BIOLOGY – Code No. 044
SAMPLE QUESTION PAPER*
CLASS – XII (2025-26)

Maximum Marks: 70 **Time: 3 hours**

General Instructions:

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions.
(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
(iv) There is no overall choice. Answer all 33 questions. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

Section – A

Q. No. 1 to 12 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

Q. No	Question	Marks
1	The male gametes are formed by: A. Mitotic division of nucleus of vegetative cell B. Meiotic division of nucleus of vegetative cell C. Mitotic division of nucleus of generative cell D. Meiotic division of nucleus of generative cell	1
2	The primary endosperm nucleus is formed by fusion of which of the following? A. A male gamete and a female gamete B. A male gamete and two polar nuclei C. A female gamete and two synergids D. Two male gametes and an egg cell	1
3	During the menstrual cycle of a human female, formation of graafian follicle is stimulated by secretion of which of the following gonadotropin hormones? A. Estrogen and progesterone B. FSH and Estrogen C. FSH and LH D. Progesterone and LH	1

**Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.*

4	The experimental proof on the thermal stability of genetic material was first provided by experiments of A. Hershey and Chase B. Meselson and Stahl C. Frederick Griffith D. Jacob an Monod	1
5	Short stretches of DNA used to identify complementary sequences in a sample are called A. Probes B. Markers C. Primers D. Minisatellites	1
6	Select the **incorrect statement** among the following. A. $p^2+2pq+q^2 = 1$. This is binomial expansion of $(p+q)^2$. B. When frequency measured differs from expected values, the difference (direction) indicates the extent of evolutionary change. C. Hardy-Weinberg principle says that phenotype frequencies in a population are stable and are constant from generation to generation. D. The gene pool (total genes and their alleles in a population) remains constant. This is called genetic equilibrium. Sum total of all the allelic frequencies is 1.	1
7	Albinism is known to be due to an autosomal recessive mutation. The first child of a couple with normal skin pigmentation was an albino. What is the probability that their second child will also be an albino? A. 100% B. 25% C. 50% D. 75%	1
8	"In Cricket species, the sound produced by rubbing the wings or legs together play a crucial role in attracting mates, any change in the morphology of Cricket legs could potentially affect their ability to produce sound". A mutant Cricket had thicker hind legs. What would you expect for this cricket species? A. The leg mutation will not lead to speciation if they diversify into new habitats. B. The leg mutation will have little effect on other external features, and therefore have little effect on speciation. C. The leg mutation will have no effect on behavior, and thus have little effect on speciation. D. The leg mutation might lead to reproductive isolation and speciation due to an effect on the mating call.	1

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<table>
<tr><td>9</td><td>Plasmodium is a pathogen that causes malaria. Identify the correct sequence of transmission of the pathogen.
<table>
<tr><th></th><th>I
Stage of pathogen as it is transferred by vector bite</th><th>II
First site in the host body where the pathogens infect and proliferates</th><th>III
Second site in the host body where the pathogen infects and manifests clinical symptoms</th><th>IV
Stage of pathogen as it is transferred to a new vector</th></tr>
<tr><td>A</td><td>Sporozoites</td><td>Erythrocyte infection</td><td>Liver infection</td><td>Gametocytes</td></tr>
<tr><td>B</td><td>Gametocytes</td><td>Erythrocyte infection</td><td>Liver infection</td><td>Sporozoites</td></tr>
<tr><td>C</td><td>Gametocytes</td><td>Liver infection</td><td>Erythrocyte infection</td><td>Sporozoites</td></tr>
<tr><td>D</td><td>Sporozoites</td><td>Liver infection</td><td>Erythrocyte infection</td><td>Gametocytes</td></tr>
</table></td><td>1</td></tr>
<tr><td>10</td><td>Which mRNA will be translated to a polypeptide chain containing 8 amino acids?
A. AUGUUAAUAGACGAGUAGCGACGAUGU
B. AUGAGACGGACUGCAUUCCCAACCUGA
C. AUGCCCAACCGUUAUUCAUGCUAG
D. AUGUCGACAGUCUAAAACAGCGGG</td><td>1</td></tr>
<tr><td>11</td><td>In order to isolate genetic material of a bacterium, the cell must be treated with
A. Lysozyme, ribonuclease, protease, chilled ethanol
B. Cellulase, ribonuclease, protease, chilled ethanol
C. Chitinase, ribonuclease, chilled ethanol, water
D. Ribonuclease, protease, chilled ethanol, water</td><td>1</td></tr>
<tr><td>12</td><td>Integrated Pest Management involves
I. Using pesticides/insecticides judiciously
II. Using biocontrol agents
III. Engaging in organic farming
A. Only I
B. Only II
C. Both I and II
D. Only III</td><td>1</td></tr>
<tr><td colspan="3">Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
A. Both A and R are true and R is the correct explanation of A.
B. Both A and R are true and R is not the correct explanation of A.
C. A is true but R is false.
D. A is False but R is true.</td></tr>
<tr><td>13</td><td>Assertion (A): The ability of the pistil to recognise the pollen is the result of a continuous dialogue between pollen and pistil.
Reason (R): This electrical dialogue allows only compatible pollen to germinate.</td><td>1</td></tr>
</table>

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<table>
<tr><td>14</td><td>Assertion (A): Some organisms are better adapted to survive in an otherwise hostile environment.
Reason (R): Adaptive ability is inherited and has a genetic basis.</td><td>1</td></tr>
<tr><td>15</td><td>Assertion (A): Excess dose of coke or crack produces a sense of euphoria, increased energy and causes hallucinations.
Reason(R): It interferes with the transport of dopamine</td><td>1</td></tr>
<tr><td>16</td><td>Assertion (A): Rosie was the first transgenic cow to make more nutritionally balanced milk for consumption by human babies.
Reason (R): The milk of Rosie cow contained human beta- lactalbumin which made the milk rich in protein.</td><td>1</td></tr>
<tr><td colspan="3">Section - B</td></tr>
<tr><td>17</td><td>During artificial hybridisation it is important to ensure that only desired pollen grains are used for pollination. How is it ensured?</td><td>2</td></tr>
<tr><td>18</td><td>How is the rate of initiation of RNA polymerase at a given promoter in a transcriptional unit of prokaryotes regulated ?</td><td>2</td></tr>
<tr><td>19</td><td>The table below shows a hypothetical blood report of a patient.
<table>
<tr><th>Test description</th><th>Observed value</th><th>Unit</th><th>Reference range</th></tr>
<tr><td>Leucocytes</td><td></td><td></td><td></td></tr>
<tr><td>Total leucocyte count</td><td>1100</td><td>Per Microliter</td><td>4400-11000</td></tr>
<tr><td>Neutrophils</td><td>31</td><td>%</td><td>55-70</td></tr>
<tr><td>Lymphocytes</td><td>25</td><td>%</td><td>20-40</td></tr>
<tr><td>Basophils</td><td>0.5</td><td>%</td><td>0.5 - 1</td></tr>
<tr><td>Eosinophils</td><td>02</td><td>%</td><td>1-4</td></tr>
<tr><td>Monocytes</td><td>0</td><td>%</td><td>1-8</td></tr>
</table>
A. Looking at the values suggest which defense mechanism/ immunity is affected and state how this defense mechanism provides immunity.
B. Name the barrier with least count and enumerate its role in providing immunity.</td><td>2</td></tr>
<tr><td>20</td><td>A cheese maker claims to be a biotechnologist. How will you support the same?</td><td>2</td></tr>
<tr><td>21</td><td><u>Attempt either option A or B.</u>
A.
(i) Compare the two ecological pyramids of biomass I and II given below and explain the situations in which this is possible.</td><td>2</td></tr>
</table>

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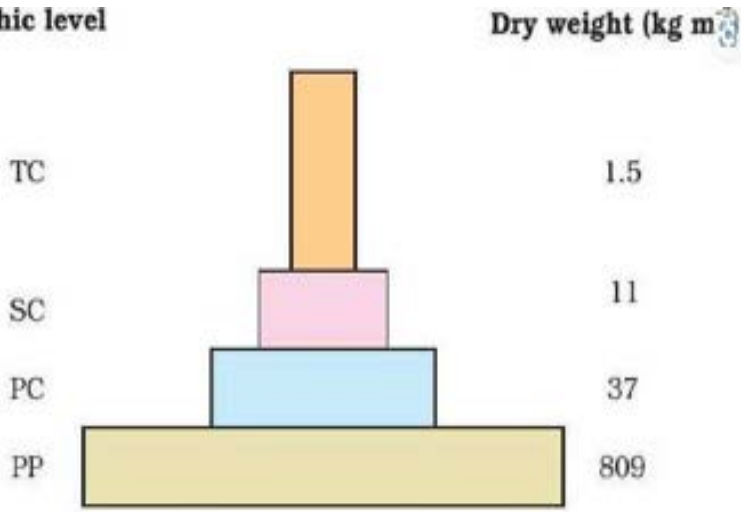

Fig. I

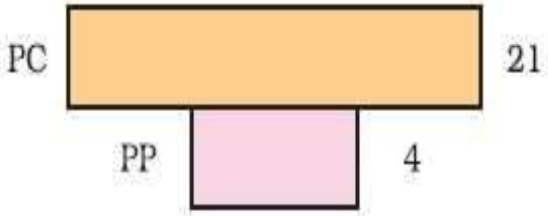

Fig. II

(ii) Construct an ideal pyramid of energy if 200,000 joules of sunlight are available.

- - - - - - - - - - - - - - - - - - -

For Visually impaired students:

A.

(i) Compare the upright and inverted ecological pyramids of biomass and explain the situations in which this is possible.

(ii) Construct an ideal pyramid of energy if 200,000 joules of sunlight is available.

OR

B. A tropical rainforest in South America is home to more than 40,000 species of plants, 3,000 of fishes, 1,300 of birds, 427 of mammals, 427 of amphibians, 378 of reptiles and 1,25,000 insects, snails and worms.

(i) From the given data, calculate the total number of known vertebrate species in the rainforest.

(ii) Give a reason to justify the huge difference in the number of plant and animal species.

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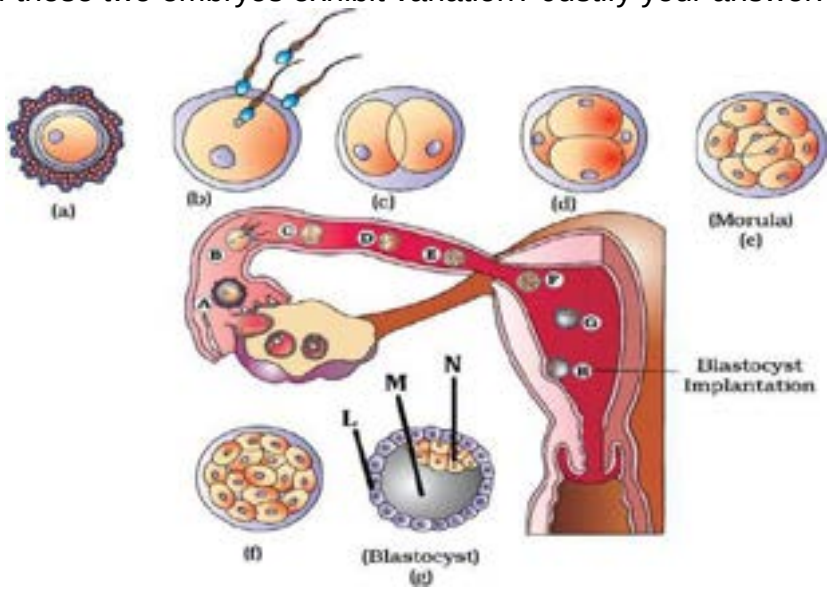
Section - C		
22	Suggest a suitable contraceptive device for the following cases with justification. (i) Mohini does not want to take the risk of conception and sexually transmitted infections (STIs). (ii) Lalita has two children and does not want any more children. (iii) Geeta wants a contraceptive that she can take till she wants to avoid conception and can resume back to her fertile life without the intervention of the doctor. Also, it should have a lower failure rate.	3
23	Given below is a figure showing transport of ovum, fertilisation and passage of growing embryo through fallopian tube in a human female. Answer the questions that follow: (i) What will be the ploidy of cells shown in (a) and (c) stage in the figure given below? (ii) What will happen if component L as shown in the figure (g) given below does not attach properly to the endometrium? (iii) In a pregnant mother (case X), during early pregnancy, the fertilised egg splits into two embryos at stage C shown in the figure given below, resulting in the formation of twins. Will the genome of cells of these two embryos exhibit variation? Justify your answer.  - - - - - - - - - - - - - - - - - - *For Visually impaired students* Explain the events and journey of an ovum in the fallopian tube of a mother from fertilisation stage to implantation.	3
24	In guinea pigs, black coat colour (G) dominates over white (g) and brown eyes (B) dominate over blue (b). The alleles for coat colour and eye colour are not linked. What will be the probability of the offspring having blue eyes and a white coat if both parents are heterozygous for eye and coat colour? Find the probability using a Punnett square	3

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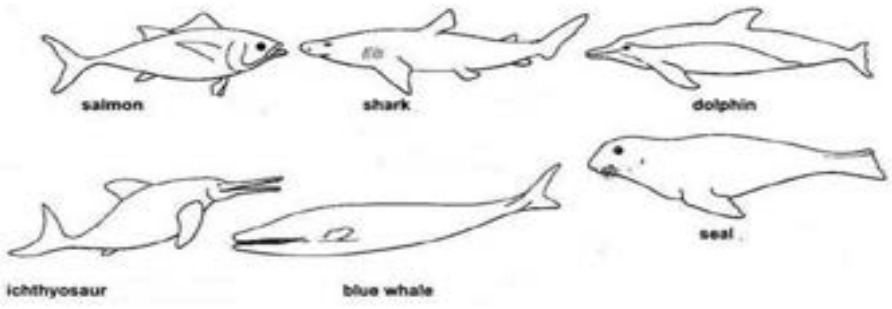
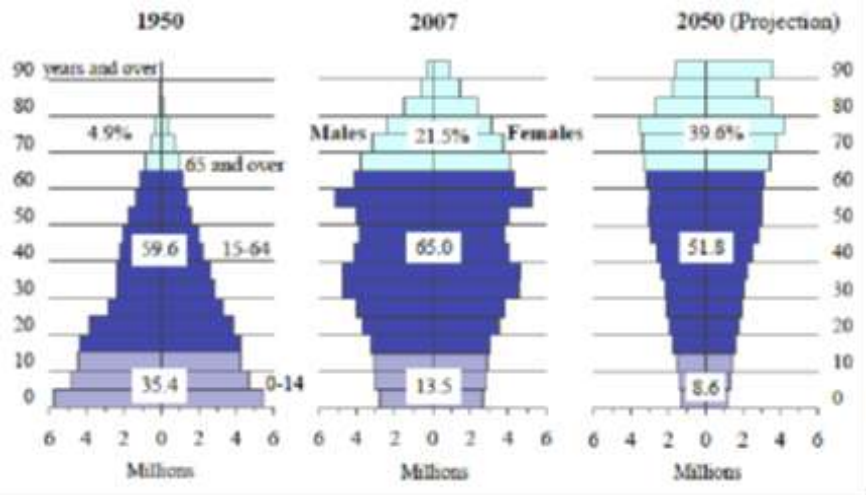
25	Shown below are certain aquatic vertebrates, where natural selection has favoured them to develop certain characteristics which enable them to live in water.  A. Name and explain the phenomenon exhibited by the above animals. B. Which one of the above is the most primitive one? What is its significance? - - - - - - - - - - - - - - - - - - - *For Visually impaired students* A. What are the basic conceptual similarities and differences between Lamarckian and Darwinian theory of evolution? B. Give an example that supports any one of the above two theories.	3
26	The Biological Oxygen Demand (BOD) of a primary effluent during sewage treatment is reduced. Enlist the process of how this is achieved.	3
27	***Attempt either option A or B.*** A. Expand ELISA. On what principle is the ELISA test based? List two ways by which an infection can be detected by this test. **OR** B. Gene expression can be controlled with the help of complementary RNA molecules. Justify it with the help of an example.	3
28	The population pyramids of Japan for 1950, 2007 and 2050 (projections) are shown below to answer the questions that follow:  	3

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	C. Identify the age pyramids for 1950, 2007 and 2050. D. What insights can you gain about their population dynamics? - - - - - - - - - - - - - - - - - - - *For visually impaired students* The population pyramid of Japan for 1950, 2007 and 2050 (projections) shows the shape of a pyramid, broad-based, inverted bell and urn shape, respectively. Answer the questions that follow: A. Identify the age pyramids for 1950, 2007 and 2050. B. What insights can you gain about their population dynamics?	
Section - D		
29	Given below is a set of information about some fruits and seeds. **Fruit** / **Fruit and seed formation** P — Nucellar cells surrounding the embryo sac develop into embryos. Q — Ovary develops into the fruit by the application of growth hormones. R — Thalamus contributes to fruit formation. S — Ovary matures into a fruit after fertilisation. On the basis of the information provided above, answer the following questions with justification for each answer. A. How many embryo sacs will be present in each ovule of S before maturation and how many egg(s) will be present in each embryo sac when the embryo sac is developed from a single megaspore? (1) B. (i) Which of these fruits exhibits polyembryony? Will their embryos exhibit genetic variation? Justify. (ii) What will be ploidy of the embryonic cells in the above case? (2) *Attempt either subpart C or D.* C. Which of these fruits can be considered as parthenocarpic? Give a reason. (1) **OR** D. Which of the fruits P, Q, R or S is a true fruit with seeds? Give reason. (1)	4
30	The graph below shows the Antibody concentration in young calves. Study the graph and answer the questions that follow:	4

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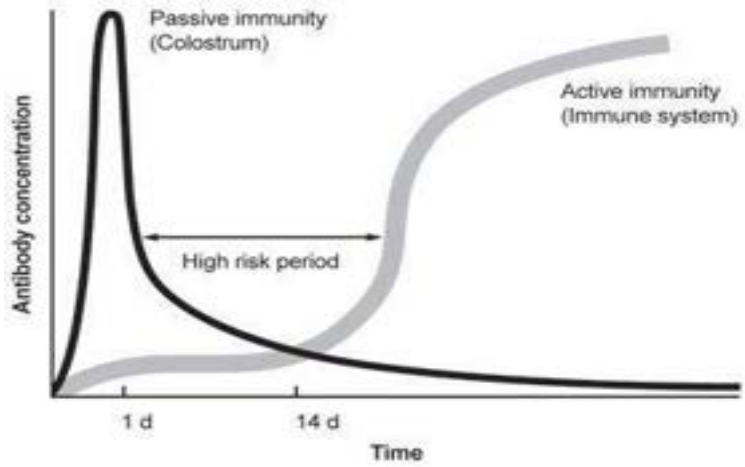

A. What do you think is the difference between passive and active immunity **i**n this case? (1)
B. What happens to passive immunity as days go by and why? (1)

Attempt either subpart C or D.

C. What kind of trend does active immunity show and why?
OR
D. What kind of immunity will be observed when a vaccine is administered to the calf and why? (2)

- - - - - - - - - - - - - - - - - -

For visually impaired students

The antibody concentration in a young calf was studied. It was found that the antibodies derived from colostrum (passive immunity) decreased from day 1 to 14, while the antibodies derived from immune cells (active immunity) increased between day 1 to day 14 and remained steady thereafter.

A. What do you think is the difference between passive and active immunity **i**n this case?
B. What happens to passive immunity as days go by and why?

Attempt either subpart C or D.

C. What kind of trend does active immunity show and why?
OR
D. What kind of immunity will be observed when a vaccine is administered to the calf and why?

Section - E

31

A. Construct a complete transcription unit with promoter and terminator on the basis of the hypothetical template strand given below. 5

B. How is transcription a more complex process in eukaryotic cells? Explain the additional processes that a precursor mRNA has to undergo in these organisms.

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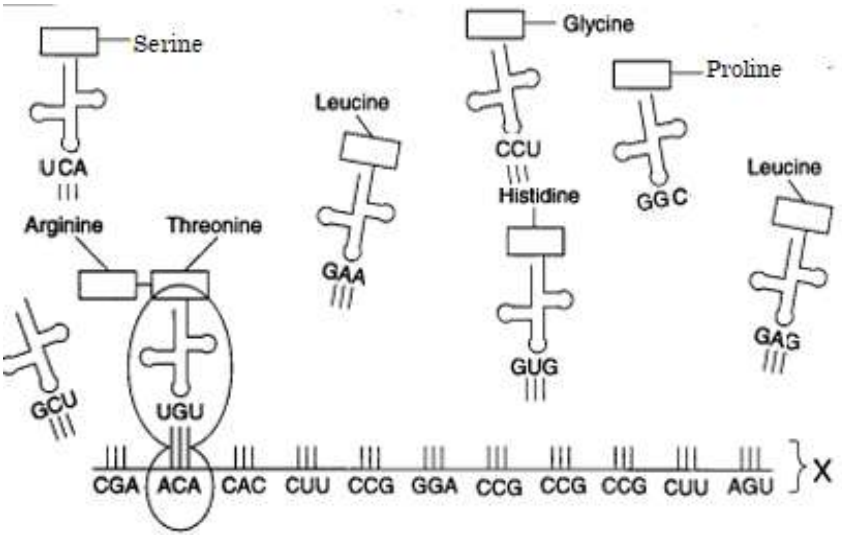
	- - - - - - - - - - - - - - - - - - *For visually impaired students* A. Why are both the strands not copied during transcription? B. How is transcription a more complex process in eukaryotic cells? Explain the additional processes that a precursor mRNA has to undergo in these organisms. **OR** A. Explain the process of aminoacylation of tRNA. Mention its role in translation. B. How do ribosomes in the cells act as factories for protein synthesis? C. Given below is a strand of mRNA undergoing the process of translation, what will be the sequence of Amino acids that will be translated? Name the triplet codons that should be added to bring to the end of translation at X.  - - - - - - - - - - - - - - - - - - *For visually impaired students* C. Explain the phenomenon that forms the genetic basis to prove that codon is a triplet and it is read in a contiguous manner.	
32	Some plant and animal pathogens serve as one of the tools of recombinant DNA (rDNA) technology.' A. Name one animal and one plant pathogen and discuss the pathogenic nature of both. State how they serve as a tool in rDNA technology. B. What are the enzymes needed for rDNA technology? C. A farmer owns a cotton farm land which is getting infested with coleopteran pests. He is not willing to use the microbes to protect his farm. i. Name an alternate method to introduce the gene of interest the pathogen would have otherwise delivered and discuss how the alternate method would deliver the gene. ii. State how this gene would control the pest.	5

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<table>
<tr><td></td><td>OR
BamH1 is a restriction enzyme which recognizes the sequence-
5' - GGATCC - 3'. The restriction activity of this enzyme is between G and G.
A. Construct the palindrome for the above sequence.
B. Draw a labeled diagram to show the formation of recombinant DNA (rDNA) using BamH1.
C. PBR322 is a plasmid that has a restriction site for this enzyme at the tetracycline resistant gene. If BamH1 were to be used, how will it impact the response of the transformant with rDNA to antibiotics-ampicillin and tetracycline. Justify.</td><td></td></tr>
<tr><td>33</td><td>Justify the following statements with suitable proof/examples: -
A. ‘competition is not limited to closely related species’
B. ‘competition is not always dependent on resources being limiting’
C. ‘competitive exclusion occurs in nature’
D. ‘competing species may evolve mechanisms for co-existence’
E. ‘competition in nature comes from what is called ‘competitive release’’
OR
A. How does a simple food chain exemplify the First Law of Thermodynamics?
B. The table below shows the number of species in different parts of the world.
<table><tr><th>Name of Place</th><th>Number of Bird species</th></tr><tr><td>Columbia</td><td>1400</td></tr><tr><td>India</td><td>1200</td></tr><tr><td>Northern South America</td><td>1300</td></tr><tr><td>New York</td><td>105</td></tr><tr><td>Denmark</td><td>504</td></tr></table>
Identify the common factor in regions with a higher number of bird species and suggest at least two reasons for this greater diversity.</td><td>5</td></tr>
</table>

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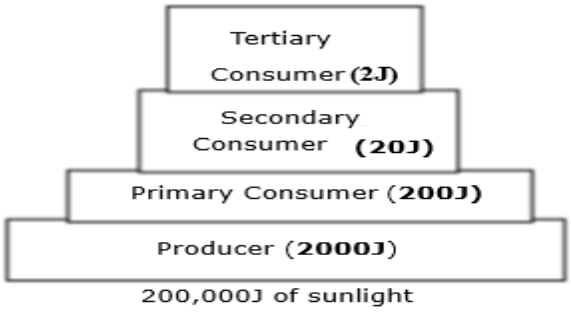
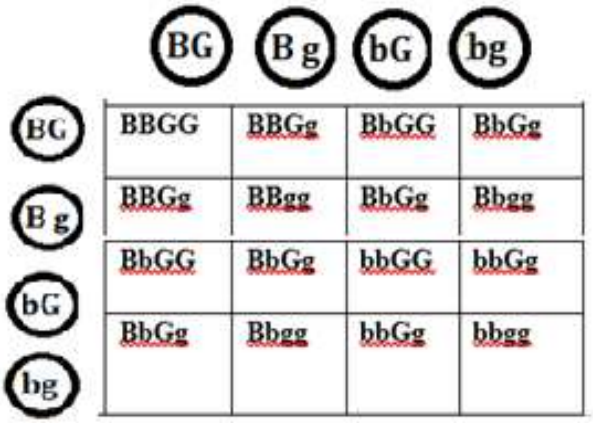
BIOLOGY Code no. 044
MARKING SCHEME
CLASS – XII (2025–26)

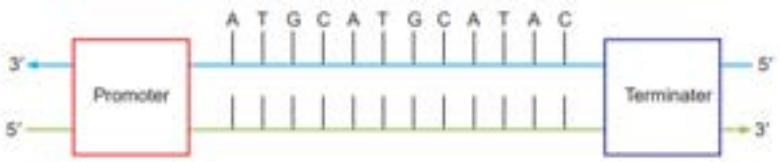
Q. No.	Answer	Marks
	Section - A	
1	C. Mitotic division of nucleus of generative cell	1
2	B. A male gamete and two polar nuclei	1
3	C. FSH and LH	1
4	C. Frederick Griffith	1
5	A. Probes	1
6	C. Hardy-Weinberg principle says that phenotype frequencies in a population are stable and are constant from generation to generation.	1
7	B. 25%	1
8	D. The leg mutation might lead to reproductive isolation and speciation due to an effect on the mating call.	1
9	D. Sporozoites, Liver infection, Erythrocyte infection, Gametocytes	1
10	B AUGAGACGGACUGCAUUCCCAACCUGA	1
11	A. Lysozyme, ribonuclease, protease, chilled ethanol	1
12	C. Both I and II	1
13	C. A is true but R is false	1
14	A. Both A and R are true and R is the correct explanation of A	1
15	A. Both A and R are true and R is the correct explanation of A	1
16	C. A is true but R is false	1
	Section - B	
17	It is achieved by emasculation and bagging techniques. If the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces using a pair of forceps is necessary. This step is referred to as emasculation. Emasculated flowers have to be covered with a bag of suitable size, generally made up of butter paper, to prevent contamination of its stigma with unwanted pollen. This process is called bagging. (1 x 2 = 2)	2
18	In a transcription unit, the activity of RNA polymerase at a given promoter is regulated by accessory proteins that have an ability to recognise start sites. (1) These regulatory proteins can act both positively (activators) and negatively	2

	(repressors) with the operator which is adjacent to the promoter in an operon unit. (1)	
19	A. Innate immunity/ non-specific type of defense/immunity present at the time of birth is effected. It provides different types of barriers to the entry of the foreign agents into our body/destroys microbes/ prevents microbial growth. (1) B. Cellular barrier-monocytes is with least count and it can phagocytose and destroy microbes. (1)	2
20	Anyone who can use/modify any living organism or their products using technology is considered to be a biotechnologist. (1) Thus, cheese maker can be a biotechnologist as he uses microbes like bacteria, fungi to make cheese for commercial purpose. (1)	2
21	A. (i) The first (upright) pyramid of biomass corresponds to a terrestrial ecosystem. Producers have maximum biomass, decreasing with herbivores (primary consumer), secondary consumer and tertiary consumer. Second (inverted) pyramid refers to a small standing crop of phytoplankton supporting a large standing crop of zooplankton/aquatic ecosystem. (1) (ii)  (1) - - - - - - - - - - - - - - - - - - *For Visually impaired students* (Answer same as (i) and (ii) above) **OR** B. (i) 3000+1300+427+427+378= 5532 (1) (ii) (a) Animals are mobile and can migrate to escape harsh conditions or explore new areas. (b) Animals have adapted to changing environments, developing complex nervous systems and receptors. Their responses are adaptive and ensure survival. Iii. Plants, being fixed, have fewer evolutionary adaptations for water, minerals, and sunlight. (Anyone, 1)	2
Section – C		
22	(i) Condoms; these act by blocking the entry of microbes and sperms in the cervix.	3

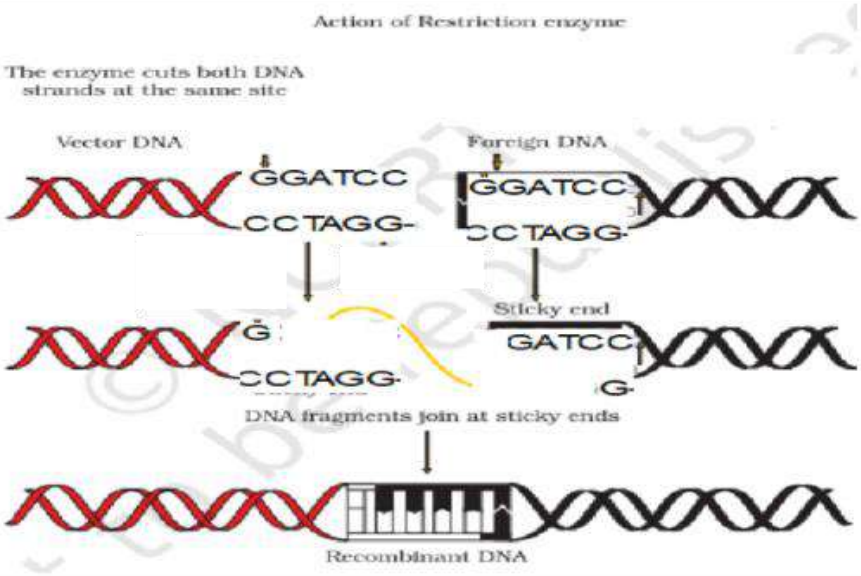
	(ii) Surgical methods such as Tubectomy by her or vasectomy by her husband as these are highly effective but irreversible methods. (iii) Oral pills containing progestogens or progestogen – estrogen combination are very effective and can be repeated as long as the female derives to prevent conception. (1 x 3 =3)	
23	(i) (a) ovum is haploid (n) and (c) – blastomeres are diploid(2n). (ii) If the trophoblast (L) does not attach to the endometrium properly, it can lead to implantation failure, pregnancy loss, and other pregnancy complications. (iii) In case X, the cells of these embryos will have identical genome as they have developed from the same zygote. (1 x 3 =3) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* • The mitotic division called cleavage starts as the zygote moves through the isthmus of the oviduct towards the uterus and forms 2,4,8,16 daughter cells called blastomeres. The embryo with 8 to 16 cell blastomeres is called a morula. (1) • The morula transforms into blastocyst and the blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass. (1) • The trophoblast layer then gets attached to the endometrium of the uterus and the inner cell mass gets differentiated as the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst which gets embedded in the endometrium leading to implantation. (1)	3
24	BbGg Male is crossed with BbGg female which are both heterozygous of both the characters for eye and coat colour. (1)  Punnett square (1) 1/16 or 6.25 % - blue eyes and white coat (1)	3
25	A. These animals exhibit convergent evolution, structures that are not anatomically similar are evolved to perform similar functions adapted to the same habitat, the fins of Salmon and Shark, flippers of Dolphins, Seals and whales. One can say that it is the similar habitat that has resulted in selection of similar adaptive features in different groups of organisms but toward the same function: hence, analogous structures are a result of convergent evolution. (2)	3

	B. Ichthyosaurs. Some of the land reptiles went back into water to evolve into fish like reptiles probably 200 mya. (1) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* A. Both Lamarck and Darwin believed that living things had hereditary traits, traits they could pass on to their offspring. They believed that some traits were more useful than others, and that over time the more useful trait would become more common. (1) The difference is that Lamarck believed that the changes in an organism experienced during its life could be passed on to succeeding generations/Inheritance of acquired characters. So, for instance Giraffe stretched its neck its entire life to eat leaves on tall plants, it would have longer-necked offspring (or any other example of Lamarckian theory). (1) Darwin believed that small, random and gradual genetic variations followed by natural selection lead to evolution- that some giraffes just naturally had longer necks, and these were the ones who had more children. So over time natural selection led to evolution of Giraffes with long neck were fitter than short-necked. (1)	
26	'Flocs' and 'activated sludge' in sewage treatment help to reduce the BOD. (i) Flocs: These are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. These are used during the secondary sewage treatment in the aeration tank to increase the rate of decomposition. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result, the BOD of sewage is reduced. As the BOD of waste is reduced to 1% of raw sewage. it is passed into the settling tank. In these tanks, flocs are allowed to undergo sedimentation. (ii) Activated sludge: The sediment of the settling tank is called activated sludge. A part of it is used as an inoculum in aeration tanks. The remaining part is passed into a large tank called an anaerobic sludge digester. In these tanks, anaerobic microbes are present that digest the organic mass as well as aerobic microbes of activated sludge. The remaining sludge is used as manure or compost.	3
27	ELISA-Enzyme Linked Immunosorbent Assay. (1) ELISA is based on antigen-antibody interaction. (1) The ways to detect the presence of infection or disease by ELISA are as follows: The presence of antigens (proteins, glycoproteins, etc.) is detected. / Antibodies produced against the pathogens are detected. (1) **OR** The technology is called RNA Interference(RNAi) The principle is to block certain genes through a process called gene silencing (1) It involves silencing of a specific mRNA due to its complementary Double-stranded RNA /dsRNA molecule that binds to and prevents translation of the	3

	mRNA(silencing). (1) Example: Resistance to nematode (*Meloidogyne incognita*) in tobacco is achieved by this (or ANY OTHER RELEVANT EXAMPLE.) (1)	
28	1950 – Expanding - The population structure in 1950 exhibits a broad-based pyramid with a wider base, indicating a higher percentage of young individuals. This suggests a population with a higher birth rate. (1) 2007 – Stable - The narrowing of the pyramid towards the top signifies a lower proportion of elderly individuals. By 2007, the population was more stable with the number of pre reproductive and reproductive age nearly being the same. Bell shape indicates static population. (1) 2050– Declining - By 2050 urn shaped pyramid shows a declining population where birth rates are very less and the populations of elderly people will increase. (1) - - - - - - - - - - - - - - - - - - <u>*For Visually impaired students*</u> Answer same as above	3
	Section – D	
29	A. One embryo sac is present in each ovule and one egg is present in each embryo sac when the embryo sac is developed from a single megaspore. (1) B. (i) P exhibits polyembryony due to occurrence of more than one embryo in a seed. Embryos developed from nucellar cells by apomixis, a form of asexual reproduction, don't show genetic variation. (1) (ii) Cells of embryos developed from diploid nucellar cells are diploid (2n) as these are formed by apomixis, a form of asexual reproduction. (1) <u>*Student to attempt either subpart C or D.*</u> C. Q, because this fruit is developed without fertilisation and will thus be seedless. (1) **OR** D. Fruit S is a true fruit with seeds. True fruits develop from the ripened ovary after fertilisation and fertilised ovules mature into seeds. (1)	4
30	A. Passive immunity – Ready made antibodies from colostrum / less effective / transient / no memory cells involved Active Immunity – Made by host's immune system/ Lag phase/ memory based/ largely effective. (1) B. In the first weeks of life, the calf's immunity is strong because it absorbs antibodies from the cow's colostrum and milk. This passive immunity peaks at day 1 and declines as the calf ages as the antibodies are used up to develop immunity against diseases. (1) <u>*Attempt either subpart C or D.*</u> C. As the calf grows, its immune system starts to produce antibodies in response to bacteria or viruses in the environment and by the time it is nearly 14 days old after which active immunity takes charge. **OR**	4

