

2012-2013

**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. Union holds

- (a) one object at a time
- (b) multiple objects at a time
- (c) both (a) and (b)
- (d) none

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

```
#include<stdio.h>
main()
{
    int x; printf ("%d", x=20, x=30, x=40);
    printf("%d",x);
}
```

- (a) 20 40 (b) 40 40 (c) 20 20 (d) none of these

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

```
main() {
    fun();
    fun();
}
fun() {
    static int i=10;
    printf("%d", i);
    i++;
}
(a) 10 10 (b) 11 10 (c) 10 11 (d) 11 11
```

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

```
main(){
    int x=3, y=2;
    while (x+y-1) {
        printf("%d", (x--+y));
    }
}
(a) 5 4 3 2 (b) 4 3 2 1 (c) none
```

V. In which header file, is the NULL macro defined

(a) stdio.h (b) conio.h (c) stdlib.h (d) none of these

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

```
main(){
    int i;
```

```
for (i=0;i<=2;i++) {
    switch (i) {
        case 1: printf("%d", i);
        case 2: printf("%d", i);
        default: printf(" %d", i);
    }
}
```

(a) 011122 (b) 012 (c) error (d) none of these

VII. How long does the loop runs: for (x=0; x=3; x++)

(a) never (b) forever (c) 3 times

VIII. Number of bytes required for double is

(a) 8 (b) 4 (c) 2 (d) 6

IX. main()

```
{ char *p=good;
char a[]="good";
printf("%d%d%d", sizeof(p), sizeof(*p), sizeof(a));
}
```

(a) 2 1 5 (b) 11 5 (c) 1 2 5 (d) none of these

X. Which of the string function returns the integer value (0,-1 or 1) ?

(a) strlen() (b) strcpy() (c) strcmp() (d) streat()

### Group B

Answer *any three* questions.

$3 \times 5 = 15$

2. (a) What is the difference between a MACRO call and a function call? Write down the potential advantages and disadvantages.

(c) Explain the role of C preprocessor.

(d) Write a C program to find the prime factors of an input integer.  
3+4+3+5

10. (a) Write a C program that outputs two 1-D arrays **min[n]** and **max[n]** containing the minimum and maximum values in each row of a  $n \times m$  2-D array of integers.

(b) Write down the functions of the following operators:

- (i) size of() operator,
- (ii) Comma operator,
- (iii) ternary operator.

(c) Distinguish between the puts() and printf() function.

(d) Discuss the role of using enumeration in C program  
7+3+2+3  
with suitable example.

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B.Tech / Even  
(12-13) / Reg

2012-13

## ENGINEERING CHEMISTRY

CY - 01

Full Marks : 70

The figures in the margin indicate full marks.

Attempt any Five questions taking at least ONE from each Group.

### GROUP—A

Time : 3 hours

1. (a) Derive the concentration of the final product for a consecutive reaction. From the expression show that the slowest step is the rate determining step.  
 $10 + 4 = 14$
2. (a) Show graphically and also mathematically that work done in isothermal process is higher than adiabatic process.  
(b) How does Gibbs' free energy vary with temperature ?  
Why the variation is highest for gas and lowest for solid.
3. (a) For ice the melting point increases with pressure-justify the statement from Clausius-Clayperon equation.  
 $5 + 5 + 4 = 14$

(Pt) Sn<sup>2+</sup>, Sn<sup>4+</sup> || Fe<sup>3+</sup>, Fe<sup>2+</sup> (Pt)

(b) A galvanic cell is constructed with Ag<sup>+</sup>/Ag and Fe<sup>3+</sup>/Fe<sup>2+</sup> electrodes. Find the concentration of Ag<sup>+</sup> at which the EMF of the cell is zero at equimolar concentration of Fe<sup>3+</sup> and Fe<sup>2+</sup>.  
(E<sup>0</sup><sub>Ag<sup>+</sup>/Ag</sub> = 0.80V and E<sup>0</sup><sub>Fe<sup>3+</sup>/Fe<sup>2+</sup></sub> = 0.77V)

G/02-520

[ Turn Over ]

( 2 )

(c) Why the activity of an enzyme depends on the pH of the solution ?

(d) What is catalytic coefficient ?  $3 + 4 + 3 + 4 = 14$

### GROUP—B

4. (a) What is polymerization ? What are the different types of polymerization reactions ? Show with examples.

