Group 1

Question Paper Solution

Branch : CS, ME .... Semester: I .... Subject: Engg. Maths - I .... Mid Term: I/~~II~~/~~Extra~~/~~Imp~~.

Submitted By : Dr. Vivek Vijay

PART – A

Q1. Evaluate $\displaystyle\lim_{(x,y)\to(0,0)} \frac{x^2 y}{x^4+y^2}$ [3]

Sol. Along $y = mx$

$$\lim_{\substack{y=mx \\ x\to 0}} \frac{x^2 y}{x^4+y^2} = \lim_{x\to 0} \frac{mx}{x^2+m^2} = 0$$

Along $y = mx^2$

$$\lim_{\substack{y=mx^2 \\ x\to 0}} \frac{x^2 y}{x^4+y^2} = \lim_{x\to 0} \frac{mx^4}{x^4+m^2x^4} = \frac{m}{1+m^2}$$

$\because$ the limit depends upon m, hence not unique.

$\therefore$ the limit does not exist.

Q2 If $u = \sin^{-1}\left(\dfrac{x^2+y^2}{x+y}\right)$, then show that [3]

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$$

Sol- Let $v = \sin u = \dfrac{x^2+y^2}{x+y} = x\left[\dfrac{1+(y/x)^2}{1+(y/x)}\right]$

$\Rightarrow v$ is a homogeneous function of degree 1

$\therefore$ by Euler's theorem

$$x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} = v$$

$$\Rightarrow x\frac{\partial}{\partial x}(\sin u) + y\frac{\partial}{\partial y}(\sin u) = \sin u$$

$$\Rightarrow x\cos u\frac{\partial u}{\partial x} + y\cos u\frac{\partial u}{\partial y} = \sin u$$

$$\Rightarrow x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$$

Q3. Find unit normal vector to the surface $x^3+y^3+3xyz=3$ at $(1,2,-1)$. [3]

Sol. Let $\phi \equiv x^3+y^3+3xyz-3=0$

Required unit vector $= \left[\dfrac{\nabla\phi}{|\nabla\phi|}\right]_{at\ (1,2,-1)}$

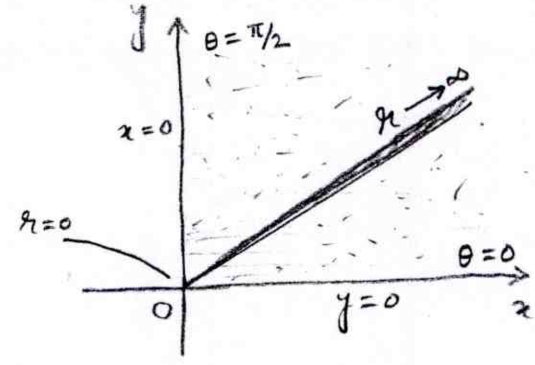
$$= \frac{-3\hat{i}+9\hat{j}+6\hat{k}}{\sqrt{126}} = \frac{-\hat{i}+3\hat{j}+2\hat{k}}{\sqrt{14}}$$

Q4. Change $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$ into polar coordinate system and evaluate. [3]

Sol. Here, the region is bounded by

$x=0$, $x\to\infty$,

$y=0$, $y\to\infty$



Now putting $x=r\cos\theta$, $y=r\sin\theta$ and replacing $dx\,dy$ by $r\,d\theta\,dr$, we get

$$\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}\,dx\,dy = \int_{\theta=0}^{\pi/2}\int_{r=0}^{\infty} e^{-r^2}\,r\,d\theta\,dr$$

$$= \int_{\theta=0}^{\pi/2}\left\{\int_{r=0}^{\infty} e^{-r^2}\,r\,dr\right\}d\theta$$

Let $e^{-r^2}=t$

$\therefore\ e^{-r^2}(-2r)\,dr=dt$

$\Rightarrow e^{-r^2}\,r\,dr = -\dfrac{dt}{2}$

Also, at $r=0$, $t=1$ and for $r\to\infty$, $t=0$

$$= \int_{\theta=0}^{\pi/2}\left\{\int_{t=1}^{0}\left(-\frac{dt}{2}\right)\right\}d\theta = \frac{\pi}{4}$$

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PART-B

Q5. If $u = e^{xyz}$, then prove that [6]

$$\frac{\partial^3 u}{\partial x\, \partial y\, \partial z} = (1 + 3xyz + x^2y^2z^2)\, e^{xyz}$$

Sol: $\frac{\partial u}{\partial z} = e^{xyz}.\, xy$

$$\frac{\partial}{\partial y}\left(\frac{\partial u}{\partial z}\right) = \frac{\partial^2 u}{\partial y\, \partial z} = x\, e^{xyz} + x^2yz\, e^{xyz}$$

$$\frac{\partial^3 u}{\partial x\, \partial y\, \partial z} = e^{xyz} + x\, e^{xyz}.(yz) + x^2yz\, e^{xyz}.(yz) + yz\, e^{xyz}(2x)$$

$$= (1 + 3xyz + x^2y^2z^2)\, e^{xyz}$$

Q6. Change the order of integration in [6]

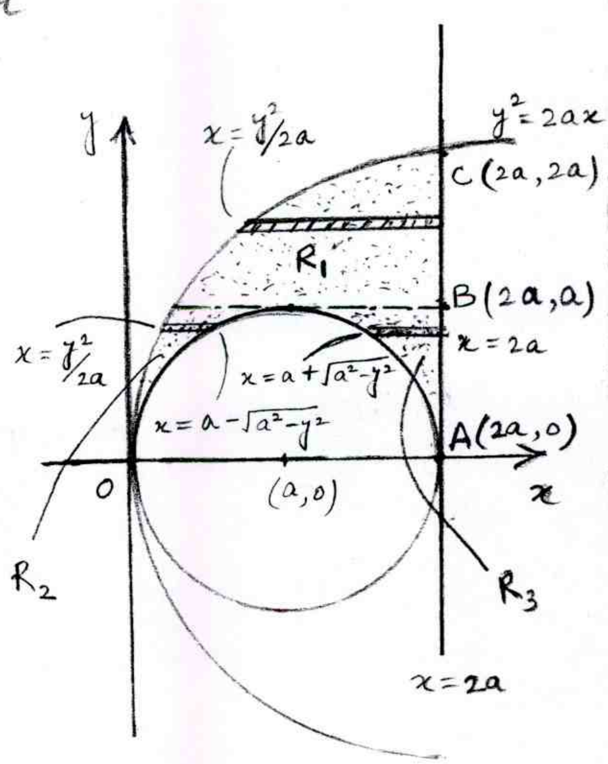
$$\int_0^{2a} \int_{\sqrt{2ax - x^2}}^{\sqrt{2ax}} f(x,y)\, dy\, dx$$

Sol- Here, the region of integration is bounded by

$x = 0$, $x = 2a$,

$y = \sqrt{2ax - x^2} \Rightarrow (x-a)^2 + y^2 = a^2$,

and $y = \sqrt{2ax} \Rightarrow y^2 = 2ax$



Now, on changing the order of integration, we get

$$I = \iint_{R_1} f(x,y)\,dx\,dy + \iint_{R_2} f(x,y)\,dx\,dy + \iint_{R_3} f(x,y)\,dx\,dy$$

$$= \int_{y=a}^{2a} \left\{ \int_{x=y^2/2a}^{2a} f(x,y)\,dx \right\} dy +$$

$$\int_{y=0}^{a} \left\{ \int_{x=y^2/2a}^{a-\sqrt{a^2-y^2}} f(x,y)\,dx \right\} dy +$$

$$\int_{y=0}^{a} \left\{ \int_{x=a+\sqrt{a^2-y^2}}^{2a} f(x,y)\,dx \right\} dy$$

{ Let $I = \int_0^{2a} \int_{\sqrt{2ax-x^2}}^{\sqrt{2ax}} f(x,y)\,dx\,dy$ (the given integral)

Q7. Find the values of constants a, b and c, so that the directional derivative of $\phi = axy^2 + byz + cx^3z^2$ at $(1,2,-1)$ has the maximum of magnitude 64 in direction parallel to z-axis. [6]

Sol. Directional derivative will be maximum along

$$[\nabla\phi]_{at(1,2,-1)} = (4a+3c)\hat{i} + (4a-b)\hat{j} + (2b-2c)\hat{k} \quad \text{——(i)}$$

As given, the directional derivative of ϕ is maximum in the direction parallel to z-axis, i.e. along $\hat{k}$,

$\therefore$ the coefficients of $\hat{i}$ and $\hat{j}$ in (i) must be 'zero'.

Hence $4a+3c=0$ ——(ii) and $4a-b=0$ ——(iii)

$$\therefore \left[\nabla\phi\right]_{at(1,2,-1)} = (2b-2c)\hat{k}$$

Now, maximum value of directional derivative is

$$\left|\left[\nabla\phi\right]_{at(1,2,-1)}\right| = 64 \text{ (given)}$$

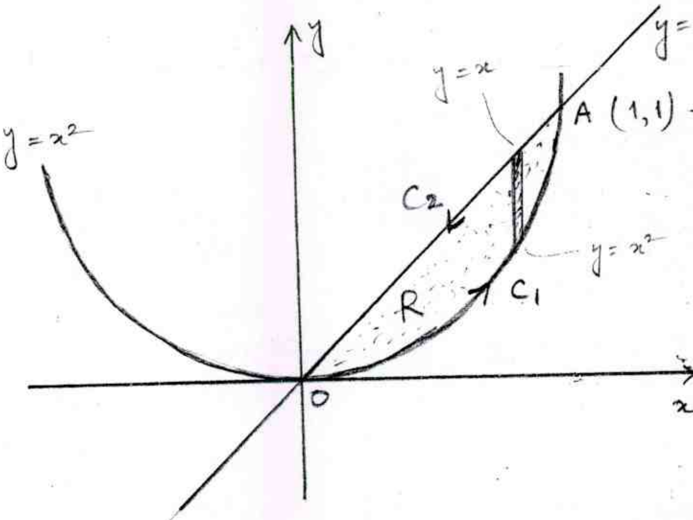
$$\Rightarrow 2b - 2c = 64 \Rightarrow b - c = 32 \quad \text{——— (iv)}$$

$\therefore$ (ii), (iii) & (iv) $\Rightarrow a = 6,\ b = 24,\ c = -8$

Q8. Verify Green's theorem for $\oint_C \{(xy+y^2)\,dx + x^2\,dy\}$, where C is the boundary of the region bounded by $y = x^2$ and $y = x$. **[8]**

Sol- By Green's theorem

$$\oint_C (M\,dx + N\,dy) = \iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dx\,dy \quad \text{——— (1)}$$



$$\text{L.H.S} = \oint_C (M\,dx + N\,dy)$$

$$= \int_{C_1}\left[(xy+y^2)\,dx + x^2\,dy\right] + \int_{C_2}\left[(xy+y^2)\,dx + x^2\,dy\right]$$

$$= \left\{\int_{x=0}^{1}(x^3+x^4)\,dx + \int_{y=0}^{1} y\,dy\right\} + \left\{\int_{x=1}^{0} 2x^2\,dx + \int_{y=1}^{0} y^2\,dy\right\} \quad \left[\begin{array}{l} C_1 : y = x^2 \\ \text{and} \\ C_2 : y = x \end{array}\right.$$

$$= \frac{19}{20} - 1 = -\frac{1}{20} \quad \text{——— (2)}$$

Now R.H.S. $= \iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right) dx\, dy$

$$= \int_{x=0}^{1}\int_{y=x^2}^{x} \{2x - (x+2y)\}\, dx\, dy = \int_{x=0}^{1} (x^4 - x^3)\, dx$$

$$= -\frac{1}{20} \quad \text{——} (3)$$

(2) & (3) $\Rightarrow$ Green's theorem is verified.