	D. Active immunity. As the vaccine contains a weakened or inactivated form of the pathogen (microbe), which is harmless but still recognized by the immune system as foreign. The immune system responds by activating lymphocytes, which produce specific antibodies to fight the pathogen. This process also leads to the creation of memory cells, which provide long-term protection by "remembering" to fight this pathogen if the person is exposed again. (2) - - - - - - - - - - - - - - - - - - - *For Visually impaired students* Same answers as given in parts a-d.	
Section – E		
31	A.  B. (2) • Transcription in eukaryotes involves one of three types of polymerases, depending on the gene being transcribed. RNA polymerase II transcribes all of the protein-coding genes, whereas RNA polymerase I transcribes rRNA genes, and RNA polymerase III transcribes rRNA, tRNA, and small nuclear RNA genes. (1) • The primary transcripts contains the coding region, exon, and non-coding region, intron, hnRNA undergoes a process where the introns are removed and exons are joined to form mRNA by the process called splicing. (1) • The hnRNA undergoes two additional processes called capping and tailing. In capping, an unusual nucleotide, methyl guanosine triphosphate, is added to the 5′-end of hnRNA. In tailing, adenylate residues (about 200–300) are added at 3′-end in a template independent manner. (1) - - - - - - - - - - - - - - - - - - - *For visually impaired students* A. If both strands act as a template, they will code for RNA molecules with different sequences as complementarity does not mean the strands are identical and hence, the sequence of amino acids in the proteins would be different. Hence, one segment of the DNA would be coding for two different proteins, and this would complicate the genetic information transfer machinery. (1) The two RNA molecules if produced simultaneously would be complementary to each other, hence would form a double stranded RNA. This would prevent RNA from being translated into protein and the exercise of transcription would become a futile one. (1) B. Transcription in eukaryotes involves one of three types of polymerases, depending on the gene being transcribed. RNA polymerase II transcribes	5

	all of the protein-coding genes, whereas RNA polymerase I transcribes rRNA genes, and RNA polymerase III transcribes rRNA, tRNA, and small nuclear RNA genes. (1) The primary transcripts contain the coding region, exon, and non-coding region, intron, hnRNA undergoes a process where the introns are removed and exons are joined to form mRNA by the process called splicing. (1) The hnRNA undergoes two additional processes called capping and tailing. In capping, an unusual nucleotide, methyl guanosine triphosphate, is added to the 5′-end of hnRNA. In tailing, adenylate residues (about 200–300) are added at 3′-end in a template independent manner. (1) **OR** A. Aminoacylation is the process by which amino acids become activated by binding with its aminoacyl tRNA synthetase in the presence of ATP. If two charged tRNAs come close during translation process the formation of peptide bond between them is energetically favourable. (1) B. The cellular factory responsible for synthesising proteins is the ribosome. In its inactive state it exists as two subunits: a large subunit and a small subunit. When the small subunit encounters an mRNA the process of translation of the mRNA to protein begins. There are two sites in the large subunit for subsequent amino acids to bind to and thus be close enough to each other for the formation of a peptide bond. The ribosome also acts as a catalyst 23S rRNA in bacteria is the enzyme-ribozyme for the formation of peptide bonds. (2) C. ARGININE, THREONINE, HISTIDINE, LEUCINE, PROLINE, GLYCINE, PROLINE PROLINE, PROLINE, LEUCINE SERINE (1) Stop codon UGA/UAG/UAA (1) - - - - - - - - - - - - - - - - - - <u>*For visually impaired students*</u> A and B as above C. Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion. Such mutations are referred to as frame-shift mutations. Insertion or deletion of three or multiple of three bases does not alter the frame. However, the mutation takes place. This proves that codon is a triplet and it is read in a contiguous manner. (2)	
32	A. Retrovirus in animals and *Agrobacterium tumefaciens* can transform normal cells into cancerous cells/*Agrobacterium tumefaciens* is responsible for causing crown gall disease/ it can transfer its T-DNA to transform normal plant cell into tumorous cells (1). They are used as cloning vectors to deliver desirable genes into animal/plant cells. (1) B. restriction enzyme and ligase. (1). C. (i) Biolistic/ gene guns can be used. The plant cells are bombarded with high velocity micro particles of gold or tungsten coated with DNA. (1) (ii) the cry gene will create Bt toxin inside the pest which will get activated in the alkaline gut of the pest and cause the gut epithelial lining to disintegrate. (1)	5

	OR A. 5' - GGATCC - 3'. 3'- CCTAGG-5' (1) B. drawing and labelling (2)  C. If ampicillin is added, the bacteria will show resistance as the gene is intact and will survive; if tetracycline is added, the bacteria will die as it will show insertional inactivation/ gene is not functional owing to insertion of the gene of interest in the tetracycline region of selectable marker. (2)	
33	A. Totally unrelated species could also compete for the same resource. For instance, in some shallow South American lakes, visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake. (1) B. Resources need not be limiting for competition to occur; in interference competition, the feeding efficiency of one species might be reduced due to the interfering and inhibitory presence of the other species, even if resources (food and space) are abundant. (1) C. Gause and other experimental ecologists believed when resources are limited the competitively superior species will eventually eliminate the other species. The Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island, apparently due to the greater browsing efficiency of the goats. (1) D. One such mechanism is 'resource partitioning'. If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities. (1) E. A species whose distribution is limited to a smaller area because of the presence of a competitively superior organism, is found to increase its range when the competing species is experimentally removed. For example, in the coasts of Scotland the superior barnacle (*Balanus*)	5

dominates the intertidal region and excludes the smaller barnacle from that zone. (1)

OR

A. Food chain and the first law of thermodynamics. The solar energy trapped by the plants is transformed to chemical energy through the process of photosynthesis. When the plants are consumed by the animals, the organic matter (chemical energy) is transferred to the animal, some amount of this organic matter is lost as heat through the process of respiration. Death of the producers or consumers will result in the organic matter getting transferred to detritivores. As demonstrated, energy is not created nor destroyed but transformed from one form to another. (2)

B. Greater diversity is seen in regions closer to equator/ tropics (latitudinal range of 23.5° N to 23.5° S) harbour more species. (1)

Reasons for this greater diversity are: (Any two reason)

- Speciation is generally a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to a greater species diversity
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contribute indirectly to greater diversity. (2, any two)

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CHEMISTRY (CODE - 043)

SAMPLE QUESTION PAPER*

CLASS XII (2025-26)

Time: 3 hours **Max. Marks: 70**

GENERAL INSTRUCTIONS:

Read the following instructions carefully.

1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

	Section-A Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.	
1	Which of the following reaction will lead to formation of ethyl methyl ketone: A. heating $CH_3CH(CH_3)CH_2OH$ with acidified $Na_2Cr_2O_7$ B. passing $CH_3C(OH)CH_3$ over heated copper C. ozonolysis of $CH_3CH_2C(CH_3)=CHCH_3$ D. acetylene on reaction with $HgSO_4/H_2SO_4$	1
2	Consider the reaction and identify B and C $CH_3CH_2CH_2CH_2Cl \xrightarrow{NaOH + Ethanol} A$ $A \xrightarrow{H_2O,\ H^+} B$ and $A \xrightarrow{(i)\ B_2H_6,\ (ii)H_2O_2,\ OH^-} C$ A. B=C= Butanol B. B= Butanol, C=Butene C. B= Butan-2-ol, C= Butanol D. B= Butene, C=Butan-2-ol	1
3	The counter ion in the coordination compound $[Co(NH_3)_5(NO_2)]Cl_2$ is A. Ammine B. Cobalt	1

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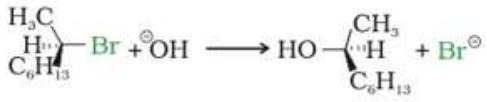
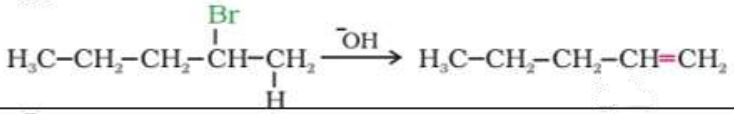
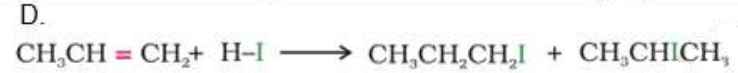
	C. Chloride D. Nitro	
4	The organic compounds A, B and C are amines having equivalent molecular weight. A and B on reaction with benzene sulphonyl chloride give white precipitate, however white precipitate obtained from compound B remains insoluble in NaOH. The variation in the boiling point of A, B and C can be seen as : A. A> B>C B. B>A>C C. A=B > C D. C>B>A	1
5	70 gm solute is dissolved in 700 gm solvent to prepare a solution having density 1.5 g/ml. The ratio of its molality and molarity will be: A. 0.77 B. 1.4 C. 0.73 D. 1.3	1
6	Match the column I and column II: Column I / Column II A.  — (i) Addition reaction B.  — (ii) Elimination reaction C.  — (iii) S_N^2 reaction D.  — (iv) S_N^1 reaction A. A-(i), B-(ii), C-(iii), D-(iv) B. A-(iv), B-(ii), C-(iii), D-(i) C. A-(i), B-(iii), C-(ii), D-(iv) D. A-(iv), B-(iii), C-(ii), D-(i)	1

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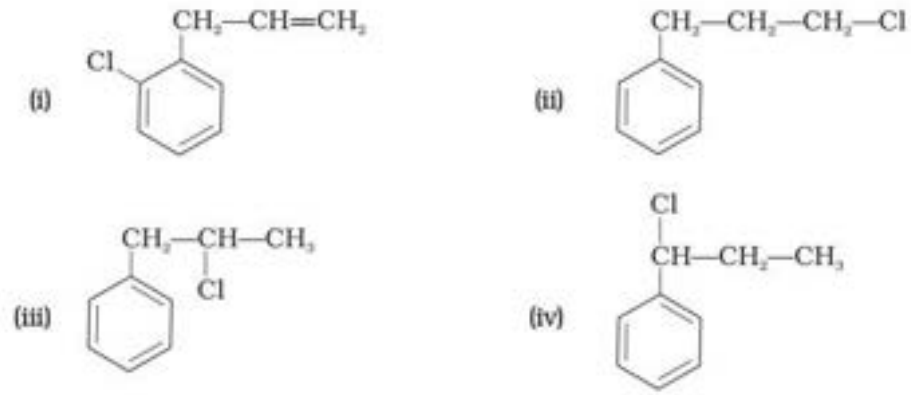
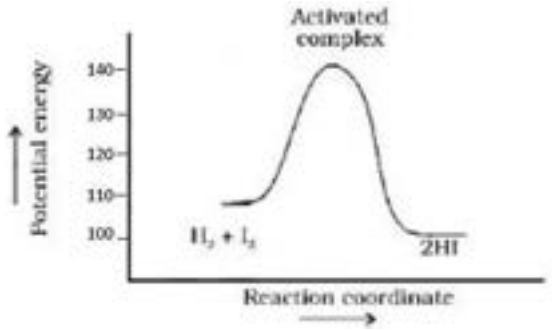
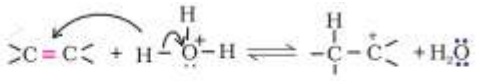
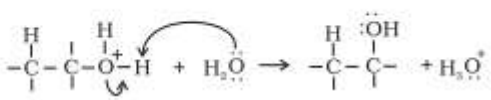
7	In o-cresol, the –OH group is attached to the carbon that is: A. sp^3 hybrid B. sp^2 hybrid C. sp hybrid D. dsp^2 hybrid	1
8	Which of the following is laevorotatory in nature : A. alpha D – glucose B. beta -D- glucose C. beta-D- fructose D. sucrose	1
9	The name inner transition metals is often used to refer to the A. lanthanoids B. actinoids C. both lanthanoids and actinoids D. d block elements	1
10	Λ_m^o CH_3COOH can be calculated if the values of the following are given: 1. Λ_m^oHCl, Λ_m^oKCl and Λ_m^o CH_3COOK 2. Λ_m^oNaCl, Λ_m^oKCl and Λ_m^o CH_3COONa 3. $\Lambda_m^o$$H_2SO_4$, $\Lambda_m^o$$Na_2SO_4$ and Λ_m^o CH_3COONa A. Only 1 B. Either 1 or 2 C. Either 1 or 3 D. Either 2 or 3	1
11	Which of the following will give a yellow or orange ppt. with 2,4 DNP? (i) Porpanal (ii) Propanone (iii) Propanoic acid A. (i) and (ii) B. (ii) and (iii) C. (i) and (iii) D. (i), (ii) and (iii)	1

12	Identify the secondary benzylic halide and primary alkyl halide from the following:  A. (i) and (iii) B. (iv) and (ii) C. (iii) and (iv) D. (i) and (ii)	1
13	**Assertion (A):** Secondary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas quantitatively. **Reason**: Nitrogen gas evolved on reaction with nitrous acid can be used for the estimation of proteins and amino acids. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
14	**Assertion (A):** Care should always be taken to ensure that solutions that flow in the blood stream are of the same osmotic pressure as that of the blood. **Reason(R):** Sodium ion and potassium ions are responsible for maintaining proper osmotic pressure balance inside and outside of the cells of organism. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1

15	**Assertion (A)**: Starch forms colloidal solution with water. **Reason (R)**: Starch contains 80-85% of amylopectin which is insoluble in water. Select the most appropriate answer from the options given below: A**.** Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
16	**Assertion (A):** Secondary cells are used in invertors. **Reason (R):** A primary cell can be recharged by passing current through it in the opposite direction after it has been used. Select the most appropriate answer from the options given below: A. Both A and R are true, and R is the correct explanation of A. B. Both A and R are true, and R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true	1
	Section-B Question No. 17 to 21 are very short answer questions carrying 2 marks each.	
17	**Attempt either option A or B** A. Answer the following: I. When 50 mL of phenol and 50 mL of aniline are mixed, predict whether the volume of the solution is equal to, greater than or less than 100 mL. Give reason to support your answer. II. Ritesh suggested adding salt to the box containing ice. He said this would keep the cold drink bottles cold for a longer time. How will Ritesh justify his suggestion? **OR** B. Answer the following: I. $BaCl_2$ on reaction with Na_2SO_4 in aqueous solution gives white precipitate. If the two solutions are separated by a semi-permeable membrane, will there be appearance of a white precipitate due to osmosis? II. Why does water stops boiling when sugar is added to boiling water.	2x1 2x1

18	Consider the graph for the reaction $H_2 + I_2 \rightleftharpoons 2HI$  I. Calculate enthalpy of reaction and activation energy for the backward reaction. II. How will the catalyst affect the rate of this reaction? Explain. ***(for visually challenged learners)*** I. Define activation energy. What will happen to activation energy if we increase the temperature? II. How will the catalyst affect the rate of an endothermic reaction?	2x1 2x1
19	Carry out following conversions : I. Nitrobenzene to 4- bromobenzenamine II. Chlorophenylmethane to 2-phenyl-ethanamine	2x1
20	Write the formula of the following coordination complex: I. diaquasilver(I) dichloridoargentate(I) II. dihydroxidobis(triphenylphosphine)nickel(II)	2x1
21	The mechanism of formation of alcohols from alkenes is given below. Rectify the errors in the mechanism and rewrite the corrected steps STEP 1  STEP 2  STEP 3 	2

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	Section-C Question No. 22 to 28 are short answer questions, carrying 3 marks each.	
22	What will be the vapour pressure of a 1 molal aqueous solution of $MgCl_2$, assuming dissociation of $MgCl_2$ to be 70 mole percent? (Vapor pressure of pure water at 25 ^oC is 23.8 mmHg)	3
23	Write the Nernst equation for the following: I. Ni (s) + Cu^{2+} (aq) → Ni^{2+} (aq) + Cu (s) II. Al (s) + $FeSO_4$ (aq) → $Al_2(SO_4)_3$ (aq) + Fe (s) III. Mg (s)/Mg^{2+} (aq)//Ag^+ (aq)/Ag(s)	3x1
24	Explain the following: I. Toluene on treatment with Cl_2 in sunlight gives benzyl chloride whereas when treated with Cl_2 in dark gives o-chlorobenzene and p-chlorobenzene. II. Finkelstein reaction is carried out in the presence of dry acetone. III. neo pentylchloride has lower boiling point than isopentylchloride.	3x1
25	Which of the following elements will: I. exhibit similar magnetic behaviour and why? Magnesium (Atomic No. 12), Chromium (Atomic No. 24), Iron (Atomic No. 26) and Molybdenum (Atomic No. 42). II. form white salts and why? Zinc (Atomic No. 30), Scandium (Atomic No. 21), Nickel (Atomic No. 28) and Vanadium (Atomic No. 23)	2x1.5
26	Arrange the products obtained in the following cases in the increasing order of their pKa values: A. Oxidation of ethanol in presence of acidified potassium dichromate B. Reaction of propanoic acid with Br_2 in the presence of red Phosphorus C. Reaction of isopropyl magnesium bromide with carbon dioxide, followed by hydrolysis. D. Reaction of propanoic acid with Cl_2 in the presence of red Phosphorous.	3

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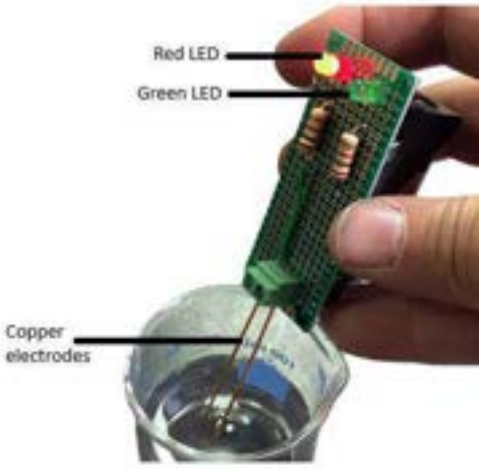
27	Carry out the following conversions. (**Attempt any 3)** I. Butan-2-one to 3-Methylpentan-3-ol II. Anisole to 4-Methoxytoluene III. Phenol to Benzene IV. Chloroethane to Ethoxy ethane	3x1
28	Answer the following questions: I. Are the enthalpies of atomisation of Zinc and Copper matched correctly? Justify your answer. Element | Enthalpy of atomisation/ $kJmol^{-1}$ Zinc | 339 Copper | 130 II. Out of sulphuric acid and hydrochloric acid, which acid will you prefer for permanganate titrations and why? III. $5NO_2^- + 2MnO_4^- + 6H^+ \rightarrow$	3x1
	Section D Question No. 29 & 30 are case-based/data -based questions carrying 4 marks each.	
29	**Conductivity of Aqueous Solutions** Electrical conductivity is based on the flow of ions. Slightly ionized substances are *weak electrolytes*. Weak acids and bases would be categorized as weak electrolytes because they do not completely dissociate in solution. Highly ionized substances are *strong electrolytes*. Strong acids and salts are strong electrolytes because they completely ionize in solution. The ions carry the electric charge through the solution thus creating an electric current. The current, if sufficient enough, will light one or both LEDs on a *conductivity meter*, shown at right.  The meter has a 9V battery, two parallel copper electrodes and	

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two LED's – one green and one red. The conductivity of a solution can be tested by switching the meter on and dipping the copper electrodes in the solution to be tested.

Substances that do not conduct an electric current are called *non-electrolytes*. Non-electrolytes do not ionize; they do not contain moveable ions. The LEDs of a conductivity meter will not light because there are no ions to carry the electric current.

The table given below is a guide to the possible conductivity measurements

Scale	Red LED	Green LED	Conductivity
0	off	off	low or none
1	dim	off	low
2	medium	off	medium
3	bright	dim	high
4	very bright	medium	very high

source: https://chem.libretexts.org

Based on the information provided above, answer the following questions: 1+1+2

I. Is it possible to identify whether the given solution is 1 M NaOH or 1 M HCl using the conductivity meter? Justify your answer.

II. What is the possible pH value of solution if the glow of green LED is medium and the red LED glows very brightly?

(i) 1 (ii) 13 (iii) 5 (iv) 8

(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iv)
(d) (iii) and (iv)

OR

Write down the observations if the conductivity meter is dipped in distilled water.

III. Refer to the table given below and draw the molar conductivity vs. concentration curve for solution A and B.

Solution	Red LED	Green LED
A	bright	dim
B	dim	off

(For Visually Challenged students)

Conductivity of Aqueous Solutions

Conductivity meter is a device which is used to identify whether the given solution is a strong, weak or non-electrolyte. The meter has a 9V battery, and two parallel copper electrodes and a 5 point scale (0 to 4) to measure conductivity of a solution. The conductivity of a solution can be tested by switching the meter on and dipping the copper electrodes in the solution to be tested.

Electrical conductivity is based on the flow of ions. Highly ionized substances are *strong electrolytes*. Strong acids and salts are strong electrolytes because they completely ionize in solution. The ions carry the electric charge through the solution thus creating an electric current. The current, if sufficient enough, will show a value of 3 or 4 on the conductivity *meter*.

Slightly ionized substances are *weak electrolytes*. Weak acids and bases would be categorized as weak electrolytes because they do not completely dissociate in solution. The values for weak electrolytes are 1 or 2 on the conductivity scale.

Substances that do not conduct an electric current are called *non-electrolytes*. Non-electrolytes do not ionize; they do not contain moveable ions. The conductivity meter shows a value of 0 in such a case as there are no ions to carry the electric current.

The following table is a guide to the possible conductivity values:

Scale	Conductivity
0	low or none
1	low
2	medium
3	high
4	very high

Based on the information provided above, answer the following questions: 1+1+2

I. Is it possible to identify whether the given solution is 1 M NaOH or 1 M HCl using the conductivity meter? Justify your answer.

II. What is the possible pH value of solution if the scale shows the value "4"

(i) 1 (ii) 13 (iii) 5 (iv) 8

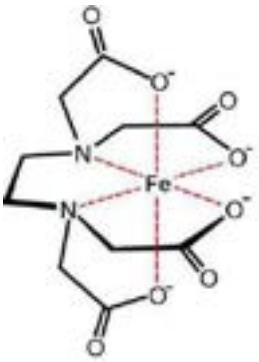
(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iv)
(d) (iii) and (iv)

OR

What will be value on the scale if the conductivity meter is dipped in distilled water?

III. Predict the electrolyte is a strong or weak electrolyte on the basis of the following observation:

Solution	Scale
A	3
B	2

30	**Iron-EDTA complex in food fortification** Food fortification is defined as the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value. It is a proven, safe and cost-effective strategy for improving diets and for the prevention and control of micronutrient deficiencies. A food product (such as rice, wheat flour, edible oil) that is fortified through the addition of fortificants is called a "vehicle".  In African and south Asian countries 40% of the population suffers from anaemia. Average human needs nearly 10mg of iron daily. Iron fortification may be useful in fighting iron deficiencies in humans. Reduced iron and several iron salts have been used in the past as iron fortification, however, not all are suitable for this purpose, in terms of iron absorption. Recent studies have shown that beverages containing sugar fortified with either Ferrous sulphate or Fe(III)- EDTA complex have high rate of absorption of iron. Ferrous sulphate as well as Fe(III)- EDTA is suitable to enrich sugar, but while iron from ferrous sulphate is precipitated and poorly absorbed when fortified sugar is added to beverages such as tea, Fe(III)- EDTA reacts slowly with tea and iron is not precipitated for at least 24 hr. Fe(III)-EDTA as iron fortification, has demonstrated so far, more advantages than that observed from other iron salts, including ferrous sulphate. But, EDTA is a chelating agent and its use in food technology to prevent oxidative damage of food has been restricted. Excessive consumption of EDTA can cause abdominal cramps, nausea, low blood pressure and damage to kidneys. According to National Institute of Health, it is unsafe to consume more than 3 g of EDTA per day or continuously for more than 5 to 7 days. The amount of EDTA necessary for 10 mg of iron fortification, is about 60 mg. This is within the safe limits and is comparable to the usual amount added to the diet. (source: Layrisse, M., & MartInez-Torres, C. (1977). Fe (III)-EDTA complex as iron fortification. *The American Journal of Clinical Nutrition*, *30*(7), 1166-1174.) **Based on the information provided above, answer the following questions:** I. Why is Fe(III)-EDTA complex stable as compared to Ferrous sulphate? **OR**	1+1+2

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

What happens when hard water is titrated against Na_2EDTA?

II. You are a doctor, working in Somalia. Will you recommend iron fortified food to your patients? Support your answer with references from the passage.

III. What is the denticity of the ligand in the Fe(III) EDTA complex. Name the atom(s) through which it can bind to the central metal ion.

Write the structure of EDTA. (Refer to figure 1)

For Visually challenged candidates

Iron-EDTA complex in food fortification

Food fortification is defined as the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value. It is a proven, safe and cost-effective strategy for improving diets and for the prevention and control of micronutrient deficiencies. A food product (such as rice, wheat flour, edible oil) that is fortified through the addition of fortificants is called a “vehicle”.

Reduced iron and several iron salts have been used in the past as iron fortification, however, not all are suitable for this purpose, in terms of iron absorption. Recent studies have shown that beverages containing sugar fortified with either Ferrous sulphate or Fe(III)- EDTA complex have high rate of absorption of iron.

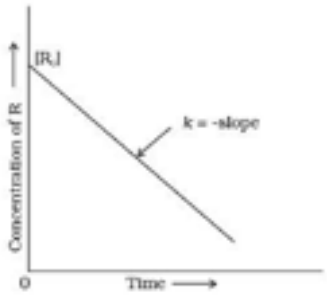
Ferrous sulphate as well as Fe(III)- EDTA is suitable to enrich sugar, but while iron from ferrous sulphate is precipitated and poorly absorbed when fortified sugar is added to beverages such as tea, Fe(III)- EDTA reacts slowly with tea and iron is not precipitated for at least 24 hr.

Fe(III)-EDTA as iron fortification, has demonstrated so far, more advantages than that observed from other iron salts, including ferrous sulphate. But, EDTA is a chelating agent and its use in food technology to prevent oxidative damage of food has been restricted. Excessive consumption of EDTA can cause abdominal cramps, nausea, low blood pressure and damage to kidneys. According to National Institute of Health, it is unsafe to consume more than 3 g of EDTA per day or continuously for more than 5 to 7 days.

The amount of EDTA necessary for 10 mg of iron fortification, is about 60 mg. This is within the safe limits and is comparable to the usual amount added to the diet.

(source: Layrisse, M., & MartInez-Torres, C. (1977). Fe (III)-EDTA complex as iron fortification. *The American Journal of Clinical Nutrition*, *30*(7), 1166-1174.)

	Based on the information provided above, answer the following questions: I. Why is Fe(III)-EDTA complex stable as compared to Ferrous sulphate? **OR** What happens when hard water is titrated against Na_2EDTA? II. You are a doctor, working in Somalia. Will you recommend iron fortified food to your patients? Support your answer with references from the passage. III. (a)What is the denticity of the ligand in the Fe(III) EDTA complex. Name the atom(s) through which it can bind to the central metal ion. (b) EDTA is an electron acceptor or an electron donor?	1+1+2
	Section-E Question No. 31 to 33 are long answer type questions carrying 5 marks each.	
31	**Attempt either A or B** A. Answer the following questions: I. Write the structure of expected product of Cannizarro reaction of 2-chlorobenzaldehyde. II. How would the presence of $-SO_3H$ group effect the basic strength of aniline. III. Convert acetic acid to ethanamine. IV. Write the steps to prepare Benzoic acid from Benzoyl chloride. V. Give a chemical test to distinguish between: propanal and propanone **OR** B. Answer the following questions: I. Write the structure of expected product of Wolf-Kishner reduction of 2 –methylbutanal. II. How would the presence of $-SO_3H$ group effect the acidic strength of benzoic acid III. Prepare acetic acid from ethanamine. IV. Convert Aniline to benzoic acid. V. Give a chemical test to distinguish between: propanal and ethanal.	5x1

32	**Attempt either A or B** A. Answer the following questions: I. Identify and give any one point of difference between the protein present in the hair and protein present in egg albumin. II. Both glucose and sucrose have aldehydic group, then why does only glucose reduces Fehling's Reagent.and not sucrose? III. Why do amino acids behave as salts? IV. What chemical change takes place during curdling of milk? V. Doctor advised a 50 year old woman enough exposure to sunlight and addition of fish and egg yolk to her diet. What is the possible disease diagnosed by the doctor? **OR** B. Answer the following questions: I. Identify and give any one point of difference between the carbohydrate present in cane sugar and carbohydrate present in milk. II. Glucose is an aldohexose and a monosaccharide. Which oxidising agent should be used to bring about oxidation of only the aldehydic group present in glucose? III. Amino acid $HOOC\text{-}CH_2CH(NH_2)CH_2COOH$.Predict whether the pH of this amino acid will be >7, 7 or <7. IV. Name the two major molecular shapes formed due to the folding of secondary structure of proteins. V. Ashish's gums bleed frequently. The doctor's prescription mentioned that Ashish is suffering from scurvy. Help him to identify two food sources to help him recover faster. .	5x1
33	**Attempt either A or B** A. I. The rate of a reaction triples when the temperature changes from 298 K to 318 K. Calculate the energy of activation of the reaction assuming that it does not change with temperature. (Given R = 8.314 $JK^{-1}mol^{-1}$, log 3 = 0.4771) II. Identify the order of reaction and write its integrated rate equation mentioning what each term in the equation represents.  **OR**	3+2

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

	B. I. Consider the following first order thermal decomposition of SO_2Cl_2 at a constant volume SO_2Cl_2 (g) → SO_2(g) + Cl_2 (g) If the total pressure of the gases is found to be 200 torr after 10 seconds and 300 torr upon the complete decomposition of SO_2Cl_2. Calculate the rate constant. (Given log 3 = 0.4771, log 2= 0.3010) II. For a bimolecular elementary reaction A + B → Products. Write the expression for the rate of reaction relating temperature and activation energy for the reaction and also mention what each term represents in the equation.	3+2

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

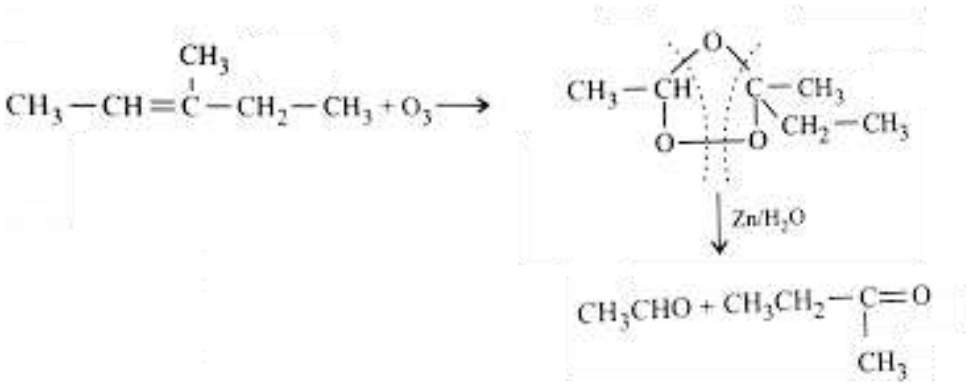
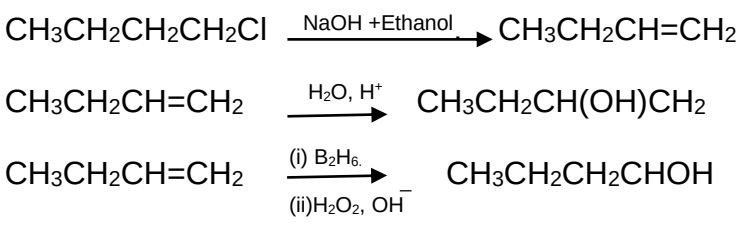
CHEMISTRY CODE - 043
MARKING SCHEME
CLASS XII (2025-26)

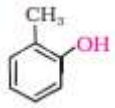
Time: 3 hours **Max. Marks: 70**

GENERAL INSTRUCTIONS:

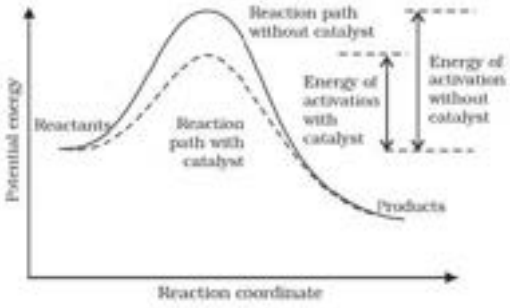
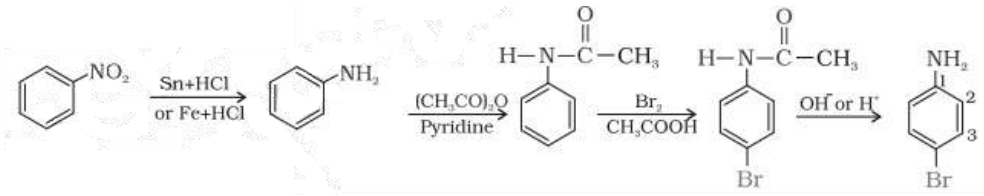
Read the following instructions carefully.

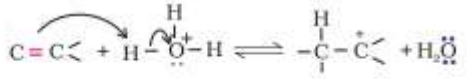
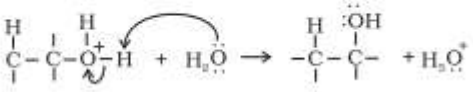
1. There are **33** questions in this question paper with internal choice.
2. SECTION A consists of 16 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each.
4. SECTION C consists of 7 short answer questions carrying 3 marks each.
5. SECTION D consists of 2 case-based questions carrying 4 marks each.
6. SECTION E consists of 3 long answer questions carrying 5 marks each.
7. All questions are compulsory.
8. Use of log tables and calculators is not allowed.