(b) What is meant by refining of crude oil ? Describe the pretreatment methods used for crude liquid fossil fuel before fractional distillation.

(c) How fractional distillation is carried out for petroleum oil? Write the name of different fractions obtained at different temperature range during fractional distillation.

$$6 + 3 + 5 = 14$$

5. (a) Compare the stability order of the following carbanions with explanations.



(b) State with explanation whether cyclooctatetraene is aromatic/antiaromatic or non-aromatic.

(c) Write short notes on:

Hyperconjugation, Inductive effect, Nucleophilicity.

$$3 + 2 + 9 = 14$$

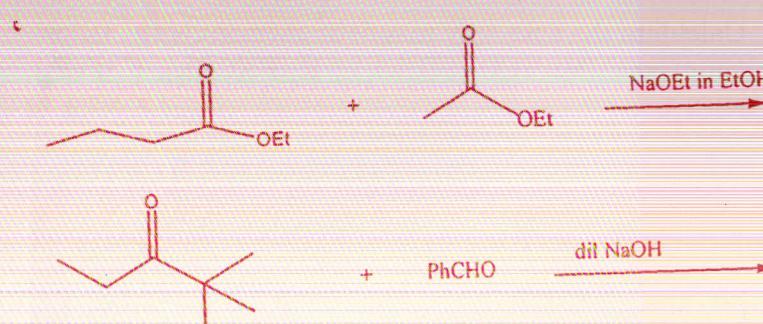
6. (a)  $S_N1$  reactions are favoured in protic polar solvents whereas  $S_N2$  reactions are favoured in aprotic polar solvents. Give proper explanation.

(b) In E2 reactions the leaving groups maintain antiperiplanarity. Explain giving stereochemical evidence.

( 3 )

(c) Distribution of products in the bromination of 1,3-butadiene depends on the temperature of the reaction. Give reasons.

(d) Predict the products:  $5 + 3 + 3 + 3 = 14$



### GROUP—C

7. (a) Derive Schrödinger wave equation.

(b) What is the necessity to convert the Cartesian coordinate to the polar coordinate ? How the Cartesian coordinate of a point A(x,y,z) can be transformed to a polar coordinate i.e. in terms of r, θ, φ ?

(c) Calculate the frequency range in Å unit of the Lyman series of lines obtained in hydrogen atomic spectrum. Given that Rydberg constant,  $R_H = 109676 \text{ cm}^{-1}$ .  $6 + 4 + 4 = 14$

8. (a) What is lattice energy ? Derive Born-Lande equation for calculating the lattice energy of an ionic crystal. Name an alternate method to determine the lattice energy ?

(b)  $\text{MgAl}_2\text{O}_4$  adopts a normal spinel structure. Define the positions of different ions in its unit cell.

(c) An element crystallizes in a structure having 'fcc' unit cell of an edge 2 Å. Calculate its density, if 200 gm of this element contains  $24 \times 10^{23}$  number of atoms.  $7 + 3 + 4 = 14$

9. (a) What is CFSE ? Write the crystal field splitting of 'd' orbitals in octahedral, tetrahedral and square-planar coordination geometry. Explain why the splitting of 'd' orbitals ( $t_{2g}$  and  $e_g$  set) is opposite to each other in octahedral and tetrahedral coordination geometry.

(b) Calculate the spin only magnetic moment of the following complexes:  $[\text{Mn}(\text{H}_2\text{O})_6]$ ,  $(\text{ClO}_4)_2$ ,  $\text{K}_4[\text{Fe}(\text{CN})_6]$ ,  $\text{K}_3[\text{FeF}_6]$ ,  $\text{Na}_2[\text{NiCl}_4]$ .  
 $7 + 7 = 14$

**BASIC ELECTRONICS****EC - 01**

Discipline : Batch A, B, C, D

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks.

Answer any five questions.

