "the square root of the mean value of the square" Determine the r.m.s. value of the current waveform shown in Fig. Q5.

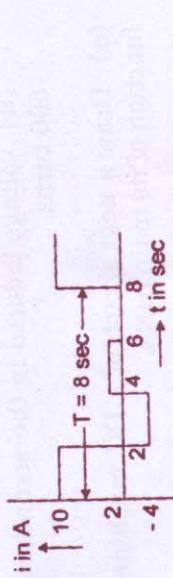


Fig. Q5

- (c) Show graphically X_L , X_C , and R of a series RLC circuit as a function of frequency f .
 (d) A series RLC circuit has 10 Ω resistance, 60 mH inductance and C farad capacitance. At a frequency of 25 Hz, the p.f. of the circuit is 45° lead. At what frequency will the circuit be resonant ?

6. (a) What are the advantages of three phase system over single phase A.C. system ?
 (b) Show that the sum of the two wattmeter readings equals the power consumed by the three phase circuit with balanced loads.

- (c) A star connected alternator supplies a delta connected load. The impedance of each branch is $(6+j8)\Omega$. The line voltage is 400 V. Obtain the current in phase of the load. Also find the current in each phase of the alternator. What is the power drawn by the load. Determine the reactive power of the load. Draw the phasor diagram to represent line current, line voltage, phase current and phase voltage of the load.

$$3 + 5 + 6 = 14$$

G/45-460

[Continued]

[Turn Over]

7. (a) Differentiate between core type and shell type transformer ?

(b) Distinguish between self excited and separately excited DC machines.

(c) The primary winding of a 50 Hz transformer is supplied from a 440 V, 50 Hz source and has 200 turns. Find

- (i) Peak value of flux
 - (ii) voltage induced in the secondary winding if it has 500 turns.
- $$4 + 4 + 6 = 14$$

8. (a) Draw a neat sketch of a DC machines and explain the function of its main parts.

(b) Derive the emf equation of a single phase transformer

(c) A 25 KVA transformer has a voltage ratio of 3300/400. What will be the primary current ?

(d) The armature of a 8-pole DC generator has 960 conductors and runs at 400 rpm. The flux per pole is 40 mWb.

- (i) Calculate the induced emf, if the armature is lap-wound
- (ii) At what speed should it be driven to generate 400 V, if the armature were wave wound ?

$$6 + 3 + 1 + 4 = 14$$

2013-14

ENVIRONMENTAL STUDIES

ES 01

Full Marks : 70

Time : 2 Hours

Figures in the margin indicate full marks.

Answer Q. No. 1 and any five from the rest.

1. (a) Fill in the blanks with suitable words: $\frac{1}{2} \times 10 = 05$
 - (i) In atmospheric composition, dry air constitutes _____ %.
 - (ii) Upper crust is _____ in composition.
 - (iii) Average salinity of sea water is about _____ ppt.
 - (iv) Ocean is _____ system in terms of water.
 - (v) About _____ % of solar radiation reaches earth's surface directly.
 - (vi) India can be divided into ten _____ regions.
 - (vii) _____ faults form at sliding plate boundaries.
 - (viii) Sphalerite is the most important ore of _____.
 - (ix) Earth's total land surface area is about _____ sq.km.
 - (x) _____ are the first life forms that evolved in the earth.
- (b) Find out whether the following statements are true. If true, write "True" and if false, write "False" against the question number.
 $\frac{1}{2} \times 10 = 05$

(2)

- (i) Rachel Carson is the author of the book Silent Spring.
- (ii) Mesopause lies at an altitude of 50 km from the surface.
- (iii) Iron is one of the big six macronutrients.
- (iv) Granite is a good aquifer rock.
- (v) Benthonic organisms are bottom dwellers.
- (vi) About 90% of fish harvesting of the oceans takes place in continental shelf zone.
- (vii) Secondary earthquake waves can travel through any medium.
- (viii) Taiga represents tree less plains.
- (ix) Clouds form in the Troposphere.
- (x) Basalt is a plutonic igneous rock.

2. (a) Explain 'Elastic Rebound Theory'.
(b) Define with sketch the 'focus' and 'epicentre' of earthquake.
(c) Discuss the scales used in measuring earthquakes.
(d) Briefly discuss 'catastrophe' and its types.
3. (a) Discuss in brief the vertical distribution of underground water.
(b) Define 'porosity' of rock with mathematical expression.
(c) Briefly discuss the composition of ocean water.
4. (a) What is 'insolation'? State the breakup of average distribution of insolation and work out the 'albedo' of the earth.