Q9. A rectangular box, open at the top, is to have a given capacity. Find the dimensions of the box requiring least material for its construction.

Sol. Let x, y, z be the dimensions of the box.

$\therefore$ its surface is $xy + 2yz + 2zx = f(x,y,z)$ [say] ——(1)

and volume is $xyz = C$ (say)

i.e. $xyz - C = 0 \equiv g(x,y,z)$ [say] ——(2)

Let $L = f + \lambda g$

$= xy + 2yz + 2zx + \lambda(xyz - C)$

For extremum

$\frac{\partial L}{\partial x} = 0 \Rightarrow y + 2z + \lambda yz = 0$ ——(3)

$\frac{\partial L}{\partial y} = 0 \Rightarrow x + 2z + \lambda xz = 0$ ——(4)

$\frac{\partial L}{\partial z} = 0 \Rightarrow 2y + 2x + \lambda xy = 0$ ——(5)

Now, multiplying ③ by x and ④ by y and then on subtracting we get $2zx - 2zy = 0 \Rightarrow x = y$

Also, multiplying ④ by y and ⑤ by z and then on subtracting we get $xy - 2xz = 0 \Rightarrow y = 2z$

$$\therefore \quad x = y = 2z = (2c)^{1/3}$$

———— x ————

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Question Paper Solution

Branch : C.S. & ME Semester: I Subject: Communication Skills
First I Mid Term: I/II/Extra/Imp. Submitted By : Dr. Nidhi Sharma

Attempt all questions:

Q1. Describe the process of Communication

A1. Communication is the process of human beings responding to the symbolic behaviour of other persons. Communication Process consists of a Sender, Receiver who encodes and decodes the message. This takes place through the channel which finally leads to the Feedback given by the Receiver.

Q2. What are the different types of Non-Verbal Communication

A2. The different types are Kinesics, Proxemics, Occulesics, Haptics, Vocalics, Chronemics, Olfactics, Appearance, Artifacts & Environment

Q3 Types of Communication Flow.

A3 Types of Communication flow are

i) Upward Communication ii) Downward Communication
iii) Horizontal Communication iv) Multi Directional Communication

Question Paper Solution

Branch : ......CS & ME............. Semester: ...... Subject: ... Communication Skills ....
...First......... Mid Term: I/II/Extra/Imp. Submitted By :.......Dr. Nidhi Sharma.....................

Q- 4 Paraphrase the poem 'No Men are Foreign" by James Kirkup.

The literal meaning of "uniform" denotes that each country involved in war must identify itself as belonging to that country so as not to kill or harm its own people. Yet, in the wearing of their country's uniform, others in another uniform contradict the meaning of the word since they are set apart and identified as different--the enemy. This contradiction of the uniformity of man is what James Kirkup's poem objects so as the poet suggests that all men are uniform themselves in the sense that they are "aware of sun and air and water" and they share humanity:

In every land is common life,That all can recognize and understand. Let us remember, whenever we are told To hate our brothers, it is ourselves....All men are uniform in that they share the essence of being human, living and loving just as others do. A conscientious objector in World War II, Kirkup makes an appeal to people with his metaphoric use of the word *uniform* to understand the universal brotherhood of man in his poem, "No Men Are Foreign."

Q-5

Explain how the story The Luncheon is full of instances to show the author's ability to laugh at himself.

The author is a humorist. Humour is a device which is employed to evoke laughter. The author has very deftly employed this device in the story The Luncheon from the beginning to the end. In the beginning of the story, the author brings out a humorous situation when he was tactfully suggested by a lady to offer her a little luncheon at a highly expensive restaurant Foyot .Given the economic condition of the author at that time, visiting Foyot was beyond his budget line. Driven by flattery, the author made all possible calculations and decided to go along with the lady to Foyot only to experience some embarrassing moments. This embarrassing moments are very humorous to the readers.

The author was taken aback at the very beginning after visiting the restaurant when the lady in the name of little luncheon ordered for salmon, then caviare and champagne and asparagus. These situations are humorous and testify to the sense of humour of the author. The way he avoided placing orders for himself in order not to reveal his budget line is also very humorous. The way he describes the lady in the beginning as a woman of forty who was imposing rather than attractive is humorous.

At the end, when the lady recommended the author to follow her example of having a so-called little luncheon, the author humorously replied that he would do better than that by eating nothing for the night that day.

Thus, the story unfolds the author's sense of humour from the beginning to the end. Every situation depicted in the story amply expresses his sense of humour.

If you can fill the unforgiving minute

With sixty seconds' worth of distance run,

Yours is the Earth and everything that's in it,

And-which is more-you'll be a Man, my son!

Q-6 What does the "unforgiving minute" suggest in the poem "If"

"If" by Rudyard Kipling is one of his most famous poems. The prose in the last stanza refers to several key points reflected throughout the poem. The "unforgiving minute" is a reference to a universal aspect of life. A minute has only sixty seconds in it, no more, no less. It does not matter what a person does during those sixty seconds, the minute is unforgiving. If a person wastes the time, they cannot get it back or ask for a reprieve from the inevitable march of time."Sixty seconds' worth of distance run" is a reminder to fill the unforgiving minute with useful activity. Kipling is suggesting the reader take the advice, run and cover distance, meaning to move through life with a purpose.

Q-7 What are the effective 7 Cs Communication

1. **Completeness:**

Completeness refers to the fact that the information sent by the sender should be complete in every aspect, so that it will result in an effective communication. The sender should analyse the receiver's mind and send him that message according to his intellectual level. Firstly, the sender should send the message by considering all the facts and figures and should convey all the relevant information, and if he fails to do so he should answer every question of the receiver by providing extra details. Let's quote a simple example here. Suppose if you are working with a company and you are dealing the engineering area, one of you customer ask about the A.C mechanism. You are supposed to provide him extra details to make him satisfy this will result in effective communication. If you failed to provide the relevant information in a short period of time, it means the **business communication** between you and your customer has failed, and he might shift to some other company.

2. **Conciseness:**

Conciseness means providing accurate information in a short period time. As we know that businessman always have short time either he is a sender or a receiver. So conciseness saves the time of both of them. To achieve conciseness in the business, every individual has to avoid repetition of words during communication.

relevant information. Besides, not consuming more time, this principle of communication helps to save money too. Remember that the basic aim of a business is to provide to the point information without using jumbo and repetitive words that takes time. For example, if your customer ask you to provide the details of your clients. You should provide him with the list of the names of the clients. Providing business and personal details are useless and just wastage of time. Always use abbreviations like I.T, W.H.O, to save the time too.

3. **Consideration:**

From business perspective, consideration means to consider receiver's nature while compiling a message by keeping himself in receiver's place. Effective communication is the one, when the sender considers the mental level, education and background of the receiver before sending the message. Sender should make a mental picture of receiver's emotions and problems before sending him a message. He should make sure that he has maintained the self-respect of the receiver and his words should not harm him. Sender should Use "you" instead of using I or We. Sender should manifest interest in the target audience. Sender must emphasize positive words in order to produce positive response. Sender should always write the message in such a way that shows benefit of the targeted audience.

4. **Concreteness**

Concreteness refers to be specific rather than to be general. General messages lead to misunderstandings that affect both the sender and the receiver. It is recommended that while communicating with the client, facts and figures should be used instead of general discussions. While communication, the words that build images should be preferred. For example, while writing a general message the sender will write "he is an intelligent boy and got first position in class" this is so confusing message. But if the sender writes "Ahmed got 78% marks in A – Level." This one is not only specific, but also build a good perception in the readers mind.

5. **Clarity**

Clarity means to be clear in the goal rather than chasing too many goals at a specific time. In business communication the messages sent should be clear with exact wordings that are short,to avoid misunderstandings. For effective communication, easy to understand words should be used. Easy wordings help in understanding the ideas and thinking of the sender. While communicating the sender should be clear of the purpose of communicating, if not so then the receiver will not understand his message. Receivers are not capable of assuming what the sender wants to say; therefore it is necessary to make easy and precise messages.

It means not only knowing the receiver ideas and thoughts, but also to know his feelings. It means that sender is sending the message by respecting the feelings of the receiver. Therefore, the sender should be polite and caring while writing a message. Courteous messages strengthen relations. Sender should use the words that show respect and care for the audience. He can use frequently "thank you" and "please" to show respect for the feelings of receiver.

7. **Correctness**

In business, correctness means the correct use of grammar, punctuation and language during communication. The message should be written in right language with accurate figures and facts. The type of language used in business is often informal i.e. the words that are used during conversation are short while in written message always abbreviations are used. Thus the last 7cs of communication have utmost importance.

(OR)

Q8 i) Smoke filled the room (Change the voice)
The room was filled by smoke

ii) Do you bake cake here (voice)
Are cakes baked here?

iii) He broke this toy (voice)
This toy was broken by him

iv) If I were the prime minister, I would discard the law of reservation

v) If I find your purse, I will give to you

vi) Unless she works hard, she will not get good marks.

Question Paper Solution

Branch : CS&ME Semester: I Subject: Engg. Physics Mid Term: I/II/Extra/Imp.
Submitted By : Dr. Komal Sharma

Part : A

Soln 1(a) Role of compensatory plate:

In absence of compensatory plate the reflected beam passes the beam splitter twice whereas the refracted beam doesnot pass even once through the beam splitter. Therefore the optical path of both beams are not equal even mirrors M_1 & M_2 are at same distances from beamsplitter. In order to equalize the optical path of these beams compensatory plate is used.

Soln 1(b) The probability of the particle in whole universe is given as

$$\int_{-\infty}^{\infty} |\psi(\vec{r},t)|^2 \, dV$$

As we know that the particle must exist somewhere in the whole universe. Therefore the probability of finding a particle in the whole universe must be maximum i.e.

$$\int_{-\infty}^{\infty} |\psi(\vec{r},t)|^2 \, dV = 1$$

This condition is known as normalization condition & the wave function which satisfies this condition is ~~known~~ said to be normalized

Soln 1(c) If the phase difference ($\Delta\phi$), measured at single point on a wave in the space at the beginning (ϕ_1) and end (ϕ_2) of a fixed time interval ($\Delta\tau$), does not change with time (τ), then the waves are said to posses temporal coherence.