	Section-A	
1	C. Ozonolysis of $CH_3CH_2C(CH_3)=CHCH_3$ 	1
2	C. B= Butan-2-ol, C= Butanol 	1
3	C. chloride	1

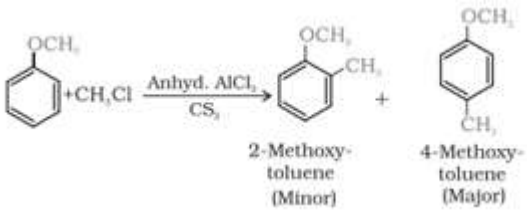
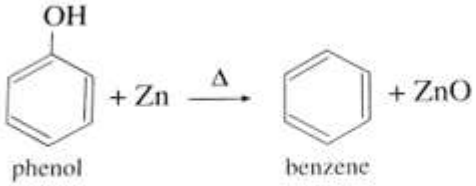
	The formula of coordination complex, the ions outside the square bracket are called counter ions.	
4	A. A> B>C A is primary, B is secondary amine, C is tertiary amine.Primary amines are having higher boiling point as compared to secondary and tertiary amines.	1
5	C. 0.73 m = $\frac{m_2}{MM_2}$ x $\frac{1000}{m_1}$ m = $\frac{70}{MM_2}$ x $\frac{1000}{700}$ M = $\frac{m_2}{MM_2}$ x $\frac{1000}{V}$ Here, V = $\frac{m_1+m_2}{d}$ = $\frac{770}{1.5}$ M = $\frac{70}{MM_2}$ x $\frac{1000\ x\ 1.5}{770}$ $\frac{m}{M}$ = $\frac{770}{700\ x\ 1.5}$ = 0.73	1
6	D. A-(iv), B-(iii), C-(ii), D-(i)	1
7	B. sp^2 hybrid. The –OH group has replaced –H of benzene ring. All carbons of benzene are sp^2 hybrid. 	1
8	C. Beta D – fructose	1
9	C. both lanthanoids and actinoids	1
10	C. Either 1 or 3 Λ_m^o CH_3COOH = $\Lambda_m^o HCl$ + Λ_m^o CH_3COOK - $\Lambda_m^o KCl$	1

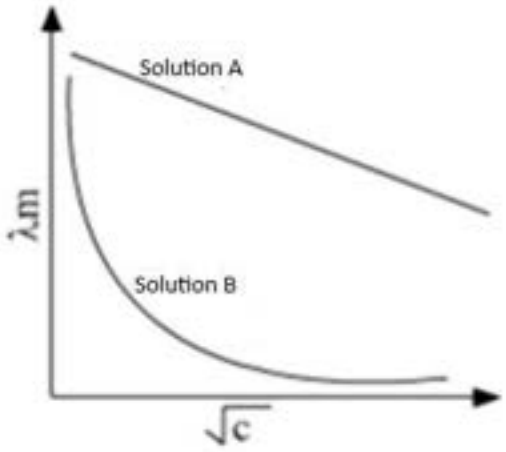
	Λ_m^o CH_3COOH = 1/2 $\Lambda_m^o H_2SO_4$ + Λ_m^o CH_3COONa – 1/2 $\Lambda_m^o Na_2SO_4$	
11	A. (i) and (ii) Aldehydes and ketones react with 2,4 dinitrophenylhydrazine to give a yellow/orange ppt of 2,4 dintirophenylhydrazone	1
12	B. (iv) and (ii)	1
13	D. A is false but R is true Primary aliphatic amines react with nitrous acid to form aliphatic diazonium salts which being unstable, liberate nitrogen gas	1
14	B. Both A and R are true, and R is not the correct explanation of A. If osmotic pressure of the solutions that flow in the blood stream is not same as that of the blood, exosmosis or endosmosis will take place.	1
15	A. Both A and R are true, and R is the correct explanation of A. In starch, the major component is 80-85% of amylopectin is insoluble in water. Hence starch is not completely soluble in water and form colloidal solution.	1
16	C. A is true but R is false. A primary cell becomes dead after use, it cannot be recharged.	1
17	**Option A** I. The volume will be less than 100 ml. The intermolecular forces between phenol and aniline is stronger than phenol-phenol and aniline-aniline which results in decrease in volume. II. Salt lowers the freezing point of water ie. it leads to depression in freezing point. This will delay the melting of ice. **OR** **Option B** I. Precipitate of $BaSO_4$ will not appear as osmosis involves movement of solvent molecules and not solute.	1 1 1

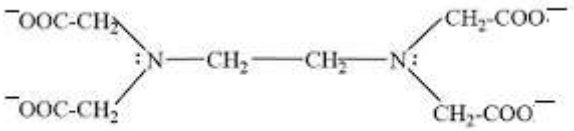
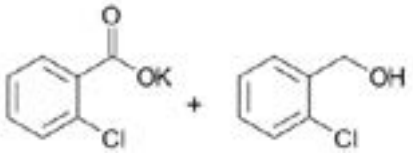
	II. Sugar being non-volatile solute, lowers the vapour pressure above the solution. This leads to elevation in boiling point.	1
18	I. Ea for backward reaction = 40 kJ/mol, ΔH= 10 kJ/mol II. Catalyst will increase the rate of reaction as the activation energy required to form intermediate activated complex between reactant and catalyst is lower than the activation energy required for forming complex without catalyst.  ***(for visually challenged learners)*** I. The minimum energy required to form the intermediate activated complex, is known as activation energy (Ea). Activation energy is the least possible energy required to start a chemical reaction. The activation energy doesn't change with change in temperature. II. Catalyst will increase the rate of reaction as the activation energy required to form intermediate activated complex between reactant and catalyst is lower than the activation energy required for forming complex without catalyst.	1 1 1 1
19	I  II. $C_6H_5CH_2Cl + KCN \longrightarrow C_6H_5CH_2CN \xrightarrow{LiAlH_4} C_6H_5CH_2CH_2NH_2$	1 1
20	I. $[Ag(H_2O)_2][Ag(Cl)_2]$ II. $[Ni(OH)_2(PPh_3)_2]$	1 1

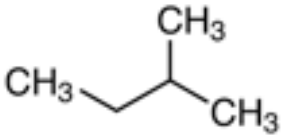
21	STEP 1  STEP 2 No error STEP 3 	1 1
22	P_A^o = 23.8 mm of Hg m = 1molal ,1mol of solute in1000g of water $n_B = 1$ mol $n_A = \frac{1000}{18} = 55.5$mol $MgCl_2 \rightarrow Mg^{2+} + 2Cl^-$ 1 0 0 $1-0.7$ 0.7 1.4 $\alpha = (i-1)/(n-1)$ n=3 $i = 0.7(2)+1$ $= 1.4 + 1 = 2.4$ $\frac{P_A^o - P_s}{P_A^o} = i\frac{n_B}{n_A + n_B}$ $\frac{23.8 - Ps}{23.8} = 2.4\ \frac{1}{56.5}$ $23.8\left(1-\frac{2.4}{56.5}\right) = Ps$ 22.9mm of Hg $= Ps$	½ ½ ½ ½ ½
23	I. $E_{cell} = E^o_{cell} - \frac{2.303\ RT}{2F}\log\ \frac{[Ni^{2+}]}{[Cu^{2+}]}$	1

	II. $E_{cell} = E^{o}_{cell} - \frac{2.303\ RT}{6F} \log \frac{[Al^{3+}]^2}{[Fe^{2+}]^3}$ III. $E_{cell} = E^{o}_{cell} - \frac{2.303\ RT}{2F} \log \frac{[Mg^{2+}]}{[Ag^{+}]^2}$	1 1
24	I. Cl_2 in presence of sunlight forms free radical as an intermediate and hence toluene undergoes free radical substitution of the alky group to form benzyl alcohol whereas Cl_2 in dark forms Cl^+, an electrophile as an intermediate, making toluene undergo electrophilic substitution and form o-chlorobenzene and p-chlororbenzene. II. NaI is soluble in dry acetone but NaCl is insoluble. NaCl precipitates out of the reaction mixture and shifts the equilibrium towards the right accoding to Le Chatelier's principle. III. The branching of the chain in neo pentylchloride is more than iso pentylchloride, which makes the molecule more compact and decreases its surface area. This decrease the magnitude of the Van der Waal's forces of attraction existing between the two molecules of neopentyl chloride. and consequently the boiling point decreases and is less than isopentyl chloride	1 1 1
25	I. Chromium and Molybdenum Cr – $[Ar]3d^5 4s^1$ Mo- $[Kr]4d^5 5s^1$ have similar electronic configuration and same number of unpaired electrons (6). Therefore, both show similar magnetic behaviour. II. Zinc and Scandium Zinc shows +2 oxidation state in its salts and Zn^{2+} – $[Ar]3d^{10}$ has no unpaired electrons as it has completely filled d subshell, so it forms white salts and Sc shows +3 oxidation state in its salts and Sc^{3+} [Ar] and no unpaired electron, so it forms white salts. Nickel and Vanadium salts are coloured as their ions have unpaired electrons.	½ 1 ½ 1
26	A. $CH_3CH_2OH \xrightarrow{\text{Acidified } K_2Cr_2O_7} CH_3COOH$ B. $CH_3CH_2COOH \xrightarrow{Br_2/\text{ Red P}} CH_3CHBrCOOH$ C. $(CH_3)_2CHMgCl \xrightarrow{(i)CO_2\ (ii)H^+,H_2O} (CH_3)_2CHCOOH$ D. $CH_3CH_2COOH \xrightarrow{Cl_2/\text{ Red P}} CH_3CHClCOOH$ Order of acidity : $CH_3CHClCOOH > CH_3CHBrCOOH > CH_3COOH > (CH_3)_2CHCOOH$	½ ½ ½ ½

	Order of pKa values: $CH_3CHClCOOH < CH_3CHBrCOOH < CH_3COOH < (CH_3)_2CHCOOH$	1
27	**Attempt any 3** I. $CH_3CH_2COCH_3 + CH_3CH_2MgCl \xrightarrow{\text{dry ether}} (CH_3CH_2)_2C(OMgCl)CH_3 \xrightarrow{H_2O} (CH_3CH_2)_2C(OH)CH_3$ II.  2-Methoxy-toluene (Minor) 4-Methoxy-toluene (Major) III.  phenol benzene IV. $CH_3CH_2Cl + CH_3CH_2ONa \longrightarrow CH_3CH_2OCH_2CH_3 + NaCl$	1 1 1
28	I. No. Enthapy of atomisation of Zinc is 130kJ/mol because it has no unpaired electrons in d subshell so the interatomic interaction is weaker than Cu. II. Sulphuric acid because hydrochloric acid is oxidised to chlorine. III. $5NO_2^- + 2MnO_4^- + 6H^+ \rightarrow 2Mn^{2+} + 5NO_3^- + 3H_2O$	1 1 1
29	I. No. Both are strong electrolytes so both the LEDs will glow. Red will be very bright and green will be medium in both cases. II. (a) (i) and (ii) **OR** **Scale** | **Red LED** | **Green LED** | **Conductivity** 0 | off | off | low or none	1 1

	III. A is strong electrolyte while B is a weak electrolyte. (marks allotted for correct curve)  **For Visually challenged** I. No. Both are strong electrolytes so both will have value of 3 or 4 on the scale II. (a) (i) and (ii) **OR** The value will be 0. III. A is a strong electrolyte and B is a weak electrolyte	1 + 1 1 1 1+1
30	I. EDTA is a chelating agent, it forms ringed complex with the central metal ion and makes the complex stable. **OR** Hardness of water is estimated by simple titration with Na_2EDTA. The Ca^{2+} and Mg^{2+} ions form stable complexes with EDTA. II. Yes, 40% of the population in Africa suffers from anaemia. Most of the patients in Somalia are likely to be anaemic. Iron fortified food will have increased the nutritional value. In the same amount of food product the patient will get higher amount of the micronutrient than present in natural product. This will help reduce cases of iron deficiency in Somalia. However, patients will be advised to consume the food product according to the recommended safe limits of the fortificant. **OR** No, though 40% of the population suffers from anaemia, iron fortified food will be recommended to patients whose reports	1 1

	suggest iron deficiency. Iron fortified food will have increased the nutritional value. In the same amount of food product the patient will get higher amount of the micronutrient than present in natural product. This fortificant can cause other ill effects to the non- anaemic population as well as could lead to higher levels of iron in the body than required. **III.** (a)6 2 Nitrogen and 4 oxygen are electron donors (b)  **For Visually challenged** I. Same as above II. Same as above III. (a) 6 2 Nitrogen and 4 oxygen are electron donors. (b) EDTA is an electron donor.	½ ½ 1
31	**Option A** I. The structures of expected products of Cannizarro reaction of 2-chloro -benzaldehyde  II. $-SO_3H$ is electron withdrawing in nature, hence it decreases the availability of lone pair for donation, hence basic nature of aniline decrease due to the presence of sulphonic group. III. Following are the steps to convert acetic acid to ethanamine. $CH_3COOH \xrightarrow{LiAlH_4} CH_3CH_2OH \xrightarrow{SOCl_2} CH_3CH_2Cl \xrightarrow[NH_3]{\text{excess of}} CH_3CH_2NH_2$ IV. Benzoic acid from Benzoyl chloride: $C_6H_5COCl \xrightarrow{H_2\text{-}Pd/BaSO_4} C_6H_5CHO \xrightarrow{\text{acidified } KMnO_4} C_6H_5COOH$	1 1 1 1

	V. The chemical test to distinguish between propanal and propanone is Tollen test (Silver Mirror) Propanal on heating in a water bath with ammonical silver nitrate (Tollen's reagent) forms a silver mirror on the sides of the test tube. Propanone on heating in a water bath with Tollen's reagent does not show any reaction. **OR** **Option B** I. Product formed on Wolf-Kishner reduction of 2 –methylbutanal is  II. The strength of benzoic acid depends on its ability to donate the proton and stability of the conjugate base formed .Sulphonic acid is an electron withdrawing group , it presence increases the ability to release proton . Hence the acidic strength will be increased . III. To convert acetic acid from ethanamine following are the steps involved : $CH_3CH_2NH_2 \xrightarrow{HNO_2} CH_3CH_2OH \xrightarrow{\text{acidified } KMnO_4} CH_3COOH$ IV. Aniline to benzoic acid: $C_6H_5NH_2 \xrightarrow{NaNO_2/\ HCl} C_6H_5N_2^+Cl^- \xrightarrow{KCN} C_6H_5CN \xrightarrow{\text{complete hydrolysis}} C_6H_5COOH$ V. a chemical test to distinguish between: propanal and ethanal Ethanal gives yellow precipitate on heating with iodine in the presence of sodium hydroxide (positive Iodoform test) Propanal will not give any reaction on heating with iodine in the presence of sodium hydroxide (negative Iodoform test)	1 1 1 1 1 1 1
32	**Option A** I. Protein present in the hair are fibrous while in egg are globular.	1

	Fibrous proteins are long fibre like and usually insoluble in water whereas globular proteins are globular and usually soluble in water.	
	II. Glucose reduces Fehling's Reagent however sucrose cannot though both have aldehydic group because glucose contains free aldehydic group whereas sucrose is a disaccharide and does not have free aldehydic group.	1
	III. Alpha -Amino acids behave as salts. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule.	1
	IV. The chemical change takes place during curdling of milk caused due to the formation of lactic acid from the lactose sugar by the bacteria present in milk.	1
	V. The possible disease is Osteoporosis, which can be cured by taking Vitamin D rich diet.	1
	OR	
	Option B	
	I. Carbohydrate present in cane sugar is sucrose which is a disaccharide composed of glucose and fructose while the carbohydrate present in milk is lactose which is a disaccharide composed of glucose and galactose	1
	II. Glucose is an aldohexose and a monosaccharide. Bromine water is a mild oxidising agent which can be used to bring about oxidation of only the aldehydic group present in glucose.	1
	III. Amino acid P is with structural formula given as – $HOOC\text{-}CH_2CH(NH_2)CH_2COOH$ The presence of two carboxylic acids shows that it is an acidic amino acid The pH will be less than 7	1
	IV. The two major molecular shapes formed due to the folding of secondary structure of proteins are alpha helix and beta pleated sheets	1
	V. Ashish is suffering from scurvy, which occurs due to deficiency of Vitamin C The sources of food are – Citrus fruits, amla and green leafy vegetables	1
33	**Option A**	
	I. Here, $T_1 = 298\,K, T_2 = 318\,K$	
	$\frac{K_2}{K_1} = 3$	
	$\log \frac{K_2}{K_1} = \frac{E_\alpha}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$	½
	$\log 3 = \frac{E_\alpha}{2.303 \times 8.314}\left[\frac{1}{298} - \frac{1}{318}\right]$	½

$$0.4771 = \frac{E_\alpha}{2.303 \times 8.314}\left[\frac{10}{298 \times 318}\right]$$ ½

$$E_\alpha = \frac{0.4771 \times 2.303 \times 8.314 \times 298 \times 318}{10}$$ ½

$$= 86567.87 \text{ J mol}^{-1}$$ 1

E_a =86.567 KJ mol^{-1} (½ mark for anwer anmd ½ for correct unit)

II. It is zero order reaction. ½

$$k = \frac{[R] - [R]_0}{t}$$ 1

Here, k is rate constant, [R] – concentration of reactant at time t, [Ro] initial concentration of reactant. ½

OR

Option B

I. $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$

$t = 0$	P_i	0	0
on completion	0	P_i	P_i
$t = 10$ sec	$P_i - x$	x	x

½

On completion

$P_T = P_i + P_i$

$P_T = 2P_i$

$P_i = \frac{300}{2}$

$= 150$ torr

After 10 seconds

$P_T = P_i - x + x + x$

$x = P_T - P_i$

$x = 200 - 150$

$x = 50$ torr ½

First order integrated rate equation

$k = \frac{2.303}{t} \log \frac{P_i}{P_i - x}$ ½

$k = \frac{2.303}{10} \log \frac{150}{150 - 50}$

	$k = \frac{2.303}{10} \log \frac{150}{100}$ $k = \frac{2.303}{10} \log \frac{3}{2}$ $k = \frac{2.303}{10} (\log 3 - \log 2)$ $k = \frac{2.303}{10} \times (0.4771 - 0.3010)$ $k = \frac{2.303}{10} \times 0.1761$ $k = 0.040\ s^{-1}$	1 ½
	II. Rate of reaction can be expressed as Rate = $Z_{AB}e^{-Ea/RT}$	1
	where Z_{AB} represents the collision frequency of reactants, A and B and $e^{-Ea/RT}$ represents the fraction of molecules with energies equal to or greater than Ea.	1

COMPUTER SCIENCE – Code No. 083
SAMPLE QUESTION PAPER*
Class - XII - (2025-26)

Time Allowed: 3 Hrs. **Maximum Marks: 70**

General Instructions:

- This question paper contains 37 questions.
- All questions are compulsory. However, internal choices have been provided in some questions. Attempt only one of the choices in such questions.
- The paper is divided into 5 Sections- A, B, C, D and E.
- Section A consists of 21 questions (1 to 21). Each question carries 1 Mark.
- Section B consists of 7 questions (22 to 28). Each question carries 2 Marks.
- Section C consists of 3 questions (29 to 31). Each question carries 3 Marks.
- Section D consists of 4 questions (32 to 35). Each question carries 4 Marks.
- Section E consists of 2 questions (36 to 37). Each question carries 5 Marks.
- All programming questions are to be answered using Python Language only.
- In-case of MCQ, text of the correct answer should also be written.

Q No.	Section-A (21 x 1 = 21 Marks)	Marks
1	State if the following statement is True or False: Using the statistics module, the output of the below statements will be 20: import statistics statistics.median([10, 20, 10, 30, 10, 20, 30])	1
2	What will be the output of the following code? L = ["India", "Incredible", "Bharat"] print(L[1][0] + L[2][-1]) a) IT b) it c) It d) iT	1
3	Consider the given expression: print(19<11 and 29>19 or not 75>30) Which of the following will be the correct output of the given expression? a) True b) False c) Null d) No output	1
4	In SQL, which type of Join(s) may contain duplicate column(s)?	1
5	What will be the output of the following Python code? str= "Soft Skills" print(str[-3::-3]) a) lSf b) Stkl c) StKi d) l	1
6	Write the output of the following Python code : for k in range(7,40,6): print (k + '-')	1
7	What will be the output of the following Python statement: print(10-3**2**2+144/12)	1
8	Consider the given SQL Query: SELECT department, COUNT(*) FROM employees HAVING COUNT(*) > 5 GROUP BY department;	1

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	Saanvi is executing the query but not getting the correct output. Write the correction.	

9	What will be the output of the following Python code?
	try:
	  x = 10 / 0
	except Exception:
	  print("Some other error!")
	except ZeroDivisionError:
	  print("Division by zero error!")
	a) Division by zero error! b) Some other error!
	c) ZeroDivisionError d) Nothing is printed
		1

10	What will be the output of the following Python code? my_dict = {"name": "Alicia", "age": 27, "city": "DELHI"} print(my_dict.get("profession", "Not Specified")) a) Alicia b)DELHI c)None d)Not Specified	1
11	What possible output is expected to be displayed on the screen at the time of execution of the Python program from the following code? import random L=[10,30,50,70] Lower=random.randint(2,2) Upper=random.randint(2,3) for K in range(Lower, Upper+1): print(L[K], end="@") a) 50@70@ b) 90@ c) 10@30@50@ d) 10@30@50@70@	1

12	What will be the output of the following Python code?
	i = 5
	print(i,end='@@')
	def add():
	  global i
	  i = i+7
	  print(i,end='##')
	add()
	print(i)
	a) 5@@12##15 b) 5@@5##12 c) 5@@12##12 d)12@@12##12
		1

13	Which SQL command can change the cardinality of an existing relation? a) Insert b) Delete c) Both a) & b) d) Drop	1
14	What is the output of the given Python code? st='Waterskiing is thrilling!' print(st.split("i")) a) ['Watersk', 'ng ', 's thr', 'll', 'ng!'] b) ['Watersk', '', 'ng ', 's thr', 'll', 'ng!'] c) ['Watersk', 'i', 'ng ', 's thr', 'll', 'ng!'] d) Error	1
15	In SQL, a relation consists of 5 columns and 6 rows. If 2 columns and 3 rows are added to the existing relation, what will be the updated degree of a relation? a) Degree: 7 b) Degree: 8 c) Degree: 9 d) Degree: 6	1
16	Which SQL command is used to remove a column from a table in MySQL? a) UPDATE b) ALTER c) DROP d) DELETE	1

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17	_____ is a protocol used for retrieving emails from a mail server. a) SMTP b) FTP c) POP3 d) PPP	1
18	Which of the following is correct about using a Hub and Switch in a computer network? a) A hub sends data to all devices in a network, while a switch sends data to the specific device. b) A hub sends data only to the devices it is connected to, while a switch sends data to all devices in a network. c) A hub and switch function the same way and can be used interchangeably. d) A hub and switch are both wireless networking devices.	1
19	Which of the following is used to create the structure of a web page? a) CSS b) HTML c) JavaScript d) FTP	1
Q20 and Q21 are Assertion(A) and Reason(R) based questions. Mark the correct choice as: a) Both A and R are True and R is the correct explanation for A. b) Both A and R are True and R is not the correct explanation for A. c) A is True but R is False. d) A is False but R is True.		
20	Assertion (A): The expression (1, 2, 3, 4).append(5) in Python will modify the original sequence datatype. Reason (R): The append() method adds an element to the end of a list and modifies the list in place.	1
21	Assertion (A): A primary key must be unique and cannot have NULL values. Reasoning (R): The primary key uniquely identifies each row in the table.	1
Q No.	**Section-B (7 x 2=14 Marks)**	**Marks**
22	A. Explain the difference between explicit and implicit type conversion in Python with a suitable example. **OR** B. Explain the difference between break and continue statements in Python with a suitable example.	2
23	The code provided below is intended to remove the first and last characters of a given string and return the resulting string. However, there are syntax and logical errors in the code. Rewrite it after removing all the errors. Also, underline all the corrections made. define remove_first_last(str): if len(str) < 2: return str new_str = str[1:-2] return new_str result = remove_first_last("Hello") Print("Resulting string: " result)	2
24	A. (Answer using Python built-in methods/functions only): I. Write a statement to find the index of the first occurrence of the substring "good" in a string named review. II. Write a statement to sort the elements of list L1 in descending order.	2

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	OR B. Predict the output of the following Python code: text="Learn Python with fun and practice" print(text.partition("with")) print(text.count("a"))	
25	A. Write a function remove_element() in Python that accepts a list L and a number n. If the number n exists in the list, it should be removed. If it does not exist, print a message saying "Element not found". **OR** B. Write a Python function add_contact() that accepts a dictionary phone_book, a name, and a phone number. The function should add the name and phone number to the dictionary. If the name already exists, print **"Contact already exists"** instead of updating it.	2

26	Predict the output of the Python code given below :
	emp = {"Arv": (85000,90000),"Ria": (78000,88000),"Jay": (72000,80000),"Tia": (80000,70000)}
	selected = [ ]
	for name in emp:
	salary = emp[name]
	average = (salary[0] + salary[1]) / 2
	if average > 80000:
	selected.append(name)
	print(selected)
		2

27	A. Write suitable commands to do the following in MySQL. I. View the table structure. II. Create a database named SQP **OR** B. Differentiate between drop and delete query in SQL with a suitable example.	2
28	A. Define the following terms: I. Modem II. Gateway **OR** B. I. Expand the following terms: HTTP and FTP II. Differentiate between web server and web browser.	2
Q No.	**Section-C (3 x 3 = 9 Marks)**	**Marks**
29	A. Write a Python function that displays the number of times the word "Python" appears in a text file named "Prog.txt". **OR** B. Write and call a Python function to read lines from a text file STORIES.TXT and display those lines which doesn't start with a vowel (A, E, I, O, U) irrespective of their case.	3
30	A list containing records of products as L = [("Laptop", 90000), ("Mobile", 30000), ("Pen", 50), ("Headphones", 1500)] Write the following user-defined functions to perform operations on a stack named Product to:	3

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	I. Push_element() – To push an item containing the product name and price of products costing more than 50 into the stack. Output: [('Laptop', 90000), ('Mobile', 30000), ('Headphones', 1500)] II. Pop_element() – To pop the items from the stack and display them. Also, display "Stack Empty" when there are no elements in the stack. Output: ('Headphones', 1500) ('Mobile', 30000) ('Laptop', 90000) Stack Emply	

31	A. Predict the output of the following Python code:
	s1="SQP-25"
	s2=""
	i=0
	while i<len(s1):
	if s1[i]>='0' and s1[i]<='9':
	Num=int(s1[i])
	Num-=1
	s2=s2+str(Num)
	elif s1[i]>='A' and s1[i]<='Z':
	s2=s2+s1[i+1]
	else:
	s2=s2+'^'
	i+=1
	print(s2)
	OR
	B. Predict the output of the following Python code:
	wildlife_sanctuary = ["Kaziranga", "Ranthambhore", "Jim Corbett", "Sundarbans", "Periyar", "Gir", "Bandipur"]
	output = [ ]
	for sanctuary in wildlife_sanctuary:
	if sanctuary[-1] in 'aeiou':
	output.append(sanctuary[0].upper())
	print(output)
		3

Q No.	**Section-D (4 x 4 = 16 Marks)**	**Marks**
32	Consider the table SALES as given below:  A. Write the following queries: I. To display the total quantity sold for each product whose total quantity sold exceeds 12. II. To display the records of SALES table sorted by Product name in descending order.	4

sales_id	customer_name	product	quantity_sold	price
S001	John Doe	Laptop	5	50000
S002	Jane Smith	Smartphone	10	30000
S003	Michael Lee	Tablet	3	15000
S004	Sarah Brown	Headphones	7	2000
S005	Emily Davis	Smartwatch	8	8000
S006	David	Smartwatch	3	16000
S007	Mark	Tablet	5	34000

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	III. To display the distinct Product names from the SALES table. IV. To display the records of customers whose names end with the letter 'e'. **OR** B. Predict the output of the following: I. SELECT * FROM Sales where product='Tablet'; II. SELECT sales_id, customer_name FROM Sales WHERE product LIKE 'S%'; III. SELECT COUNT(*) FROM Sales WHERE product in ('Laptop', 'Tablet'); IV. SELECT AVG(price) FROM Sales where product='Tablet';	
33	Raj is the manager of a medical store. To keep track of sales records, he has created a CSV file named Sales.csv, which stores the details of each sale. The columns of the CSV file are: Product_ID, Product_Name, Quantity_Sold and Price_Per_Unit. Help him to efficiently maintain the data by creating the following user-defined functions: I. Accept() – to accept a sales record from the user and add it to the file Sales.csv. II. CalculateTotalSales() – to calculate and return the total sales based on the Quantity_Sold and Price_Per_Unit.	4
34	Pranav is managing a Travel Database and needs to access certain information from the Hotels and Bookings tables for an upcoming tourism survey. Help him extract the required information by writing the appropriate SQL queries as per the tasks mentioned below: **Table: Hotels** **Table: Bookings**	4

H_ID	Hotel_Name	City	Star_Rating
1	Hotel1	Delhi	5
2	Hotel2	Mumbai	5
3	Hotel3	Hyderabad	4
4	Hotel4	Bengaluru	5
5	Hotel5	Chennai	4
6	Hotel6	Kolkata	4

B_ID	H_ID	Customer_Name	Check_In	Check_Out
1	1	Jiya	2024-12-01	2024-12-05
2	2	Priya	2024-12-03	2024-12-07
3	3	Alicia	2024-12-01	2024-12-06
4	4	Bhavik	2024-12-02	2024-12-03
5	5	Charu	2024-12-01	2024-12-02
6	6	Esha	2024-12-04	2024-12-08
7	6	Dia	2024-12-02	2024-12-06
8	4	Sonia	2024-12-04	2024-12-08

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

<table>
<tr><td></td><td>I. To display a list of customer names who have bookings in any hotel of 'Delhi' city.
II. To display the booking details for customers who have booked hotels in 'Mumbai', 'Chennai', or 'Kolkata'.
III. To delete all bookings where the check-in date is before 2024-12-03.
IV. A. To display the Cartesian Product of the two tables.
OR
B. To display the customer’s name along with their booked hotel’s name.</td><td></td></tr>
<tr><td>35</td><td>MySQL database named WarehouseDB has a product_inventory table in MySQL which contains the following attributes:
• Item_code: Item code (Integer)
• Product_name: Name of product (String)
• Quantity: Quantity of product (Integer)
• Cost: Cost of product (Integer)
Consider the following details to establish Python-MySQL connectivity:
• Username: admin_user
• Password: warehouse2024
• Host: localhost
Write a Python program to change the Quantity of the product to 91 whose Item_code is 208 in the product_inventory table.</td><td>4</td></tr>
<tr><td>Q No.</td><td>Section-E (2 X 5 = 10 Marks)</td><td>Marks</td></tr>
<tr><td>36</td><td>Mr. Ravi, a manager at a tech company, needs to maintain records of employees. Each record should include: Employee_ID, Employee_Name, Department and Salary.
Write the Python functions to:
I. Input employee data and append it to a binary file.
II. Update the salary of employees in the "IT" department to 200000.</td><td>2+3</td></tr>
<tr><td>37</td><td>XYZNova Inc. is planning a new campus in Hyderabad while maintaining its headquarters in Bengaluru. The campus will have four buildings: HR, Finance, IT, and Logistics. As a network expert, you are tasked with proposing the best network solutions for their needs based on the following:
<table>
<tr><th>From</th><th>To</th><th>Distance (in meters)</th></tr>
<tr><td>HR</td><td>Finance</td><td>50</td></tr>
<tr><td>HR</td><td>IT</td><td>175</td></tr>
<tr><td>HR</td><td>Logistics</td><td>90</td></tr>
<tr><td>Finance</td><td>IT</td><td>60</td></tr>
<tr><td>Finance</td><td>Logistics</td><td>70</td></tr>
<tr><td>IT</td><td>Logistics</td><td>60</td></tr>
</table>
Number of Computers in Each Block:
<table>
<tr><th>Block</th><th>Number of Computers</th></tr>
<tr><td>HR</td><td>60</td></tr>
<tr><td>Finance</td><td>40</td></tr>
<tr><td>IT</td><td>90</td></tr>
</table></td><td>5</td></tr>
</table>

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

	Logistics	35	
	I. Suggest the best location for the server in the Hyderabad campus and explain your reasoning. II. Suggest the placement of the following devices: a) Repeater b) Switch III. Suggest and draw a cable layout of connections between the buildings inside the campus. IV. The organisation plans to provide a high-speed link with its head office using a wired connection. Which of the cables will be most suitable for this job? V. A. What is the use of VoIP? **OR** B. Which type of network (PAN, LAN, MAN, or WAN) will be formed while connecting the Hyderabad campus to Bengaluru Headquarters?		

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COMPUTER SCIENCE – Code No. 083
MARKING SCHEME
Class - XII - (2025-26)

Time Allowed: 3 Hrs. **Maximum Marks: 70**

General Instructions:

- This question paper contains 37 questions.
- All questions are compulsory. However, internal choices have been provided in some questions. Attempt only one of the choices in such questions.
- The paper is divided into 5 Sections- A, B, C, D and E.
- Section A consists of 21 questions (1 to 21). Each question carries 1 Mark.
- Section B consists of 7 questions (22 to 28). Each question carries 2 Marks.
- Section C consists of 3 questions (29 to 31). Each question carries 3 Marks.
- Section D consists of 4 questions (32 to 35). Each question carries 4 Marks.
- Section E consists of 2 questions (36 to 37). Each question carries 5 Marks.
- All programming questions are to be answered using Python Language only.
- In-case of MCQ, text of the correct answer should also be written.

Q No.	Section-A (21 x 1 = 21 Marks)	Marks
1	**Answer:** True **(1 mark for correct answer)**	1
2	**Answer:** c) It **(1 mark for correct answer)**	1
3	**Answer:** b) False **(1 mark for correct answer)**	1
4	**Answer:** Equi-Join or Cartesian Join **(1 mark for correct answer)**	1
5	**Answer:** a) lSf **(1 mark for correct answer)**	1
6	**Answer:** Error as unsupported operand type(s) for +: 'int' and ‘str' **(1 mark for the correct answer)**	1
7	**Answer:** -59.0 **(1 mark for the correct answer)**	1

8	**Answer:** SELECT department, COUNT(*) FROM employees GROUP BY department HAVING COUNT(*) > 5; **(1 mark for correct answer)**	1
9	**Answer:** b) Some other error! **(1 mark for correct answer)**	1
10	**Answer:** d) Not Specified **(1 mark for correct answer)**	1
11	**Answer:** a) 50@70@ **(1 mark for correct answer)**	1
12	**Answer:** c) 5@@12##12 **(1 mark for correct answer)**	1
13	**Answer:** c) Both a) & b) **(1 mark for correct answer)**	1
14	**Answer:** b) ['Watersk', '', 'ng ', 's thr', 'll', 'ng!'] **(1 mark for correct answer)**	1
15	**Answer:** a) Degree: 7 **(1 mark for correct answer)**	1
16	**Answer:** b) ALTER **(1 mark for correct answer)**	1
17	**Answer:** c) POP3 **(1 mark for correct answer)**	1
18	**Answer:** a) A hub sends data to all devices in a network, while a switch sends data to the specific device **(1 mark for correct answer)**	1

19	**Answer:** b) HTML **(1 mark for correct answer)**	1
Q20 and Q21 are Assertion(A) and Reason(R) based questions. Mark the correct choice as: a) Both A and R are True and R is the correct explanation for A. b) Both A and R are True and R is not the correct explanation for A. c) A is True but R is False. d) A is False but R is True.		
20	**Answer:** d) A is False but R is True **(1 mark for correct answer)**	1
21	**Answer:** a) Both A and R are true and R is the correct explanation for A **(1 mark for correct answer)**	1
Q No.	**Section-B (7 x 2=14 Marks)**	**Marks**

22	**Answer:**
	A. Implicit Conversion: Python automatically converts one data type to another.
	