(3)

- (b) Describe the mechanism of "enhancement of greenhouse effect" with a suitable sketch.
- (c) State the classification of Ionosphere. $4 + 5 + 3 = 12$
5. (a) Briefly describe the characteristics of the convergent plate boundaries.
- (b) What are "extrusive" and "intrusive" igneous rocks ?
Briefly state their characters citing examples of each type.
- (c) Describe the internal zones of the earth with suitable sketch. $5 + 4 + 3 = 12$
6. (a) How balance of ozone is naturally maintained in stratosphere ?
(b) Why the lowest temperature of troposphere is found above the equator, not above the pole ?
(c) Discuss the effects of acid rain.
7. (a) What is 'symbiosis'? Explain different types of symbiotic relationships.
(b) What is 'trophic level'? How the trophic level of an organism is determined ?
(c) What is 'biodiversity'? Why biodiversity should be preserved ?
8. (a) Show with a diagram the annual distribution of solar energy from the source to the sink.
(b) How pressure varies in the atmosphere with increase in altitude ?
(c) What are 'effluent' and 'influent' rivers ?
(d) Briefly discuss the role of oceans in moderating earth's temperature.

[Continued]

G/43-440

[Turn Over]

(4)

9. (a) What is 'Gaia Hypothesis'?

(b) What is 'metamorphism'? What is meant by 'agents of metamorphism'?

(c) Define the terms 'species' and 'population'.

(d) What are 'hotspots' of diversity? Name the hotspots of diversity in India. $2 + 4 + 4 + 2 = 12$

2013-14**ENGLISH****HS - 01****Full Marks : 70****Time : Three Hours***The figures in the margin indicate full marks.***1. Attempt any two of the following questions :** $12 \times 2 = 24$

- (a) Write an essay on Amitav Ghosh's *The Calcutta Chromosome* as a science fiction. 12
- (b) Write a note on the narrative technique of *The Calcutta Chromosome?* 12

(c) *The Calcutta Chromosome* is a novel of fevers, delirium, and discovery. Discuss. 12**(d) Comment on the mystical elements in *The Calcutta Chromosome.* 12****2. Answer any four of the following questions in not more than 200 words each :** $6 \times 4 = 24$

- (a) Why does the Actor come rushing to the stage at the beginning of the play in *Hayavadana*? What is the reaction of the Bhagavata on listening to the experience of the Actor? 4+2=6

- (b) "Why did you put up with our torture?"

What kind of torture did the 'you' put up with? Why did he put up with the torture he was subjected to? What was the reaction of the speaker on hearing his reply? 2+2+2=6

- (c) How does Girish Karnad use miming as a theatrical device in *Hayavadana*? 6

(2)

(3)

P/9/40-440

- (d) *Hayavadana* is a play of transformations. Discuss
Hayavadana in the light of this observation. 6
(e) "You had to hop around him twittering 'Kapila! Kapila!' every minute."

Who says this to whom? Explain the use of the word, 'twittering' in this context. 2+4=6

3. Write an essay on any one of the following topics : 12×1=12

- (a) An Imaginary Chat between a Technocrat and a Peasant.
(b) Globalisation and Indian Society.
(c) Technology and Nature.

4. Find out the error (if any), and write the sentences again.

$$1 \times 5 = 5$$

- (a) Neither story are labelled as true.
(b) Judith and Hammeth are almost the same in height, but the later is slightly taller.
(c) The concerned students are asked by the Dean to attend the games.
(d) The wheel came of the ring and hit the nearby wall.
(e) No sooner had he seen the tiger then all surrounding him started screaming.

5. Point out the differences in meaning between the pair of sentences below. 1×5=5

- (a) I never sleep on train.
and
I never sleep in train.
(b) Dispense your charities fairly well.
and
Dispense with your charities.

(c) Let us repair the house.

and

Let us repair to the house.

(d) Let us begin the inaugural session.

and

Let us begin with the inaugural session.

(e) Search the thief.

and

Search for the thief.

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A
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V

201

ENGINEERING ECONOMICS & ACCOUNTANCY

HSS - 02

Time - Three Hours Full Marks - 70

The questions are of equal value.