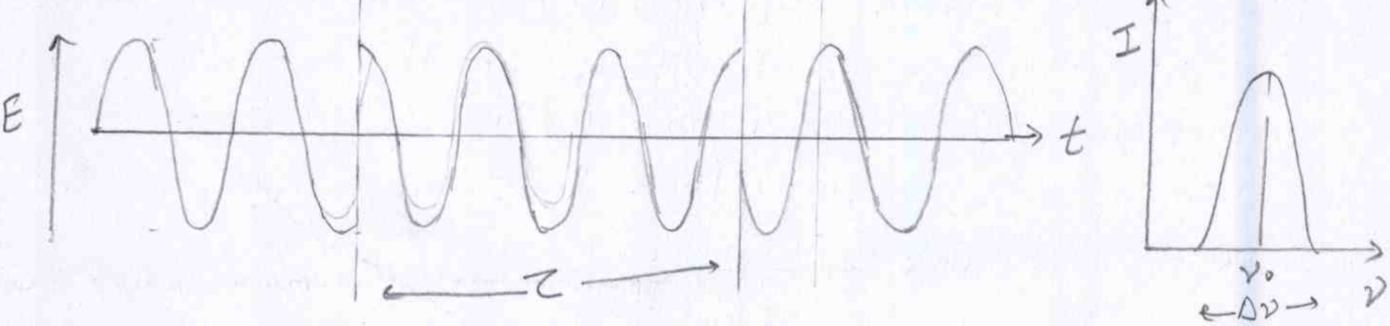
Q1(d)

Sol^n If we use a plane mirror instead of lower glass plate in Newton's rings experiment, the ~~rays~~ transmitted rays will also be reflected and no part will be transmitted at all. Due to superposition of reflected and transmitted light a general illumination will be formed & rings will disappear.

Part B (Attempt any two)

Q2(a)

Sol^n **Coherence time**: As we know that in ordinary source, light is emitted when excited atoms make a transition from the upper excited state to lower ground state. When an excited atom returns to the initial state, it emits pulse of short duration of the order of 10^{-10} second. Thus the field remains sinusoidal for time intervals of 10^{-10} second, after which the phase changes abruptly as given in fig. Similar light waves are also emitted due to the other transitions. There is no phase relation between the waves emitted from different atoms as the process of emission from the atom is random. The light waves emitted from a light source can be represented by small wave trains.



The average time interval for which definite phase relationship exists (i.e. the field remains sinusoidal) is known as temporal coherence time (τ_c)

Coherence time (τ_c) relates to the finite bandwidth of the source. In general, it is reciprocal of bandwidth $\tau_c = \frac{1}{\Delta\nu}$, where $\Delta\nu$ is the frequency bandwidth.

Coherence length: The average length of the wavetrains for which the field remains sinusoidal is called "Coherence length". It is the distance in the direction of wavefront propagation, within which the amplitude and phase of the wave can be considered well defined, predictable, and therefore subject to possible wave interference. It is denoted by L_c

$$L_c = c\tau_c \quad \text{where } c \rightarrow \text{speed of light}$$

Coherence length is also defined as the average length of wavetrain during which phase of waves is predictable i.e.

$$L_c = n\lambda$$

where n = number of wavetrain and λ = wavelength.

(b) The wave function of a particle inside a potential box of width 'a' when the particle is in n^{th} state.

$$\psi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x}{a}\right)$$

∴ Probability of a particle that can be found between $x=0$ and $x=a/n$ is

$$P = \int_0^{a/n} |\psi_n(x)|^2 dx$$

$$\Rightarrow \quad P = \frac{2}{a}\int_0^{a/n} \sin^2\left(\frac{n\pi x}{a}\right) dx$$

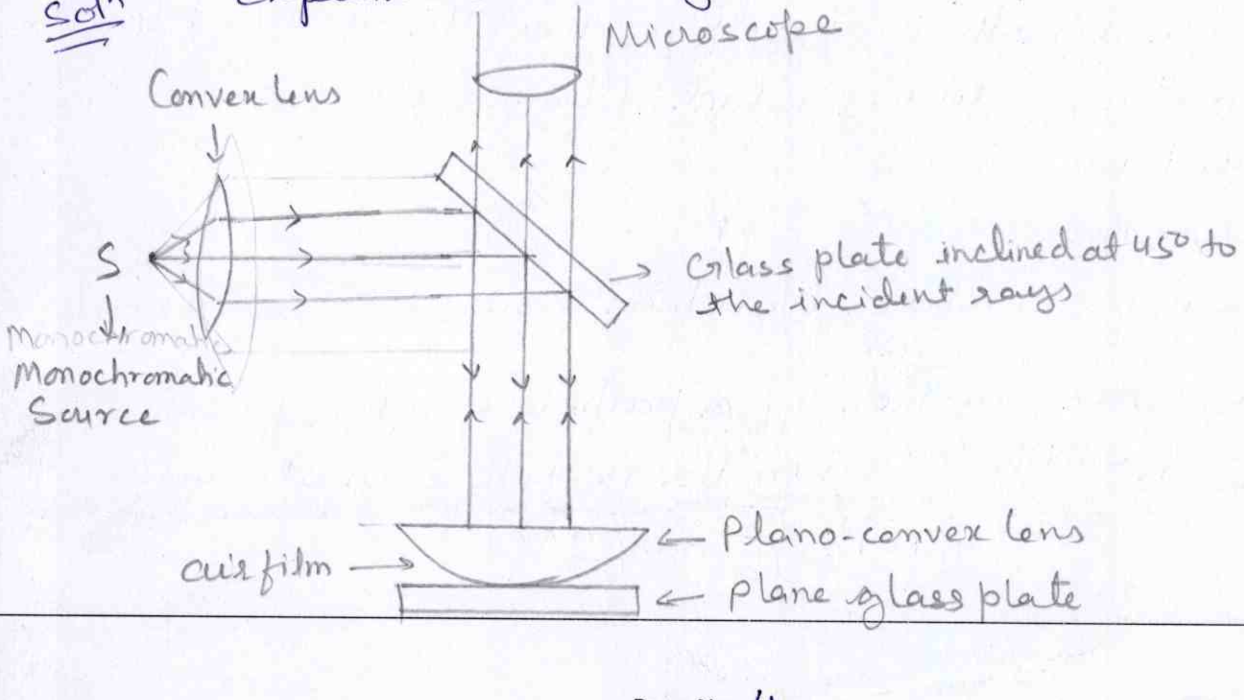
$$= \frac{2}{a}\int_0^{a/n} \left[\frac{1-\cos\left(\frac{2n\pi x}{a}\right)}{2}\right] dx$$

$$= \frac{1}{a}\left\{\int_0^{a/n} dx - \int_0^{a/n} \cos\left(\frac{2n\pi x}{a}\right) dx\right\}$$

$$= \frac{1}{a}\left[\left(x\right)_0^{a/n} - \left(\frac{a}{2n\pi}\sin\frac{2n\pi x}{a}\right)_0^{a/n}\right]$$

$$\boxed{P = \frac{1}{n}} \quad \text{Ans}$$

Q3(a)
Soln Experimental Arrangement



Ex Determination of wavelength of sodium light.

1. Experimental arrangement as given in figure.
2. Light from an extended monochromatic light source (sodium lamp) is allowed to fall normally on the system (Plano convex lens + Plane glass plate),
3. Light rays reflect from upper and lower layers of the air film present betn lens and glass plate.
4. When this air film is viewed in reflected light, alternate bright and dark concentric rings are seen around the point of contact.
5. Measure the diameter of n^{th} order dark ring in case of reflected light, which is given by

$$D_n^2 = 4n\lambda R \quad \text{— (1)}$$

6. Similarly measure the diameter of $(n+m)^{th}$ dark rings, which is given as

$$D_{n+m}^2 = 4(n+m)\lambda R \quad \text{— (2)}$$

7. On subtracting eqn (2) from (1), we have

$$D_{n+m}^2 - D_n^2 = 4(n+m)\lambda R - 4n\lambda R = 4m\lambda R$$

$$\Rightarrow \lambda = \frac{D_{n+m}^2 - D_n^2}{4mR} \quad \text{— (3)}$$

This expression is used to determine the wavelength λ. Here R is the radius of curvature of plano convex lens and can be measured by using a spherometer, using the formula $R = \frac{l^2}{6h} + \frac{h}{2}$

Here l = seperation betn two legs of spherometer
h = difference of the readings of the spherometer on plane glass plate and curved surface of the lens.

By knowing the values of D_n^2, D_{n+m}^2 & R we can determine wavelength of sodium light.

Q 3(b)
Soln (b) Given
wavelength of incident light $\lambda = 5000\text{Å}$
$= 5000 \times 10^{-10} m$
$= 5 \times 10^{-7} m$

By changing path length of movable mirror 'd', Number of finges cross the field of view = $N = 50$

formula used

$$2d = N\lambda$$

$$d = \frac{N\lambda}{2} = \frac{50 \times 5 \times 10^{-7}}{2} = 125 \times 10^{-7} m$$
$$= 1.25 \times 10^{-5} m$$

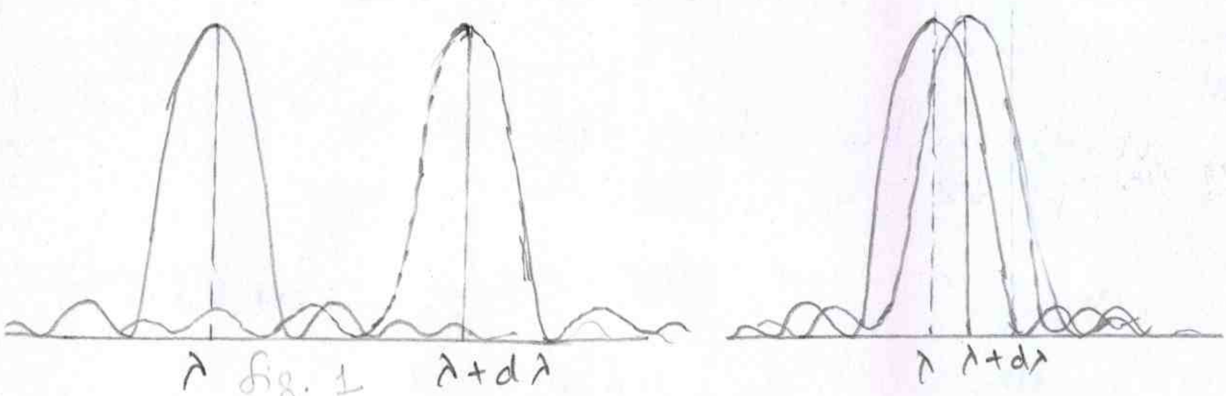
Ans

Q 4(a)
Soln Rayleigh's Criterion of Resolution

According to Rayleigh two nearby point source images or spectral lines of equal intensities are said to be just resolved if the position of the central maxima of the diffraction pattern due to one coincides with the first minimum of the diffraction pattern due to other and vice versa.

If A and B are the principal (central maxima) of the diffraction patterns of two spectral lines of wavelengths λ & $\lambda+d\lambda$. In this case (fig.1) the difference in the angle of diffraction is large and the two images can be seen as seperate ones. The angle of diffraction corresponding to the central maximum of the image B is greater than the angle of diffraction corresponding to the first minimum at the right of A. Hence the two spectral lines will appear well resolved.

fig.1 completely resolved   fig.2 unresolved



In fig 2. the central maxima corresponding to the wavelengths λ & $\lambda+d\lambda$ are very close. The angle of diffraction corresponding to the first minimum of A is greater than the angle of diffraction corresponding to the central maximum of B. The two images overlap & they cannot be distinguished as seperate images.