	Example:
	x = 10
	y = 3.5
	result = x + y # x is implicitly converted to float
	Explicit Conversion: The user manually converts one data type to another using functions like int(), float().
	Example:
	x = "10"
	y = int(x) # Explicit conversion from string to integer
	
	(1 mark for correct difference)
	(1/2 mark for each correct example)
	OR
	B. Break exits the loop entirely, while continue skips the current iteration and moves to the next one.
	Example of break:
	for i in range(5):
	  if i == 2:
	  break # Exits the loop
	  print(i)
	Output:
	1
	Example of continue:
	for i in range(5):
	  if i == 2:
		2

	continue # Skips printing 2
	print(i)
	Output:
	1
	3
	4
	5
	(1 mark for correct difference)
	(1/2 mark for each correct example)	

23	**Answer:** **def** remove_first_last(str): if len(str) < 2: return str new_str = str[1:**-1**] return new_str result = remove_first_last("Hello") **print**("Resulting string: "**,** result) **(1⁄2 mark each for correcting 4 mistakes)**	2
24	**Answer:** A. I. index = review.find("good") **(1 mark for correct answer)** II. L1.sort(reverse=True) **(1 mark for correct answer)** **OR** B. ('Learn Python ', 'with', ' fun and practice') **(1 mark for correct answer)** 3 **(1 mark for correct answer)**	2

25	**Answer:**
	A.
	def remove_element(L, n):
	if n in L:
	L.remove(n)
	print(L)
	else:
	print("Element not found")
	OR
	B.
	def add_contact(phone_book, name, number):
	if name in phone_book:
	print("Contact already exists")
	else:
	phone_book[name] = number
	print("Contact added successfully")
	(1/2 mark for function definition)
	(1½ marks for the correct/similar logic)
		2

26	**Answer:** ['Arv', 'Ria'] **(2 marks for the correct output)**	2

27	**Answer:** A. I. Desc table_name; or describe table_name; II. Create database SQP; (1 mark for each correct answer.) **OR** B. The DELETE query removes all the records or specific records from a table, preserving the table structure. Example: DELETE FROM Employees WHERE EmployeeID = 5; The DROP query removes the entire table or database along with its data. Example: DROP TABLE Employees; **(1 mark for correct difference)** **(1/2 mark for each correct example)**	2
28	**Answer:** A. I. A modem is a device that helps connect your computer or other devices to the internet. It converts digital signals from your device into analog signals that can travel through phone lines or other networks, and vice versa. II. A gateway is a device that connects two different networks and helps them communicate with each other. It translates the data between different network types, allowing them to work together. **(1 mark for each correct definition)** **OR** B. I. HTTP: Hypertext Transfer Protocol and FTP: File Transfer Protocol (1/2 mark for each correct expansion.) II. A web server stores and delivers web pages to users over the internet. A web browser requests and displays these web pages on the user's device. **(1 mark for correct point of difference)**	2
Q No.	**Section-C (3 x 3 = 9 Marks)**	**Marks**

29	**Answer:**
	A.
	
	def count_python():
	count = 0
	with open("Prog.txt", 'r') as file:
	text = file.read()
	words = text.split()
	for word in words:
	if word.lower() == "python":
	count += 1
	print("The word Python appears", count, "times.")
	
	(1/2 mark for correct function header)
	(1/2 mark for correctly opening the file)
	(1/2 mark for correctly reading from the file)
	(1/2 mark for splitting the text into words)
	(1/2 mark for correct use of counter variable)
		3

	(1/2 mark for displaying the result)
	OR
	B.
	def display_non_vowel_lines():
	  with open("STORIES.TXT", "r") as file:
	  print("Lines that don't start with a vowel:")
	  lines = file.readlines()
	  for line in lines:
	  if line[0].lower() not in 'aeiou':
	  print(line)
	display_non_vowel_lines()
	(1/2 mark for correct function header)
	(1/2 mark for correctly opening the file)
	(1/2 mark for correctly reading from the file)
	(1 mark for correctly displaying the desired lines)
	(1/2 mark for correctly calling the function)	

30	**Answer:**
	I.
	L = [("Laptop", 90000), ("Mobile", 30000), ("Pen", 50), ("Headphones", 1500)]
	product = []
	def Push_element(L):
	  for i in L:
	  if i[1] > 50:
	  product.append(i)
	  print(product)
	
	II.
	def Pop_element(product):
	  while product:
	  print(product.pop())
	  else:
	  print("Stack Emply")
	
	(1½ marks for each correct part)
		3

31	**Answer:** A. QP-^14 **(3 marks for the correct output)** **OR** B. ['K', 'R'] **(3 marks for the correct output)**	3
Q No.	**Section-D (4 x 4 = 16 Marks)**	**Marks**
32	**Answer:** A. I. SELECT Product, SUM(Quantity_Sold) FROM SALES GROUP BY Product HAVING SUM(Quantity_sold) > 12; II. SELECT * FROM SALES ORDER BY Product DESC; III. SELECT DISTINCT Product FROM SALES; IV. SELECT * from SALES where Customer_Name like "%e";	4

(4 x 1 mark for each correct query)

OR

B.

I.

sales_id	customer_name	product	quantity_sold	price
S003	Michael Lee	Tablet	3	15000
S007	Mark	Tablet	5	34000

II.

sales_id	customer_name
S002	Jane Smith
S005	Emily Davis
S006	David

III.

COUNT(*)
3

IV.

AVG(price)
24500.0000

(4 x 1 mark for each correct query)

33 **Answer:** 4

I.

```
import csv
def Accept():
    product_id = input("Enter Product ID: ")
    product_name = input("Enter Product Name: ")
    quantity_sold = int(input("Enter Quantity Sold: "))
    price_per_unit = float(input("Enter Price Per Unit: "))
    with open('Sales.csv', 'a', newline='') as file:
        writer = csv.writer(file)
        writer.writerow([product_id, product_name, quantity_sold, price_per_unit])
    print("Sales record added successfully.")
```

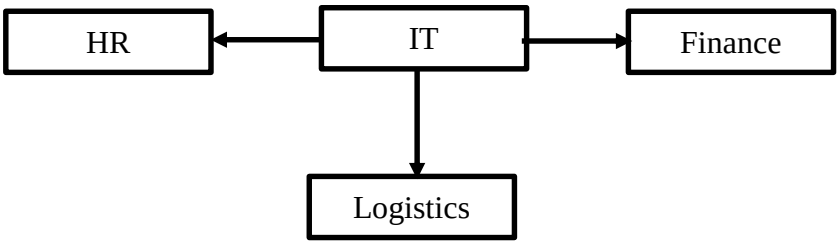
(1/2 mark for correctly taking user input)
(1/2 mark for opening the file in append mode)
(1/2 mark for correctly creating the writer object)

	(1/2 mark for correctly using writerow() of writer object)
	
	II.
	def CalculateTotalSales():
	  total_sales = 0.0
	  with open('Sales.csv', 'r') as file:
	  reader = csv.reader(file)
	  for row in reader:
	  total_sales += int(row[2]) * float(row[3])
	  print("Total Sales is:", total_sales)
	
	(1/2 mark for opening in the file in right mode)
	(1/2 mark for correctly creating the reader object)
	(1/2 mark for correctly checking the condition)
	(1/2 mark for correctly displaying the total sales)
	
	Note (for both parts (I) and (II)):
	Ignore import csv as it may be considered the part of the complete program.	

34	**Answer:** I. SELECT Customer_Name FROM Hotels, Bookings WHERE Hotels.H_ID = Bookings.H_ID AND City = 'Delhi'; II. SELECT Bookings.* FROM Hotels, Bookings WHERE Hotels.H_ID = Bookings.H_ID AND City IN ('Mumbai', 'Chennai', 'Kolkata'); III. DELETE FROM Bookings WHERE Check_In < '2024-12-03'; IV. A. SELECT * FROM Hotels, Bookings; **OR** B. SELECT Customer_Name, Hotel_Name FROM Hotels, Bookings WHERE Hotels.H_ID = Bookings.H_ID; **(4 x 1 mark for each correct query)**	4
35	**Answer:** import mysql.connector connection = mysql.connector.connect(host='localhost',user='admin_user',password='warehouse2024',database='WarehouseDB') cursor = connection.cursor() update_query = "UPDATE product_inventory SET Quantity = 91 WHERE Item_code = 208" cursor.execute(update_query) connection.commit() print("Data updated successfully.") cursor.close() connection.close() **(1/2 mark for correctly importing the connector object)** **(1/2 mark for correctly creating the connection object)** **(1/2 mark for correctly creating the cursor object)**	4

	(1 mark for correct creation of update query) **(1 mark for correctly executing the query with commit)** **(1/2 mark for correctly closing the connection)**	
Q No.	**Section-E (2 X 5 = 10 Marks)**	**Marks**

36	**Answer:**
	I.
	import pickle
	def append_data():
	  with open("emp.dat", 'ab') as file:
	  employee_id = int(input("Enter Employee ID: "))
	  employee_name = input("Enter Employee Name: ")
	  department = input("Enter Department: ")
	  salary = float(input("Enter Salary: "))
	  pickle.dump([employee_id, employee_name, department, salary], file)
	  print("Employee data appended successfully.")
	
	(1/2 mark for correctly defining the function header)
	(1/2 mark for correctly opening the file in append mode)
	(1/2 mark for correctly taking user input)
	(1/2 mark for using dump() method of the pickle module)
	
	II.
	def update_data():
	  updated = False
	  employees = []
	  with open("emp.dat", 'rb') as file:
	  try:
	  while True:
	  employee = pickle.load(file)
	  if employee[2] == "IT":
	  employee[3] = 200000
	  updated = True
	  employees.append(employee)
	  except EOFError:
	  pass
	  with open("emp.dat", 'wb') as file:
	  for employee in employees:
	  pickle.dump(employee, file)
	  if updated:
	  print("Salaries updated for IT department.")
	  else:
	  print("No employee found in the IT department.")
	
	(1/2 mark for correctly defining the function header)
	(1/2 mark for correctly opening the file)
	(1 mark for using load() with while loop and try-except block)
	(1 mark for checking the condition and updating the value)
		2+3

	Note: Note (for both parts (I) and (II)): (i) Ignore import pickle as it may be considered the part of the complete program.	
37	**Answer:** I. Block IT should house the server as it has maximum number of computers. II. a) Repeater is to be placed between Block IT to Block HR as distance between them is more than 100 metres. b) Switch is to be placed in each and every building. III. Draw the star topology cable layout.  IV. Optical Fibre V. A. Voice over Internet Protocol (VoIP) is a technology that allows users to make phone calls and other communications over the Internet instead of a traditional phone line. **OR** B. WAN will be formed. **(5 x 1 mark for each correct part)**	5

ENGLISH CORE-Code No. 301
SAMPLE QUESTION PAPER
CLASS-XII-(2025-26)

Time allowed: 3 Hrs. **Maximum Marks: 80**

General Instructions

Read the following instructions very carefully and follow them:

i. This question paper has 13 questions. All questions are compulsory.

ii. This question paper contains three sections:

Section A: Reading Skills,

Section B: Creative Writing Skills

Section C: Literature.

iii. Attempt all questions based on specific instructions for each part. Write the correct question number and part thereof in your answer sheet.

iv. Separate instructions are given with each question/part, wherever necessary.

v. Adhere to the prescribed word limit while answering the questions.

SECTION A
READING SKILLS (22 marks)

1. Read the following passages. 12

Ours was the marsh country, down by the river, within twenty miles of the sea. My first most vivid and broad impression of the identity of things seems to me to have been gained on a memorable raw afternoon towards evening. The low leaden line beyond was the river; and that the distant savage lair from which the wind was rushing was the sea; and that the small bundle of shivers growing afraid of it all and beginning to cry, was Pip.

“Hold your noise!” cried a terrible voice, as a man started up from among the graves at the side of the bushes. “Keep still, or I’ll make you pay!”

A fearful man, all in coarse grey, with a great iron on his leg. A man with no hat, and with broken shoes, and with an old rag tied round his head. A man who had been soaked in water, and smothered in mud, limped, and shivered, and glared, and growled; and whose teeth chattered in his head as he seized me.

“Tell us your name!” said the man. “Quick! Give it mouth!”

“Pip. Pip, sir.”

“Show us where you live,” said the man. “Point out the place!”

The man, after looking at me for a moment, emptied my pockets. There was nothing in them but a piece of bread which he ate ravenously.

“Now lookee here!” said the man. “Where’s your mother?”

“There, sir!” said I.

He started, made a short run, and stopped and looked over his shoulder.

“Oh!” said he, coming back. Who’s that?” he asked, pointing.

“My sister, sir, —Mrs. Joe Gargery, —wife of Joe Gargery, the blacksmith, sir.”

“Blacksmith, eh?” said he. And looked down at his leg.

After darkly looking at his leg, he came close to me, took me by both arms, and tilted me back as far as he could hold me; so that his eyes looked most powerfully down into mine, and mine looked most helplessly up into his.

“Now lookee here,” he said, “You know what a file and wittles is?”

“Yes, sir.”

After each question he tilted me over a little more, so as to give me a greater sense of helplessness and danger.

“You get me a file.” He tilted me again. “And wittles.” He tilted me again. “You bring ’em both to me.”

I was dreadfully frightened, and so giddy that I clung to him with both hands, and said, “If you would kindly please to let me keep upright, sir, perhaps I shouldn’t be sick, and perhaps I could attend more.”

He did. Then, he held me by the arms, in an upright position, and went on with his terms.

Source: Great Expectations by Charles Dickens / 448 words

Answer the following questions, based on the passage above.

I Which textual evidence tells us that Pip was trembling? 1

II Complete the following with a suitable reason. 1

The writer refers to the sea as a ‘savage lair’ in order to tell the reader that ____.

III The writer emphasises Pip’s vulnerability in all of the following ways EXCEPT — 1

A. through the description of the harsh landscape
B. via the behaviour of the frightening man
C. through Pip’s helplessness and fear
D. via Pip’s knowledge of the surrounding area

IV What type of statement is made in the phrase "Keep still, or I’ll make you pay!"? 1

A. caution
B. threat
C. prediction
D. announcement

V Based on his initial appearance, how can we say that the ‘fearful man’ was in a state of discomfort? (Any one reason) 1

VI. Which one of the following statements best explains the phrase "Give it mouth!"? 1

A) Speak loudly B) Open your mouth wide C) Answer the question

VII. The man ate the bread 'ravenously'. What does this suggest about his condition? 1

VIII What does the man’s question, “Where’s your mother?” and his reaction when Pip points to her suggest about his intentions? (Answer in about 40 words) 2

IX How does the man’s action of forcing Pip to look up at him contribute to the tension in the scene? (Answer in about 40 words) 2

X Complete the following with the most suitable option. 1

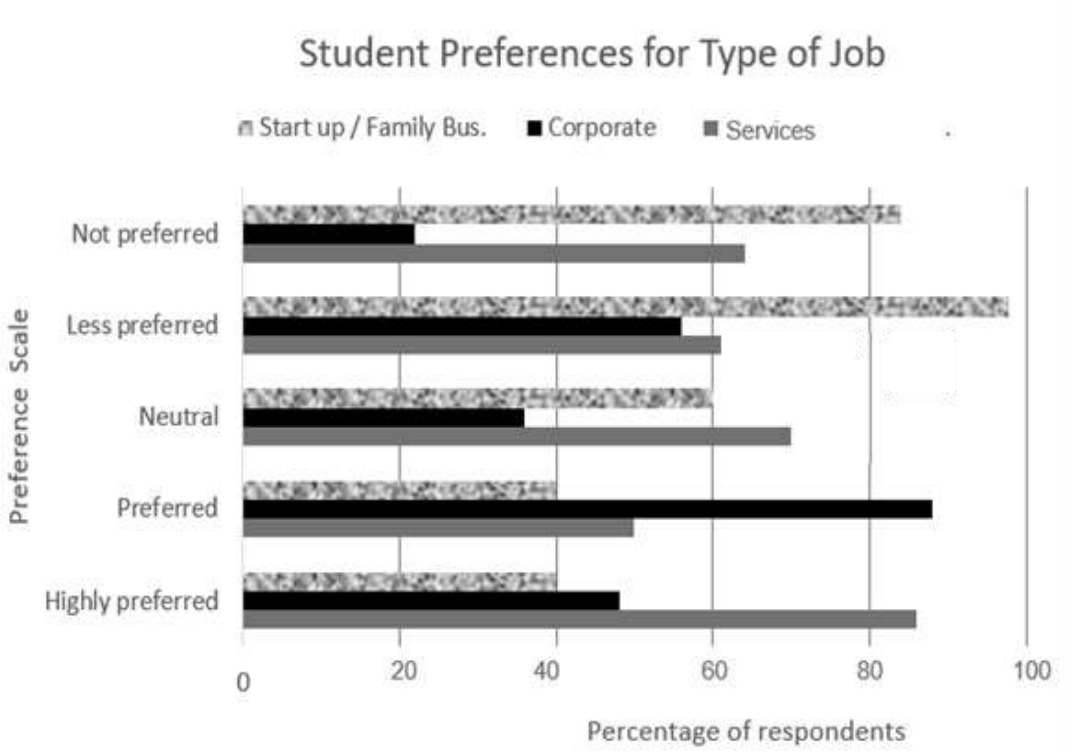
The main idea of the text is _____.

A. Pip's encounter with a frightening man who demands information
B. the harshness of Pip's environment and the fear it creates
C. Pip's struggle to understand the man’s intentions and stay calm
D. the importance of family relationships in Pip’s life

2. Read the following carefully. 10

1 A recent survey was conducted among 2,000 college students and young professionals to analyse preferences for different types of jobs, including corporate roles, personal start-ups or family businesses, and service professions (example - defense, nursing, police). The study aimed to identify trends in career aspirations, the factors influencing these preferences, and their implications for workforce planning and education systems. Participants were asked to rank their preferences on a five-point scale.

2 The study covered respondents across urban and semi-urban areas, representing diverse educational, economic, and cultural backgrounds. Researchers ensured diversity in gender, socioeconomic status, and career stages to make the findings representative of a broad spectrum of opinions. Data collection involved online questionnaires and in-person interviews, ensuring a comprehensive understanding of job preferences. The data was displayed as a bar graph given below.



3 Corporate jobs were commonly associated with financial stability, growth opportunities, and access to structured career paths. Start-ups and family businesses, on the other hand, appealed to those valuing autonomy, creativity, and the chance to work in more flexible environments. Service professions were perceived as fulfilling and prestigious, especially among individuals motivated by a sense of duty.

4 The survey also highlighted several challenges. Geographic variations were significant, with urban respondents gravitating more toward corporate roles, while semi-urban participants showed a stronger inclination for service professions and family businesses. Respondents indicated limited mentorship opportunities and a lack of clarity about the long-term prospects of non-corporate careers as barriers influencing their decisions.

5 The findings provide a foundation for further research into how cultural, regional, and generational influences shape career choices. Future studies could explore factors such as gender-based preferences, emerging industries, mentorship availability, and the role of technological advancements in shaping job markets. Additionally, longitudinal research could track how these preferences evolve as respondents advance in their careers. This could help educational institutions and employers develop tailored strategies to better align with the aspirations and values of young job seekers. Moreover, policies encouraging skill development and mentorship programmes may bridge the gaps identified in this survey, ensuring more informed career decisions among youth.

Created for academic usage / 348 words

10

Answer the following questions, based on the given passage.

I. What was the main purpose of the survey conducted among 2,000 college students and young professionals? 1

A. To determine the popularity of specific jobs in rural areas versus urban areas
B. To explore patterns in career aspirations and the factors influencing them
C. To analyse the success rate of startups and family businesses
D. To assess the salary expectations of young professionals opting for jobs

II. Fill in the blank with the correct option from those given in brackets. 1

The study ensured diversity in gender, socioeconomic status, and career stages to make the findings _____ (accurate / representative / specific).

III. Fill in the blank with reference to the given bar graph chart.

The profession preference for which policymakers primarily need to provide encouraging incentives is ____. 1

For the Visually Impaired Candidates

Complete the following suitably.

When the researcher uses the phrase 'a broad spectrum of opinions' in the line 'to make the findings representative of a broad spectrum of opinions', the researcher refers to ____. (Ref: Paragraph 2)

IV. Based on the bar graph, which of the following statements best reflects the correct trend in job preferences?

A. Corporate jobs are more in the 'Least preferred' category than service professions. 1
B. Service professions are less preferred than corporate jobs on the 'Neutral' scale.
C. Service professions have a higher percentage of respondents marking them as 'Highly Preferred' compared to corporate jobs.
D. Corporate jobs and service professions have an equal percentage of respondents marking them as 'Preferred.'

For the Visually Impaired Candidates

Why does the researcher associate start-ups and family businesses with individuals who value autonomy? (Ref: Paragraph 3)

A. They allow individuals to independently make decisions and innovate.
B. They guarantee long-term financial security and growth.
C. They require minimal risk-taking and provide fixed schedules.
D. They are managed by corporate guidelines ensuring stability.

V. Riya wishes to have a regular salary and defined growth in her career. Why is a corporate job better suited for her compared to joining a start-up or family business? 2
(Ref: Paragraphs 3 & 4)

VI. When the researcher says 'Respondents indicated limited mentorship opportunities,' what does s/he mean by 'limited mentorship opportunities'? 1

A. Lack of financial resources to hire mentors for jobs
B. Absence of training programmes in semi-urban areas
C. Reluctance of respondents to seek career advice from unknown people
D. Difficulty in finding experienced professionals to guide career paths

(Ref: Paragraph 4)

VII. How might further studies in the understanding of emerging industries and technological advancements empower youth to make well-informed career decisions? 2
(Ref: Paragraph 5)

VIII Select the option that is **NOT** addressed in this study. 1

A. The purpose of the survey
B. The impact of gender on career preferences
C. Regional and demographic variations in preferences
D. Challenges faced by respondents
E. The methodology used for data collection

SECTION B
CREATIVE WRITING SKILLS (18 marks)

All the names and addresses used in the questions are fictitious. Resemblance, if any, is purely coincidental.

3. Attempt any one of the two, (A) or (B), in about 50 words 1x4=4

A. You are Daljeet Kaur, a member of the Teen Well-Being Association, Chandigarh. The Association is planning to organise free pottery classes every Sunday morning at the community hall to encourage creativity among young residents. Write a notice in about 50 words, informing the residents of the event and inviting registrations. Include all the necessary details. Put your notice in a box.

OR

B. You are Keerthi, the Secretary of the Environmental Club of ABC School, Madurai. Your school is organising an 'Eco-Fiesta' to raise awareness about environmental issues. Draft a notice in about 50 words, inviting students to participate in various activities and setting up of food stalls. Include all the necessary details. Put your notice in a box.

4. Attempt any one of the two, (A) or (B), in about 50 words. 1x4=4

A. As the Cultural Secretary, Vignesh Kumar, of JKL School, Jamshedpur, draft an invitation for the Annual Music Festival, inviting Gajendra Hansda, an acclaimed local musician, to perform and judge the event. Provide the essential details in about 50 words.

OR

B. You are Bina Bedekar, currently residing at 45, Ashok Vihar, Nagpur. You have been invited to inaugurate a science exhibition at your alma mater, National Public School, Mumbai. Write a formal reply in about 50 words, accepting the invitation and expressing your gratitude.

5. Attempt any one of the two, (A) or (B), in 120-150 words 1x5=5

A. You are Pranab Chauhan, residing at 13-A, Gol Bazaar, Jaisalmer. Write a letter to the editor of *The Nation Today*, highlighting the need to assess sports talent at a young age by sports teachers and coaches to ensure that talent does not go unrecognised. Emphasise the importance of grooming young sportspersons to create a larger pool of talented athletes for the future. Draft the letter using your own ideas as well as the cues given.

- Spotting natural abilities during formative years.
- Building foundational skills early for long-term success.
- Instilling discipline, teamwork, and sportsmanship from a young age.
- Creating a larger pool of skilled athletes for the future.
- Building a strong sports culture and national pride.

OR

B. You are Lakshmi Kapur from 51/A, second floor, Shalimar Vihar, Delhi. You have come across the following advertisement in *The Urban Echo* for the post of a Junior Marketing Executive at a leading marketing firm. Write a letter expressing your interest in the position. Include your bio-data along with the application.

Join the Trendsetters Digital Agency

We are a leading marketing firm looking for dynamic individuals with:

- Strong communication skills
- An understanding of digital marketing
- Ability to work well in a team

Educational Requirements: Graduate in Marketing, Communication, or related field

Experience: Not mandatory, but prior exposure to digital marketing is an advantage

Interested candidates should send their applications with a resume.

Contact:

Trendsetters Digital Agency

Address: 12-B, Green Street,

New Delhi, 110001

1x5=5

6. Attempt any one of the two, (A) or (B), in 120-150 words

A. Digital communication tools have revolutionised the educational landscape. The introduction of online learning platforms, virtual classrooms, and interactive tools has made education more accessible and engaging. You are Nooran Sheikh. Write an article for the monthly magazine edition of *The Progressive Educator* and *discuss* the role of digital communication in education. Write the article using your own ideas as well as the cues given.

- Student engagement
- Accessibility of education
- Teachers and students' roles
- Learning outcomes

OR

B. The cultural festival in LMN School, Kochi, was held recently to celebrate the school's achievements. As the senior editorial board member, Devaki Fernandes, write this report for the school magazine detailing various aspects of the festival. Write the report using your own ideas as well as the cues given.

- Organisation and significance
- Performances and exhibition
- Participant engagement
- Overall success.

SECTION C
LITERATURE (40 marks)

7. Read the following extracts and solve ANY ONE of the given two, (A) or (B). 1x6=6

A … I saw my mother,
beside me,
doze, open mouthed, her face
ashen like that
of a corpse and realised with
pain
that she was as old as she
looked but soon
put that thought away, and
looked out at Young Trees sprinting, the merry children spilling
out of their homes…

(My Mother at Sixty-six)

I. What does the imagery of the ‘ashen face’ of the mother suggest about her physical condition? 1

II. Complete the following with the correct option. 1

The speaker’s use of the word 'realised' suggests that her awareness was _____ (delayed / expected / sudden).

III. How does the phrase ‘merry children spilling out of their homes’ contribute to the tone of the passage? 1

IV. Complete the sentence by filling in the blank with a suitable phrase. 1

The primary theme highlighted in the extract is the _____ , as the narrator reflects on her mother’s frailty and aging.

V. What can be inferred about the emotional state of the speaker in the extract? 1

a) Distracted by the liveliness of the surroundings
b) Concerned about her mother’s discomfort
c) Overwhelmed by a sense of anguish
d) Preoccupied with thoughts about life experiences

VI. All of the following are true for the extract EXCEPT – 1

a) The comparison to a ‘corpse’ highlights the speaker’s fear of losing her mother.
b) The poet makes exclusive use of melancholic imagery in the given lines.
c) The speaker’s internal conflict creates a relatable portrayal of human relationships.
d) The universality of themes makes the lines relevant to the readers.

OR

B When Aunt is dead, her terrified hands will lie
Still ringed with ordeals she was mastered by.
The tigers in the panel that she made
Will go on prancing, proud and unafraid (Aunt Jennifer’s Tigers)

I What does the phrase ‘terrified hands’ suggest about Aunt’s life? 1

II Complete the following suitably. 1

The tigers’ proud and playful movements reflect _____.

III Examine briefly how the tigers in the panel contrast with Aunt’s life experiences. 1

IV. Fill in the blank with the correct option from those given in the brackets. 1

The phrase ‘still ringed’ refers to both the literal _____ (shape of the embroidery panel / wedding band on her finger) and the figurative ‘ring’ of constraints and ordeals imposed by her marriage.

V. If a student were to interpret the word 'prancing' in a real-world context, which of the following would it best represent? 1

a) An employee working under the pressure of deadlines.
b) A soldier standing firm and ready for battle at the frontier.
c) A child playing freely in a park, unburdened by responsibilities.
d) A bird trapped in a cage, longing to be free and fly high.

VI. What does the poet imply about the art in the line 'The tigers in the panel that she made will go on prancing'? 1

a) Art is a timeless expression that outlives its creator, continuing to embody their spirit and desires.
b) The tigers symbolise Aunt Jennifer's fleeting empowerment, which will fade over time.
c) The panel is a temporary escape for Aunt Jennifer, offering solace only during her lifetime.
d) The permanence of the tigers in the panel contrasts with the transient nature of Aunt Jennifer's struggles.

8. Read the following extracts and solve ANY ONE of the given two, (A) or (B). 4x1=4

A. My three hundred dollars bought less than two hundred in old-style bills, but I didn't care; eggs were thirteen cents a dozen in 1894.
But I've never again found the corridor that leads to the third level at Grand Central Station, although I've tried often enough. Louisa was pretty worried when I told her all this, and didn't want me to look for the third level any more, and after a while I stopped; I went back to my stamps. But now we're both looking, every weekend…

(The Third Level)

I. What does Charley's indifference to the cost of old-style bills and his focus on the price of eggs in 1894 suggest about his view of the past? 1

II. Complete the sentence suitably. 1

Charley has been unsuccessful in finding the corridor to the third level despite ____.

III. Where is the irony in Louisa's reaction to Charley's search for the third level in this extract? 1

IV. Complete the following with a correct option based on the context in the extract. 1
The phrase 'I went back to my stamps' suggests _____.

a) finding comfort in a hobby that is familiar
b) choosing a new hobby to forget earlier pursuits
c) attempting to engage together in a new hobby
d) approaching a familiar hobby with enthusiasm

OR

B. Derry: What they think.

Mr Lamb: What do they think, then?

Derry: You think.... 'Here's a boy.' You look at me...and then you see my face and you think. 'That's bad. That's a terrible thing. That's the ugliest thing I ever saw.' You think, 'Poor boy.' But I'm not. Not poor. Underneath, you are afraid. Anybody would be. I am. When I look in the mirror, and see it, I'm afraid of me.

Mr Lamb: No, Not the whole of you. Not of you.

Derry: Yes!

[Pause] (On the Face of It)

I. What does Mr. Lamb mean when he says, "No. Not the whole of you. Not of you"? 1

II. What might Derry be thinking during the pause after he insists, "Yes!"? 1

Choose the most appropriate option:

A. "Why doesn't he understand me?"

B. "He's pretending to care like everyone else."

C. "Maybe he really sees more than just my face."

D. "I should leave. He doesn't get it."

III. Fill in the blank with a suitable word: 1

Mr. Lamb's response suggests that he sees Derry's face as only one _____ of who he is.

IV. What does this exchange reveal about the emotional distance Derry feels and Mr. Lamb's attempt to bridge it? 1

9. Read the following extracts and solve ANY ONE of the given two, (A) or (B). 1x6=6

A. She said this in such a friendly manner that the rattrap peddler must have felt confidence in her.
'It would never have occurred to me that you would bother with me yourself, miss,' he said. 'I will come at once.'
He accepted the fur coat, which the valet handed him with a deep bow, threw it over his rags, and followed the young lady out to the carriage, without granting the astonished blacksmiths so much as a glance.
But while he was riding up to the manor house he had evil forebodings.
"Why the devil did I take that fellow's money?" he thought. "Now I am sitting in the trap and will never get out of it."

(The Rattrap)

I. Which of the following best reflect the 'friendly manner' Edla exhibits toward the rattrap peddler as referred to in the extract? 1

1. Pay a compliment
2. Show kindness
3. Provide financial support
4. Be respectful
5. Speak in an excited tone

Select the most suitable option.

A. 1 and 5
B. 2 and 4
C. 1, 2 and 3
D. 3, 4 and 5

II. Fill in the blank with a correct option from those given in the brackets, based on the information in the extract. 1

The peddler threw the fur coat over his rags and followed Edla out to the carriage, _____ (enthusiastically / silently / reluctantly).

III. How did the peddler feel toward Edla after accepting the fur coat and making his statement? 1

A. He decided to humour her gesture.
B. He felt obligated to trust her kindness.
C. He remained unsure about her true intentions.
D. He recognised and appreciated her compassion.

IV. What might have been the most likely reason the blacksmiths were astonished when the peddler accepted the coat and left with Edla? 1

V. Justify that guilt was the primary cause of the peddler's sense of evil foreboding, based on the information in the extract? 1

VI. Complete the following suitably. 1

When the peddler says, "…I will never get out," his statement stems from his guilt over stealing ‘that fellow’s’ money and his fear that _____ .

OR

B. “She thinks money grows on trees, don’t she, Dad?”, said little Derek, hanging on the back of his father’s chair.
Their mother sighed. Sophie watched her back stooped over the sink and wondered at the incongruity of the delicate bow which fastened her apron strings. The delicate-seeming bow and the crooked back.
The evening had already blacked in the windows and the small room was steamy from the stove and cluttered with the heavy-breathing man in his vest at the table and the dirty washing piled up in the corner. Sophie felt a tightening in her throat. She went to look for her brother Geoff.

(Going Places)

I. Fill in the blank by choosing the correct option from those given in the brackets. 1

The literal meaning conveyed via the phrase ‘the evening had already blacked in the windows’ is the_____ (arrival of night / shadow over ambitions).

II. What was mother most likely thinking when she sighed? 1

1. "Life would have been different if money did grow on trees!"
2. "I wish he would stop troubling my dear Sophie."
3. "We can only wish; we’ve never had enough anyway."
4. "I’m too tired to respond to such comments anymore."
5. "Our struggles will never end; no matter what Sophie dreams of."

Select the most suitable option.

A. 1, 3 and 5
B. 2, 4 and 5
C. 1 and 4
D. 2 and 3

III. The delicate bow on Sophie’s mother’s apron and her crooked back highlights the theme of _____. 1

A. appearance vs. reality
B. resilience through hardship
C. the fragility of youth
D. the complexity of familial love

IV. The line from the extract that correctly captures Sophie’s emotional response to the contrast between her dreams and the limitations of her current circumstances is ‘_____.’ 1

V. What does the writer emphasise by associating the term ‘cluttered’ with ‘heavy breathing’? 1

VI. How does the setting of the room contribute to the mood of the extract? 1

10. **Answer any five of the following six questions in 40 50 words each :** 5x2=10

I. What role does the French language played in 'The Last Lesson', in the context of the narrator's feelings towards it? 2

II. What lesson can individuals learn from Douglas's experience in overcoming his fear of water? (Deep Water) 2

III. Based on what Keats' suggests in 'A Thing of Beauty,' how can recognising the lasting value of beauty help someone in the real world cope with challenges or difficulties? 2

IV. What does the reference to fishermen not harming whales and the man gathering salt looking at his hurt hands signify in the poem? (Keeping Quiet) 2

V. How does Rudyard Kipling's refusal to be interviewed point towards the intrusive and unwelcome nature of interviews? (The Interview I & II) 2

VI What is the significance of a narrator in 'Lost Spring' as opposed to a plain narrative? 2

11. **Answer any two of the following three questions in 40 -50 words each :** 2x2=4

I. How can participating in educational programmes like 'Students on Ice', which take students to places like Antarctica, help raise awareness about the impact of geological changes and environmental issues? (Journey to the End of the Earth) 2

II. What does Zitkala-Sa's description of being 'tossed about in the air like a wooden puppet' reveal about her feelings of powerlessness and cultural displacement? (The Memories of Childhood: The Cutting of My Long Hair) 2

III. What does Derry's remark, "Think, you might have been blinded, or born deaf, or have to live in a wheelchair...," reveal about his perspective on how people console others? (On the Face of It) 2

12. **Answer any one of the following two questions, in about 120-150 words.** 1x5=5

A How do 'Indigo' by Louis Fischer and 'The Roadside Stand' by Robert Frost, highlight the theme of exploitation, and what similarities do they reveal about the plight of marginalised communities?

OR

B How can the character of the office boy in 'Poets and Pancakes,' who harbours dreams, be compared to Sophie from 'Going Places,' who is quite aspirational? Consider their ambitions and the obstacles they face in their respective

environments.

13. Answer any one of the following two questions, in about 120-150 words 1x5=5

A Justify how Sadao's character arc is more central to the moral dilemma in the 'The Enemy' as opposed to Hana's.

OR

B Analyse how the narrative technique used in 'The Tiger King', enhances the impact of the story on the reader.

ENGLISH CORE -Code No. 301
MARKING SCHEME
CLASS-XII-(2025-26)

General Instructions: -

1. The Marking Scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, then due marks should be awarded accordingly.
2. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".
3. If more than one option is mentioned in the answer of multiple choice questions, then no marks to be awarded.