Group - A

(Micro Economics & Accountancy)

Answer any four questions.

1. Distinguish between different concepts of Elasticity of Demand. Explain the factors determining the value of elasticity. How does it influence government policy ?
 2. Derive the profit maximizing conditions of a firm. Distinguish between short run and long run equilibrium of a firm.
 3. (a) Define an isoquant.
(b) What are the properties of an isoquant?
(c) Determine the optimum commodity combination for a consumer whose objective is stated as follows:

Group B

(Macro Economics)

Answer any three questions.

Where,

 $M \rightarrow$ money income of the consumer $p_i \rightarrow$ unit price of good Q_i $q_i \rightarrow$ quantity of good Q_i consumed α, β are parametric constants.

$$1+2+7=10$$

The questions are of equal value.

1. Explain different components of National Income. Which one be treated as best reflector of country's performance ? Distinguish between VAT & Sales Tax.

2. Derive the Consumption and Saving Function. Explain with example the role of different factors (other than income) influencing the consumption and saving function.
3. Determine the equilibrium value of output of an economy using a suitable diagram . Examine the stability of equilibrium when $MPC > 1$.
4. (a) State the law of variable proportions.
 (b) Explain the three stages of production in short run with a suitable diagram.
5. (a) In which stage do you prefer to operate and why ?
 (b) Classify Dr. and Cr. according to the Modern Approach.

(c) Write up the following transactions in the Journal of Mr. A :

Mr. A started business with Rs. 50,000
 Purchased goods for cash: Rs. 10,000
 Sold goods for cash: Rs. 15,000
 Purchased goods from Mr. X on credit: Rs. 5,000
 Sold goods to Mr. B on credit: Rs. 6,000
 Purchased furniture for Rs. 4,000
 Purchased plant for Rs. 10,000
 Paid wages: Rs. 400

$$1+2+7=10$$

2013-14

MATHEMATICS - II

MA - 02

Full Marks : 70

Time : Three Hours

The figures in the margin indicate full marks.

The given symbols have their usual meanings.

Answer question number 1 and any five from the rest.

(2½×4)+(12×5)

1. (a) Find three linearly independent eigen vectors of the identity matrix of order 3 corresponding to the eigen value 1.

- (b) Obtain two linearly independent solutions of the ODE

$$x^2 \frac{d^2y}{dx^2} + 4y = 0.$$

- (c) Test the convergence of the integral

$$\int_0^1 \frac{1}{x^{\frac{1}{3}}} dx$$

- (d) Find $L\{t^2 e^t\}$.

2. (a) Use Laplace transform to solve the differential equation

$$\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 9 = 0, \text{ given that } y=0 \text{ and } \frac{dy}{dx} = 0, \text{ when } x=0. \quad 6$$

- (b) Using convolution theorem, find the inverse Laplace transform of

P.T.O.

(2)

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(3)

$$F(s) = \frac{1}{s^2(s+5)}.$$

6

equations :

$$x + 2y - z = 2$$

$$x - y + z = 5$$

$$3x + 3y + az = b + 8$$

6

when

(b) Find the volume of the solid obtained by revolving the astroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ about the x -axis.

6

4. (a) Define subspace of a vector space over a field. Check whether the set

$$S = \{(x, y, z) \in \mathbb{I}^3 : x^2 + y^2 + z^4 = 0\}$$

forms a subspace of \mathbb{I}^3 over \mathbb{I} or not.

2+4

$$(b) \text{ Find the characteristic equation of the matrix } A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{pmatrix}$$

hence find its inverse.

5. (a) Obtain the canonical form of the quadratic form

$$2x_1x_2 - 6x_2x_3 + 2x_3x_1$$

and also find its nature, rank, index and signature.

6

(b) State one necessary and sufficient condition for diagonalizability of a matrix $A \in M_n(\mathbb{I})$. Check the diagonalizability of the matrix $\begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$ over the field \mathbb{I} .

2+4=6

6. (a) Discuss the solutions of the following system of linear equations :

$$x + 2y - z = 2$$

$$x - y + z = 5$$

$$3x + 3y + az = b + 8$$

3. (a) Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\tan x} dx = \frac{\pi}{\sqrt{2}}$ using $\Gamma(m)\Gamma(1-m) = \frac{\pi}{\sin m\pi}$.

6

- (i) $a = -1, b = 1$,
(ii) $a = -1, b = 2$, and
(iii) $a = 1, b = 7$.