Question Paper Solution

Branch : CSLME **Semester:** I **Subject:** Engg. Physics **Mid Term:** I/II/Extra/Imp.
Submitted By : Dr. Kamal Sharma

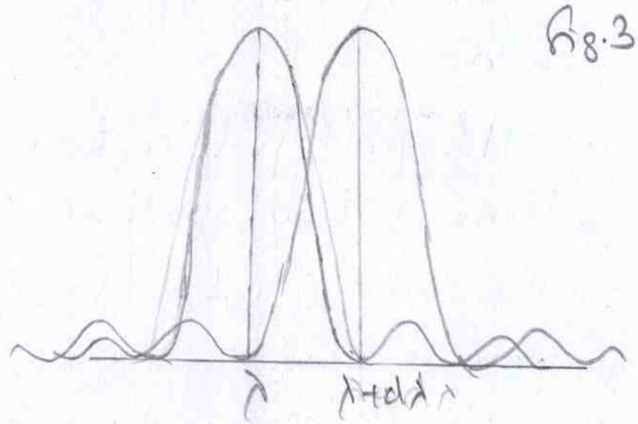


fig. 3. just resolved

In fig 3. the position of the central maximum of A (wavelength λ) coincides with the position of the first minimum of B (wavelength λ+dλ). Similarly, the position of the central maximum of B coincides with the position of the first minimum of A. In this case the spectral lines can be distinguished from one another and according to Rayleigh they are said to be just resolved.

Q4(b)
Sol^n^ Wavelengths of two spectral lines of incident light

$\lambda_1 = 6000\,\text{Å} = 6\times10^{-7}\,m$ & $\lambda_2 = 6000.5\,\text{Å}$
$= 6000.5\times10^{-10}\,m$

Width of grating $= 10\,mm = 10\times10^{-3}\,m = W$

formula used

$$\frac{\lambda}{d\lambda} = nN = \frac{(e+b)\sin\theta}{\lambda}N \quad \left[\text{as } n = \frac{(e+b)\sin\theta}{\lambda}\right]$$

$$= \frac{W}{\lambda}\sin\theta \quad [\text{as } (e+b)N = W]$$

$$\sin\theta = \frac{\lambda^2}{W d\lambda} = \frac{(6000\times10^{-10} + 6000.5\times10^{-10})^2}{4(10\times10^{-3}\,m \times 0.5\times10^{-10})}$$

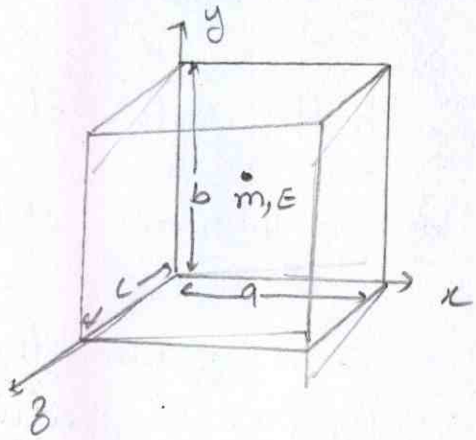
$$\sin\theta = \frac{3.6\times10^{-13}}{5\times10^{-13}} = 0.72$$

$$\theta = \sin^{-1}(0.72) = 46.054^\circ \quad \text{Ans}$$

Part C (Attempt any one)

Q5
Sol^n Let us consider the motion of a particle of mass m and energy E in a three dimensional box of dimensions as length 'a', breadth 'b' and height 'c', as shown in figure.

The box has perfectly rigid walls of infinite potential at boundary $x=0$ and $x=a$, at $y=0$ and $y=b$ and at $z=0$ and $z=c$. A particle does not loose energy when it collides with such walls, so that total energy of particle remains constt. The potential energy (V) of the particle is infinite at all six faces of the box, while inside the box potential V is constant, say zero for convenience.



Then the potential experienced by the particle can be given as

$$V(x,y,z) = 0 \quad \begin{cases} 0 < x < a \\ 0 < y < b \\ 0 < z < c \end{cases}, \qquad V(x,y,z) = \infty \quad \begin{cases} x \le 0, x \ge a \\ y \le 0, y \ge b \\ z \le 0, z \ge c \end{cases}$$

Hence the particle moves as free inside the box but when it reaches at boundaries, a force ($F = -dV/dx = -\infty$) acts on the particle due to infinite potential at boundaries in a direction opposite to its motion. In result particle's direction of motion changes and it remains inside the box and cannot exist outside the box. Hence the wave-function associated with the particle outside the box is zero.

Time independent three dimensional Schrödinger's wave equation is given as

$$\frac{\partial^2 \psi(x,y,z)}{\partial x^2} + \frac{\partial^2 \psi(x,y,z)}{\partial y^2} + \frac{\partial^2 \psi(x,y,z)}{\partial z^2} + \frac{2m}{\hbar^2}\left[E - V(x,y,z)\right]\psi(x,y,z) = 0$$

As the potential energy $V(x,y,z) = 0$ (inside the box)

$$\frac{\partial^2 \psi(x,y,z)}{\partial x^2} + \frac{\partial^2 \psi(x,y,z)}{\partial y^2} + \frac{\partial^2 \psi(x,y,z)}{\partial z^2} + \frac{2mE}{\hbar^2}\psi(x,y,z) = 0 \quad -(1)$$

Let us assume that the wave function $\psi(x,y,z)$ is equal to the product of three independent functions of x, y & z.

Let the solution of equation (1) is

$$\psi(x,y,z) = X(x)\,Y(y)\,Z(z) \quad -(2)$$

Using relation (2) in (1)

$$Y(y)Z(z)\frac{\partial^2 X(x)}{\partial x^2} + X(x)Z(z)\frac{\partial^2 Y(y)}{\partial y^2} + X(x)Y(y)\frac{\partial^2 Z(z)}{\partial z^2} + \frac{2mE}{\hbar^2}X(x)Y(y)Z(z) = 0 \quad -(3)$$

On dividing eqn (3) by $X(x)\,Y(y)\,Z(z)$, we have

$$\underbrace{\frac{1}{X(x)}\frac{\partial^2 X(x)}{\partial x^2}}_{\text{A function of } x \text{ only}} + \underbrace{\frac{1}{Y(y)}\frac{\partial^2 Y(y)}{\partial y^2}}_{\text{A function of } y \text{ only}} + \underbrace{\frac{1}{Z(z)}\frac{\partial^2 Z(z)}{\partial z^2}}_{\text{A function of } z \text{ only}} + \underbrace{\frac{2mE}{\hbar^2}}_{\text{constant}} = 0 \quad -(4)$$

In this equation all the terms on L.H.S are independent to each other, so that each term can be put equal to some constant. Thus we can write.

$$\frac{1}{X(x)}\frac{\partial^2 X(x)}{\partial x^2} = -k_x^2 \quad \text{or} \quad \frac{\partial^2 X(x)}{\partial x^2} + k_x^2 X(x) = 0 \quad -(5)$$

$$\frac{1}{Y(y)}\frac{\partial^2 Y(y)}{\partial y^2} = -k_y^2 \quad \text{or} \quad \frac{\partial^2 Y(y)}{\partial y^2} + k_y^2 Y(y) = 0 \quad -(6)$$

$$\frac{1}{Z(z)}\frac{\partial^2 Z(z)}{\partial z^2} = -k_z^2 \quad \text{or} \quad \frac{\partial^2 Z(z)}{\partial z^2} + k_z^2 Z(z) = 0 \quad -(7)$$

and $k_x^2 + k_y^2 + k_z^2 = \dfrac{2mE}{\hbar^2}$ — (8)

The solution of eqn (5) can be written as

$$X(x) = A_1 \sin k_x \cdot x + B_1 \cos k_x \cdot x \quad -(9)$$

Here A_1 & B_1 are constants and can be determined by using boundary conditions

At $x=0$, $X(x)=0$, we have

$$0 = A_1 \sin k_x \cdot 0 + B_1 \cos k_x \cdot 0$$

$$\Rightarrow B_1 = 0 \quad -(10)$$

Using eqn (10) in (9), we get

$$X(x) = A_1 \sin k_x x \quad -(11)$$

~~Using~~ At $x=a$, $X(x)=0$, we have

$0 = A_1 \sin k_x \cdot a$ i.e. $\sin k_x a = 0$, $A_1 \neq 0$

$k_x \cdot a = n_x \pi$ — (12) $\Rightarrow k_x = \frac{n_x \pi}{a}$ where $n_x = 1, 2, 3 \ldots$

Using eq^n (12) in (11), we have

$$X(x) = A_1 \sin\left(\frac{n_x \pi}{a}\right)x \quad \text{— (13)}$$

Using normalization condition bet^n boundary $x=0$ & $x=a$, we have

$$\int_0^a |X(x)|^2 dx = 1 \Rightarrow \int_0^a \left|A_1 \sin\left(\frac{n_x \pi x}{a}\right)\right|^2 dx = 1$$

$$\Rightarrow A_1^2 \int_0^a \sin^2\left(\frac{n_x \pi x}{a}\right) dx = 1$$

$$\Rightarrow A_1^2 \int_0^a \left(\frac{1 - \cos \frac{2 n_x \pi x}{a}}{2}\right) dx = 1$$

$$\Rightarrow \frac{A_1^2}{2}\left[\int_0^a 1 . dx - \int_0^a \cos\left(\frac{2 n_x \pi}{a} x\right) dx\right] = 1$$

$$\Rightarrow \frac{A_1^2}{2}\left[(x)_0^a - \left[\frac{\sin \frac{2 n_x \pi x}{a}}{2 n_x \pi / a}\right]_0^a\right] = 1$$

$$\frac{A_1^2}{2} . a = 1$$

$$A_1 = \sqrt{\frac{2}{a}} \quad \text{— (14)}$$

Using value of constant A_1 from eqn (14) in (13), we get

$$X(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n_x \pi}{a} x\right) \quad \text{--- (15)}$$

Similarly the solution of eqn (6) & (7) can be given as:

$$Y(y) = \sqrt{\frac{2}{b}} \sin\left(\frac{n_y \pi}{b} y\right) \quad \text{--- (16)}$$

$$Z(z) = \sqrt{\frac{2}{c}} \sin\left(\frac{n_z \pi}{c} z\right) \quad \text{--- (17)}$$

Using eqn (15), (16) and (17) in eqn (2), we will get Eigen function for a free particle in three dimensional box

$$\psi(x,y,z) = \frac{2\sqrt{2}}{\sqrt{abc}} \sin\left(\frac{n_x \pi}{a} x\right) \sin\left(\frac{n_y \pi}{b} y\right) \sin\left(\frac{n_z \pi}{c}\right) z \quad \text{--- (18)}$$

Energy Eigen Value:

As $k_x = \frac{n_x \pi}{a}$, $k_y = \frac{n_y \pi}{b}$ & $k_z = \frac{n_z \pi}{c}$

from eqn (8)

$$k_x^2 + k_y^2 + k_z^2 = \frac{2mE}{\hbar^2}$$

$$\left(\frac{n_x \pi}{a}\right)^2 + \left(\frac{n_y \pi}{b}\right)^2 + \left(\frac{n_z \pi}{c}\right)^2 = \frac{2mE}{\hbar^2}$$