	SECTION A: READING SKILLS (22 marks)	
1. Answer the following questions, based on the passage above. (Literary Passage**)**		**12**
I	'...the small bundle of shivers growing afraid of it all...'	**1**
II	…that the sea is a wild, untamed, and menacing force / contribute to the ominous atmosphere of the scene / amplifying the sense of danger that Pip feels	**1**
III	D) Pip's knowledge of the surrounding area [a) speaks of a scene in a place that feels cold, oppressive, and dangerous, which heightens Pip's sense of fear and helplessness. b) creates a feeling of menace due to the man's appearance, reinforcing Pip's fear and powerlessness in the situation. c) shows his terror and helplessness. d) is the Key because it refers to qualities that would imply Pip is capable and confident, which contradicts the idea of vulnerability.]	**1**
IV	B) threat [caution would be advice; prediction would involve stating what will happen in the future and an announcement would be a formal declaration. The Key is b) 'threat' as it directly communicates a potential consequence of harm or punishment.]	**1**
V	(Any one) ▪ Being soaked in water and smothered in mud, which are physical conditions that typically cause discomfort) ▪ Limping, which indicates possible injury or physical strain, contributing to discomfort. ▪ Shivering and teeth chattering, which suggests cold or nervousness, both of which are associated with discomfort.	**1**
VI	C) Answer the question [The phrase is not specifically asking for increased volume or referring to a physical action like opening the mouth. The phrase is urging Pip to give a verbal response.]	**1**

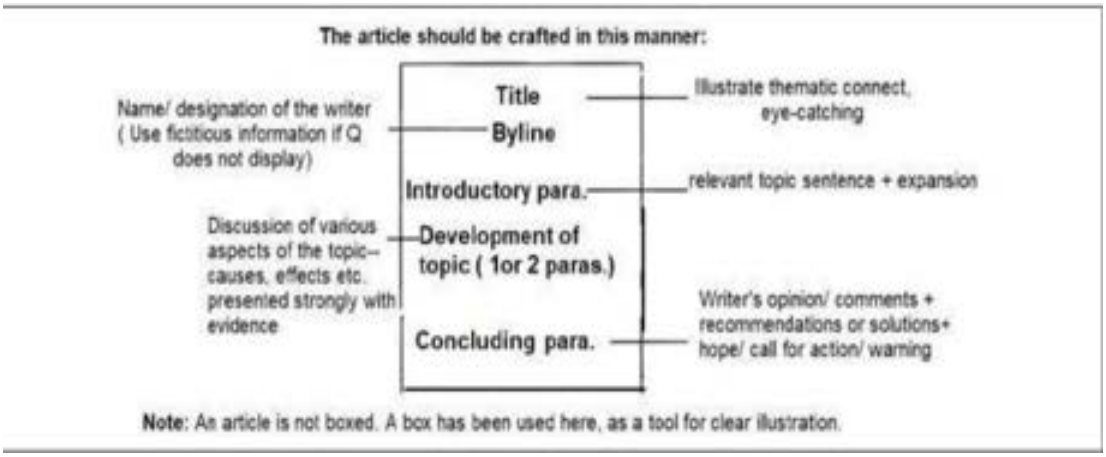
VII	It suggests that the man was extremely hungry.	**1**
VIII	It suggests that he is trying to gather information about Pip's family. When he asks about Pip's mother and looks over his shoulder, it shows he is possibly evaluating his surroundings or considering where Pip's family might be, perhaps to assess if anyone is around to stop him and contemplating the best way to proceed without interference.	**2**
IX	It increases the tension by emphasising the power dynamic between them. Pip is physically tilted backward, which makes him feel small and defenseless. This action not only makes Pip vulnerable but also intensifies the fear he feels. The man's control over Pip's position enhances the sense of intimidation, creating a more fearful and uneasy atmosphere in the scene.	**2**
X	A) Pip's encounter with a frightening man who demands information [a) directly addresses the core of the scene, where the man's aggressive behavior and questioning of Pip create tension and fear. b), though relevant to the setting, is more of a background detail than the main focus. c) could have been possible, but it is more of an internal reaction of Pip rather than the central idea of the extract. d), doesn't capture the primary conflict of the scene and the family context is just briefly mentioned.]	**1**
2.	**Answer the following questions, based on given passage.**	**10**
I	B) To explore patterns in career aspirations and the factors influencing them	**1**
II	Representative	**1**
III	Start-ups/Family Business	**1**
	For the Visually Impaired Candidates	
	…capturing diverse perspectives from individuals of varying genders, socio-economic statuses, educational backgrounds, and career stages.	**1**
IV	C) Service professions have a higher percentage of respondents marking them as 'Highly Preferred' compared to corporate jobs.	**1**
	For the Visually Impaired Candidates	
	A) They allow individuals to independently make decisions and innovate.	**1**
V	A corporate job is better suited for Riya because it provides financial stability through a steady salary and offers structured career paths with clear opportunities for growth. Start-ups, on the other hand, often involve higher risks, irregular income, and less defined progression, which may not align with her preference for stability and predictability. (Response requires reason for corporate job -1 m + reason why start-up / family business is unsuitable- 1 m)	**2**
VI	D) Difficulty in finding experienced professionals to guide career paths	**1**
VII	Further studies on emerging industries would provide insights into new and evolving career opportunities, helping youth align their aspirations with market demands. Research on technological advancements could highlight tools like virtual training platforms, AI-driven career guidance, and remote work technologies, making career resources more accessible. (Response requires explanation for emerging industries -1 m + technological advancements - 1 m)	**2**

VIII	b) The impact of gender on career preferences	**1**
SECTION B-CREATIVE WRITING SKILLS (18 marks)		
3.	▪ Format :1 Box, name of issuing authority- organisation/ agency (top centre), NOTICE (centre), date of issue (aligned left) Authorisation name, designation & signature (bottom left) NOTE-full credit if all aspects included. Partial credit (½ mark) if one-two aspects are missing. No credit if more than two aspects are missing. ▪ Content: 2 ▪ Accuracy of Spelling and Grammar: 1	4
4.	Format – 1 Content -2 Accuracy of spelling and grammar -1 A-(Letter type formal / third person) B-(Letter type formal, first/ third person)	4
5.	A. Letter to the Editor ▪ Format: 1 (Note -use of 'Yours truly' at close) ▪ Organisation of Ideas: 1 ▪ Content: 2 As per cues + ideas ▪ Accuracy of Spelling and Grammar :1 B. Job Application ▪ Format: 1 ▪ Organisation of Ideas: 1 ▪ Content: 2 → Covering Letter • Reference to the advertisement • Conveying suitability for the position (as advertised) • Submission of application → Bio data as separate enclosure • Profile of self • Educational Qualifications (include advertised requirements) • Work experience/s (if relevant) • References • Any other relevant information ▪ Accuracy of Spelling and Grammar :1	5
6.	Format: 1 Organisation of Ideas: 1 Content: 2 Accuracy of Spelling and Grammar :1	

Article Writing

Format
• Title & By line

Organisation & Content:

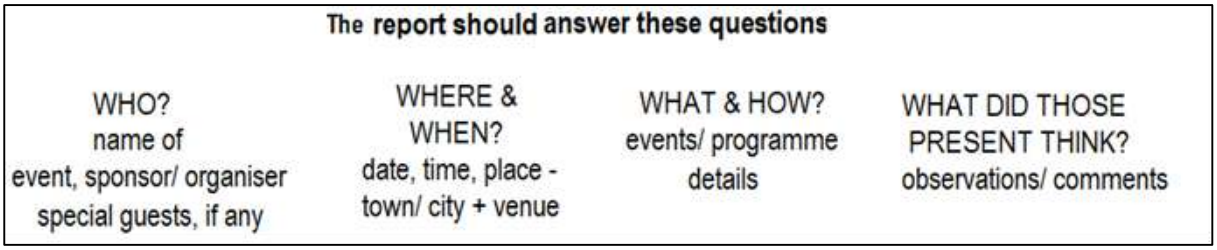


Report Writing

Format
- Headline & By line
- Reporting place and date

Paragraphing organisation (Introductory paragraph + one or two Body paragraphs including event details + Concluding paragraph inclusive of witness accounts)

Organisation & Content:



	SECTION C-LITERATURE (40 marks)	
7	**Read the following extracts and solve ANY ONE of the given two, (A) or (B)**	**6**
A		
I	(Any two) she is frail, aged, in a declining physical condition, vulnerable, weakening health, lacks vitality	**1**
II	sudden	**1**

III	It introduces a contrast of vitality, joy and exuberance against the sombre and reflective mood created by the imagery of the mother's frailty.	**1**
IV	(Any one) certainty of mortality / inevitability of death / transient nature of life	**1**
V	C) Overwhelmed by a sense of anguish	**1**
VI	B) The poet makes exclusive use of melancholic imagery in the given lines. [a) True: The 'ashen face' compared to a 'corpse' suggests the speaker's fear of mortality and loss. b) False: While melancholic imagery ('ashen face' etc.) is present, the poet also uses vibrant imagery ('young trees sprinting' and 'merry children spilling') to create a contrast. Thus, melancholic imagery is not used exclusively. c) True: The internal conflict of hiding her sadness resonates deeply with human relationships. d) True: Universal themes such as aging, mortality, and the passage of time make the extract relatable to readers.]	**1**
	OR	
B		
I	The phrase suggests that Aunt's life has been filled with struggles shaped by fear, anxiety, and oppression / The phrase signifies her emotional and psychological state, shaped by years of fear and oppression	**1**
II	…the enduring power of Aunt Jennifer's creative spirit, even after her death	**1**
III	The tigers in the panel are bold, fearless, and free, symbolising strength, courage, and confidence. In contrast, Aunt's life is marked by fear, struggle, and oppression, which prevents her from living with the same power and freedom that her tigers represent.	**1**
IV	wedding band on her finger	**1**
V	C) A child playing freely in a park, unburdened by responsibilities.	**1**
VI	B) Art is a timeless expression that outlives its creator, continuing to embody their spirit and desires. [a) is correct because the poet prevails upon the enduring nature of art in this line, as the tigers, symbolising fearlessness and freedom, will persist even after Aunt Jennifer's death. This highlights how art immortalises the creator's emotions, aspirations, and essence, transcending the limitations and constraints of their mortal life. Option b) - d) incorrectly focus on the transience of art or misinterpret the tigers' symbolism.]	**1**
8.	**Read the following extracts and solve ANY ONE of the given two, (A) or (B)**	**4**
A.		
I	Charley's indifference to the cost of old-style bills and his focus on the cheap price of eggs in 1894 shows that he values the simplicity and affordability of the past, where things were less expensive and more relaxed.	**1**
II	frequent efforts at locating it	**1**

III	The irony lies in the fact that Louisa initially worries and urges Charley to stop searching for the third level, but later, both of them end up looking for it together every weekend. [Her initial worry about Charley's obsession with the third level contrasts with her eventual participation in the same quest, which creates an ironic shift in her behaviour]	**1**
IV	a) finding comfort in a hobby that is familiar	**1**
B		
I	Mr. Lamb means that Derry's appearance is not his whole identity. He sees beyond the scarred face to the person within and wants Derry to understand that he is more than what people see on the surface.	**1**
II	Correct option: c) "Maybe he really sees more than just my face." The pause suggests Derry is processing Mr. Lamb's words, possibly reconsidering his belief that no one sees beyond his disfigurement.	**1**
III	Mr. Lamb's response suggests that he sees Derry's face as only one aspect of who he is.	**1**
IV	The exchange reveals that Derry feels deeply misunderstood and defined by his appearance, while Mr. Lamb tries to connect with him on a human level by challenging Derry's belief that no one can see beyond his scar.	**1**
9.	**Read the following extracts and solve ANY ONE of the given two, (A) or (B)**	**6**
A		
I	B) 2 and 4 [b) is correct because Edla's entire demeanor toward the rattrap peddler is built on kindness (2) and she does not look down on him despite his being a vagabond, treating him with respect (4). Her tone is formal not casual / excited (5) , doesn't offer money(3) and there is no evidence of any compliment paid (1) hence a) , c) and d) are incorrect.]	**1**
II	silently	**1**
III	D) He recognised and appreciated her compassion. (This shows genuine appreciation and trust, not just politeness or obligation. His willingness to go with her and accept the fur coat without resistance indicates that he feels seen and valued—something he likely hasn't experienced in a long time.) (a) implies insincerity, which isn't supported by the extract ; (b) The extract doesn't suggest obligation; his response feels voluntary. (c) There is no sign of doubt or suspicion in his words or actions at that moment.	**1**
IV	Because the peddler, a poor vagabond in rags, was treated with respect and generosity by Edla, which was an unusual gesture of kindness for someone of his status.	**1**
V	Because his thoughts explicitly reveal regret and anxiety about stealing the 'fellow's' money / show that his guilt over the theft is weighing heavily on him This self-awareness and fear of being caught clearly stem from his guilt, making it the primary driver of his forebodings.	**1**
VI	…Edla's kindness and the situation at the manor house might lead to his exposure as a thief	**1**

B		
I	arrival of the night	**1**
II	A) 1, 3 and 5 [Option a) is correct because (1) aligns with the tone of resignation and wistfulness in the mother's sigh. (3) is a direct reflection of their financial hardships. The mother's sigh likely conveys her acceptance of the reality that money has always been scarce for their family. (5) mother's awareness of the impracticality of Sophie's grand dreams given their circumstances. (2) doesn't fit as the context does not indicate the mother perceives Derek's remark as 'troubling Sophie.' (4) suggests irritation or fatigue but mother's sigh in this context appears more reflective of their financial struggles and her resignation]	**1**
III	A) appearance vs. reality [The delicate bow on Sophie's mother's apron symbolises grace and beauty, whereas her crooked back represents the harsh realities of her life, such as physical toil and hardship.]	**1**
IV	Sophie felt a tightening in her throat.	**1**
V	The writer emphasises the oppressive and suffocating environment of Sophie's household. The heavy breathing of her father is not just a physical sound but a metaphorical representation of the overwhelming weight of fatigue, labour, and monotony that dominates their lives. [The word 'cluttered' conveys a sense of overcrowding and disorder, suggesting that even intangible elements like exhaustion and hardship fill and overwhelm the small, confined space of their home.]	**1**
VI	The setting of the room, which is cluttered and steamy from the stove, creates a sense of discomfort and hardship. This contributes to the mood of weariness and tension in the family's daily life, which Sophie is acutely aware of.	**1**
10.	**Answer ANY FIVE of the following six questions in 40 50 words each:** **1 -Content 1- Expression ½ -1 deducted from overall, for Accuracy**	**5 x 2 = 10**
I	The narrator's feelings towards the French language shift from indifference to deep appreciation and respect when it is no longer allowed to be taught. Also, French, in the story, symbolises the loss of freedom and the imposition of foreign control over the region. Therefore, the narrator's sense of loss and regret reflects the emotional impact of this change.	**2**
II	Individuals can learn that fear can be overcome through perseverance, determination, and gradual exposure to the source of fear. Douglas's experience teaches that facing challenges step by step, with proper guidance and practice, allows one to conquer even the most deep-seated fears, leading to personal growth and freedom.	**2**

III	Keats portrays beauty as something that 'will never pass into nothingness,' implying that, unlike fleeting material comforts, beauty offers lasting emotional and psychological support. In the real world, during times of hardship, turning to the enduring beauty of nature, art, or meaningful experiences can provide a sense of peace and restoration OR Just as Keats speaks of beauty creating a 'bower quiet' and offering 'sweet dreams,' recognising beauty in our surroundings or lives can act as a refuge from stress, offering perspective and a sense of tranquility. This connection with beauty can help shift focus from negativity and provide hope, strength, and a reminder that there is always something uplifting to turn to, even in the toughest times.	**2**
IV	The reference signifies a pause in exploitative and destructive human activities. It reflects the poet's call for introspection and awareness of the harm humans cause to nature and themselves. By pausing, the fishermen and the salt gatherer are shown as reconnecting with their humanity and reflecting on their actions.	**2**
V	Kipling's refusal highlights the invasion of privacy that often accompanies public life. The refusal shows that the value of an individual's work or thoughts should not be reduced to a commercial or public spectacle. Kipling's stance emphasises the discomfort and control that is often stripped away during the process of an interview.	**2**
VI	The narrator in Lost Spring adds depth and empathy, offering critical insights into Saheb and Mukesh's struggles within systemic poverty. Unlike a plain narrative, the narrator reflects on social inequalities and privileges, making readers more emotionally engaged. Her observations contextualise the boys' lives within broader social issues, urging reflection and creating a more impactful critique of injustice.	**2**
11.	**Answer ANY TWO of the following three questions in 40 50 words each.** **1 -Content 1- Expression ½ -1 deducted from overall, for Accuracy**	**2 x 2 =4**
I	Programmes like 'Students on Ice' provide hands-on experiences, allowing students to witness environmental changes firsthand. This immersive learning fosters a deeper understanding of geological shifts and the importance of addressing climate change, encouraging informed action and advocacy for the planet's future. It also inspires a sense of responsibility in young people to actively contribute to sustainability and environmental conservation.	**2**
II	The comparison to a puppet suggests that she is being manipulated by external forces, unable to act according to her own will. This metaphor point towards her feelings of being dehumanised and treated like an object rather than a person with free will. It also reflects the broader theme of cultural displacement, as she is forced into an environment where her Native American identity is undermined, and she must comply with the rigid rules of the boarding school.	**2**
III	This remark reflects Derry's frustration with the way people console others by comparing struggles. He feels such comparisons dismiss his pain, highlighting his sensitivity and resentment toward invalidating his personal experiences. It shows his	**2**

	desire to be understood for his individual challenges rather than being generalised or pitied.	
12.	**Answer ANY ONE of the following two questions, in about 120-150 words.** **Content 2 Expression 2 Accuracy 1**	

A.

While 'Indigo' delves into the economic and systemic oppression of sharecroppers by British landlords, 'The Roadside Stand' highlights the plight of rural people exploited by urban elites and a neglectful system. Both works emphasise the imbalance of power and the struggles of those at the bottom of the societal hierarchy.

In 'Indigo', the exploitation of Champaran's peasants is evident in the oppressive sharecropping system, where British landlords forced them to grow indigo on a portion of their land and unfairly profited from it. Similarly, 'The Roadside Stand' portrays a countryside inhabitant selling their goods by the roadside, hoping for a fair chance at economic survival. Their disappointment reflects the false promises of development, as urban buyers and authorities fail to address their needs, leaving them trapped in poverty.

Both texts reveal a shared truth—exploitation persists when power dynamics remain unchecked, and progress often bypasses those who need it most. While Gandhi's efforts in 'Indigo' offer a path of hope through resistance, Frost's poem serves as a poignant reminder of the ongoing neglect faced by rural communities. Together, they highlight the importance of empathy, equity, and advocacy in combating exploitation.

B·

In both 'Poets and Pancakes' and 'Going Places', the characters of the office boy and Sophie share common traits of ambition and dreams that surpass their immediate realities.

The office boy, like Sophie, dreams of achieving something greater—he aspires to be a star actor, director, or writer, but is stuck in a subordinate role in the make-up department. Similarly, Sophie dreams of running a boutique or becoming an actress, yet is constrained by financial limitations and family's expectations. Both characters, despite their seemingly humble positions, hold onto lofty dreams that offer them an escape from their current circumstances.

However, while Sophie is often dismissive of the practicality of her ambitions, focusing instead on grand ideals, the office boy seems more realistic in his understanding of the obstacles he faces, despite his unfulfilled aspirations.

Both characters represent dreams and ambitions constrained by their environments. While their pursuits are met with limitations, they reflect the universal desire to transcend one's current situation and achieve something greater.

13.	**Answer any one of the following two questions, in about 120-150 words.** **Content 2 Expression 2 Accuracy 1**	**1 x 5 =5**

A·

Sadao's character arc in 'The Enemy' is central to the moral dilemma of the story. Initially, Sadao is deeply loyal to his country and driven by a sense of patriotism, yet he is a doctor sworn to

preserve life. When the American prisoner washes ashore, Sadao's internal conflict emerges—should he help an enemy soldier, risking his own safety, or adhere to his nationalistic duty.
As the story progresses, Sadao's arc moves from hesitation and reluctant duty to genuine compassion for the soldier. He goes beyond his initial patriotic impulses, deciding to save the life of the wounded man, showing his internal growth and moral courage. His arc symbolises the triumph of humanity over nationalism, as he eventually values the life of an individual over political allegiances.
In contrast, Hana's transformation is subtler. While she starts with fear and repulsion, her compassion grows, but she does not undergo the same profound transformation as Sadao. Her evolution is more passive, as she supports her husband's decision rather than leading it.
Thus, Sadao's arc is more central to the story's moral conflict.

B.

The satirical tone is central to the narrative, as Kalki uses humour and irony to critique the Maharaja's blind obsession with fulfilling a prophecy. Through exaggerated events, such as the Maharaja's declaration to kill 100 tigers or the astrologer's dramatic predictions, the narrative highlights the absurdity of human arrogance and misplaced priorities.
The detached third-person omniscient narrator adds to this effect, providing sardonic commentary on the Maharaja's actions, which invites readers to critically evaluate his decisions rather than empathise with him.
The use of foreshadowing and dramatic irony keeps the reader engaged. The prophecy of the 100th tiger causing the Maharaja's death looms over the narrative, creating anticipation and humour as the Maharaja ironically believes he can outwit fate.
The ultimate twist, where a wooden tiger indirectly causes his death, adds a layer of poignant irony.
Additionally, Kalki critiques human folly and power through the dialogues, hyperbole, and absurdities of the plot, leaving readers entertained yet reflective.

MATHEMATICS – Code No. 041
SAMPLE QUESTION PAPER
CLASS - XII (2025-26)

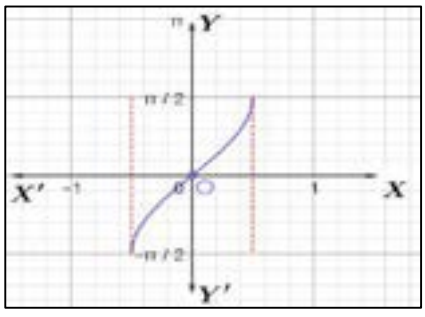
Maximum Marks: 80 **Time: 3 hours**

General Instructions:

Read the following instructions very carefully and strictly follow them:

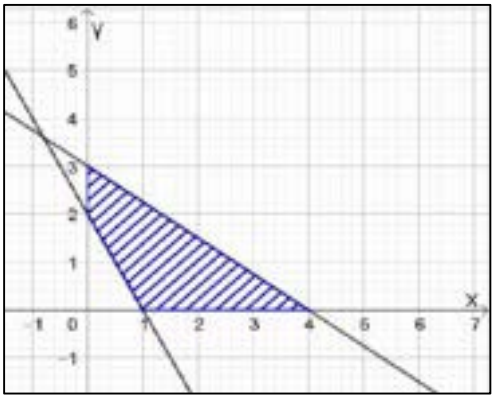
1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) with only one correct option and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.
9. Use of calculator is not allowed.

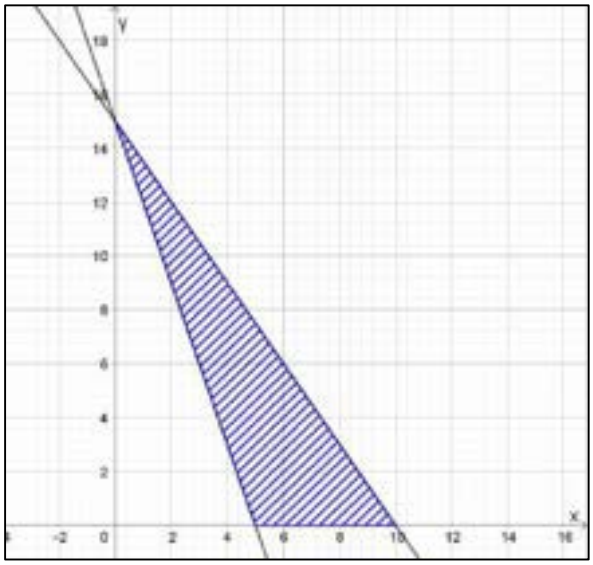
SECTION-A
This section comprises of multiple choice questions (MCQs) of 1 mark each.
Select the correct option (Question 1 - Question 18)

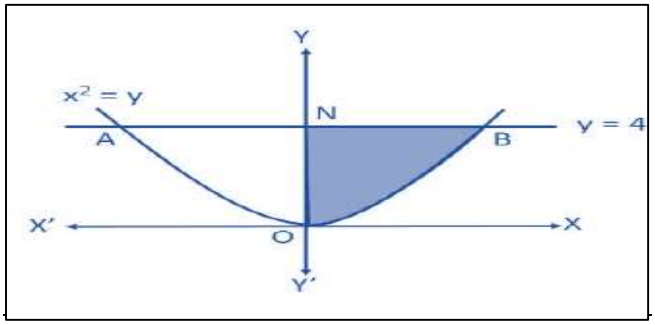
Q.No.	Questions	Marks
1.	Identify the function shown in the graph  (A) $\sin^{-1} x$ (B) $\sin^{-1}(2x)$ (C) $\sin^{-1}\left(\frac{x}{2}\right)$ (D) $2\sin^{-1} x$	**1**
	For Visually Impaired:	
1.	Inverse Trigonometric Function, whose domain is $\left[-\frac{1}{3}, \frac{1}{3}\right]$, is ...	
	(A) $\cos^{-1} x$ (B) $\cos^{-1}\left(\frac{x}{3}\right)$	
	(C) $\cos^{-1}(3x)$ (D) $3\cos^{-1} x$	

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

2.	If for three matrices $A = [a_{ij}]_{m\times 4}$, $B = [b_{ij}]_{n\times 3}$ and $C = [c_{ij}]_{p\times q}$ products AB and AC both are defined and are square matrices of same order, then value of m, n, p and q are: (A) $m = q = 3$ $and\, n = p = 4$ (B) $m = 2, q = 3$ $and\, n = p = 4$ (C) $m = q = 4$ $and\, n = p = 3$ (D) $m = 4, p = 2$ $and\, n = q = 3$	1
3.	If the matrix $A = \begin{bmatrix} 0 & r & -2 \\ 3 & p & t \\ q & -4 & 0 \end{bmatrix}$ is skew-symmetric, then value of $\frac{q+t}{p+r}$ is…. (A)-2 (B) 0 (C) 1 (D) 2	1
4.	If A is a square matrix of order 4 and $\lvert adj\ A\rvert = 27$, then $A\ (adj\ A)$ is equal to (A) 3 (B) 9 (C) 3 I (D) 9 I	1
5.	The inverse of the matrix $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is… (A) $\begin{bmatrix} 0 & 0 & 3 \\ 0 & 2 & 0 \\ 5 & 0 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} \frac{1}{3} & 0 & 0 \\ 0 & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (C) $\begin{bmatrix} -\frac{1}{3} & 0 & 0 \\ 0 & -\frac{1}{2} & 0 \\ 0 & 0 & -\frac{1}{5} \end{bmatrix}$ (D) $\begin{bmatrix} -3 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -5 \end{bmatrix}$	1
6.	Value of the determinant $\begin{vmatrix} \cos 67^o & \sin 67^o \\ \sin 23^o & \cos 23^o \end{vmatrix}$ is (A) 0 (B) $\frac{1}{2}$ (C) $\frac{\sqrt{3}}{2}$ (D) 1	1
7.	If a function defined by $f(x) = \begin{cases} kx + 1, & x \le \pi \\ \cos x, & x > \pi \end{cases}$ is continuous at $x = \pi$, then the value of k is (A) π (B) $\frac{-1}{\pi}$ (C) 0 (D) $\frac{-2}{\pi}$	1
8.	If $f(x) = x\tan^{-1}x$, then $f'(1)$is equal to (A)$\frac{\pi}{4} - \frac{1}{2}$ (B)$\frac{\pi}{4} + \frac{1}{2}$ (C)$-\frac{\pi}{4} - \frac{1}{2}$ (D)$-\frac{\pi}{4} + \frac{1}{2}$	1
9.	A function $f(x) = 10 - x - 2x^2$ is increasing on the interval (A) $\left(-\infty, -\frac{1}{4}\right]$ (B) $\left(-\infty, \frac{1}{4}\right)$ (C) $\left[-\frac{1}{4}, \infty\right)$ (D)$\left[-\frac{1}{4}, \frac{1}{4}\right]$	1
10.	The solution of the differential equation $xdx + ydy = 0$ represents a family of (A) straight lines (B) parabolas (C) Circles (D) Ellipses	1

11.	If $f(a+b-x)=f(x)$, then $\int_a^b x\, f(x)dx$ is equal to (A) $\frac{a+b}{2}\int_a^b f(b-x)dx$ (B) $\frac{a+b}{2}\int_a^b f(a-x)dx$ (C) $\frac{b-a}{2}\int_a^b f(x)\,dx$ (D) $\frac{a+b}{2}\int_a^b f(x)dx$	1
12.	If $\int x^3 \sin^4(x^4)\cos(x^4)\,dx = a\sin^5(x^4)$ + C, then a is equal to (A) $-\frac{1}{10}$ (B) $\frac{1}{20}$ (C) $\frac{1}{4}$ (D) $\frac{1}{5}$	1
13.	A bird flies through a distance in a straight line given by the vector $\hat{\imath}+2\hat{\jmath}+\hat{k}$. A man standing beside a straight metro rail track given by $\vec{r}=(3+\lambda)\hat{\imath}+(2\lambda-1)\hat{\jmath}+3\lambda\hat{k}$ is observing the bird. The projected length of its flight on the metro track is (A) $\frac{6}{\sqrt{14}}$ units (B) $\frac{14}{\sqrt{6}}$ units (C) $\frac{8}{\sqrt{14}}$ units (D) $\frac{5}{\sqrt{6}}$ units	1
14.	The distance of the point with position vector $3\hat{\imath}+4\hat{\jmath}+5\hat{k}$ from the y-axis is (A) 4 units (B) $\sqrt{34}$ units (C) 5 units (D) $5\sqrt{2}$ units	1
15.	If $\vec{a}=3\hat{\imath}+2\hat{\jmath}+4\hat{k}$, $\vec{b}=\hat{\imath}+\hat{\jmath}-3\hat{k}$ and $\vec{c}=6\hat{\imath}-\hat{\jmath}+2\hat{k}$ are three given vectors, then $(2\vec{a}.\hat{\imath})\hat{\imath}-(\vec{b}.\hat{\jmath})\hat{\jmath}+(\vec{c}.\hat{k})\hat{k}$ is same as the vector (A) $\vec{a}$ (B) $\vec{b}+\vec{c}$ (C) $\vec{a}-\vec{b}$ (D) $\vec{c}$	1
16.	A student of class XII studying Mathematics comes across an incomplete question in a book. Maximise $Z=3x+2y+1$ Subject to the constraints $x\geq 0, y\geq 0, 3x+4y\leq 12$, He/ She notices the below shown graph for the said LPP problem, and finds that a constraint is missing in it: Help him/her choose the required constraint from the graph.  The missing constraint is (A) $x+2y\leq 2$ (B) $2x+y\geq 2$ (C) $2x+y\leq 2$ (D) $x+2y\geq 2$	1

16.	**For Visually Impaired:** If $Z = ax + by + c$, where $a, b, c > 0$, attains its maximum value at two of its corner points (4,0) and (0,3) of the feasible region determined by the system of linear inequalities, then (A) $4a = 3b$ (B) $3a = 4b$ (C) $4a + c = 3b$ (D) $3a + c = 4b$	
17.	The feasible region of a linear programming problem is bounded but the objective function attains its minimum value at more than one point. One of the points is (5,0).  Then one of the other possible points at which the objective function attains its minimum value is (A) (2,9) (B) (6,6) (C) (4,7) (D) (0,0) **For Visually Impaired:** The graph of the inequality $3x + 5y < 10$ is the (A) Entire XY −plane (B) Open Half plane that doesn't contain origin (C) Open Half plane that contains origin, but not the points of the line $3x + 5y = 10$ (D) Half plane that contains origin and the points of the line $3x + 5y = 10$	1
18.	A person observed the first 4 digits of your 6-digit PIN. What is the probability that the person can guess your PIN? (A) $\frac{1}{81}$ (B) $\frac{1}{100}$ (C) $\frac{1}{90}$ (D) 1	1

	ASSERTION-REASON BASED QUESTIONS **(Question numbers 19 and 20 are Assertion-Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below.)** (A) Both (A) and (R) are true and (R) is the correct explanation of (A). (B) Both (A) and (R) are true but (R) is not the correct explanation of (A). (C) (A) is true but (R) is false. (D) (A) is false but (R) is true.	
19.	**Assertion (A):** Value of the expression $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) + \tan^{-1} 1 - \sec^{-1}(\sqrt{2})$ is $\frac{\pi}{4}$. **Reason (R):** Principal value branch of $\sin^{-1} x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and that of $sec^{-1} x$ is $[0, \pi] - \left\{\frac{\pi}{2}\right\}$.	1
20.	**Assertion(A):** Given two non-zero vectors $\vec{a}$ and $\vec{b}$. If $\vec{r}$ is another non-zero vector such that $\vec{r} \times (\vec{a} + \vec{b}) = \vec{0}$. Then $\vec{r}$ is perpendicular to $\vec{a} \times \vec{b}$. **Reason (R):** The vector $(\vec{a} + \vec{b})$ is perpendicular to the plane of $\vec{a}$ and $\vec{b}$	1
	SECTION B **This section comprises of 5 very short answer (VSA) type questions of 2 marks each.**	
21A	Evaluate $\tan\left(\tan^{-1}(-1) + \frac{\pi}{3}\right)$ **OR**	2
21B	Find the domain of $\cos^{-1}(3x - 2)$	
22	If $y = \log \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$, then prove that $\frac{dy}{dx} - \sec x = 0$	2
23A	Find: $\int \frac{(x-3)}{(x-1)^3} e^x \, dx$ **OR**	2
23B	Find out the area of shaded region in the enclosed figure. 	

23 B	**For Visually Impaired:** Find out the area of the region enclosed by the curve $y^2 = x$, $x = 3$ and x-axis in the first quadrant.	
24.	If $f(x+y) = f(x)f(y)$ for all $x, y \in$ R and $f(5)$= 2, $f'(0) = 3$, then using the definition of derivatives, find $f'(5)$.	2
25.	The two vectors $\hat{\imath} + \hat{\jmath} + \hat{k}$ and $\widehat{3\imath} - \hat{\jmath} + 3\hat{k}$ represent the two sides OA and OB, respectively of a ΔOAB, where O is the origin. The point P lies on AB such that OP is a median. Find the area of the parallelogram formed by the two adjacent sides as OA and OP.	2
	SECTION C **This section comprises of 6 short answer (SA) type questions of 3 marks each.**	
26A.	If $x^y = e^{x-y}$ prove that $\frac{dy}{dx} = \frac{\log x}{(\log(xe))^2}$ and hence find its value at $x = e$.	3
	OR	
26B.	If $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ find $\frac{d^2y}{dx^2}$.	
27	A spherical ball of ice melts in such a way that the rate at which its volume decreases at any instant is directly proportional to its surface area. Prove that the radius of the ice ball decreases at a constant rate.	3
28A	Sketch the graph $y = \|x+1\|$. Evaluate $\int_{-4}^{2} \|x+1\| dx$. What does the value of this integral represent on the graph?	3
	OR	
28B	Using integration find the area of the region $\{(x,y) : x^2 - 4y \leq 0, y - x \leq 0\}$	
	For Visually Impaired:	
28A	Define the function $y = \|x+1\|$. Evaluate $\int_{-4}^{2} \|x+1\| dx$. What does the value of this integral represent?	
	OR	
28B	Using integration find the area enclosed within the curve: $25x^2 + 16y^2 = 400$	
29A	Find the distance of the point $(2,-1,3)$ from the line $\vec{r} = (2\hat{\imath} - \hat{\jmath} + 2\hat{k}) + \mu(3\hat{\imath} + 6\hat{\jmath} + 2\hat{k})$ measured parallel to the z-axis.	3
	OR	
29B	Find the point of intersection of the line $\vec{r} = (3\hat{\imath} + \hat{k}) + \mu(\hat{\imath} + \hat{\jmath} + \hat{k})$ and the line through $(2,-1,1)$ parallel to the z-axis. How far is this point from the z-axis?	