1. (a) Briefly discuss about the conductivity of intrinsic semiconductor at temperature at 0 °K and 300 °K respectively. 3

(b) Explain the formation of barrier potential in p-n junction. 3

(c) Derive the expression for the electrical conductivity of an intrinsic semiconductor. Hence show that the conductivity of an N-type semiconductor is  $\sigma_n = ne\mu_n$ . 4 + 1 = 5

(d) At 300K the intrinsic carrier concentration of silicon is  $1.5 \times 10^{16}/\text{m}^3$ . If the electron and hole mobilities are 0.13 and 0.05  $\text{m}^2/\text{v.s}$  respectively, then determine the intrinsic resistivity of silicon at 300K. 3

2. (a) Draw the circuit diagram of a forward-biased and reverse-biased p-n junction diode. Write the expression for the voltage-current characteristics of the diode. Draw the characteristic curve and explain its nature. (1 + 1) + 2 + 3 = 7

(b) The reverse saturation current of a p-n junction Ge diode is  $10\mu\text{A}$ . Find the voltage to be applied across the junction to obtain a forward current of 30 mA at 300K. 3

(c) Explain with a circuit diagram, the use of a Zener diode as a reference diode. 4

( 2 )

3. (a) Draw the bridge rectifier circuit and explain its operation. 5

(b) In a half-wave rectifier, a diode of forward resistance  $20\Omega$  is used to rectify the sinusoidal voltage of amplitude 155 V. The load resistance is  $1K\Omega$ . Calculate

- the peak load current,
  - the dc load current,
  - peak inverse voltage,
  - dc load voltage,
  - dc output power.
- (c) With suitable diagram explain the operation of a positive clamping circuit with input as a sinusoidal signal and peak amplitude of  $V_m$ . 5

4. (a) Show and explain the different current components of a transistor when the emitter junction is forward biased and the collector junction is reverse biased. 4

- (b) Draw the circuit diagram of common emitter transistor and explain its input and output characteristics. 5
- (c) For a transistor derive the relationship between  $\alpha$  and  $\beta$ . 2

- (d) In a common base transistor amplifier when the emitter current is 1 mA its collector current becomes 0.995 mA. Calculate the common base current gain ( $\alpha$ ) and common-emitter current gain ( $\beta$ ). 3

5. (a) With the help of load-line, explain what is meant by quiescent point of a transistor. 5

- (b) Discuss the voltage divider bias circuit for a transistor. 5
- (c) Explain the role of  $R_E$  connected at the emitter in emitter feedback bias circuit. 4

( 3 )

6. (a) Derive the expression for the overall gain of a negative feedback amplifier. Explain how negative feedback in an amplifier helps in reducing the nonlinear distortion and output noise. 3 + 3 + 2 = 8

- (b) In a negative feedback amplifier, the voltage gain of the internal amplifier is 100 and feedback ratio is 0.04. Find

- the overall voltage gain with feedback
- the amount of feedback in dB. 1 + 1 = 2
- Explain the differentiation operation using op-amp circuits. 4

7. (a) Simplify the Boolean expression using Boolean algebra

$$\begin{aligned} & \overline{\overline{AB}} + \overline{A} + AB \\ (i) \quad & (B + BC)(B + \overline{BC})(B + D). \quad 3 + 3 = 6 \\ (ii) \quad & \end{aligned}$$

- (b) Realize AND and OR gate using two-input NAND and NOR gate. 8

8. Write short notes on any two of the following : 7  $\times$  2 = 14
- Diode clipper circuit to limit the positive peak of the input voltage.
  - CRO
  - Wien-Bridge Oscillator.

#### Some useful constants:

Boltzmann constant:  $K=1.38 \times 10^{-23} \text{ J K}^{-1}$ , Plank's constant  $h=6.626 \times 10^{-34} \text{ Js}$ ; Intrinsic carrier concentration of Si at room temperature is  $1.5 \times 10^{10} \text{ cm}^{-3}$ .

$1kT$  at room temperature = 0.0256 eV  
Electronic charge =  $1.6 \times 10^{-19}$  Coulomb

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**ELECTRICAL CIRCUITS****EE - 01**

Time - 3 hours

Full Marks - 70

*The figures in the margin indicate full marks.*

Answer question no. 1, 2 and any five from the rest.

1. Answer in brief.

 $1 \times 10 = 10$ 

- (i) What is lumped resistance ?
- (ii) State Kirchhoff's Current Law.
- (iii) What do you mean by bilateral circuit ?
- (iv) What is the unit of reluctance ?
- (v) What is reciprocal of reactance ?
- (vi) What do you mean by RYB phase sequence ?
- (vii) What do you mean by power factor of an AC circuit ?
- (viii) What is the time constant of a series circuit consisting of resistance and capacitance ?
- (ix) Write the expression of Q-factor for series RLC circuit in terms of circuit parameters.
- (x) What are the conditions for which wattmeter gives negative deflection in AC circuit ?