Hence the allowed value of energy are

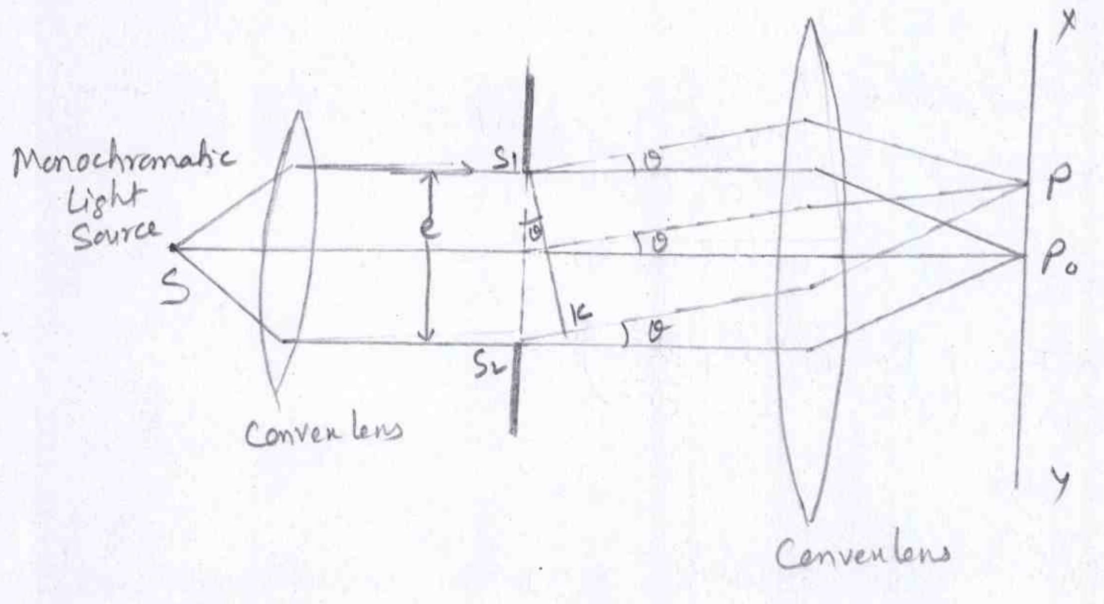
$$E = \frac{\pi^2 \hbar^2}{2m} \left(\frac{n_x^2}{a^2} + \frac{n_y^2}{b^2} + \frac{n_z^2}{c^2}\right) \quad \text{--- (19)}$$

Degeneracy of Energy ~~level~~ states:

The Schrodinger wave equation in three dimensions introduces three quantum numbers that quantize the energy and the same energy can be obtained by different set of quantum numbers $(n_x n_y n_z)$

The different sets of quantum numbers $(n_x n_y n_z)$ corresponds to different wave functions but may have same energy. Such energy states are known as degenerate states.

Q6
Soln Let $S_1 S_2$ is a slit of width 'e'. The monochromatic light of wavelength λ incident normally on this slit of width 'e'. According to Huygen's principal, each point in slit $S_1 S_2$ sends out secondary wavelets in all forward directions.



The secondary wavelets diffracted in the direction of incident ray are focussed at point P_0 on screen while the secondary wavelets diffracted through an angle 'θ' are focussed at a different point P on screen. Since point P_0 is equivalent for all the secondary wavelets starting from slit S_1S_2. So the wavelets reaching at point P_0 will be in phase and a maximum intensity will be found at P_0.

The path difference betn the secondary wavelets focussing at point P and diffracting through an angle 'θ' by the slit S_1S_2 increases continuously from extreme points of slit S_1 to S_2 as shown in fig. To evaluate this path difference between secondary wavelets emitting from S_1 and S_2. Let S_1K be a perpendicular to S_2K. Since the optical path of ~~all~~ secondary wavelets from the plane S_1K to point P are equal, the path difference betn wavelets from S_1 to S_2 in a dirn θ can be given from right angle triangle S_1KS_2 as

$$S_2K = S_1S_2 \sin\theta \qquad \{S_1S_2 = e\}$$

$$S_2K = e\sin\theta \qquad \text{--- (1)}$$

Equivalent phase difference

$$\delta = \frac{2\pi}{\lambda} e\sin\theta \qquad \text{--- (2)}$$

Eqn (2) gives the phase difference betn extreme secondary wavelets starting from S_1 and S_2 which

increases continuously from S_1 to S_2
Let us divide width $S_1 S_2 = e$ of the slit in p equal parts. then phase difference betn wavelets from two consecutive elements will be δ/p. Similarly amplitude of each secondary wavelet is assumed to be a (let), since each part has same width.
Now the resultant disturbance from all these elements can be calculated by using vector addition of polygon method or phasor diagram method. for this purpose construct a polygon of each of equal length 'a' and having successive phase δ/p start from pt. S_1 and ends at S_2 as shown in fig.

vector addition of polygon method

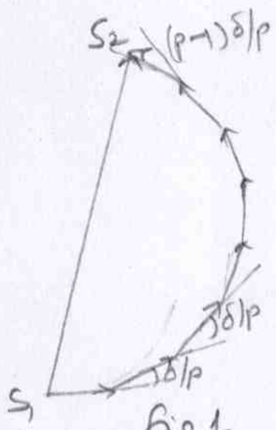


fig 1

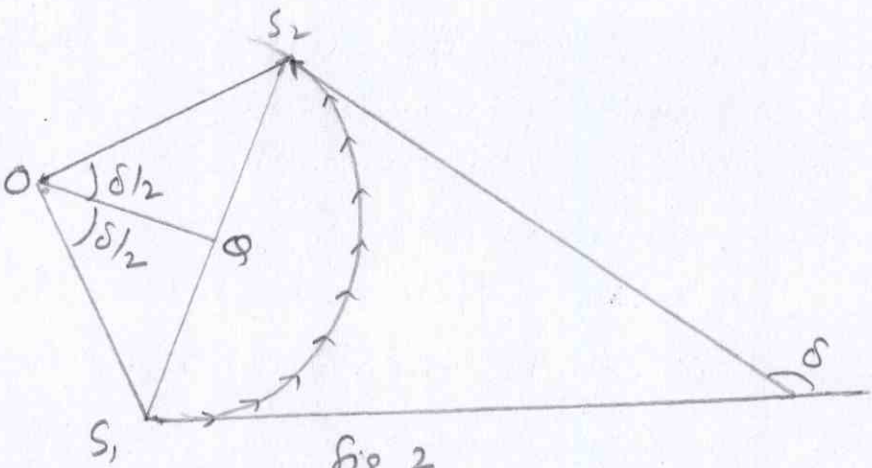


fig 2

This line $S_1 S_2$ will represent the resultant disturbance. Since the number of secondary wavelets is very large, then this step curve can be considered as a continuous arc. The phase difference betn the wavelets from extreme ends of the slit $S_1 S_2$ is the angle betn tangent at the point S_1 & S_2.

Angle $\delta = \frac{arc}{radius} = \frac{S_1 S_2}{OS_2} = \frac{pa}{r}$ — (3)

$\Rightarrow r = \frac{pa}{\delta}$ — (4) $\{S_1S_2 = pa, OS_1 = OS_2 = r\}$

Resultant amplitude $S_1S_2 = 2S_1Q$ — (5)

Draw a perpendicular OQ from the centre of the arc S_1S_2 on chord which divide the line S_1S_2 in two equal parts.

$\angle S_1OQ = \angle S_2OQ = \delta/2$ — (6)

from ΔS_1OQ $\sin\delta/2 = \frac{S_1Q}{OS_1}$ $\Rightarrow S_1Q = OS_1 \sin\delta/2$ — (7)

from (5) & (7) $S_1S_2 = 2S_1Q = 2OS_1 \sin\delta/2$ $\{OS_1 = r\}$

$S_1S_2 = 2r\sin\delta/2$ — (8)

from (4) & (8)

$S_1S_2 = 2\frac{pa}{\delta}\sin\delta/2 = \frac{pa}{\delta/2}\sin\delta/2$ — (9)

Let $S_1S_2 = R$ is the resultant amplitude

$R = pa\left(\frac{\sin\alpha}{\alpha}\right)$ — (10)

where $\alpha = \delta/2 = \pi/\lambda \; e\sin\theta$ — (11)

As we know $I \propto R^2$, so the resultent intensity

$I = KR^2 = Kp^2a^2\left(\frac{\sin\alpha}{\alpha}\right)^2 = I_0\left(\frac{\sin\alpha}{\alpha}\right)^2$

$\Rightarrow \boxed{I = I_0\left(\frac{\sin\alpha}{\alpha}\right)^2}$ — (12)

Intensity and position of central maxima :

For the central point P_0, the angle of diffraction for all secondary wavelets $\theta = 0°$

So $\alpha = \frac{\pi}{\lambda} e \sin\theta = 0$

then $\lim_{\alpha \to 0} \frac{\sin\alpha}{\alpha} = 1$

& maximum intensity i.e. $I_{max} = I_0$ — (13)

Intensity and position of secondary maxima

In order to find the position of secondary maxima, differentiate eq^n (12) with respect to α and equate it to zero.

i.e. $\frac{dI}{d\alpha} = 0 \Rightarrow \frac{d}{d\alpha}\left[I_0\left(\frac{\sin\alpha}{\alpha}\right)^2\right] = 0$

$$\Rightarrow 2I_0\left(\frac{\sin\alpha}{\alpha}\right)\left[\frac{\alpha.\cos\alpha - \sin\alpha.1}{\alpha^2}\right] = 0 \quad —(14)$$

here $I_0 \neq 0$

$\frac{\sin\alpha}{\alpha} \neq$ (If this equal to zero corresponds to minima)

$\alpha \neq 0$ (If this equal to zero corresponds to principal maxima)