30.	Solve graphically: Maximise $Z = 2x + y$ subject to $x + y \leq 1200$ $x + y \geq 600$ $y \leq \frac{x}{2}$ $x \geq 0, y \geq 0$.	3
30	**For Visually Impaired:** The objective function $Z = 3x + 2y$ of a linear programming problem under some constraints is to be maximized and minimized. The corner points of the feasible region are $A(600,0), B(1200,0), C(800, 400)$ and $D(400, 200)$. Find the point at which Z is maximum and the point at which Z is minimum. Also, find the corresponding maximum and minimum values of Z.)	
31.	Two students Mehul and Rashi are seeking admission in a college. The probability that Mehul is selected is 0.4 and the probability of selection of exactly one of the them is 0.5. Chances of selection of them is independent of each other. Find the chances of selection of Rashi. Also find the probability of selection of at least one of them.	3
	SECTION D **This section comprises of 4 long answer (LA) type questions of 5 marks each**	
32.	For two matrices $A = \begin{bmatrix} 3 & -6 & -1 \\ 2 & -5 & -1 \\ -2 & 4 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 & -1 \\ 0 & -1 & -1 \\ 2 & 0 & 3 \end{bmatrix}$, find the product AB and hence solve the system of equations: $3x - 6y - z = 3$ $2x - 5y - z + 2 = 0$ $-2x + 4y + z = 5$	5
33A	Evaluate: $\int_0^1 \frac{\log(1+x)}{1+x^2}\, dx$ **OR**	5
33B	Find $\int \frac{(3 \sin\theta - 2)\cos\theta}{5 - cos^2\theta - 4\sin\theta}\, d\theta$	
34A	Solve the differential equation: $y + \frac{d}{dx}(xy) = x(\sin x + x)$ **OR**	5
34B	Find the particular solution of the differential equation: $2y\, e^{x/y} dx + (y - 2x\, e^{x/y})\, dy = 0$ given that $y(0) = 1$	

35.	The two lines $\frac{x-1}{3} = -y, z+1=0$ and $\frac{-x}{2} = \frac{y+1}{2} = z+2$ intersect at a point whose y-coordinate is 1. Find the co-ordinates of their point of intersection. Find the vector equation of a line perpendicular to both the given lines and passing through this point of intersection.	5

SECTION- E

This section comprises of 3 case-study/passage-based questions of 4 marks each with subparts. The first two case study questions have three subparts (I), (II), (III) of marks 1, 1, 2 respectively. The third case study question has two subparts of 2 marks each

36. **Case Study -1** 4

A city's traffic management department is planning to optimize traffic flow by analyzing the connectivity between various traffic signals. The city has five major spots labelled $A, B, C, D, and\ E$.

The department has collected the following data regarding one-way traffic flow between spots:

1. Traffic flows from A to B, A to C, and A to D.
2. Traffic flows from B to C and B to E.
3. Traffic flows from C to E.
4. Traffic flows from D to E and D to C.

The department wants to represent and analyze this data using relations and functions. Use the given data to answer the following questions:

I. Is the traffic flow reflexive? Justify. [1]

II. Is the traffic flow transitive? Justify. [1]

III A. Represent the relation describing the traffic flow as a set of ordered pairs. Also state the domain and range of the relation.

OR

III B. Does the traffic flow represent a function? Justify your answer. [2]

37.	**Case Study -2**	4

LED bulbs are energy-efficient because they use significantly less electricity than traditional bulbs while producing the same amount of light. They convert more energy into light rather than heat, reducing waste. Additionally, their long lifespan means fewer replacements, saving resources and money over time.

A company manufactures a new type of energy-efficient LED bulb. The cost of production and the revenue generated by selling x bulbs (in an hour) are modelled as

$C(x) = 0.5x^2 - 10x + 150$ and $R(x) = -0.3x^2 + 20x$ respectively, where $C(x)$ and $R(x)$ are both in ₹.

To maximize the profit, the company needs to analyze these functions using calculus. Use the given models to answer the following questions:

I. Derive the profit function $P(x)$ [1]

II. Find the critical points of $P(x)$. [1]

III A. Determine whether the critical points correspond to a maximum or a minimum profit by using the second derivative test.

OR

III B. Identify the possible practical value of x (i.e., the number of bulbs that can realistically be produced and sold) that can maximize the profit, if the resources available and the expenditure on machines allows to produce minimum 10 but not more than 18 bulbs per hour. Also calculate the maximum profit. [2]

38.	**Case Study -3** Excessive use of screens can result in vision problems, obesity, sleep disorders, anxiety, low retention problems and can impede social and emotional comprehension and expression. It is essential to be mindful of the amount of time we spend on screens and to reduce our screen-time by taking regular breaks, setting time limits, and engaging in non-screen-based activities.  In a class of students of the age group 14 to 17, the students were categorised into three groups according to a feedback form filled by them. The first group constituted of the students who spent more than 4 hours per day on the mobile screen or the gaming screens, while the second group spent 2 to 4 hours /day on the same activities. The third group spent less than 2 hours /day on the same. The first group with the high screen time is 60% of all the students, whereas the second group with moderate screen time is 30% and the third group with low screen time is only 10% of the total number of students. It was observed that 80% students of first group faced severe anxiety and low retention issues, with 70% of second group, and 30% of third group having the same symptoms. I. What is the total percentage of students who suffer from anxiety and low retention issues in the class? [2] II. A student is selected at random, and he is found to suffer from anxiety and low retention issues. What is the probability that he/she spends screen time more than 4 hours per day? [2]	4

MATHEMATICS – Code No. 041
MARKING SCHEME
CLASS – XII (2025-26)

SECTION-A (MCQs of 1 mark each)		
Sol. N.	**Hint / Solution**	**Marks**
1	Clearly from the graph Domain is $\left[-\frac{1}{2},\frac{1}{2}\right]$ So graph is of the function $\sin^{-1}(2x)$ **Answer is (B)** $\sin^{-1}(2x)$	**1**
1 (V.I.)	Domain is $\left[-\frac{1}{3},\frac{1}{3}\right]$ So the function is $\cos^{-1}(3x)$ **Answer is (C)** $\cos^{-1}(3x)$	**1**
2	AB is defined so n=4 AC is defined so p=4 AB and AC are square matrices of same order so $m \times 3 = m \times q \Rightarrow q = 3 = m$ **Answer is (A)** $m = q = 3 \;\; and \; n = p = 4$	**1**
3	As A is skew symmetric So $p = 0, q = 2, r = -3, t = 4$ So $\frac{q+t}{p+r} = \frac{6}{-3} = -2$ **Answer is (A) -2**	**1**
4	$\lvert adj\ A\rvert = 27 \Rightarrow \lvert A\rvert^3 = 27 = 3^3 \Rightarrow \lvert A\rvert = 3$ $A\ (adj\ A) = \lvert A\rvert\ I = 3\ I$ **Answer is (C) 3 *I***	**1**
5	Inverse of the matrix $\begin{bmatrix}3 & 0 & 0\\ 0 & 2 & 0\\ 0 & 0 & 5\end{bmatrix} = \begin{bmatrix}\frac{1}{3} & 0 & 0\\ 0 & \frac{1}{2} & 0\\ 0 & 0 & \frac{1}{5}\end{bmatrix}$ **Answer is (B)**	**1**
6	$\begin{vmatrix}\cos 67^o & \sin 67^o\\ \sin 23^o & \cos 23^o\end{vmatrix} = \cos 67^o \cos 23^o - \sin 67^o \sin 23^o = \cos(67^o + 23^o) = \cos 90^o = 0$ **Answer is (A) 0**	**1**
7	$f(x)$ is continuous at $x = \pi$ $\Rightarrow \lim_{x\to\pi^-}(kx+1) = \lim_{x\to\pi^+} cos\ x = f(\pi)$ $\Rightarrow \lim_{h\to 0}[k(\pi - h) + 1] = \lim_{h\to 0} cos(\pi + h) = k\pi + 1$ $\Rightarrow k\pi + 1 = -1 \qquad \Rightarrow k = \frac{-2}{\pi}$ **Answer is (D)** $\frac{-2}{\pi}$	**1**

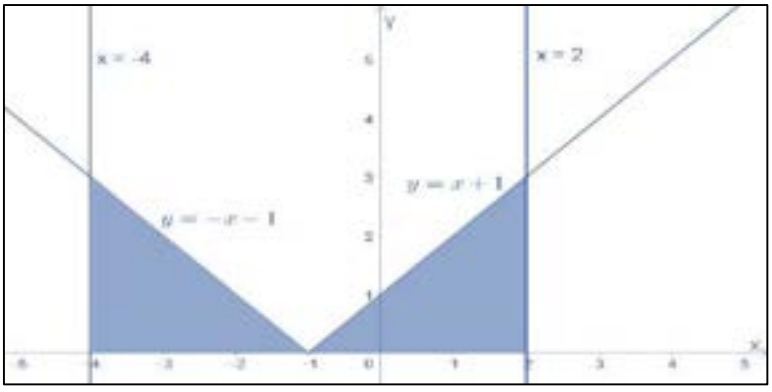
8	$f(x) = x\tan^{-1}x$ $f'(x) = 1.\tan^{-1}x + x.\frac{1}{1+x^2}$ $f'(1) = 1.\tan^{-1}1 + \frac{1}{1+1} = \frac{\pi}{4} + \frac{1}{2}$ **Answer is (B) $\frac{\pi}{4} + \frac{1}{2}$**	**1**
9	$f(x) = 10 - x - 2x^2$ $\Rightarrow f'(x) = -1 - 4x$ For increasing function $f'(x) \geq 0$ $\Rightarrow -(1 + 4x) \geq 0$ $\Rightarrow (1 + 4x) \leq 0$ $\Rightarrow x \leq -1/4$ $\Rightarrow x \in \left(-\infty, -\frac{1}{4}\right]$ **Answer is (A) $\left(-\infty, -\frac{1}{4}\right]$**	**1**
10	$xdx + ydy = 0$ $\Rightarrow \int xdx = -\int ydy$ $\Rightarrow \frac{x^2}{2} = -\frac{y^2}{2} + k$ $\Rightarrow x^2 + y^2 = 2k$ Solution is $x^2 + y^2 = 2k$, k being an arbitrary constant. **Answer is (C) Circles**	**1**
11	$I = \int_a^b x\,f(x)dx = \int_a^b (a + b - x)f(a + b - x)dx$ $\Rightarrow I = \int_a^b (a + b - x)f(x)dx$ (given $f(a + b - x) = f(x)$) $\Rightarrow I = \int_a^b (a + b)\,f(x)dx - \int_a^b x\,f(x)dx$ $\Rightarrow 2\,I = (a + b)\int_a^b f(x)dx$ $\Rightarrow I = \frac{1}{2}(a + b)\int_a^b f(x)dx$ **Answer is (D) $\frac{a+b}{2}\int_a^b \boldsymbol{f(x)dx}$**	**1**
12	Let $I = \int x^3 sin^4(x^4)\cos(x^4)\,dx$ Let $\sin(x^4) = t \Rightarrow 4x^3\cos(x^4)\,dx = dt \Rightarrow x^3\cos(x^4) = \frac{1}{4}\,dt$ Thus $I = \int t^4\,(\frac{1}{4}\,dt\,) = \frac{1}{20}\,t^5$ + C = $\frac{1}{20}\,sin^5(x^4)$ + C $\Rightarrow I = \frac{1}{20}\,sin^5(x^4) + C = a\ sin^5(x^4)$ + C So, $a = \frac{1}{20}$ **Answer is (B) $\frac{1}{20}$**	**1**
13	The projection of the vector $\hat{\imath} + 2\hat{\jmath} + \hat{k}$ on the line $\vec{r} = (3\hat{\imath} - \hat{\jmath}) + \lambda(\hat{\imath} + 2\hat{\jmath} + 3\hat{k})$ is $\frac{1x1 + 2x2 + 1x3}{\sqrt{1^2+2^2+3^2}} = \frac{8}{\sqrt{14}}$ units **Answer is (C) $\frac{8}{\sqrt{14}}$ units**	**1**

14	The distance of the point (a, b, c) from the y-axis is $\sqrt{a^2+c^2}$ So, the distance is $\sqrt{3^2+5^2}$ = $\sqrt{34}$ units. **Answer is (B) $\sqrt{34}$ units**	**1**
15	$(2\vec{a}.\hat{\imath})\hat{\imath} - (\vec{b}.\hat{\jmath})\hat{\jmath} + (\vec{c}.\hat{k})\hat{k} = (2\times 3)\hat{\imath} - (1)\hat{\jmath} + (2)\hat{k}$ $= 6\hat{\imath} - \hat{\jmath} + 2\hat{k} = \vec{c}$ **Answer is (D) $\vec{c}$**	**1**
16	The points (1,0) and (0,2) satisfy the equation $2x + y = 2$ And shaded region shows that (0,0) doesn't lie in the feasible solution region So, the inequality is $2x + y \geq 2$ **Answer is (B) $2x + y \geq 2$**	**1**
16 (V.I.)	(4,0) and (0,3) gives maximum value so $Z_{(4,0)} = Z_{(0,3)} \Rightarrow 4a + c = 3b + c \Rightarrow 4a = 3b$ **Answer is (A) $4a = 3b$**	**1**
17	The student may read the point (2,9) from the line on the graph. The student may find the equation $3x + y = 15$ joining (5,0) and (0,15) and then verify the point (2,9) satisfies it. **Answer is (A) (2,9)**	**1**
17 (V.I.)	**Answer is (C)** Open Half plane that contains origin, but not the points of the line $3x + 5y = 10$	**1**
18	**Answer is (B) $\frac{1}{100}$** The person knows the first 4 digits. So the person has to guess the remaining two digits. P (guessing the PIN)=1×1×1×1×$\frac{1}{10}\times\frac{1}{10} = \frac{1}{100}$	**1**
19	$\sin^{-1}\left(\frac{\sqrt{3}}{2}\right) + \tan^{-1}1 - \sec^{-1}(\sqrt{2}) = \frac{\pi}{3} + \frac{\pi}{4} - \frac{\pi}{4} = \frac{\pi}{3} \neq \frac{\pi}{4}$ So, A is false. Principal Value branch of $\sin^{-1}x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and that of $sec^{-1}x$ is $[0,\pi] - \left\{\frac{\pi}{2}\right\}$. So, R is true **Answer is (D)Assertion is false, but Reason is true**	**1**
20	C. $\vec{r}\times(\vec{a}+\vec{b}) = \vec{0} \Rightarrow \vec{r}$ is parallel to $(\vec{a}+\vec{b})$ and $(\vec{a}+\vec{b})$ lies on the plane of $\vec{a}$ and $\vec{b}$. So, $\vec{r}$ is parallel to the plane of $\vec{a}$ and $\vec{b} \Rightarrow \vec{r}$ is perpendicular to $(\vec{a}\times\vec{b})$. So, Assertion is true But $(\vec{a}+\vec{b})$ lies on the plane of $\vec{a}$ and $\vec{b}$, so $(\vec{a}+\vec{b})$ is not perpendicular to the plane of $\vec{a}$ and $\vec{b}$ Therefore, Reason is false. **Answer is (C) Assertion is true, but Reason is false**	**1**

SECTION B
(VSA type questions of 2 marks each)

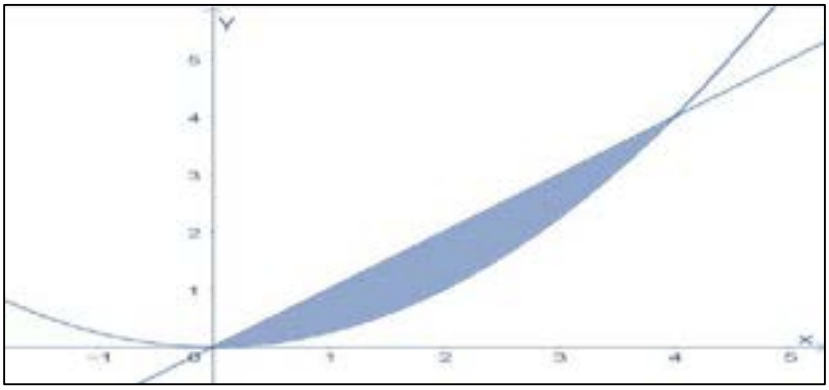
21A	$\tan\left(\tan^{-1}(-1)+\frac{\pi}{3}\right)=\tan\left(-\frac{\pi}{4}+\frac{\pi}{3}\right)$	½
	$=\frac{\tan\frac{\pi}{3}-\tan\frac{\pi}{4}}{1+\tan\frac{\pi}{3}\tan\frac{\pi}{4}}$	1
	$=\frac{\sqrt{3}-1}{1+\sqrt{3}}$ *or* $2-\sqrt{3}$	½
	OR	OR
21B	For domain, $-1\le 3x-2\le 1$	½
	$\Rightarrow 1\le 3x\le 3$	½
	$\Rightarrow \frac{1}{3}\le x\le 1$	½
	So, domain of $\cos^{-1}(3x-2)$ is $\left[\frac{1}{3},1\right]$	½
22	$y=\log\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)$	
	Differentiating with respect to x	
	$\frac{dy}{dx}=\frac{1}{\tan\left(\frac{\pi}{4}+\frac{x}{2}\right)}.sec^2\left(\frac{\pi}{4}+\frac{x}{2}\right).\frac{1}{2}$	½
	$=\frac{\cos\left(\frac{\pi}{4}+\frac{x}{2}\right)}{\sin\left(\frac{\pi}{4}+\frac{x}{2}\right)}.\frac{1}{cos^2\left(\frac{\pi}{4}+\frac{x}{2}\right)}.\frac{1}{2}$	
	$=\frac{1}{2\sin\left(\frac{\pi}{4}+\frac{x}{2}\right)\cos\left(\frac{\pi}{4}+\frac{x}{2}\right)}=\frac{1}{\sin\left(\frac{\pi}{2}+x\right)}=\frac{1}{\cos x}$	1
	$\Rightarrow \frac{dy}{dx}-\sec x=0$	½
23A	$\int\frac{(x-3)e^x}{(x-1)^3}\,dx=\int\frac{(x-1-2)e^x}{(x-1)^3}\,dx$	
	$=\int\left(\frac{1}{(x-1)^2}-\frac{2}{(x-1)^3}\right)e^x\,dx=\int\left(\frac{1}{(x-1)^2}+\frac{d}{dx}\left(\frac{1}{(x-1)^2}\right)\right)e^x\,dx$	1
	$=\frac{e^x}{(x-1)^2}$ + c (as $\int(f(x)+f'(x))e^x\,dx=e^x\,f(x)$ + c)	1
	OR	OR
23B	A = $\int_0^4 x\,dy$ = $\int_0^4\sqrt{y}\,dy$	
	$=\frac{2}{3}\times y^{3/2}\Big]_{y=0}^{y=4}=\frac{16}{3}$ sq. units	1
		1
23B	**For Visually Impaired:**	
	A = $\int_0^3 y\,dx$ = $\int_0^3\sqrt{x}\,dx$	1
	$=\frac{2}{3}\times x^{3/2}\Big]_{x=0}^{x=3}=2\sqrt{3}$ sq. units	1

24	Given $f(x+y) = f(x)f(y)$ $f(0+5) = f(0)f(5)$ $\Rightarrow \quad f(0) = 1$ $f'(5) = \lim_{h\to 0} \frac{f(5+h)-f(5)}{h} = \lim_{h\to 0} \frac{f(5)f(h)-f(5)}{h}$ $[\because f(x+y) = f(x)f(y)]$ $= \lim_{h\to 0} \frac{2f(h)-2}{h}$ $[\because f(5) = 2]$ $= 2 \lim_{h\to 0} \frac{f(h)-1}{h} = 2 \lim_{h\to 0} \frac{f(h)-f(0)}{h} = 2f'(0)$ $= 2(3)$ $[\because f'(0) = 3]$ $= 6$	½ 1 ½
25	The vector $\overrightarrow{OP} = \frac{1}{2}(4\hat{\imath} + 4\hat{k}) = 2\hat{\imath} + 2\hat{k}$ Area of the parallelogram formed by the two adjacent sides as OA and OP $= \left\lvert(\overrightarrow{OA} \times \overrightarrow{OP})\right\rvert = \left\lVert\begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 1 & 1 & 1 \\ 2 & 0 & 2 \end{vmatrix}\right\rVert$ $= \lvert 2\hat{\imath} - 2\hat{k}\rvert$ $= 2\sqrt{2}$ square units.	½ ½ ½ ½
	SECTION C **(SA type questions of 3 marks each)**	
26A	$x^y = e^{x-y}$ Taking log of both sides $y \log x = (x-y)\log e$ $y \log x + y = x$ (since $\log e = 1$) $\Rightarrow \quad y = \frac{x}{1+\log x}$ Differentiating with respect to x $\frac{dy}{dx} = \frac{(1+\log x).1 - x.\frac{1}{x}}{(1+\log x)^2}$ $= \frac{\log x}{(\log e + \log x)^2}$ $= \frac{\log x}{(\log(x\,e))^2}$ Now $\left.\frac{dy}{dx}\right]_{x=e} = \frac{\log e}{(\log e^2)^2} = \frac{1}{(2\log e)^2} = \frac{1}{2^2} = \frac{1}{4}$ (as $\log e = 1$) **Alternative Solution:** $x^y = e^{x-y}$ Taking log of both sides $y \log x = (x-y)\log e$ $y \log x + y = x$ (since $\log e = 1$) Differentiating both sides w.r.t. x $\log x \frac{dy}{dx} + \frac{y}{x} + \frac{dy}{dx} = 1$ $\Rightarrow \frac{dy}{dx}(1+\log x) = 1 - \frac{y}{x}$ $\Rightarrow \frac{dy}{dx} = \frac{x-y}{x(1+\log x)} = \frac{x-\frac{x}{1+\log x}}{x(1+\log x)} = \frac{x(1+\log x)-x}{x(1+\log x)^2} = \frac{x(1+\log x-1)}{x(\log e+\log x)^2} = \frac{\log x}{(\log(xe))^2}$ Now $\left.\frac{dy}{dx}\right]_{x=e} = \frac{\log e}{(\log e^2)^2} = \frac{1}{(2\log e)^2} = \frac{1}{2^2} = \frac{1}{4}$ (as $\log e = 1$)	1 1 1

	OR	OR
26B	$\frac{dx}{d\theta} = a(1-\cos\theta)$, $\frac{dy}{d\theta} = a(0+\sin\theta)$,	1
	$\Rightarrow \frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{a\sin\theta}{a(1-\cos\theta)}$	
	$= \frac{2\sin\left(\frac{\theta}{2}\right)\cos\left(\frac{\theta}{2}\right)}{2sin^2\left(\frac{\theta}{2}\right)} = \cot\frac{\theta}{2}$	1
	$\Rightarrow \frac{d^2y}{dx^2} = -\frac{1}{2}\,cosec^2\left(\frac{\theta}{2}\right)\frac{d\theta}{dx}$	
	$= -\frac{1}{2a}\,cosec^2\left(\frac{\theta}{2}\right)\frac{1}{2sin^2\left(\frac{\theta}{2}\right)}$	
	$= -\frac{1}{4a}cosec^4\left(\frac{\theta}{2}\right)$	1
27	Let r be the radius of ice ball at time t .	
	$V = \frac{4}{3}\pi r^3$…… (1)	½
	S = $4\pi r^2$……..(2)	
	Given $\frac{dV}{dt} \propto$ S	
	$\Rightarrow \frac{dV}{dt} = -$ k S (where k is some positive constant) ……(3)	½
	Differentiating (1) w.r.t. t, we get	
	$\frac{dV}{dt} = \frac{4}{3}\,\pi.(3\,r^2)\frac{dr}{dt}$	1
	$\frac{dV}{dt} = 4\pi r^2\frac{dr}{dt}$ ……. (4)	
	$\Rightarrow$ - k S = $4\pi r^2\frac{dr}{dt}$ (from (3) and (4))	½
	$\Rightarrow$ - k S = S $\frac{dr}{dt}$ (using (2))	
	$\Rightarrow \frac{dr}{dt} = -$ k	½
	⇒ radius of the ice-ball decreases at a constant rate	
28A		1
	$\int_{-4}^{2}\lvert x+1\rvert dx = \int_{-4}^{-1}(-x-1)\,dx + \int_{-1}^{2}(x+1)\,dx$	½
	$= -\frac{(x+1)^2}{2}\Big]_{-4}^{-1} + \frac{(x+1)^2}{2}\Big]_{-1}^{2}$	½
	$= -\left(0-\frac{9}{2}\right)+\left(\frac{9}{2}-0\right) = 9$	½
	It represent the area of shaded region bounded by the curve $y = \lvert x+1\rvert$, $x-$ axis and the lines $x = -4\ and\ x = 2$	½

OR

28B



1

Required Area = $\int_0^4 x\,dx - \int_0^4 \frac{x^2}{4}dx$ 1

$= \frac{x^2}{2}\Big]_0^4 - \frac{1}{12}[x^3]_0^4$ ½

$= \frac{1}{2}(16-0) - \frac{1}{12}(64-0) = 8 - \frac{16}{3} = \frac{8}{3}$ sq. units ½

For Visually Impaired:

$$y = |x+1| = f(x) = \begin{cases} -x-1, & x < -1 \\ x+1, & x \geq -1 \end{cases}$$ 1

$\int_{-4}^{2}|x+1|dx = \int_{-4}^{-1}(-x-1)\,dx + \int_{-1}^{2}(x+1)\,dx$

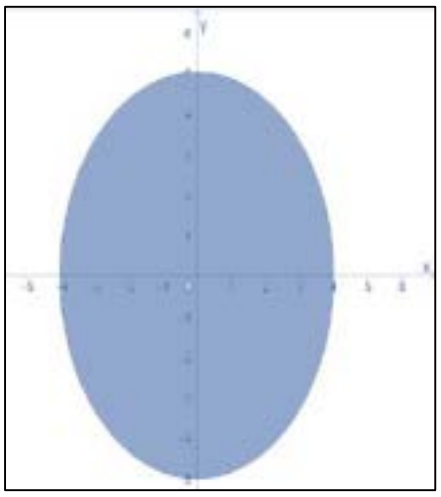
$= -\frac{(x+1)^2}{2}\Big]_{-4}^{-1} + \frac{(x+1)^2}{2}\Big]_{-1}^{2}$ 1

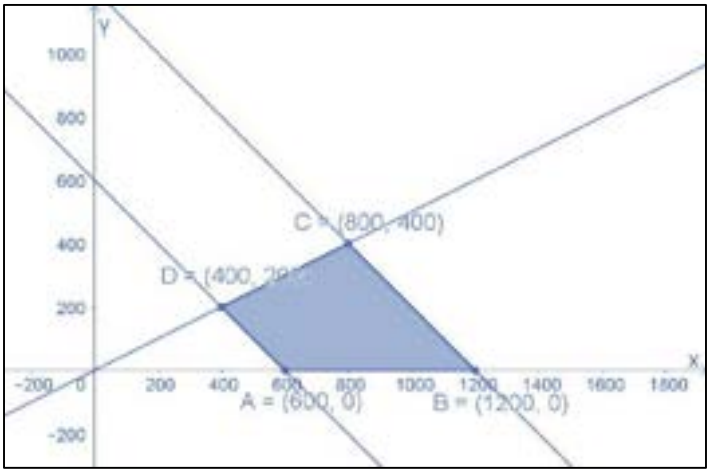
$= -\left(0-\frac{9}{2}\right) + \left(\frac{9}{2}-0\right) = 9$

It represent the area of shaded region bounded by the curve $y = |x+1|$, 1

$x-$ axis and the lines $x = -4\ and\ x = 2$

OR



	$25x^2 + 16y^2 = 400 \Rightarrow \frac{x^2}{16} + \frac{y^2}{25} = 1 \Rightarrow \frac{x^2}{4^2} + \frac{y^2}{5^2} = 1 \Rightarrow y = \frac{5}{4}\sqrt{4^2 - x^2}$ Required Area = $4\int_0^4 \frac{5}{4}\sqrt{4^2 - x^2}\,dx$ $= 5\left[\frac{x\sqrt{4^2-x^2}}{2} + \frac{4^2}{2}\sin^{-1}\left(\frac{x}{4}\right)\right]_0^4$ $= 5[0 + 8\sin^{-1}(1) - 0]$ $= 40 \times \frac{\pi}{2} = 20\pi$ sq. units	1 1 1
29A	The line through $(2,-1,3)$ parallel to the z-axis is given by $\vec{r} = (2\hat{\imath} - \hat{\jmath} + 3\hat{k}) + \lambda(\hat{k})$ Any point on this line is P $(2,-1,3+\lambda)$ Any point on the given line $\vec{r} = (2\hat{\imath} - \hat{\jmath} + 2\hat{k}) + \mu(3\hat{\imath} + 6\hat{\jmath} + 2\hat{k})$ is Q $(2+3\mu, -1+6\mu, 2+2\mu)$ For the intersection point Q $(2+3\mu, -1+6\mu, 2+2\mu)$ = P (2, -1, 3+ λ) $\Rightarrow 2 = 2 + 3\mu \Rightarrow \mu = 0$ The point of intersection is $(2,-1,2)$ The distance from $(2,-1,3)$ to $(2,-1,2)$ is clearly 1 unit. **Alternative Solution:** Any point on the line through $(2,-1,3)$ parallel to the z-axis is $(2,-1,\lambda)$ Any point on the given line is $(2+3\mu, -1+6\mu, 2+2\mu)$ Therefore, $2 = 2 + 3\mu \Rightarrow \mu = 0$ The point of intersection is $(2,-1,2)$ The distance from $(2,-1,3)$ to $(2,-1,2)$ is clearly 1 unit.	1 ½ ½ ½ ½ 1 1 ½ ½
29B	**OR** The line through (2,−1,1)parallel to the z-axis is $\vec{r} = (2\hat{\imath} - \hat{\jmath} + \hat{k}) + \lambda(\hat{k})$ Any point on this line is P (2, −1, 1+ λ) Any point on the given line is A (3+ μ, μ, 1+ μ) A (3+ μ, μ, 1+ μ) = P (2, −1, 1+ λ) $\Rightarrow \mu = -1$ The point of intersection is (2, −1,0) The distance of $(2,-1,0)$ from the z-axis is $\sqrt{2^2 + (-1)^2} = \sqrt{5}$ units.	1 1 ½ ½
30	Sketching the graph  	$1\frac{1}{2}$

30	Corner points A(600,0), B(1200,0), C(800,400), D(400,200) Values of Z: $Z_A = 1200, Z_B = 2400, Z_C = 2000, Z_D = 1000$ Maximum $Z = 2400$ when $x = 1200$ and $y = 0$ **For Visually Impaired:** At Corner points A(600,0), B(1200,0), C(800,400), D(400,200) Values of Z are $Z_A = 1800, Z_B = 3600, Z_C = 3200, Z_D = 1600$ Maximum Value of Z = 3600 at B(1200,0) And Minimum Value of Z= 1600 at D(400,200)	½ ½ ½ 1 1 1
31	Let the events be: A: Mehul is selected B: Rashi is selected Then according to the question, A and B are independent events and $P(A) = 0.4, \quad P(A \cap \bar{B}) + P(B \cap \bar{A}) = 0.5$ Let $P(B) = x$ Then $P(A \cap \bar{B}) + P(B \cap \bar{A}) = 0.5$ $\Rightarrow P(A)P(\bar{B}) + P(B)P(\bar{A}) = 0.5$ $\Rightarrow 0.4(1-x) + x(1-0.4) = 0.5$ $\Rightarrow 0.4 - 0.4x + 0.6x = 0.5$ $\Rightarrow 0.2x = 0.5 - 0.4 = 0.1$ $\Rightarrow x = \frac{0.1}{0.2} = \frac{1}{2} = 0.5$ So, probability of selection of Rashi = 0.5 Probability of selection of at least one of them $= 1 - P(\bar{A} \cap \bar{B})$ $= 1 - P(\bar{A})P(\bar{B})$ $= 1 - 0.6 \times 0.5$ $= 1 - 0.3 = 0.7$	 1 1 1
	SECTION D **(LA type questions of 5 marks each)**	
32	$AB = \begin{bmatrix} 3 & -6 & -1 \\ 2 & -5 & -1 \\ -2 & 4 & 1 \end{bmatrix}\begin{bmatrix} 1 & -2 & -1 \\ 0 & -1 & -1 \\ 2 & 0 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} = I$ So, $A^{-1} = B \; and \; B^{-1} = A$ Given system of equations is $3x - 6y - z = 3, \;\; 2x - 5y - z + 2 = 0, \;\; -2x + 4y + z = 5$ In matrix form it can be written as: $AX = C$, where $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \; and \; C = \begin{bmatrix} 3 \\ -2 \\ 5 \end{bmatrix}$ Here $\lvert A \rvert = -3 - 0 + 2 = -1 \neq 0$ So, the system is consistent and has unique solution given by the expression $X = A^{-1}C = BC$ $\Rightarrow X = \begin{bmatrix} 1 & -2 & -1 \\ 0 & -1 & -1 \\ 2 & 0 & 3 \end{bmatrix}\begin{bmatrix} 3 \\ -2 \\ 5 \end{bmatrix} \Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \\ 21 \end{bmatrix}$ Thus $x = 2, y = -3, z = 21$	1 ½ ½ ½ ½ 1 ½

33A	Let $x = \tan\theta \Rightarrow dx = sec^2\theta\, d\theta$	½
	$I = \int_0^{\frac{\pi}{4}} \frac{\log(1+tan\theta)}{1+tan^2\theta} . sec^2\theta \; d\theta$	
	$I = \int_0^{\frac{\pi}{4}} log\,(1+tan\theta)d\theta = \int_0^{\frac{\pi}{4}} log\,\left[1+\tan\left(\frac{\pi}{4}-\theta\right)\right] d\theta$	1
	$=\int_0^{\frac{\pi}{4}} \log\left[1+\frac{1-\tan\theta}{1+\tan\theta}\right] d\theta$	1
	$=\int_0^{\frac{\pi}{4}} \log\left[\frac{1+\tan\theta+1-\tan\theta}{1+\tan\theta}\right] d\theta$	
	$=\int_0^{\frac{\pi}{4}} \log\left[\frac{2}{1+\tan\theta}\right] d\theta$	
	$=\int_0^{\frac{\pi}{4}} \log 2 \; d\theta - \int_0^{\frac{\pi}{4}} \log[1+tan\theta] \; d\theta$	1
	$= \log 2 \times x]_0^{\frac{\pi}{4}} - I$	
	$\Rightarrow \; 2I = \frac{\pi}{4}\log 2$	1
	$\Rightarrow \; I = \frac{\pi}{8}\log 2$	½
33B	**OR**	OR
	I = $\int \frac{(3\,\sin\theta-2)\cos\theta}{5-cos^2\theta-4\sin\theta} d\theta = \int \frac{(3\,sin\theta-2)\,cos\theta}{5-(1-sin^2\theta)-4\,sin\,\theta} d\theta$	½
	$Let \quad sin\,\theta = t \implies cos\,\theta \; d\theta = dt$	
	$I = \int \frac{(3t-2)}{5-(1-t^2)-4t} dt$	1
	$= \int \frac{(3t-2)}{t^2-4t+4} dt = \int \frac{3t-2}{(t-2)^2} dt$	
	Let $\frac{3t-2}{(t-2)^2} = \frac{A}{(t-2)} + \frac{B}{(t-2)^2}$	
	$3t-2 = A(t-2)+B$	
	Comparing the coefficients of t and constant terms on both sides	½
	$A = 3, -2A+B = -2, B = 4$	+½
	$\int \frac{(3\,\sin\theta-2)\cos\theta}{5-cos^2\theta-4\sin\theta} d\theta = \int \frac{3}{t-2} dt + \int \frac{4}{(t-2)^2}$ dt	
	$= 3\log\lvert t-2\rvert - \frac{4}{t-2} + C$	1+1
	$= 3\log\lvert sin\,\theta - 2\rvert - \frac{4}{\sin\theta-2}$ + C	½
34A	$y + \frac{d}{dx}(\,xy\,) = x\,(\sin x + x)$	
	$\implies y + (x\frac{dy}{dx} + y\,) = x\,(\sin x + x)$	1
	$\implies 2y + x\frac{dy}{dx} = x\,(\sin x + x)$	
	$\implies \frac{dy}{dx} + \frac{2y}{x} = (\sin x + x)$	
	This a linear differential equation of the form $\frac{dy}{dx} + Py = Q$	
	P= $\frac{2}{x}$,Q=$(\sin x + x)$	1
	I.F =$e^{\int \frac{2}{x} dx}$= $e^{2\,log\,x}$= $e^{log\,x^2}$ = x^2	
	Solution will be y . I.F =$\int Q.IF\, dx$	1
	$yx^2 = \int (sin\,x + x)\,x^2$ dx	
	$yx^2 = \int sinx.x^2\, dx + \int x^3\, dx$	