6

(b) Solve: $(D^2 - 2D + 1)y = xe^x \sin x$

7. (a) Apply the method of variation of parameters to solve the differential equation :

$$\frac{d^2y}{dx^2} + y = \sec^3 x \tan x$$

$$(b) \text{ Solve: } \left(y^2 e^{xy^2} + 4x^3 \right) dx + \left(2xye^{xy^2} - 3y^2 \right) dy = 0.$$

8. (a) Find the cubic Lagrange's interpolating polynomial from the following data :

x	0	1	2	5
y	2	3	12	147

6

(b) Find a root of the equation $x - 2 \sin x = 0$ using the secant method, correct up to three decimal places.

2+4=6

ENGINEERING PHYSICS

PH 01

Full Marks : 70

Time : 3 Hours

The figures in the margin indicate full marks.

Answer any five questions.

1. (a) Show that the average energy of a weakly damped harmonic oscillator decays exponentially with time.
(b) Set up the differential equation of the motion of the oscillator undergoing forced oscillation and obtain the expression for amplitude and phase constant.
(c) Two simple harmonic oscillators of masses 10gm and 899 gm oscillate separately under the action of same restoring force. Calculate the ratio of their frequencies.
$$5 + 5 + 4 = 14$$
2. (a) Derive Eyring's reverberation time formula.
(b) Define absorption coefficient. Obtain formula for average absorption coefficient.
(c) The time of reverberation of an empty hall is 1.5 seconds. With 500 audiences present in the hall the time of reverberation falls to 1.4 seconds. Find the number of persons present in the hall, if the time of reverberation falls down to 1.312 seconds.
$$5 + 4 + 5 = 14$$
3. (a) Solve the Schrödinger wave equation for a particle moving in a rectangular potential box and obtain its energy levels. Show that the eigen-values of energy are discrete.

(2)

(b) Find the wavelength of the waves associated with an electron having kinetic energy equal to 1 MeV. $10 + 4 = 14$

4. (a) What is symmetry operation of crystal structure? Show that five fold rotation is not possible in crystal system.

(b) Find out atomic packing fraction of

(i) f.c.c.

(ii) b.c.c.

$$(iii) \text{h.c.p. structure.} \quad (4 + 3) + (2 + 2 + 3) = 14$$

5. (a) Obtain an expression for fringe width in case of Young's double slit experiment. Prove that in this case of interference, dark and bright bands are of equal width.

(b) Discuss the phenomenon of interference in thin films and obtain the expression of thickness of thin film in terms of effective path difference for reflected light. Also obtain the conditions for maxima and minima.

(c) In Newton's ring arrangement, a source is emitting two wavelength $\lambda_1 = 6000\text{\AA}$ and $\lambda_2 = 5900\text{\AA}$. It is found that n^{th} dark ring and $(n+1)^{\text{th}}$ dark ring coincides with each other. Find the diameter of the n^{th} dark ring if the radius of curvature of lens is 90 cm. $(3 + 1) + (5 + 2) + 3 = 14$

6. (a) What is diffraction? Explain clearly the difference between interference and diffraction.

(b) Derive an expression for the intensity distribution due to Fraunhofer Diffraction at a single slit and show that the intensity of the 1st subsidiary maximum is about 4.5% of that of the principal maximum.

(c) A plane grating has 15000 lines per inch. Find the angle of separation of the 5048\AA and 5016\AA lines of helium in second order spectrum. $(1 + 2) + 8 + 3 = 14$

(3)

7. What is a Laser? Write down the important characteristics of a laser radiation. What are the basic components of a laser? Explain briefly the working principle of He-Ne Laser with suitable diagram. Write down few applications of Laser. A step index fibre has a core of refractive index 1.52 and a cladding of refractive index 1.48. Determine its numerical aperture and acceptance angle. $2 + 2 + 2 + 4 + 2 + 2 = 14$

8. What do you mean by polarization of light? Can a sound wave show the phenomenon of polarization? Define the terms

(a) Double refraction

(b) Optic axis.

What is a Nicol prism? Briefly describe (with suitable diagram) its action as a polariser and as an analyser.

Two polaroids are adjusted so as to obtain maximum intensity. Find the angle through which one Polaroid must be rotated to reduce the intensity to one-fourth of maximum intensity.

$$2 + 1 + 3 + 1 + 4 + 3 = 14$$