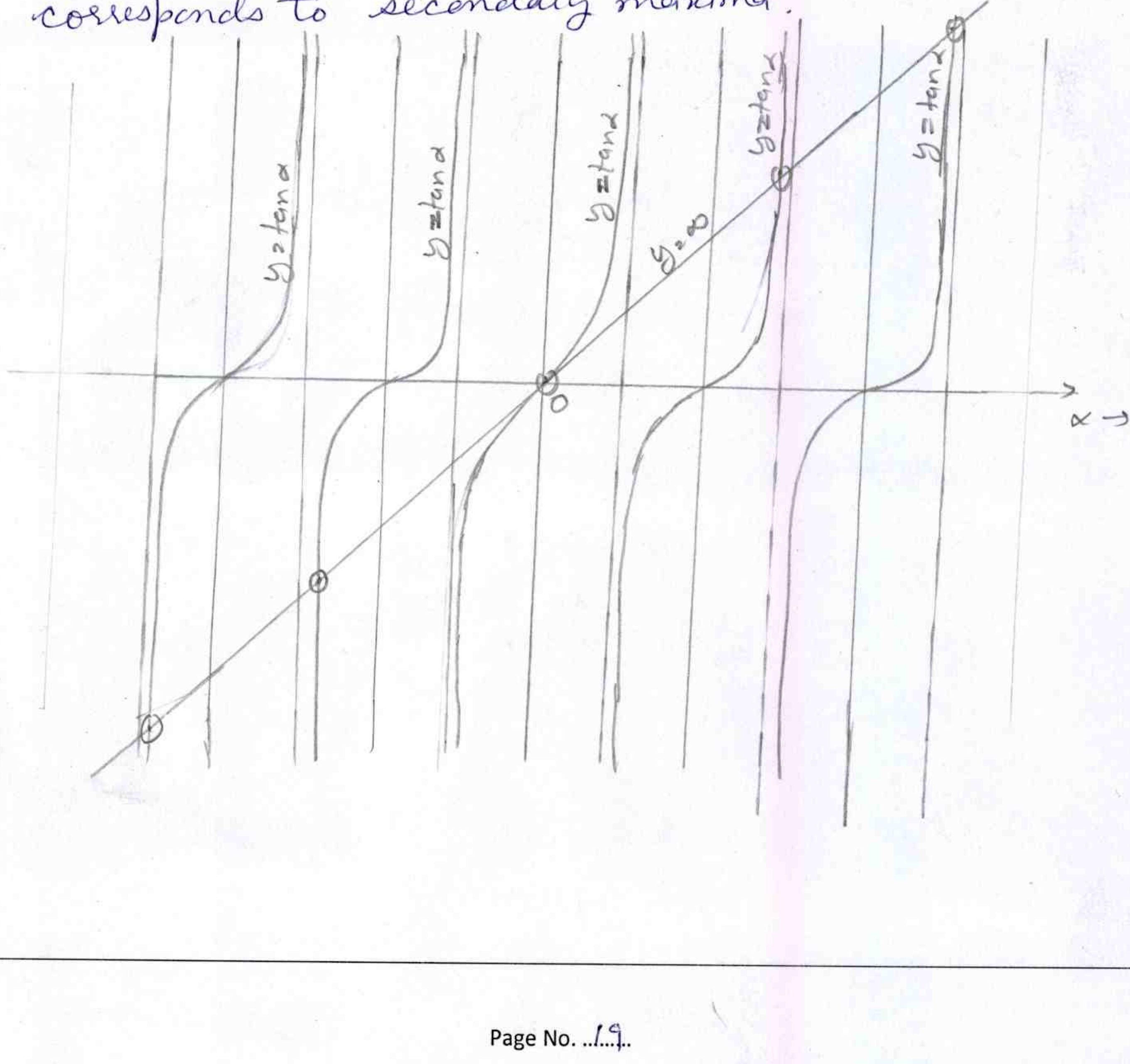
Hence from eq^n (14) we have

$$\alpha\cos\alpha - \sin\alpha = 0 \Rightarrow \alpha = \tan\alpha \quad -(15)$$

Eq^n (15) gives the condition for secondary maxima. This equation can be solved by plotting both the curves on a single graph.

$y = \alpha$ — (16) & $y = \tan\alpha$ — (17)

The eqn (16) represents ~~the~~ a straight line passing through origin and makes an angle of 45^o from the x-axis and the eqn (17) are the discontinuous curves from $y = -\infty$ to $y = +\infty$. The points of intersection of these two curves gives the values of 'α' which corresponds to secondary maxima.



The approximate values of α are $\alpha = 0, \pm 3\pi/2, \pm 5\pi/2$ --- $(2n+1)\pi/2$, more exact values of α are $\alpha = 0, \pm 1.43\pi, \pm 2.46\pi, \pm 3.47\pi$ ---

On substituting these values of α in eq^n (12), we get the intensities of various second order maxima.

for central maxima $\alpha = 0$

$$I = I_0 \left(\frac{\sin\alpha}{\alpha}\right)^2 = I_0 \quad \text{--- (18)}$$

for first secondary maxima $\alpha = \pm 3\pi/2$

$$I_1 = I_0 \left(\frac{\sin 3\pi/2}{3\pi/2}\right)^2 = \frac{4I_0}{9\pi^2} \quad \text{--- (19)}$$

for second secondary maxima $\alpha = \pm 5\pi/2$

$$I_2 = I_0 \left(\frac{\sin 5\pi/2}{5\pi/2}\right)^2 = \frac{4I_0}{25\pi^2} \quad \text{--- (20)}$$

Thus the relative intensities of successive maxima are nearly in ratio

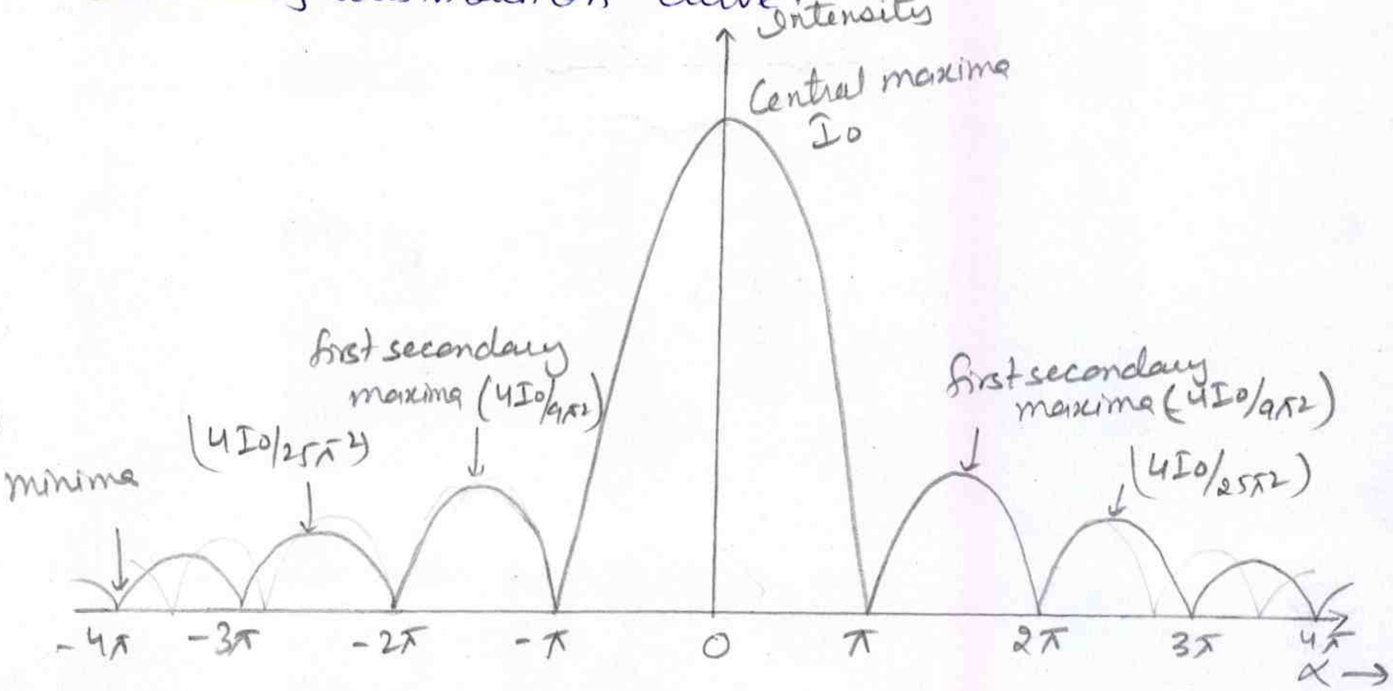
$$I_0 : \frac{4I_0}{9\pi^2} : \frac{4I_0}{25\pi^2} : \frac{4I_0}{49\pi^2} : \text{---}$$

$$1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} : \text{---} \qquad \text{Proved}$$

Question Paper Solution

Branch : CS&ME Semester: I Subject: Engg. Physics Mid Term: I/II/Extra/Imp.
Submitted By : Dr. Kamal Sharma

Intensity distribution curve



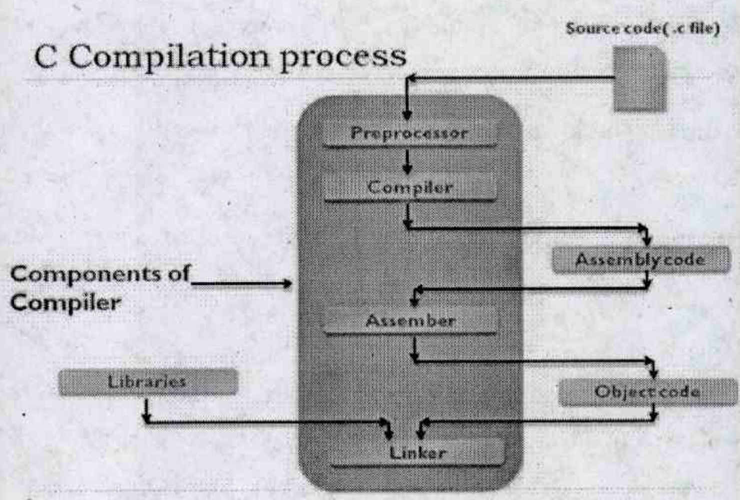
Swami Keshvanand Institute of Technology, Management &Gramothan,
Ramnagaria, Jagatpura, Jaipur-302017

Question Paper Solution

Branch:Group-I (CS,ME) **Semester: I-year I-sem** **Subject: Programming for Problem Solving** **Mid Term: I-midterm**
Submitted By: Dolly Mittal

Q.1 (A) The Four Stages of Compiling a C Program. Compiling a C program is a multi-stage process. At an overview level, the process can be split into four separate stages:

1. Preprocessing
2. Compilation
3. Assembly
4. Linking

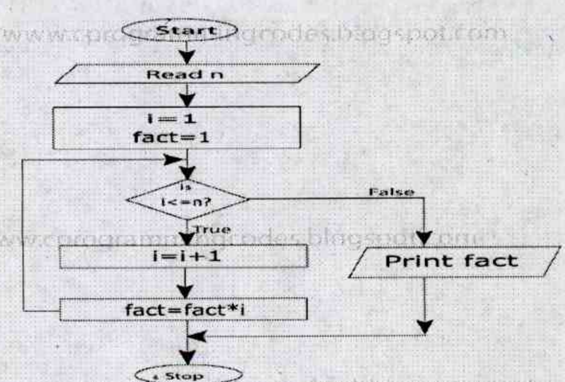


Q.1 (B) Keywords are the fixed words in C which have some predefined meaning. Keywords cannot be used as identifiers. For example for, do, switch etc. C has total 32 reserved keywords.
Identifiers refers to the name of variable, array and function. Following rules must be considered while defining identifiers:

(1) they may have alphabets, digits and underscore symbol.
(2) They cannot have any whitespaces.
(3) The first letter of an identifier cannot be a digit.
(4) Keywords cannot be used in identifiers name.

for example int name; (valid)
1_name is an invalid identifier
roll number (invalid)

Q.1 (C)



Q.1 (D)

Array – Arrays a kind of data structure that can store a fixed-size sequential collection of elements of the same type. An array is used to store a collection of data, but it is often more useful to think of an array as a collection of variables of the same type.

Instead of declaring individual variables, such as number0, number1, ..., and number99, you declare one array variable such as numbers and use numbers[0], numbers[1], and ..., numbers[99] to represent individual variables. A specific element in an array is accessed by an index.

All arrays consist of contiguous memory locations. The lowest address corresponds to the first element and the highest address to the last element.