	$\Rightarrow \quad yx^2 = -x^2\cos x + 2\int x\cos x\, dx \; + \frac{x^4}{4}$ + C	1
	$\Rightarrow yx^2 = -x^2 cos\, x$ +2 $(x\, sinx + cos\, x)$ + $\frac{x^4}{4}$ + C	
	Which is the required solution	1
	OR	
34B	$2y\, e^{x/y}dx + (\, y - 2x\, e^{x/y}\,)\, dy = 0$	
	$\Rightarrow \quad \frac{dx}{dy} = \frac{2x\, e^{x/y} - y}{2y\, e^{x/y}} = \frac{2\frac{x}{y} e^{\frac{x}{y}} - 1}{2\, e^{\frac{x}{y}}}$	1
	It is a homogeneous differential equation.	
	Let $x = vy \Rightarrow \frac{dx}{dy} = v + y\frac{dv}{dy}$	1
	$v + y\frac{dv}{dy} = \frac{2ve^v - 1}{2e^v}$	
	$\Rightarrow y\frac{dv}{dy} = \frac{2ve^v - 1}{2e^v} - v = \frac{2ve^v - 1 - 2ve^v}{2e^v}$	
	$\Rightarrow \quad y\frac{dv}{dy} = \frac{-1}{2e^v}$	
	$\Rightarrow 2e^v\, dv = -\frac{dy}{y}$	1
	$\int 2e^v\, dv = -\int \frac{dy}{y}$	
	$\Rightarrow 2e^v = -\log\lvert y\rvert$ + C	
	$\Rightarrow 2e^{\frac{x}{y}} +"\, log\lvert y\rvert$ = C	1
	When $x = 0$, $y = 1$, C = 2	
	Required solution 2 $e^{\frac{x}{y}}$ + $\log\lvert y\rvert$ = 2	1
35	Let $\frac{x-1}{3} = \frac{y-0}{-1} = \frac{z+1}{0} = \lambda$ $\Rightarrow$ Any point on it is $(3\,\lambda + 1, -\lambda, -1)$	½
	For the point where $y = 1$ $\Rightarrow$ $\lambda = -1$	1
	$\Rightarrow$ The point is $(-2, 1, -1)$	½
	The directions of the two lines are $\vec{m} = 3\hat{\imath} - \hat{\jmath}$	1
	and $\vec{n} = -2\hat{\imath} + 2\hat{\jmath} + \hat{k}$	½
	$\vec{m} \times \vec{n} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 3 & -1 & 0 \\ -2 & 2 & 1 \end{vmatrix} = -\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$	1
	The equation of the required line is	
	$\vec{r} = (-2\hat{\imath} + \hat{\jmath} - \hat{k}) + \mu(-\hat{\imath} - 3\hat{\jmath} + 4\hat{k})$	½
	Alternative Solution:	
	Let $\frac{x-1}{3} = \frac{y-0}{-1} = \frac{z+1}{0} = \lambda$ $\Rightarrow$ Any point on it is $(3\,\lambda + 1, -\lambda, -1)$	½
	For the point where $y = 1$ $\Rightarrow$ $\lambda = -1$	1
	$\Rightarrow$ The point is $(-2, 1, -1)$	½
	Let the direction ratios of the required line be a, b, c	
	Then $3a - b = 0$	
	And $-2a + 2b + c = 0$	1
	Solving we get $\frac{a}{-1} = \frac{-b}{3} = \frac{c}{4} \Rightarrow \frac{a}{-1} = \frac{b}{-3} = \frac{c}{4}$	1
	The required line is $\frac{x+2}{-1} = \frac{y-1}{-3} = \frac{z+1}{4} = \mu$	½
	In vector form $\vec{r} = (-2\hat{\imath} + \hat{\jmath} - \hat{k}) + \mu(-\hat{\imath} - 3\hat{\jmath} + 4\hat{k})$	½

	SECTION- E **(3 case-study/passage-based questions of 4 marks each)**	
36	I. Traffic flow is not reflexive as $(A, A) \notin R$ (or no major spot is connected with itself) II. Traffic flow is not transitive as $(A, B) \in R \text{ and } (B, E) \in R, \text{but } (A, E) \notin R$ III A. $R = \{(A, B), (A, C), (A, D), (B, C), (B, E), (C, E), (D, E), (D, C)\}$ $\text{Domain} = \{A, B, C, D\}$ $\text{Range} = \{B, C, D, E\}$ **OR** III B. No, the traffic flow doesn't represent a function as A has three images.	1 1 1 ½ + ½ 1+1
37	I. $P(x) = R(x) - C(x) = -0.3x^2 + 20x - (0.5x^2 - 10x + 150)$ $= -0.8x^2 + 30x - 150$ II. For critical points $P'(x) = 0 \Rightarrow -1.6x + 30 = 0$ $\Rightarrow x = \frac{30}{1.6} = \frac{300}{16} = 18.75$ III A. Now $P''(x) = -1.6$ In particular $P''(18.75) = -1.6 < 0$ So, critical value $x = 18.75$ corresponds to a maximum profit. **OR** III B. As x is the number of bulbs, so practically 18 bulbs correspond to a maximum profit. Maximum profit is $P(18) = -0.8 \times 18^2 + 30 \times 18 - 150$ $= -259.2 + 540 - 150$ $= 540 - 409.2 = ₹130.80$	1 1 1 1 1 1
38	Let the events be E_1: the student is in the first group (time spent on screen is more than 4 hours) E_2: the student is in the second group (time spent on screen is 2 to 4 hours) E_3: the student is in third group (time spent on screen is less than 2 hours) A: the event of the student showing symptoms of anxiety and low retention $P(E_1) = \frac{60}{100}$ $P(E_2) = \frac{30}{100}$ and $P(E_3) = \frac{10}{100}$ $P(A\|E_1) = \frac{80}{100}$ $P(A\|E_2) = \frac{70}{100}$ and $P(A\|E_3) = \frac{30}{100}$ I. $P(A) = P(E_1) \times P(A\|E_1) + P(E_2) \times P(A\|E_2) + P(E_3) \times P(A\|E_3)$ $= \frac{60}{100} \times \frac{80}{100} + \frac{30}{100} \times \frac{70}{100} + \frac{10}{100} \times \frac{30}{100} = \frac{72}{100} = 72\%$ II. $P(E_1\|A) = \frac{P(E_1 \cap A)}{P(A)}$ $= \frac{\left(\frac{60}{100} \times \frac{80}{100}\right)}{\left(\frac{72}{100}\right)} = \frac{48}{72} = \frac{2}{3}$	 2 2

PAINTING CODE - 049
SAMPLE QUESTION PAPER*
CLASS: XII (2025- 26)

Time – 2 hours **Max Marks – 30**

General Instructions

Read the following instructions carefully.

- There are 16 questions in this question paper with internal choice.
- SECTION A consists of 8 multiple-choice questions carrying 1 mark each.
- SECTION B consists of 5 short answer questions carrying 2 marks each (Answer in about 100 words).
- SECTION C consists of 3 long answer questions carrying 6 marks each (Answer in about 200 words).

S.No.	SECTION-A	Marks
	Select the right answer from the given options:	
1.	In the painting Chand Bibi Playing Polo, what is the colour of the horse she is striding? (i) Red (ii) Yellow (iii) Blue (iv) white	1
2.	How are the faces depicted in the painting “Krishna with Gopies”? (i) Side Profile Faces (ek chashm) (ii) 1.25 Profile Faces (sava chashm) (iii) 1.5 Profile Faces (derh chashm) (iv) Front faces. (do chashm)	1
3.	**Assertion (A):** The artistically sculpted image of Ganesha was created by Sculptor P. V. Janakiram. **Reason (R):** The artist used wood for making this sculpture. (i) Both A and R are true, and R is the correct explanation of A (ii) Both A and R are true, but R is not the correct explanation of A (iii) A is true but R is false (iv) A is false and R is True	1
4.	Devanagari script has been used by the artist in which of the following paintings? (i) Shiva and Sati (ii) Falcon on Bird Rest (iii) Children (iv) Kabir and Raidas.	1

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

5.	**Assertion (A): A**rtist Nuruddin of Bikaner school created the painting Krishna on swing, which is divided in two parts. **Reason (R)** Here the architectural interior of the palace and garden scene are depicted in two parts. (i) Both A and R are true, and R is the correct explanation of A (ii) Both A and R are true, but R is not the correct explanation of A (iii) A is true but R is false (iv) A is false and R is True	1
6.	Who among the following artists painted 'Radhika'? (i) Nandlal Bose (ii) Abanindranath Tagore (iii) Ram Gopal Vijayvargiya (iv) Mohammad Abdur Rehman Chughtai	1
7.	Around whose head has the artist painted a halo? (i) Chand Bibi (ii) Saint Kabir (iii) Hazrat Nizamuddin Auliya (iv) Amir Khusro	1
8.	In the painting 'Maru Ragini' which animal is depicted in the foreground. (i) Horses (ii) An Elephant (iii) A Lion (iv) Dog	1
	SECTION-B	
9.	(A) i. Which colours in the Indian National Flag represent courage and sacrifice, peace and faith, chivalry and prosperity? Which symbol inspires us to continuously work toward progress? ii. In your own words, explain how the national flag inspires you to become a good and committed citizen. **OR** (B) In her graphic print, Anupam Sud reflects the dark side of society, portraying the difficult life of a widow. i. Write the name of this print and its medium. ii. Suggest ways to eliminate such social evils from society.	2
10.	(A) This renowned Rajasthani miniature painting teaches the moral values of *Raghukul*. The dominance of white, blue, and green, along with repeated human figures, conveys the narrative effectively. i. Identify the painting, the artist, sub school and medium of the artwork. ii. What human values do you learn from this painting? OR	2

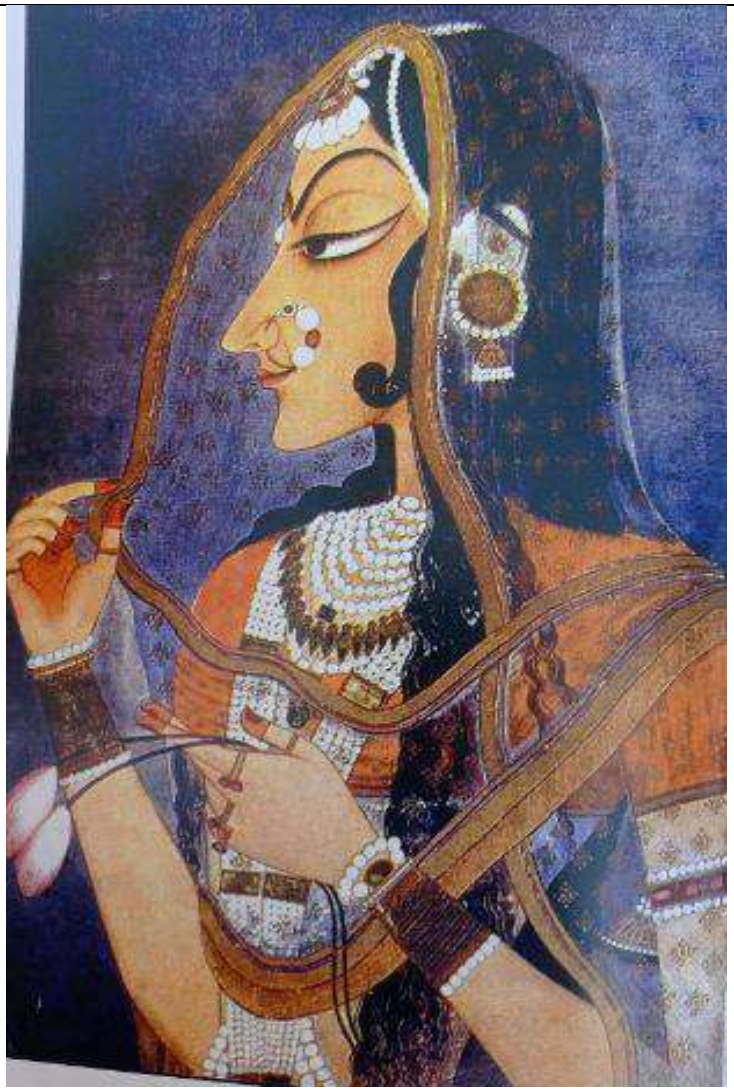
*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

	(B) The Mughal miniature art style is famous for its grandeur. However, the depiction of female figures is limited. i. Identify the artist and the painting from your course that includes both female figures and Mughal grandeur. ii. Explain the artwork briefly using aesthetic parameters.	
11.	Both the paintings mentioned below depict women empowerment from different perspectives—through compassion and faith or courage and bravery. 'Chaugan Players' OR 'Mother Teresa' i. Identify the artist of any one of the paintings and its medium. ii. Describe in brief how the above-mentioned characteristics are displayed in the painting.	2
12.	In the center of a Mughal school of miniature painting, the divine image of God is depicted in larger-than-life size. i. Write the name of the painting and its artist. ii. Describe the compositional arrangement of the painting. OR i. Describe any two main features of Pahari miniature school ii. Name any one artist and the sub-school to which he belonged.	2
13.	(A) This soul-stirring Bengal School painting places divine figures at the centre. Here Shiva is shown as the first lover and the artist has projected his pain and helplessness by creating an extremely sad and gloomy atmosphere. i. Identify the painting and its artist.? ii. Describe the painting based on its compositional arrangement OR (B) Identify the symbolic painting made by artist Abanindaranath Tagore which is included in your course of study, i. Identify the tittle and medium of the artwork.	2

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

	ii. Describe the painting and how does the monochromatic color scheme used in the background compliment the mood and atmosphere.	
	SECTION-C **Attempt <u>any two</u> questions from the given options**	
14.	From your syllabus, identify the artwork by Amrita Shergill made before independence, where instead of women's faces, she has painted dark areas. i. Write the name and medium of the painting. Describe which major Indian issue is depicted in the artwork and what task are the figures shown doing? ii. Explain the picture in detail in your own words and tell which condition of Indian women is the artist trying to depict? iii. Why are the faces shown in dark? What does the use of colour signify?	6
15.	According to your syllabus, identify the artwork painted by an Indian modern artist in which Lord Rama has been depicted in a mood that contrasts his usually calm nature. i. Identify the Painting, artist, medium and which emotion of Lord Ram has been depicted in this artwork? ii. While describing the painting in detail, explain how far has the Artist been successful in depicting the subject matter? iii. Who is the main figure shown in the picture and which qualities of his character would you like to adopt?	6
16.	Carefully observe and identify the given Rajasthani miniature painting i. Write the name of the painting, its artist and two main features of the respective style seen here? ii. Describe the picture on the basis of aesthetic parameters and justify how the artist has fused feminine softness with empowerment. iii. Explain, how the Government of India has given this painting its due recognition and made this artwork important.	6

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

*Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.

PAINTING CODE - 049
MARKING SCHEME
CLASS: XII (2025- 26)

Time – 2 hours **Max Marks – 30**

General Instructions

Read the following instructions carefully.

1. There are 16 questions in this question paper with internal choice.
2. SECTION A consists of 8 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 5 short answer questions carrying 2 marks each (Answer in about 100 words).
4. SECTION C consists of 3 long answer questions carrying 6 marks each (Answer in about 200 words).

S.No.	SECTION-A (MCQ BASED)	Marks
	Select the right answer from the given options:	
1	(i)	1
2	(i)	1
3	(iii)	1
4	(ii)	1
5	(i)	1
6	(iv)	1
7	(iii)	1
8	(iv)	1
	SECTION-B	
9	Symbolic meaning of flag and colours – 1 mark Justification for the inspiration – 1 mark <u>Key points that can be used in the answer:</u> MEANING OF FLAG COLOURS, SAFFRON, WHITE GREEN, BLUE, COURAGE, PEACE, SACRIFICE, STRENGTH, PROSPERITY, UNITY, DHARMA CHAKRA. 24 SPOKES, LAW, 24 HOURS OF THE DAY, COMMITMENT, DUTY, PROPORTION AND RATIO OF OUR FLAG ETC.) (OR) Name of the artist, medium & technique – 1 mark Justification– 1 mark <u>Key points that can be used in the answer:</u> (OF WALLS, ANUPAM SUD, ETCHING ON PAPER, MODERN	2

	ARTWORK, URBAN SCENE, LIFE OF WOMEN, DARK FACES, FEMALE FIGURES, USE OF BRICKS, REPRESENTATION OF SOCIETY, MONOCHROMATIC PRINT ETC.)	
10	Name of the artist, painting – 1 mark Depiction of human values – 1 mark <u>Key points that can be used in the answer:</u> (GUMAN, JAIPUR, TEMPERA, RAMA FIGURE, 49 FIGURES, WRITTEN INSCRIPTION, MALE AND FEMALE FORMS, SAINTS, RESPECT TOWARDS ELDER, SIMPLE HUT, NATURE, STORY NARRATION, HALO, WELL BALANCED COMPOSITION, LOVE TOWARDS YOUNGER BROTHER AND FATHER, RESPECT FOR MOTHERS, EXILE, KEEPING PROMISE, AESTHETIC QUALITIES OF THE PAINTING ETC.) (OR) Name of the artist, painting – 1 mark Depiction of aesthetical parameters – 1 mark <u>Key points that can be used in the answer:</u> 'Darashikoh ki Baarat' (DECORATED HORSES, BRIGHT COLOURS, USE OF FIREWORKS, FEMALES ON ELEPHANTS, GROOM IN THE MIDDLE, HALO ON KING FACE, JEWELLERY, MUGHAL COSTUMES, TOO MANY FIGURES, ARTIST - HAJI MADNI.)	2
11	Artist &. Medium – 1 mark Description of the characteristics – 1 mark <u>Key points that can be used in the answer:</u> (DECORATED HORSES, BRIGHT COLOURS, USE OF ORANGE COLOUR, BELL SHAPED GHAGRA, GALLOPING HORSES, JEWELLERY ADORNED PRINCESS, FIGURES AT THE BACK ARE BIG, JODHPUR SUB SCHOOL, ARTIST - DANA.) (OR) Artist &. Medium – 1 mark Description of the characteristics – 1 mark <u>Key points that can be used in the answer:</u> (ABSTRACT FIGURES, BOLD LINES, BLUE BORDER, HOLLOW FACES, LOVE, COMPASSION AND CARE, MOTHER AND CHILD BOND, DEPICTION OF DIFFERENT AGE, WELL BALANCED COMPOSITION ETC.)	2

12	Artist and painting– 1 marks Compositional arrangement – 1 marks <u>Key points that can be used in the answer:</u> 'KRISHNA LIFTING MOUNT GOVERDHAN'MISKIN (KRISHNA FIGURE, PITAMBER, GARLAND, TOO MANY FIGURES, DEPICTION OF FLORA AND FAUNA, ANIMALS, STYLIZED MOUNTAINS, MUGHAL COSTUME, BRIGHT COLOURS, AESTHETIC QUALITIES OF THE PAINTING ETC.) (OR) Artist and medium– 1 mark Characteristics– 1 mark <u>Key points that can be used in the answer:</u> 'Krishna with Gopis' (MANAKU, WATER COLOUR TEMPERA, PITAMBER, KRISHNA FIGURE, COSTUMES, FOLDED HANDS, SMILING FACES, ETERNAL AND DEVINE LOVE, JEWELLERY, FEMALE FORMS, DEVOTION.) 'Nand, Yashoda and Krishna with Kinsmen going to Vrindavan' (NAINSUKH, WATER COLOUR TEMPERA, PITAMBER, KRISHNA FIGURE, COSTUMES, BRIGHT COLOURS, SMILING FACES, KINSMEN, JEWELLERY, MULTIPLE FORMS AND FIGURE.)	2
13	Name of the Painting and Artist – 1 mark Description and Compositional Arrangement – 1 mark <u>Key points that can be used in the answer:</u> (SHIV AND SATI, NANDLAL BOSE, SAD FACE, PAIN, SUFFERING, AGONY, WELL COMPOSED, MALE AND FEMALE FORM, DETAILED LINES, FEETS VISIBLE OF THE BODY, DULL BACKGROUND, MONOCHROMATIC COLOURS) (OR) Name of the artwork and Medium – 1 mark Description of Painting and Technique – 1 mark <u>Key points that can be used in the answer:</u> (JOURNEY'S END, DARK BACKGROUND, WASH TECHNIQUE, PAIN,SUFFERING, AGONY, WELL COMPOSED, CAMEL FORM, HEAVY BURDEN, EXCESSIVE WORK TAKEN, SMALL SIZE, DULL COLOURS, AESTHETIC QUALITIES OF THE PAINTING ETC.)	2

	SECTION-C **Attempt <u>any two</u> questions from the given options**	
14	Name of the Painting, Medium, Work, Major Issue Depicted – 2 marks Explanation of the Painting – 2 marks Description and Colour application – 2 marks <u>Key points that can be used in the answer:</u> (HALDI GRINDERS, OIL ON CANVAS, MODERN ARTWORK, RURAL SCENE, LIFE OF WOMEN AND ROUTINE WORK, DARK FACES, FEMALE FIGURES, USE OF TREES, REPRESENTATION OF SOCIETY, IMPORTANT ROLE OF FEMALE ARTISTS IN REVIVING INDIAN ART, AESTHETIC QUALITIES OF THE PAINTING ETC.)	6
15	Painting, artist, medium and emotion – 2 marks Description of subject matter and Artwork– 2 marks Identification of qualities and main figure – 2 marks <u>Key points that can be used in the answer:</u> (FORCEFUL, ANGER ON SEA GOD, LORD RAMA, LIGHTNING AND THUNDERSTORM, FLOWING DHOTI, REALISTIC DRAWING, DESTRUCTIVE SEA WAVES, OIL MEDIUM, AESTHETIC QUALITIES OF THE PAINTING ETC. PRIDE, SELF RESPECT, POWER, WISDOM, ANGER)	6
16	Name of the Painting and Artist, Two Features – 2 marks Description of aesthetic qualities and justification – 2 marks Depiction of relevance and importance– 2 marks <u>Key points that can be used in the answer:</u> (RADHA- BANI THANI, NIHALCHAND, KISHANGARH, TEMPERA, WATERCOLOURS ON PAPER, NATURAL COLOURS, POINTED FACE, POINTED CHIN, BOW LIKE EYEBROWS, POINTED NOSE, CURLY HAIR, LOTUS SHAPED EYES, TRANSPARENT CHUNARI, LOTUS BUDS, DELICATE AND THIN FINGERS, BRIGHT COLOURS, AESTHETIC QUALITIES OF THE PAINTING ETC.)	6

PHYSICAL EDUCATION (048)
Sample Question Paper
Class XII (2025-26)

TIME ALLOWED: 3 HRS MAX MARKS: 70

GENERAL INSTRUCTIONS:

1. The question paper consists of 5 sections and 37 Questions.
2. Section A consists of question 1-18 carrying 1 mark each and is multiple choice questions. All questions are compulsory
3. Sections B consist of questions 19-24 carrying 2 marks each and are very short answer types and should not exceed 60-90 words. Attempt any 5.
4. Sections C consist of Question 25-30 carrying 3 marks each and are short answer types and should not exceed 100-150 words. Attempt any 5.
5. Sections D consist of Question 31-33 carrying 4 marks each and are case studies.
6. Section E consists of Question 34-37 carrying 5 marks each and are long answer types and should not exceed 200-300 words. Attempt any 3.

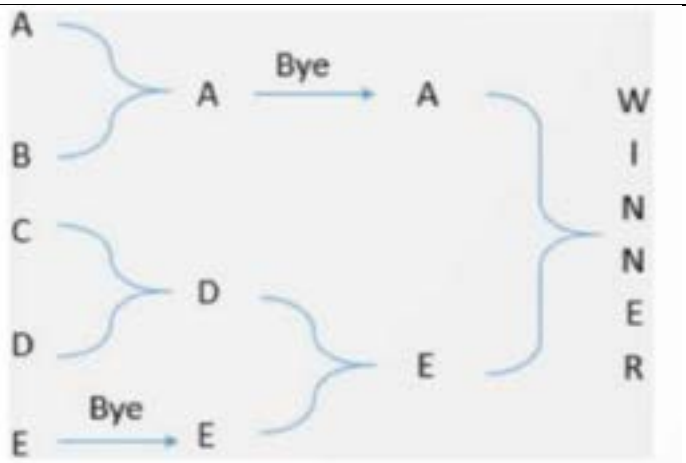
<table>
<tr><td>Q No.</td><td></td><td>Marks</td></tr>
<tr><td></td><td><u>SECTION A</u></td><td></td></tr>
<tr><td>Q1.</td><td>A tournament where every team plays with every other team once and the number of matches is
determined with the help of the formula N(N-1) is called as:

(a) knockout tournament (b) double league tournament
(c) single league tournament (d) none of these</td><td>[1]</td></tr>
<tr><td>Q2.</td><td>Given below are the two statements labelled Assertion (A) and Reason (R).
Assertion (A): Knockout tournament is very time-consuming.
Reason (R): Each team must compete with all other teams
In context of the above two statements, which one of the following is correct?
(a) A is true, but R is false
(b) A is false, but R is true
(c) Both A and R are true and R is the correct explanation of A
(d) Both A and R are true, but R is not the correct explanation of A</td><td>[1]</td></tr>
<tr><td>Q3.</td><td>Match the following:
<table><tr><th>Column I</th><th>Column II</th></tr><tr><td>(a) Garun asana
(b) Horse riding
(c) Rope skipping
(d) Hal asana</td><td>(i) Flat foot
(ii) Lordosis
(iii) Knock knees
(iv) Bow legs</td></tr></table>(a) A-(iv), B-(iii), C-(i), D-(ii)
(b) A-(ii), B-(iv), C-(i), D-(iii)
(c) A-(iii), B-(i), C-(iii), D-(iv)
(d) A-(i), B-(ii), C-(iii), D-(iv)</td><td>[1]</td></tr>
</table>

Q4.	What is nutrition? (a) Essential substances of food like proteins, fats, carbohydrates, etc. (b) Consuming correct ratio of nutrients (c) Dynamic process in which consumed food is digested (d) Both (a) and (b)	**[1]**
Q5.	Identify the yoga asana below.  (a) Uttana Mandukasana (b) Paschim tan asana (c) Dhanu asana (d) Hal asana	**[1]**
Q6.	Which of the following is a yoga pose for treatment of obesity? (a) Gomulka asana (b) Bhujang asana (c) Paschim tan asana (d) Vajrayana	**[1]**
Q7.	Who are the participants in Special Olympics? (a) Veterans (b) Children and adults with intellectual disabilities (c) Physically handicapped (d) Both (b) and (c)	**[1]**
Q8.	Female Athlete Triad does not include _____. (a) Amenorrhea (b) Oligomenorrhea (c) Osteoporosis (d) Bulimia Nervosa	**[1]**
Q9.	Find the odd one out. (a) Calcium (b) Sulfur (c) Potassium (d) Iron	**[1]**
Q10.	What is the dimension of layout in Johnsen-Methney Test of Motor Educability? (a)15 × 3 feet (b) 15 × 3 meters c) 15 × 2 feet (d) 15 × 2 meters	**[1]**

Q11.	Which of the following is not a short-term effect of exercise on muscular system? (a) Accumulation of lactate (b) Increased blood supply (c) Muscular hypertrophy (d) Increased muscle temperature	**[1]**
Q12.	Which of these is not a soft tissue injury? (a) Abrasion (b) Dislocation (c) Strain (d) Incision	**[1]**
Q13.	Which of the following helps with ice skating? (a) Rolling friction (b) Sliding friction (c) Static friction (d) Gliding friction	**[1]**
Q14.	Which of the following is NOT the factor effecting projectile trajectory? (a) Gravity (b) Angle of release (c) Buoyant force (d) Air resistance	**[1]**
Q15.	Self-talk refers to our _____ consisting of statements we say to ourselves, either in our mind or out loud. (a) Internal thoughts (b) Internal behavior (c) Internal soul (d) Internal emotions	**[1]**
Q16.	**Assertion (A):** Aggression is part of human behavior and is necessary for an individual to live and struggle for higher achievements. **Reason (R):** Aggression is inevitable and inseparable in sport activities. In the context of the above two statements, which one of the following is correct? (a) (A) is false, but (R) is true. (b) (A) is true, but (R) is false. (c) Both (A) and (R) are true and (R) is the correct explanation of (A). (d) Both (A) and (R) are true, but (R) is not the correct explanation of (A).	**[1]**
Q17.	The method of training that involves repeated bouts of high-intensity work followed by periods of rest or low-intensity activity is known as _____. (a) Continuous Training (b) Interval Training (c) Fartlek Training (d) Circuit Training	**[1]**
Q18.	Which of the following is not a type of coordinative ability? (a) Orientation Ability (b) Acceleration Ability (c) Grouping Ability (d) Dynamic Ability	**[1]**

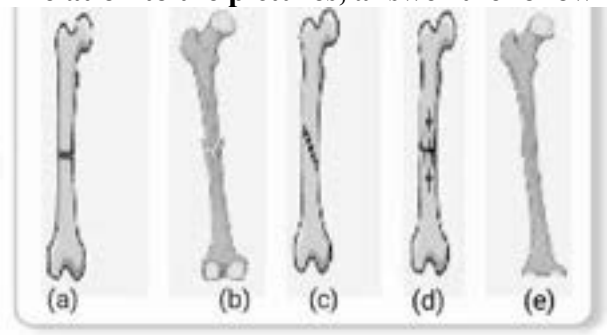
Q19.	Differentiate between the three types of spinal deformity	**[2]**
Q20.	What is a balanced diet? Mention its importance also. [1+1]	**[2]**
Q21.	A male student performed the Harvard Step Test for 4 minutes. His pulse was recorded during the recovery periods as 58 beats in the first half-minute, 50 beats in the second, and 42 beats in the third. Using the Harvard Step Test formula, calculate his Fitness Index and state whether his score falls in the Excellent, Good, or Average category.	[1½+½] **[2]**
Q22.	Enlist any four types of fracture.	½ * 4 **[2]**
Q23.	Write a short note on Sports Psychology**.**	**[2]**
Q24.	A football player wants to improve his acceleration and quick reaction during a match. Suggest two suitable training methods and justify how each will help improve his performance.	[1+1] **[2]**
Q25.	League tournament is a better way to judge the best team of the tournament. Comment.	**[3]**
Q26.	Discuss the exercise guidelines for different age groups.	[1+1+1] **[3]**
Q27.	Explain strategies to make Physical Activities Accessible for CWSN.	**[3]**
Q28.	Discuss the importance of pre, during and post competition diet in detail.	[1+1+1 **[3]**
Q29.	A gymnast maintains a handstand position on the balance beam, then performs a flip. Differentiate between the types of equilibrium shown and explain how they help in performance.	[1+2] **[3]**
Q30.	Describe personality. Explain dimensions of personality.	[1+2] **[3]**
Q31.	**Read the following text carefully and answer the questions that follow:** Competing in physical activities has been the natural tendency of humans. The competitions or tournaments are held according to the set rules and regulations. The success of the tournament depends upon suitable fixture	**[4]**



1. The method followed in drawing the fixture is:
   a) Random method
   b) Knock out method
   c) League cum knockout method
   d) League method
2. The number of matches played can be calculated by the formula _____.
   a) 2N
   b) N+1
   c) N/2
   d) N - 1
3. What is the advantage of this tournament?
   a) More matches are played
   b) Less number of teams participate
   c) The knockout tournament takes less time and is economical
   d) All teams play equal number of matches
4. What is the term used if privilege is given to a team to play at a higher round?
   a) Bye
   b) Draw
   c) Super seeding
   d) Any of the above

Q32. **Based on the picture given below, answer the following questions.** **[4]**

1. Identify the logo.
   (a) Special Olympics
   (b) Paralympics
   (c) Deaflympics
   (d) Special Olympics Bharat
2. What does the circle signify?