2. Answer with explanation.

2×5

- (i) Find the equivalent resistance across  $x-y$  of Fig. 1.

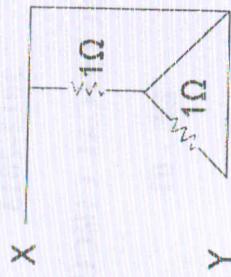
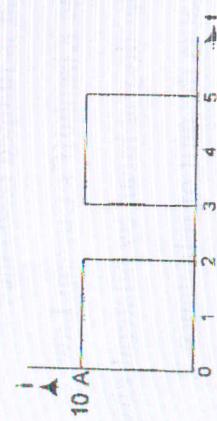


Fig. 1

- (ii) A 30 amp current in the primary of a transformer results in a primary flux of 0.5 Wb. Given  $N_1 = N_2 = 200$  and  $k = 0.9$ , find  $L_1$  and  $L_2$ .

- (iii) Determine the rms and average values of the current waveform shown in Fig. 2.



- (v) A moving coil instrument gives a full scale deflection

- for a current of 20 mA with a potential difference of 200 mV across it. Calculate (a) shunt required to use it as an ammeter to get a range of 0-20A and (b) Multiplier required to use it as voltmeter of range 0-500 V.

3. (i) What are the limitations of ohm's law?

- (ii) Give brief description about independent and dependent sources with example.

- (iii) Determine the node voltages  $V_1$ ,  $V_2$  and  $V_3$  of Fig. 4 by nodal method.

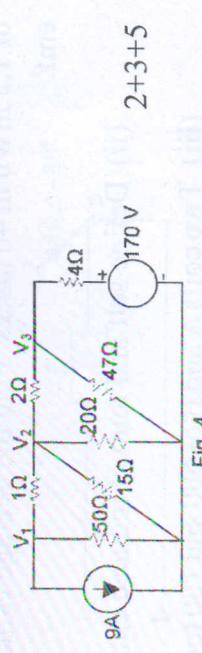


Fig. 4

4. (i) State and explain superposition theorem.

- (ii) Find the current in the 4 Ω resistor of the circuit of Fig. 5 by superposition theorem.

- (iv) Given  $Z_1 = (3.4 - j6.6)$  Ω,  $Z_2 = (8.5 + j4.1)$  Ω,  $V_0 = 10V$ ,  $f = 50$  Hz. Find the power factor of the circuit shown in Fig. 3.

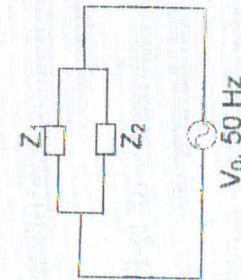


Fig. 5

5. (i) Prove that the (internal impedance of the source) will be the complex conjugate of (load impedance) when maximum power is delivered from the source to the load. Also prove that the efficiency will be 50% at this condition.

10. (i) Describe with relevant diagrams the different methods of excitation of dc machine.

(ii) A 6 pole d.c. machine has 300 conductors and each conductor is capable of carrying 80 A without excessive temperature rise. The flux per pole is 0.015 Wb and the machine is driven at 1800 r.p.m.

Compute the total current, e.m.f., power developed in the armature and electromagnetic torque, if the armature conductors are:

- (a) Wave connected and
- (b) Lap connected.

4+6

< D >

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## ENVIRONMENTAL STUDIES

GE - 01

Time - 3 hours

Full Marks - 70

The figures in the margin indicate full marks.

Answer question 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) \_\_\_\_\_ theory explains the origin of tectonic earthquakes.

(iii) All solar heat is absorbed within \_\_\_\_\_ of the ocean surface.

(iv) Average salinity of sea water is about \_\_\_\_\_

(v) The prey species have a \_\_\_\_\_ reproductive rate than predator species.

(vi) \_\_\_\_\_ is an important ore of copper.

(vii) Mid-oceanic ridges form at \_\_\_\_\_ plate boundaries.

(viii) \_\_\_\_\_ Hypothesis was proposed by James Lovelock.

(ix) \_\_\_\_\_ is the energy sink.

(x) \_\_\_\_\_ is the most abundant element in the whole earth.