To declare an array in C, a programmer specifies the type of the elements and the number of elements required by an array as follows –

```
type arrayName [ arraySize ];
```

This is called a *single-dimensional* array. The **arraySize** must be an integer constant greater than zero and **type** can be any valid C data type. For example, to declare a 10-element array called **balance** of type double, use this statement –

```
double balance[10];
```

Here *balance* is a variable array which is sufficient to hold up to 10 double numbers.

```
/* Program: 1-DarrayDemo.c */
#include <stdio.h>
int main ()
{
  int arr[5] = {1, 2, 3, 4, 5}; // array of 5 integers
  for (int i = 0; i < 5; i++)
  {
    printf("value at %d location is: %d\n", i, arr[i]);
  }
  return 0;
}
```

2-D array : A two dimensional array (will be written 2-D hereafter) can be imagined as a matrix or table of rows and columns or as an array of one dimensional arrays. Following is a small program `twoDimArrayDemo.c` that declares a 2-D array of 4x3 (4 rows and 3 columns) and prints its elements.

```
/* Program: twoDimArrayDemo.c */
#include <stdio.h>
#define ROWS 4
#define COLS 3
int main ()
{
    // declare 4x3 array
```

```
    int matrix[ROWS][COLS] = {{1, 2, 3},
                              {4, 5, 6},
                              {7, 8, 9},
                              {10, 11, 12}};

    for (int i = 0; i < ROWS; i++)
    {
        for (int j = 0; j < COLS; j++)
        {
            printf("%d\t", matrix[i][j]);
        }
        printf("\n");
    }
    return 0;
}
```

Q.1 (E)

```
#include<stdio.h>
#include<math.h>
void main()
{
        int a,r,s,min;
        printf("enter the ages of ajay,ram,shyam");
        scanf("%d%d%d",&a,&r,&s);
       min=(a<r)?(a<s?a:s): (r<s?r:s);
    printf("youngest is=%d",min);
}
```

Q. 2 (A) It is sometimes desirable to skip some statements inside the loop or terminate the loop immediately without checking the test expression.

In such cases, `break` and `continue` statements are used.

break Statement :-
The break statement terminates the loop (for, while and do...while loop) immediately when it is encountered. The break statement is used with decision making statement such as if...else.

```
while (test Expression)
{
    // codes
    if (condition for break)
    {
        break;
    }
    // codes
}
```

```
for (init, condition, update)
{
    // codes
    if (condition for break)
    {
        break;
    }
    // codes
}
```

```
#include <stdio.h>
int main()
{
 int n;
for(n =1; n <=5; n++)
if(n==3)
break;
else
printf("%d",n);
return (0);
}
```

OUTPUT
=====

Sum of positive elements:1 2

continue Statement :-
The continue statement skips some statements inside the loop. The continue statement is used with decision making statement such as if...else.

```
while (test Expression)
{
     // codes
     if (condition for continue)
     {
          continue;
     }
     // codes
}
```

```
for (init, condition, update)
{
     // codes
     if (condition for continue)
     {
          continue;
     }
     // codes
}
```

```
#include <stdio.h>
int main()
{
int n;
for(n =1; n <=5; n++)
if(n==3)
continue;
else
printf("%d",n);
return (0);
}
```

OUTPUT
=====
Sum of positive elements:1 2 4 5

The major difference between `break` and `continue` statements in C language is that a `break` causes the innermost enclosing loop or `switch` to be exited immediately. Whereas, the `continue` statement causes the next iteration of the enclosing `for`, `while`, or `do` loop to begin. The `continue` statement in `while` and `do` loops takes the control to the loop's *test-condition* immediately, whereas in the `for` loop it takes the control to the *increment*step of the loop.
The `continue` statement applies only to loops, not to `switch`. A `continue` inside a `switch` inside a loop causes the next loop iteration.

Q.2(B)

```
#include<stdio.h>
```

```
int main()
{
int n, reversedInteger =0, remainder, originalInteger;

   printf("Enter an integer: ");
   scanf("%d",&n);
   originalInteger = n;
// reversed integer is stored in variable
while( n!=0)
{
      remainder = n%10;
      reversedInteger = reversedInteger*10+ remainder;
      n /=10;
}
// palindrome if orignalInteger and reversedInteger are equal
if(originalInteger == reversedInteger)
      printf("%d is a palindrome.", originalInteger);
else
      printf("%d is not a palindrome.", originalInteger);
return0;
}
```

Q. 3(A)

Concatenation of two strings:

```
#include <stdio.h>
int main()
{
    char s1[100], s2[100], i, j;

    printf("Enter first string: ");
    gets(s1);

    printf("Enter second string: ");
    gets(s2);

    // calculate the length of string s1
    // and store it in i
    for(i = 0; s1[i] != '\0'; ++i);

    for(j = 0; s2[j] != '\0'; ++j, ++i)
    {
        s1[i] = s2[j];
```

```
    }

    s1[i] = '\0';

    printf("After concatenation: %s", s1);
printf("no of concatenated characters: %d",j);

    return 0;
}
```

Q. 3(B)

if vs else_if :-

Programs do not always flow in a sequential manner. Situations do arise when there is a decision to be made or a piece of code that needs to be repeated. Control structures aid this by defining what needs to be done in the program and under what conditions. These are known as conditional statements that judge a statement on Boolean outputs of true or false.

```
// Program using multiple if statements
#include <stdio.h>
int main()
{
        int mark =0;
        printf("Enter the mark: ");
        scanf("%d", &mark);
        if(mark >= 80)
                printf("Grade is A ");
        if(mark >= 60)
                printf("Grade is B");
        if(mark >= 40)
                printf("Grade is C");
        if(mark < 40 && mark >= 0)
                printf("Grade is D");
        if(mark < 0 || mark >=100)
                printf("Invalid Mark");
}
```

In above program using multiple IF statements all the conditions will be checked even if first IF condition is true. Te second thing is that there is always chances to execute more than one IF statements if more than two conditions are true.

In place of multiple IF statements if we use ELSE_IF ladder then always only one condition will be true.

```
// Program using else if ladders
#include <stdio.h>
int main()
{
        int mark =0;
        printf("Enter the mark: ");
        scanf("%d",&mark);
        if(mark >= 80)
                printf("Grade is A ");
        else if(mark >= 60)
                printf("Grade is B");
        else if(mark >= 40)

printf("Grade is C");
        else if(mark < 40 && mark >= 0)
                printf("Grade is D");
        else
                printf("Invalid Mark");
        getch();
}
```

Q. 4(A)

```
void main()
{
int arr[10],n,i,v,f=0;
printf("enter number of element");
scanf("%d", &n);
printf("enter array element");
for(i=0;i<n;i++)
scanf("%d",&arr[i]);
printf("enter element for which frequency needs to be counted");
scanf("%d",&v);
for(i=0;i<n;i++)
{
if(arr[i]==v)
f++;
}
printf("frequency of %d is %d", v,f);
getch();
}
```

Q. 4 (B) (i)

```
#include<stdio.h>
int main()
{
int i, j;
   char number= 'A';

for(i=1; i <= 5; i++)
   {
for(j=1; j <= i; ++j)
       {
          printf("%c", number);
          ++number;
       }

       printf("\n");
   }
return0;
}
```

Q. 4 (B) (ii)

```
#include<stdio.h>
int main()
{
int i, j,k;

for(i=1; i <= 4; i++)
   {
for(j=1; j <= 4-i; ++j)
      {
         printf(" ");
      }
for(k=1;k<=(2*i-1);k++)
    {
       printf("*");
    }
      printf("\n");
  }
return0;
}
```

==

======THE END

==

Question Paper Solution

Branch : CS, ME Semester: I Subject: BEE Mid Term: I/II/Extra/Imp.
Submitted By : Ajay Bhardwaj

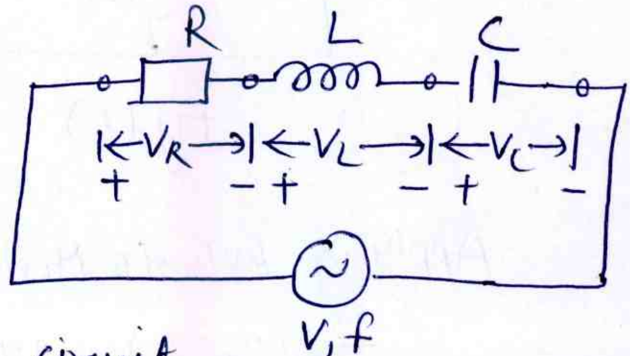
Part-A

Ans.1. Maximum Power Transfer Theorem

This Theorem states that maximum power is absorbed from a network when the load resistance is equal to the output resistance of the network as seen from the terminals of the load.

Ans.2.

The general expression for the total impedance of this series RLC circuit is



$$Z = R + j(X_L - X_C)$$

The resonance in a series RLC circuit requires that

$$X_L = X_C \quad \text{or} \quad X_L - X_C = 0 \quad \text{or} \quad \omega L = \frac{1}{\omega C}$$

$$\text{or} \quad \boxed{f_0 = \frac{1}{2\pi\sqrt{LC}}} \quad \because \omega = 2\pi f$$

Ans.3.

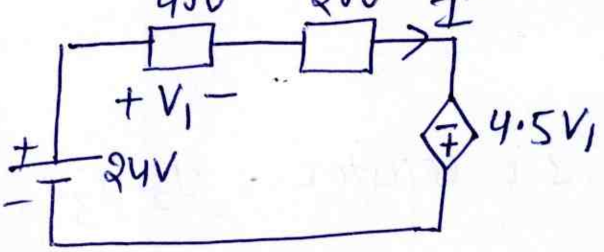


fig.(a)

Applying KVL in this circuit

$$-24 + 4I + 2I - 4.5V_1 = 0$$

$$\because V_1 = 4I$$

Hence

$$-24 + 6I - 4.5(4I) = 0$$

$$-24 - 12I = 0$$

$$\boxed{I = -2A}$$

Question Paper Solution

Branch : CS, ME Semester: I Subject: BEE Mid Term: I/II/Extra/Imp.
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Part-B

Sol. 4

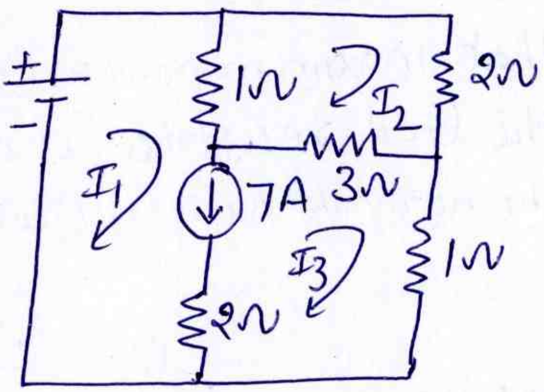


fig.(b)

In fig (b),
Meshes 1 and 3 will form a supermesh:-

$I_1 - I_3 = 7A$ --- (i)

Applying KVL to the outer path of the supermesh:-

$7 - 1(I_1 - I_2) - 3(I_3 - I_2) - I_3 = 0$

$-I_1 + 4I_2 - 4I_3 = -7$ --- (ii)

Applying KVL to Mesh 2:-

$-1(I_2 - I_1) - 2I_2 - 3(I_2 - I_3) = 0$

$I_1 - 6I_2 + 3I_3 = 0$ --- (iii)

Solving eqn (i), (ii) and (iii)

$I_1 = 9A$

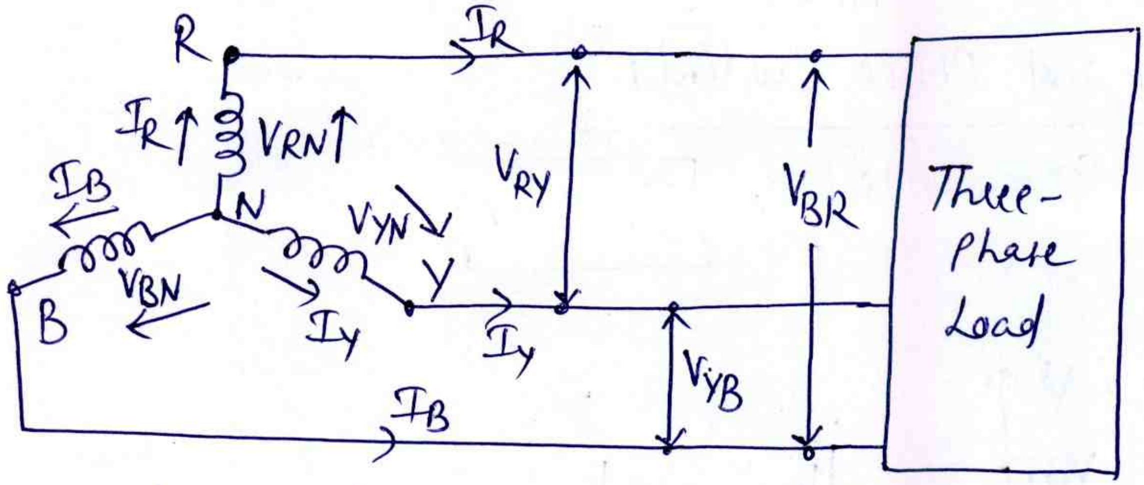
$I_2 = 2.5A$

$I_3 = 2A$

Current through the 3Ω resistor $= I_2 - I_3$

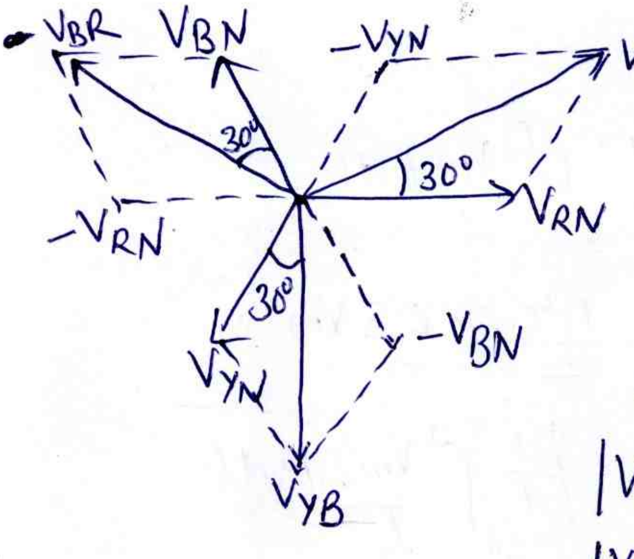
$= 2.5 - 2 = 0.5A$

Sol. 5. Star-Connected Three-phase system



Line voltage and Phase voltage

$$V_{RY} = V_{RN} + V_{NY} = V_{RN} - V_{YN} = V_{RN} + (-V_{YN})$$
$$V_{YB} = V_{YN} + (-V_{BN}) \; ; \; V_{BR} = V_{BN} + (-V_{RN})$$



$$|V_{RY}| = \sqrt{(|V_{RN}|)^2 + |-V_{YN}|^2 + 2|V_{RN}||-V_{YN}|\cos 60^\circ}$$

$$V_{RY} = \sqrt{V_{RN}^2 + V_{YN}^2 + 2V_{RN}V_{YN}\cdot\frac{1}{2}}$$

In a balanced system

$$|V_{RY}| = |V_{YB}| = |V_{BR}| = V_L$$
$$|V_{RN}| = |V_{YN}| = |V_{BN}| = V_{ph}$$

$$V_L = \sqrt{V_{ph}^2 + V_{ph}^2 + 2V_{ph}^2\cdot\frac{1}{2}} = \sqrt{3V_{ph}^2} = \sqrt{3}\,V_{ph}$$

$$\boxed{V_L = \sqrt{3}\,V_{ph}}$$

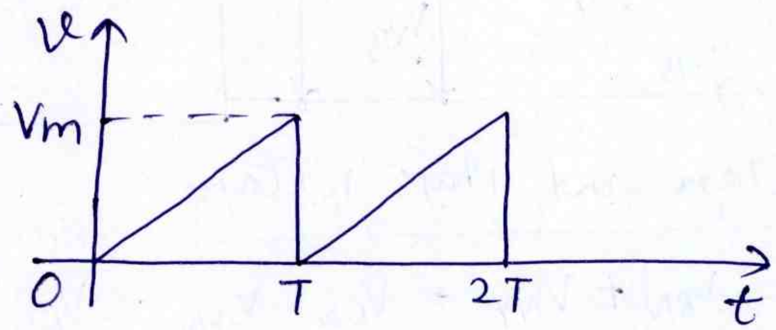
Hence the phasor V_{RY} can be written as

$$V_{RY} = \sqrt{3}\, V_{ph} \angle 30^\circ \quad (\because \text{Line voltage is } \sqrt{3} \text{ times phase voltage})$$

Line and Phase Currents

In Star connection, $\boxed{I_L = I_{ph}}$

Sol. 6



RMS and average value

$$v = \frac{V_m}{T} t \qquad 0 < t < T$$

$$V_{avg} = \frac{1}{T}\int_0^T v(t)\,dt = \frac{1}{T}\int_0^T \frac{V_m}{T} t\,dt$$

$$= \frac{V_m}{T^2}\left[\frac{t^2}{2}\right]_0^T = \frac{V_m}{T^2}\cdot\frac{T^2}{2} = 0.5\,V_m$$

$$V_{rms} = \sqrt{\frac{1}{T}\int_0^T v^2(t)\,dt} = \sqrt{\frac{1}{T}\int_0^T \frac{V_m^2}{T^2}\cdot t^2\,dt}$$

$$= \sqrt{\frac{V_m^2}{T^3}\left[\frac{t^3}{3}\right]_0^T} = \sqrt{\frac{V_m^2}{T^3}\left[\frac{T^3}{3}\right]} = \sqrt{\frac{V_m^2}{3}}$$

$$V_{rms} = 0.577\,V_m$$

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Question Paper Solution

Branch : CS, ME Semester: I Subject: BEE Mid Term: I/II/Extra/Imp.
Submitted By : Ajay Bhardway

Part-C

Sol. 7

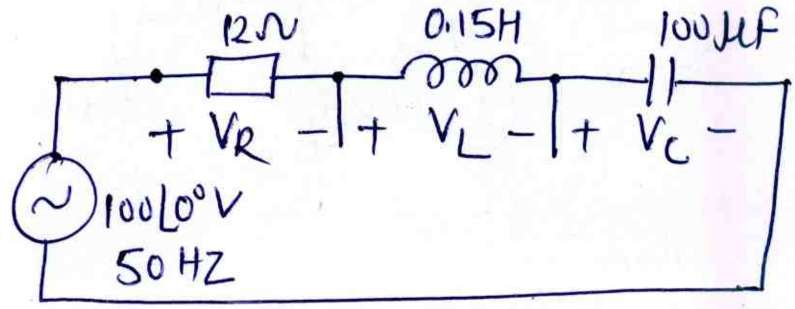


fig.(d) series RLC circuit

$X_L = \omega L = 2\pi f L = 100\pi \times 0.15 = 47.1\,\Omega$

$X_C = 1/\omega C = 1/(100\pi \times 100 \times 10^{-6}) = 31.8\,\Omega$

(a) The impedance, $Z = R + j(X_L - X_C) = 12 + j(47.1 - 31.8)$

$= (12 + j15.3)\,\Omega = 19.4\angle 51.9^\circ\,\Omega$

(b) $I = \dfrac{V}{Z} = \dfrac{100\angle 0^\circ}{19.4\angle 51.9} = 5.15\angle -51.9^\circ\ A$

(c) The phase angle $\phi = -51.9^\circ$

(d) The voltage, $V_R = IR = 5.15 \times 12 = 61.8\,V$;

$V_L = IX_L = 5.15 \times 47.1 = 242.5\,V$;

$V_C = IX_C = 5.15 \times 31.8 = 163.7\,V$

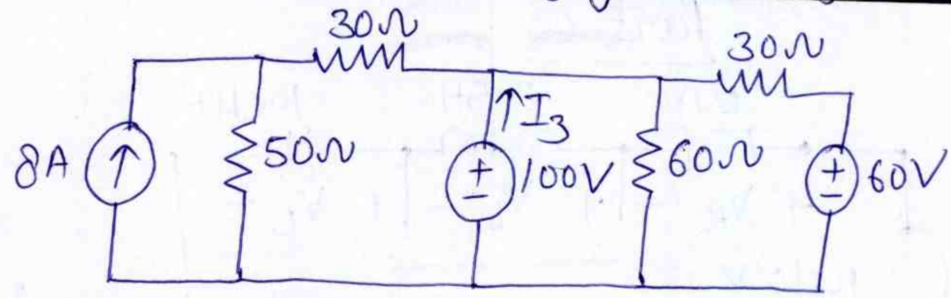
(e) The Power factor $= \cos 51.9^\circ = 0.617$ lagging

(f) The active power $= VI\cos 51.9^\circ = 317.75\,W$

Question Paper Solution

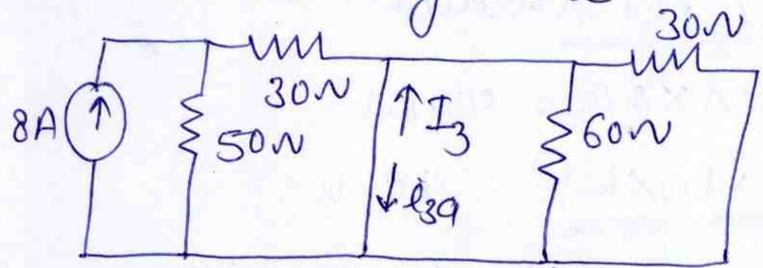
Branch : CS, ME Semester: I Subject: BEE Mid Term: I/II/Extra/Imp.
Submitted By : Ajay Bhardwaj

Sol. 8



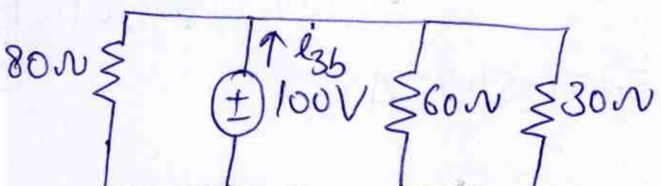
Superposition Principle

1. 8A source acting alone



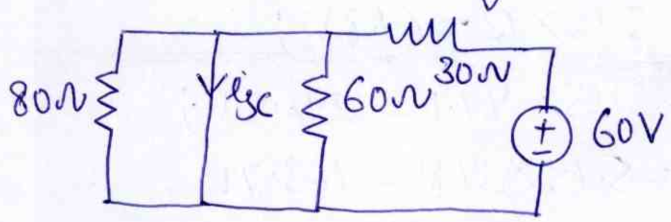
$$i_{3a} = \frac{8\times 50}{50+30} = \frac{400}{80} = 5A$$

2. 100V source acting alone



$$i_{3b} = \frac{100}{16} = 6.25A$$

3. 60V source acting alone



$$i_{3c} = \frac{60}{30} = 2A$$

Summing the responses algebraically

$$I_3 = -i_{3a} + i_{3b} - i_{3c} = -5 + 6.25 - 2 = -0.75A$$

$$\boxed{I_3 = -0.75A}$$