(b) Find out whether the following statements are true. If true, write "True" and if false, write "False" against the question number.

(i) Stratopause lies at an altitude of 80km from the surface.

(ii) Albedo accounts for about 30% of total solar radiation reaching earth.

(iii) India can be divided into three biogeographic regions.

(iv) Basalt is a basic volcanic rock.

(v) Earth is a closed system in terms of energy.

(vi) Perched water is found in the zone of aeration.

(vii) Secondary carnivores belong to third trophic level.

(viii) Oxygen cycles slowly.

(ix) Crust is about 100 km thick below the oceans.

(x) Combustion of fossil fuels may produce  $\text{NO}_x$ .

2. (a) Define 'environmental hazard' and 'catastrophe'.

(b) Briefly state the structural and non-structural measures that can be adopted in flood management.

(c) Name the earthquake-prone areas around earth. What is Richter scale ?

3. (a) What are the different parts and their percentage share in the hydrosphere?

(b) How temperature changes with increase in depth of the ocean?

(c) Briefly state the vertical distribution of underground water.

4. (a) Briefly explain the evolution of the atmosphere.

(b) What is meant by 'energy balance' in the atmosphere?

(c) State the common effects of ozone depletion.

6+3+3=12

5. (a) Describe the characteristics of the crust with a suitable sketch.

(b) Briefly state the characteristics of divergent plate boundaries. Give examples.

(c) State the classification of igneous rocks in a tabular form citing examples of each type.

6. (a) How acid rain is formed? State the important effects of acid rain on human health and ecosystem.

(b) Explain 'greenhouse effect'. What are the important effects of global warming ?

7. (a) Define 'ecosystem'. What are the different components of ecosystem?

(b) Briefly describe the interactions amongst the members of an ecological community.

(c) Explain the terms 'habitat' and 'niche'. (4+5+3=12)

4+4+4=12

8. (a) What is 'biogeochemical cycle'? Briefly describe 'carbon cycle'.

(b) What is meant by 'hotspots' of biodiversity? Name the hotspots of diversity in India.

(c) What are the factors on which distribution of biomes depend? State the classification of biomes.  
5+3+4=12

9. (a) Define 'sustainability'.

(b) How metamorphism is classified on the basis of dominance of agent(s)?

(c) Explain with suitable sketch how temperature changes with altitude in atmosphere?

(d) Define 'mineral'.

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B.Tech/Reg/Even Sem /2012-13

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ENGLISH

HS - 01

Time - 3 hours

Full Marks - 70

*The figures in the margin indicate full marks.*

1. Attempt any two of the following questions:—

2+4+4+2=12

12×2=24

2 - *Σ* 5

Q(a) What is the significance of the day 'August 20' in *The Calcutta Chromosome* by Amitav Ghosh? How is malaria related to the entire process of 'interpersonal transference'? What is the 'Calcutta Chromosome'?  
2+6+4=12

(b) From where is the concept of the 'cult of silence' derived? Why do the members of the cult not claim social attraction? How do they attain 'immortality' through their own way?  
4+4+4=12

(c) How is Antar related to Murugan? How is Phulboni involved with the members of the cult? What does Antar find out at last and how?  
2+4+6=12

Q(d) How does Amitav Ghosh give a vivid pen-picture of a middle-class Bengali life through the description of Urmila's family? What do Urmila and Murugan find out in Kaliaghata?  
6+6=12

6+6=12

① (G)

2. Answer *any four* of the following questions in not more than 200 words : -

→ (a) "It's a long story."

Narrate the story in your own word.

(b) The characters in *Hayavadana* suffer from identity crisis. Explain the justification of this observation.

(c) Cite the examples of non-verbal communication used in *Hayavadana*.

(d) Who is the Bhagabata? What is his role in the play, *Hayavadana* ?

(e) In which city is the action of the play, *Hayavadana* located? Who is the ruler of that city? What kind of a ruler was he? Who are the two youths living in that city? Who were their fathers?

3. Match the following and make a sentence from every word given in Column A:

Column A

(a) Aisle

(1) overthrow

(b) Coupe

(2) walkway

(c) Coo

(3) fuss

(d) Isle

(4) island

(e) Coup

(5) car

Column B

(1) overthrow

(2) walkway

(3) fuss

(4) island

(5) car

4. Supply the appropriate word in the following:  $\frac{1}{2} \times 10 = 5$
- (a) Ravi has achieved all this glory in \_\_\_\_\_ year. (a/an/the)
- (b) Rohit had \_\_\_\_\_ his baby on the chair before moving for the presentation. (lay/laid/lain)
- (c) Director, as well as officers, \_\_\_\_\_ on strike (is/are)
- (d) No party in centre could \_\_\_\_\_ the opportunity to oust the existing government. (cease/seize/siege)
- (e) One of the dealers of Chopper deal \_\_\_\_\_ a relative of then IAF Chief. (was/were)
- (f) The furniture of this whole institute \_\_\_\_\_ of good quality. (is/are)
- (g) Neither Rita nor her friends \_\_\_\_\_ ready to attend the late night party. (was/were)
- (h) Children go to \_\_\_\_\_ school to learn something. (the/a/-not required)
- [had/would have/have/ \_\_\_\_\_ (not required)]
- (i) If Sangeeta had worked hard, she \_\_\_\_\_ succeeded.
5. Write an essay on *any one* of the following in about 500 words. ( $12 \times 1 = 12$  marks)
- (a) Relevance of Students' Union in Colleges.
- (b) Reservation Policy in India.

G

B.Tech / Even  
(12 -13) / Reg

2012-13

**ENGINEERING PHYSICS**

**PH - 01**

*Full Marks : 70*

*Time : 3 hours*

*The figures in the margin indicate full marks.*

*Answer any five questions.*

1. (a) Deduce the equation of motion of forced oscillations of a one-dimensional damped harmonic oscillator and obtain its general solution explaining transient and steady states. Calculate the amplitude and phase difference of forced oscillations by analyzing the steady state behaviour of a forced oscillator. Explain the dependence of the amplitude of the forced oscillator on the frequency of the driving force. 10
- (b) Explain critical damping and draw the graph illustrating displacement-time behaviour for this case. 4
2. (a) What do you mean by reverberation and reverberation time ? Derive Eyring's reverberation time formula for a dead room. Show that Sabine's reverberation time formula is a special case of Eyring's formula.  $2 + 6 + 2 = 10$
- (b) Discuss the factors influencing acoustic properties of buildings. 4
3. (a) Solve the Schroedinger 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. 10

( 2 )

(b) Using Heisenberg's uncertainty principle estimate the radius of the first Bohr orbit in the hydrogen atom. 4

4. Describe briefly the seven systems of crystal with example. What are the effective number of atoms per unit cell of bcc and fcc lattices ? With reference to crystal state what do you understand by the terms

- (i) Co-ordination number
- (ii) atomic packing factor.

Show that the atomic packing factor for bcc lattice is  $\sqrt{3}\pi/8$ .

$$7 + 2 + 2 + 3 = 14$$

5. Define Interference of light waves. State the essential conditions for permanent interference pattern. Discuss with suitable ray diagram the formation of circular interference fringes with reflected light in Newton's ring experiment. Hence show that fringe width decreases as the diameter of the rings increases. In Newton's ring experiment when the air space between the lens and the plate is replaced by a transparent liquid, the diameter of  $n^{\text{th}}$  dark ring changes from 1.2 to 1 cm. Find the refractive index of the liquid. 2 + 2 + 6 + 2 + 2 = 14

6. Explain different classes of diffraction of light waves. Find an expression for the intensity distribution pattern due to double slit Fraunhofer diffraction. Write down the conditions of maxima and minima. What are missing orders in a double slit diffraction pattern ? Calculate the missing orders and plot the intensity distribution pattern graphically for  $b = a$ . Where 'a' is the slit width and 'b' is the width of the opaque space.

$$7 + 2 + 2 + 3 = 14$$

7. What are the properties of a laser beam ? Describe the construction and working principle of He- Ne laser. For a step index optical fiber the refractive indices of the core and the cladding are 1.563 and 1.498 respectively. Calculate the numerical aperture and acceptance angle. 2 + 8 + 4 = 14

( 3 )

8. What do you understand by the term polarization of light ? Light waves can be polarized but sound waves cannot— why ? What do you mean by uniaxial and biaxial crystals ? Explain plane, circularly and elliptically polarized light. How are they produced and detected ? Calculate the polarizing angle for light travelling from water of refractive index 1.33 to glass of refractive index 1.53.

$$2 + 2 + 3 + 5 + 2 = 14$$


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