	(a) Unity (b) Ears (c) Strength (d) Iris 3. In which year was it held for the first time? (a) 2001 (b) 1924 (c) 1948 (d) 1968 4. What are the four colours in the logo? (a) Red, Yellow, Black, Blue (b) Red, Blue, Green, Yellow (c) Yellow, Black, Red, Green (d) Brown, Blue, Green, Red	
Q33.	**In relation to the pictures, answer the following questions:**  1. When the two ends of the injured bone enter into each other it is said to be. (a) Comminuted Fracture (b) Greenstick Fracture (c) Impacted Fracture (d) Transverse Fracture 2. _____ is a comminuted fracture. (a) (d) (b) (b) (c) (e) (d) (a) 3. When the bone is broken into many pieces at one place or different places, it is called. (a) Oblique Fracture (b) Impacted Fracture (c) Comminuted Fracture (d) Greenstick Fracture 4. _____ fracture occurs in a straight line at a right angle to the shaft of the bone. Usually caused by a direct blow (a) Greenstick Fracture (b) Oblique Fracture (c) Transverse Fracture (d) Impacted Fracture (Question for Visually Impaired) Vitamins and minerals are essential nutrients which protect us from various diseases and are helpful for general development of the body. 1. _____ is a group of 8 water-soluble vitamins which are important for cellular metabolism.:	**[4]**

	a) Vitamin A b) Vitamin K c) Vitamin B d) Vitamin D 2. _____ disease is caused due to lack of Vitamin B. a) Anemia b) Kwashiorkor c) Scurvy d) Beri Beri 3. Vitamin_____ is important for healthy bones and teeth. a) K b) A c) D d) C 4. Vitamin_____ is needed for blood clotting a) A b) D c) K d) E	
Q34.	What do you mean by Asthma. Mention its symptoms. Explain the procedure, benefits and contraindications of an asana beneficial for the patient of arthritis.	[1+2+2] **[5]**
Q35.	Make a table of test items listed under fitness test by SAI (Age group 9-18 yrs) Explain the Procedure and Scoring of 50 MTS Run and Partial Curl Up	[1+2+2] **[5]**
Q36.	What do you understand by circuit training? How will a coach plan circuit training sessions with 6 stations to develop the fitness of his new trainees? Explain.	[1+4] **[5]**
Q37.	What is a lever? Discuss the application of Lever in sports.	[2+3] **[5]**

PHYSICAL EDUCATION (048)
Class XII
2025-26
Answer Key

TIME ALLOWED: 3 HRS MAX MARKS: 70

Q No.	Answer	Marks
	SECTION A	
Q1.	B. Double league tournament	1
Q2.	A. A is true, R is false	1
Q3.	A. A-(iv), B-(iii), C-(i), D-(ii)	1
Q4.	C. Dynamic process in which consumed food is digested	1
Q5.	C. Dhanur asana	1
Q6.	C. Paschimottan asana	1
Q7.	B. Children and adults with intellectual disabilities	1
Q8.	B. Oligomenorrhea	1
Q9.	D. Iron	1
Q10.	C. 15 × 2 feet	1
Q11.	C. Muscular hypertrophy	1
Q12.	B. Dislocation	1
Q13.	B. Sliding fiction	1
Q14.	C. Buoyant force	1
Q15.	A. Internal thoughts	1
Q16.	D. Both (A) and (R) are true but R is not the correct explanation of (A).	1
Q17.	B. Interval Training	1
Q18.	A. Orientation ability	1
	SECTION B	
Q19.	Differentiate between the three types of spinal deformity. Kyphosis ● Outward curvature of the thoracic spine (hunchback appearance) ● Head and shoulders lean forward ● Common in older adults or due to poor posture ● Can cause breathing issues and back pain in severe cases Lordosis ● Excessive inward curvature of the lumbar spine (swayback) ● Abdomen and buttocks protrude outward ● Often caused by weak abdominal muscles or obesity ● May lead to lower back discomfort and postural imbalance Scoliosis ● Lateral (sideways) curvature of the spine in 'S' or 'C' shape ● Uneven shoulders or hips may be visible ● Can be congenital or develop during adolescence ● Severe cases may affect lung and heart function (any two)	[1+1]
Q20.	What is balanced diet? Mention its importance Balanced Diet – Definition [1]	[2]

	● Contains all essential nutrients in correct proportion. Importance of Balanced Diet (Any 2-3 points): ● Provides energy ● Supports growth and repay ● Boosts immunity ● Prevents deficiencies and diseases ● Maintains body functions efficiently	
Q21.	A male student performed the Harvard Step Test for 4 minutes. His pulse was recorded during the recovery periods as 58 beats in the first half-minute, 50 beats in the second, and 42 beats in the third. Using the Harvard Step Test formula, calculate his Fitness Index and state whether his score falls in the Excellent, Good, or Average category Formula: Fitness Index = (Duration of exercise in seconds × 100) ÷ (2 × Sum of pulse counts in recovery) Step 1: Duration = 4 minutes = 240 seconds Sum of pulse = 58 + 50 + 42 = 150 beats Step 2: Fitness Index = (240 × 100) ÷ (2 × 150) = 24000/300 = 80 Category - Good	[2]
Q22.	Enlist any four types of fracture. i. Simple Fracture ii. Compound Fracture iii. Comminuted Fracture iv. Greenstick Fracture v. Transverse Fracture vi. Oblique Fracture vii. Impacted Fracture (any four)	[1/2*4]
Q23.	Write a short note on Self Talk. Sports psychology is a field that studies how psychological factors influence athletic performance and participation in sports, exercise, and physical activity. It examines the mental aspects of sports, including motivation, anxiety, stress, and the impact of sports on well-being. Key Areas of Focus: • **Performance Enhancement:** Sports psychologists help athletes improve their performance by using psychological techniques like goal setting, visualization, relaxation, and self-talk. • **Mental Health and Well-being:** They also address the impact of sports on an individual's mental health, including issues like burnout, anxiety, and depression. • **Team Dynamics:** Sports psychology can also help improve team dynamics and communication, fostering a more positive and collaborative environment. • **Coaching and Training:** They work with coaches to understand how to create effective training programs	[1/2*4]

	that incorporate psychological principles. • **Social and Developmental Aspects:** Sports psychologists study how sports participation affects an individual's social development and overall well-being. (any four)	
Q24.	A football player wants to improve his acceleration and quick reaction during a match. Suggest two suitable training methods and justify how each will help improve his performance. 1. Acceleration Sprints – Improve the player's ability to quickly reach top speed during sudden movements in a match. 2. Reaction Drills – Enhance response time to game situations like passes or opponent movements.	[1+1]
	SECTION C	
Q25.	League tournament is a better way to judge the best team of the tournament. Comment. ● Equal opportunities to all the teams ● League matches minimize impact of luck or unexpected outcomes ● Judged on basis of multiple matches ● Ranking of basis of points earned ● Less pressure on teams with compassion to knockout tournament ● Scope of improvement	[3]
Q26.	Discuss the exercise guidelines for different age groups. Children (Under 5 years): o At least 180 minutes/day of physical activity. o Tummy time (30 mins) for infants who aren't mobile. o Avoid being restrained for over 1 hour at a time. o Limit or avoid screen time, depending on age. Adolescents (5–17 years) o Minimum 60 minutes/day of moderate to vigorous activity. o Include muscle and bone-strengthening exercises 3 days/week. o Prefer aerobic activities like running, swimming, cycling. o Limit screen time and reduce sedentary behavior. Senior Citizens (65+ years): o 150–300 minutes/week of moderate aerobic activity. o Do balance and strength exercises 2–3 days/week. o Be physically active daily; avoid long sitting hours. o Adapt intensity as per health conditions and ability.	[1+1+1]
Q27.	Explain strategies to make Physical Activities Accessible for CWSN. Strategies to Make Physical Activities Accessible for CWSN: 1. **Sensory Integration** – Reduce loud music, use natural lighting, and provide	[3]

	headphones/sunglasses. 2. **Positive Behaviour Support (PBIS)** – Use picture schedules and encourage positive interactions. 3. **Team Building Activities** – Focus on creative, cooperative games over competition. 4. **Accessible Surfaces** – Use gym mats or level fields to support mobility and wheelchair use. 5. **Inclusive Classrooms** – Educate CWSN alongside others to promote acceptance. 6. **Assistive Technology** – Use tools like large balls, bells, or string-attached equipment. 7. **Adaptive Physical Education** – Modify rules and games based on individual needs. 8. **Creative Game Focus** – Use imaginative games to build confidence and reduce pressure. (4 points)	
Q28.	Discuss the importance of pre, during and post competition diet in detail. Pre-Competition Diet o Provides energy, prevents early fatigue, and ensures smooth digestion before performance. o Consume high-carbohydrate foods like rice, pasta, or bread for sustained energy. o Prefer easily digestible, low-fat, and non-fried meals taken 3–4 hours before the event. During Competition Diet o Maintains hydration, energy, and electrolyte balance to avoid fatigue and muscle cramps. o Sip on glucose-rich drinks or electrolyte solutions to maintain blood sugar and sodium levels. o Include small portions of quick energy foods like banana or energy gels if needed. Post-Competition Diet o Supports recovery by replenishing lost fluids and restoring glycogen levels in muscles. o Eat carbohydrate-rich foods such as fruits, sandwiches, or energy bars immediately after. o Rehydrate with fluids like water, juice, or sports drinks to replace lost electrolytes.	[1+1+1]
Q29.	A gymnast maintains a handstand position on the balance beam, then performs a flip. Differentiate between the types of equilibrium shown and explain how they help in performance. a) Static equilibrium – ● Shown during handstand; ● Body is balanced and at rest. b) Dynamic equilibrium – ● Shown during flip; ● Stability maintained while in motion. o Helps maintain balance, control, and fluidity during transitions and	[2+1]

	performance.	
Q30.	Describe personality. Explain dimensions of personality. >Personality is the combination of physical, mental, psychological, and emotional traits that make an individual unique. 1. Physical Dimension o Height and weight o Body structure and posture o Facial appearance and complexion 2. Mental Dimension o Intellect and reasoning ability o Decision-making power o Memory and concentration 3. Psychological Dimension o Emotions and mood stability o Self-confidence and motivation o Willpower and attitude	[3]
Q31.	1. b) Knockout method 2. d) N - 1 3. c) Knockout tournament takes less time and is economical 4. a) Bye	[1*4=4]
Q32.	1. (c) Deaflympics 2. (d) Iris 3. (b) 1924 4. (b) Red, Blue, Green, Yellow	[1*4=4]
Q33.	1. (c) Impacted Fracture 2. (b) (b) 3. (c) Comminuted Fracture 4. (c) Transverse Fracture (FOR VISUALLY IMPAIRED) 1. b) Vitamin B 2. d) Beri Beri 3. c) D 4. c) K	[1*4=4]
Q34.	What do you mean by Asthma. Mention its symptoms. Explain the procedure, benefits and contraindications of an asana beneficial for the patient of asthma. Asthma is a chronic respiratory condition where the airways become inflamed and narrow, leading to difficulty in breathing. It often triggers coughing, wheezing, shortness of breath, and chest tightness. Symptoms of Asthma: ● Difficulty in breathing ● Wheezing (whistling sound while breathing)	[1+2+2]

	● Tightness in chest ● Frequent coughing, especially at night or early morning ● Fatigue during physical activity Mats asana (Fish Pose) Procedure 1. Lie flat on your back with legs extended and hands beside the thighs. 2. Place the hands underneath the hips with palms facing down. 3. Lift the chest upward while arching the back and tilt the head backward so that the crown touches the floor. 4. Hold the posture while breathing deeply and slowly. 5. Return to the starting position gently. Benefits: ❖ Expands the chest and improves lung capacity. ❖ Helps ease respiratory issues like asthma and bronchitis. ❖ Stimulates the throat and opens nasal passages for easier breathing. ❖ Strengthens the upper back and neck muscles. ❖ Reduces anxiety and stress, which can trigger asthma. Contraindications: ❖ Avoid in case of serious neck or back injury. ❖ Not suitable for individuals with high blood pressure or migraines. ❖ Should be performed under guidance if suffering from spinal disorder.	
Q35.	Make a table of test items listed under fitness test by SAI (Age group 9-18 yrs) Explain the Procedure and Scoring of 50 MTS Run and Partial Curl Up. AGE GROUP: 9-18+ YEARS | CLASS 4 to 12 For 1. Body Composition (BMI) 2. Strength a. Abdominal (Partial Curl-up) b. Muscular Endurance (Push Ups for Boys, Modified Push Ups for Girls) 3. Flexibility (Sit and Reach Test) 4. Cardiovascular Endurance (600 Meter Run/Walk) 5. Speed (50 mt. Dash) 50 MTR DASH (STANDING START) Procedure: A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position should be static (dead start). The tester should provide hints for maximizing speed (such as keeping low, driving hard with the arms and legs) and encouraged to continue running hard through the finish line.	[2.5+2.5]

	Scoring: Time taken for completion ABDOMINAL (PARTIAL CURL-UP) Procedure: The subject lies on a cushioned, flat, clean surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards) closer to the ground, parallel to the body. The subject raises the trunk in a smooth motion, keeping the arms in position, curling up the desired amount (at least 6 inches above/along the ground towards the parallel strip). The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor. Scoring: Record the maximum number of Curl ups in a certain time period (30 seconds).	
Q36.	What do you understand by circuit training? How a coach will plan circuit training sessions with 6 stations to develop fitness of his new trainees? Explain 1. A training method where different exercises are performed in a sequence (stations) with minimal rest. 2. Each station targets a specific fitness component or muscle group. 3. Helps improve overall fitness efficiently in limited time. 6 Sample Stations (Exercises): ● 1. Push-ups ● 2. Squats ● 3. Skipping ● 4. Sit-ups ● 5. Shuttle runs ● 6. Plank hold (Or any other suitable) Components to be Developed in New Trainees: ● Strength ● Endurance ● Flexibility ● Speed ● Agility ● Coordination (Explanation of each point along with a circuit)	[1+4]
Q37.	What is a lever? Explain the types of levers with the help of example. A Lever is a simple machine that provides mechanical advantage to magnify the force necessary to overcome a resistance. There are three types of levers ● Class 1 lever (see saw/ seated dumbbell triceps) ● Class 2 lever (pushing against the block in sprint start/ calf raises) ● Class 3 lever (fishing rod/ leg extensions)	[1+3+1]

	(each type to be explain with help of examples)	

PHYSICS – Code No. 042
SAMPLE QUESTION PAPER
CLASS – XII (2025 – 26)

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains **sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark each**, **Section B** contains **five questions of two marks each**, **Section C** contains seven questions of three marks each, **Section D** contains **two case study-based questions of four marks each** and **Section E** contains **three long answer questions of five marks each**.
(5) There is no overall choice. However, an internal choice has been provided in two question in Section B, one question in Section C and all three questions in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary

i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $m_p = 1.7 \times 10^{-27}$ kg
iv. $e = 1.6 \times 10^{-19}$ C
v. $\mu_0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$
vi. $h = 6.63 \times 10^{-34}$ J s
vii. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2 N^{-1} m^{-2}}$
viii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

SECTION A		
Q.No.	**Question**	**Marks**
1.	If a charged hollow sphere and a solid sphere of aluminum and copper of equal radii are in electrostatic equilibrium, then which of the following statements is true? (A) Both the spheres are having equal charges. (B) The hollow sphere will have more charge than solid sphere at its surface. (C) The aluminum sphere will have more charge on its surface than copper sphere. (D) If hollow sphere is also made up of aluminum then it will have more charge.	1

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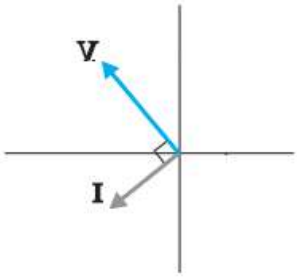
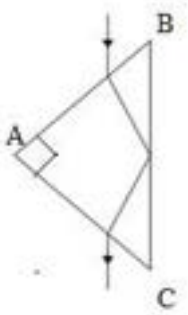
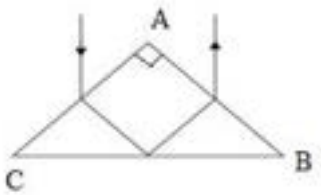
2.	A coil contains N turns of insulated copper wire of diameter d and resistivity ρ wound on a cylinder of diameter D. What is the total resistance between the two ends of the coil of copper wire?(given: D>>d) (A) $\frac{4\rho ND}{d^2}$ (B) $\frac{8\rho ND}{d^2}$ (C) $\frac{2\rho ND}{d^2}$ (D) $\frac{12\rho ND}{d^2}$	1
3.	If the phasor diagram for a device connected to AC supply is as shown in the fig, then which of the following statements is true?  (A) When the frequency of the AC source is increased than the impedance of the device decreases. (B) This device behaves as conducting wire when connected across DC source. (C) When the frequency of the AC source is decreased than the impedance of the device decreases. (D) D. This device stores energy in the form of magnetic potential energy.	1
4.	Which of the following statement is true for the radio waves and the gamma rays? (A) The energy of gamma rays is lesser than that of the radio waves. (B) The frequency of the radio waves is higher than that of gamma rays. (C) The radio waves and the gamma rays have the same energy. (D) The energy of radio waves is lesser than that of the gamma rays.	1
5.	A glass prism has internal angles of 45°, 45° and 90°. The glass has a critical angle of 45°. Which of the following ray diagrams depicts the possible path the of light through the prism? (A) (B)  	1

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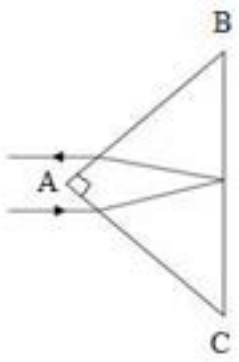
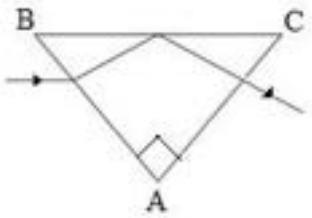
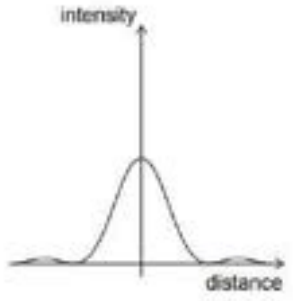
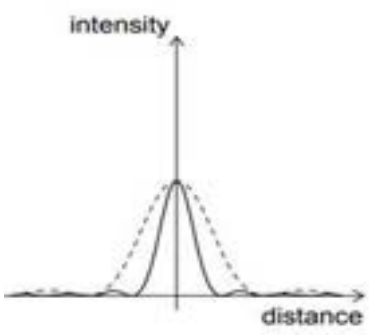
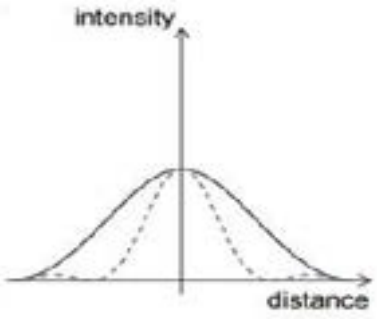
	(C) (D)   **For VI-Candidates** Light passes from a certain medium into air. The critical angle of the given medium is Θ, which of the following expressions gives the speed of light in the given medium? Where c is the speed of light in air. (A) $\frac{1}{c\sin\theta}$ (B) $\frac{\sin\theta}{c}$ (C) $\frac{c}{\sin\theta}$ (D) $c\sin\theta$	
6.	The light from a monochromatic source is incident on a single slit and the resulting diffraction pattern is viewed on a screen. The graph shows the variation of the intensity with the distance on the screen.  The width of slit is increased keeping the intensity of the source the same. Which of the following graphs is correct? (The original curve is shown with a dashed line.) (A) (B)   	1

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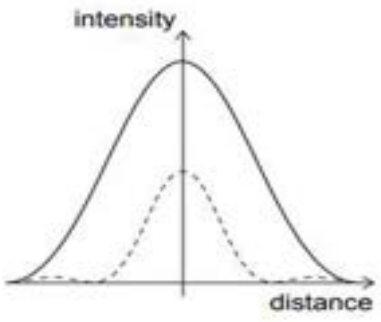
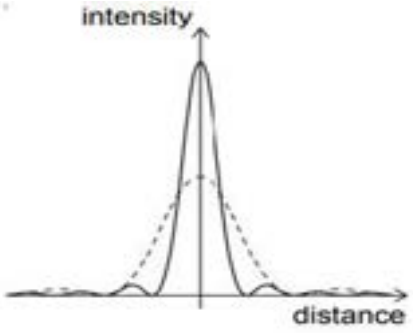
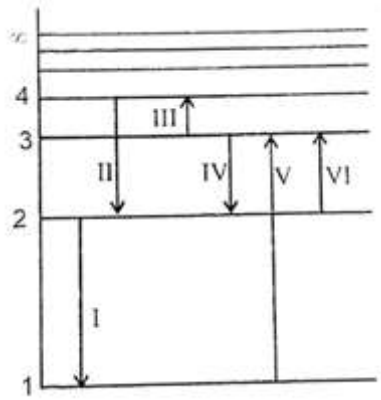
	(C)  (D)  **For VI-Candidates** The phenomenon of superposition of two waves, resulting in redistribution of energy is known as…… (A) diffraction (B) interference (C) reflection (D) refraction	
7.	Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength?  (A) I (B) III (C) IV (D) VI	1
	(for V.I. Candidates) Which of the following transitions corresponds to the emission of the radiation of the maximum wavelength? I — From 4^{th} orbit to 2^{nd} orbit. II — From 2^{nd} orbit to 1^{st} orbit. III — From 3^{rd} orbit to 4^{th} orbit. IV — From 3^{rd} orbit to 2^{nd} orbit. V — From 1^{st} orbit to 3^{rd} orbit. VI — From 2^{nd} orbit to 3^{rd} orbit. (A) I (B) III (C) IV (D) VI	

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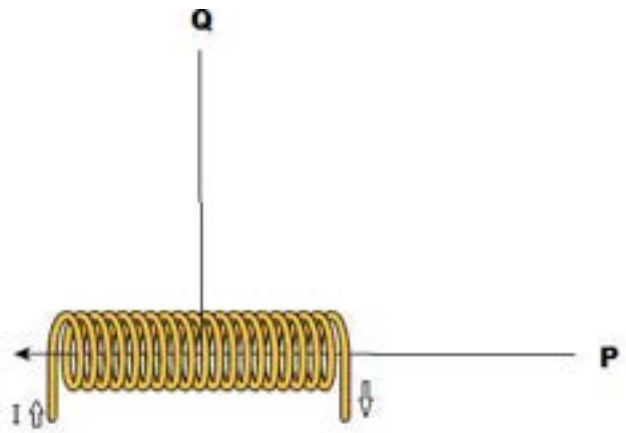
8.	A charged particle is projected along the axis of a current carrying loop. Which of the following statements is true? (A) The acceleration of the charged particle will depend on the velocity with which it is projected. (B) The acceleration of the charged particle will depend on the magnitude of the current passing through the coil. (C) The acceleration of the charged particle will depend on the radius of the coil. (D) The charged particle will move with constant velocity.	1
9.	Two small identical magnets are allowed to fall freely one through a vertical solenoid of 20 m made up of copper and another in air through the same vertical distance. The time taken by the two magnets to fall will be (A) same in both the cases. (B) more for the magnet falling in air. (C) more for the magnet falling through the solenoid. (D) infinite.	1
10.	The emf generated by an AC generator is given by $V=V_o \sin \omega t$, where ω is angular frequency of armature of generator. What will be the emf if the angular frequency is doubled (A) $V=V_o \sin 2\omega t$ (B) $V=2V_o \sin \omega t$ (C) $V=2V_o \sin 2\omega t$ (D) $V=V_o \sin \omega t$	1
11.	The ratio of the nuclear densities of two nuclei having the mass numbers 8 and 27 is (A) 8:27 (B) 3:2 (C)2:3 (D) 1:1	1
12.	When we move magnetic compass from point P to Q then which of the following statement is true  	1

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	(A) The deflection of the magnetic needle at P and Q will be in the same direction. (B) The deflection of the magnetic needle at P and Q will be in the opposite directions. (C) The deflection of the magnetic needle at P and Q will be perpendicular to each other. (D) The deflection of the magnetic needle at P and Q will be inclined at 45^o with respect to each other.	
	For Questions 13 to 16, two statements are given one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion. (B) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (C) Assertion is true but Reason is false. (D) Both Assertion and Reason are false.	
13.	**Assertion (A):** Total energy of an electron in hydrogen atom is negative. **Reason (R):** The centripetal force is provided by electrostatic force.	1
14.	**Assertion (A):** The critical angle of light passing from glass to air is minimum for violet colour. **Reason (R):** The wavelength of blue light is greater than the light of other colours.	1
15.	**Assertion (A):** Two light sources emitting waves of similar wavelengths are coherent. **Reason (R):** Two light sources emitting waves having zero or constant phase difference are known as coherent sources.	1
16.	**Assertion (A):** For three point charges to be in equilibrium, they must be collinear. **Reason(R):** One of the three charges must have different polarity than rest of the two.	1
	SECTION B	
17.	The amplitude of the magnetic field of a plane electromagnetic wave propagating along positive X axis in vacuum is 510 nT$\hat{k}$ and its angular frequency is 60 x 10^6 rad/sec. Write the expression for the electric field $\left(\vec{E}\right)$.	2
18.	The following graph shows the potential difference across the terminals of a cell against its load current.	2

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	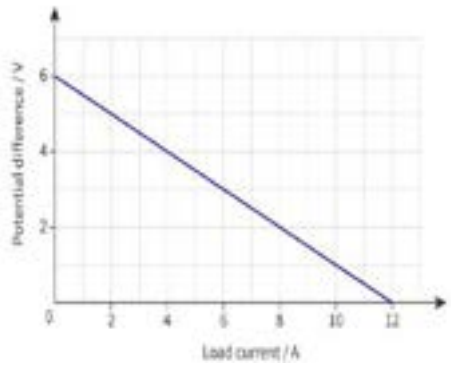 Find, (I) the emf of the cell and (II) the internal resistance of the cell. **For VI candidates** Find the relation between internal resistance, emf, external resistance and the total current in the circuit ?	
19.	A charge q is placed inside a sphere of radius 'a' filled with water and another charge 2q is placed inside cube of side '2a' which is vacuumed inside. Find the ratio of the flux linked with the sphere to that linked with the cube. (Take relative permittivity of water as 80)	2
20(I)	Write an expression for the magnetic force per unit length between two parallel thin current carrying wires. Hence define one ampere. **OR**	2
20(II)	Draw a diagram representing the behaviour of magnetic field lines for a (A) diamagnetic & (B) paramagnetic substance. **For VI-Candidates** Sate Gauss's law of magnetism? Hence find the magnetic flux linked with the sphere enclosing a current carrying solenoid?	2
21(I)	How does the impact parameter affect the trajectory of a α – particles scattered by a heavy nucleus? What is the value of impact parameter for head on collision of α – particles with the nucleus? **OR**	2
21(II)	Plot a graph showing variation of de-Broglie wavelength λ versus $\frac{1}{\sqrt{V}}$, where V is accelerating potential for a particle of mass m and charge q. Obtain the slope of this graph.	

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SECTION C		
22.	With the help of circuit diagram explain working of the full wave rectifier.	3
23.	(I) The current I_1 in a wire is getting divided in two wires with currents I_2 and I_3 at a junction in a circuit.The currents in the three wires are related by $I_1 = I_2 + I_3$. (A) State the fundamental law from which this relation is derived. (B) Explain the validation of law of conservation of energy in Kirchhoff's voltage law? (II) How the balancing condition gets affected if you are interchanging the galvanometer and the cell in the Wheat stone bridge?	3
24.	A fast-moving neutron collides with the nucleus of Plutonium (Pu), thereby producing Xenon (Xe) and Zirconium (Zr) along with neutrons. (I) Write the nuclear fission reaction. (II) Find the energy released in the above nuclear reaction. Given atomic masses: m $(^{239}_{94}Pu) = 239.052157$u, m $(^{103}_{40}Zr) = 102.926597$u, m $(^{134}_{54}Xe) = 133.905040$u & m $(^{1}_{0}n) = 1.00866$u.	3
25.	A compound microscope consists of an objective lens of focal length 0.82 cm and an eyepiece lens of focal length 2.9 cm. An object is placed 0.91 cm from the objective lens. The image is formed at the near point (25 cm) from the eye. (I) Calculate that the angular magnification of the microscope. (II) Draw the ray diagram of compound microscope in normal adjustment.	3
26.	Draw the reflected wave front for a plane wave front incident on a plane reflecting surface. Hence verify the laws of reflection using Huygen's principle. **For VI Candidates** (I) Define wave front? (II) Define wavelet? (III) What will be the shape of the wave front intercepted by a large reflecting type telescope on earth, due to a star far-away from our solar system?	3

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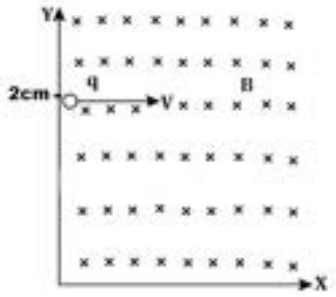
27(I)	If a point sized object having charge 1C and mass 1g is projected with velocity of $2\hat{\imath}$ m/s from a point (0,2cm,0) in the region of magnetic field -0.1$\hat{k}$ T which spreads in the first quadrant.  (A) What will be the shape of the path followed by the given charged particle? (B) At what point it will cross the X-axis? (C) What will be the kinetic energy of particle when it will enter in the fourth quadrant? **OR**	3
27(II)	A solenoid has a core of material with relative permeability 200. The windings of the solenoid are insulated from the core and carry a current of 1A. If the number of turns is 2000 per metre, calculate (A) magnetic intensity, (B) magnetic field & (C) magnetisation	3
28.	A conducting coil of 50 turns and area $\frac{5}{\pi}$ cm^2 is rotating along the axis of solenoid of length 50cm and 2000 turns, carrying current of 5 A. What will be the value of maximum emf generated?	3
	SECTION - D	
29	When an external voltage is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal it is said to be forward biased. The applied voltage mostly drops across the depletion region and the voltage drop across the p-side and n-side of the junction is negligible. When an external voltage is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. The applied voltage mostly drops across the depletion region.	1 Mark each

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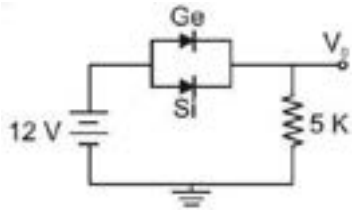
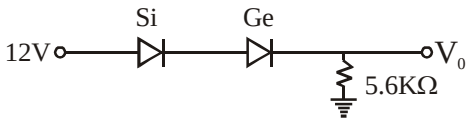
(I) Ge and Si diodes start conducting at 0.3 V and 0.7 V respectively. In the following figure if Ge diode connection are reversed, the value of V_0 changes by (assume that the Ge diode has large breakdown voltage)



(A) 0.2 V (B) 0.4 V

(C) 0.6 V (D) 0.8 V

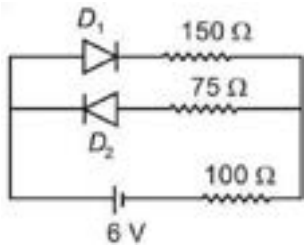
(II.) The value of V_0 and I_d for the network are :



(A) 13 V, 2.32mA (B) 11.7 V, 2.08mA

(C) 11.3V, 2.01mA (D) 11V, 1.96mA

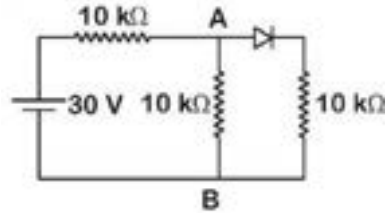
(III.) The circuit shown below contains two ideal diodes, each with a forward resistance of 50Ω. If the battery voltage is 6 V, the current through the 100Ω resistance (in amperes) is



(A) 0.036 (B) 0.020

(C) 0.030 (D) 0.027

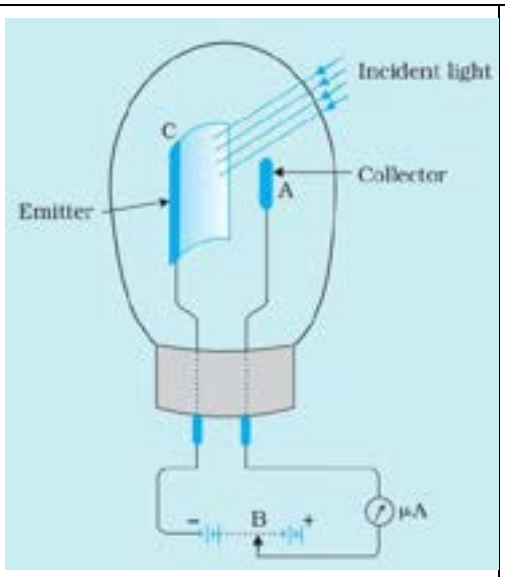
(IV) In the figure, potential difference between A and B is



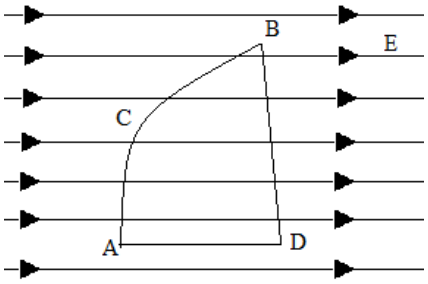
(A) Zero (B) 5 V

(C) 10 V (D) 15 V

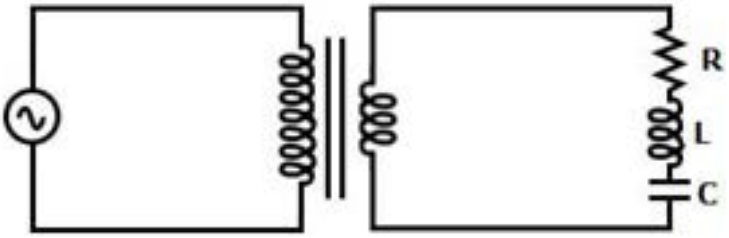
** Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.*

30.	Photoelectric effect is phenomenon of the ejection of electrons when the radiation of suitable frequency is made to fall on the surface of a metal. When light of suitable wavelength falls on the emitter C given in the diagram, the photoelectrons are emitted. These photoelectrons are drawn to the collector A. The photoelectric current of the order of a few microamperes can be normally obtained from the device given in figure. The device given converts a change in intensity of illumination into a change in photocurrent. This current can be used to operate control systems and in light measuring devices. The devices are made up of metals with low ionization enthalpies, for example platinum whose work function is 6.35 eV. 	
	(I) If infrared radiation of 3 x 10^{11} Hz is used as incident radiation, determine the reading of microammeter? Justify mathematically.	2
	(II) In the given diagram, if terminal B is shifted towards the left then how will it affect the reading of the microammeter? **(for V.I. candidates)** (II) If the supplied voltage is decreased, then what will be effect on the reading of the microammeter?	1
	(III) Plot a graph showing this variation in reading of micrometre on shifting the terminal B towards the right. **(for V.I. candidates)** (III) If the intensity of incident radiation is doubled, by what factor will the kinetic energy change?	1
SECTION E		
31(I)	(A) A dielectric slab of thickness t, is introduced between the plates of parallel plate capacitor of area A and separation d (where t<d). Find an expression for the capacitance with the dielectric slab. (B) A copper sphere of capacitor C is dropped in ocean. Will the capacitance of the sphere increase, decrease or remain same? Justify. (C) A capacitor is connected across a source of potential difference V and then the separation 'd' between the plates is increased using insulating stick. Plot 'V' vs 'd' graph for the given capacitor.	2+2+1

** Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.*

	For VI Candidates (C) A capacitor is connected across potential difference V and is then separation between plates 'd' is increase using insulating stick. Will the energy stored in capacitor increase or decrease? Justify **OR**	
31 (II)	(A) If a charge of 1μC is placed at the origin and another charge of 3 μC placed at the point (20m,0m,0m) in an external uniform electric field of 40V/m $\hat{\imath}$ with the electric potential at origin to be zero. Find the electrical potential energy of system. (B) If one charge particle is moved from A to C To B and another charge particle of equal magnitude is moved from A to D to B, In uniform external magnetic field. Than for which charge particle more work will be needed? (use fig for reference)  (C) Electrostatic potential is constant throughout the volume of conductor has the same value on its surface why? **For VI candidates** (C) If A charge particle is taken from A to B from two different path one path has resistance of 10Ω and another has capacitance of 3μF. work done by which path will be more.	3+1+1
32(I)	(A) Derive lens maker's formula. (B) Equi-convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 10cm? **OR**	3+2
32(II)	(A) Define angle of deviation in a prism? (B) Obtain the relation A+δ=i+e for a prism where A is the angle of prism, δ is the angle of deviation, i is the angle of incidence and e is the angle of emergence. Write this relation for the minimum deviation? (C) Write the condition for minimum deviation.	1+3+1

** Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.*

33(I)	(A) State the working principle of a moving coil galvanometer? What modification is required in the galvanometer to make its scale linear? (B) If a galvanometer of resistance 49.5Ω has range of 0.05A. What will be the value of resistance needed to convert it in ammeter of range 5A? (C) How these two resistors should be connected to galvanometer in both cases? **OR**	2+2+1
33(II)	(A) An input potential V_{in}=200 Sin $100\pi t$ V is provided to an ideal transformer having 1000 turns in primary coil and 100 turns in secondary coil as shown in figure. The load circuit has a resistance of 4Ω, a capacitive reactance of 2Ω and an inductive reactance of 6Ω.  Find: (i) the output voltage across the load circuit (ii) the current flowing through the load circuit (iii) the power supplied to the load circuit by the transformer (B) State the working principle of a transformer and explain how it is a key component in the transfer of electrical power over long distances.	3+2

** Please note that the assessment scheme of the Academic Session 2024-25 will continue in the current session i.e. 2025-26.*

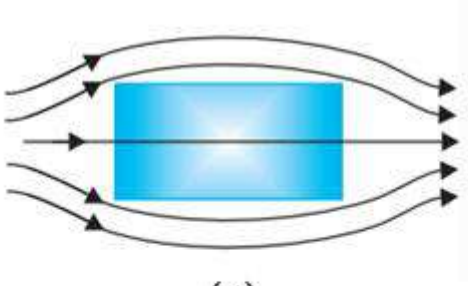
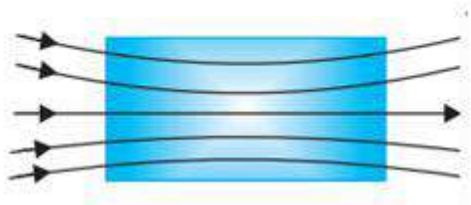
PHYSICS – Code No. 042
MARKING SCHEME
CLASS – XII (2025 – 26)

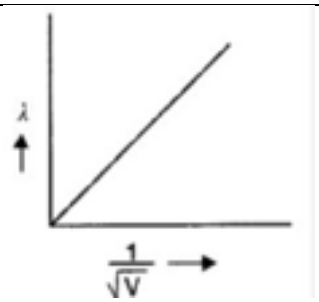
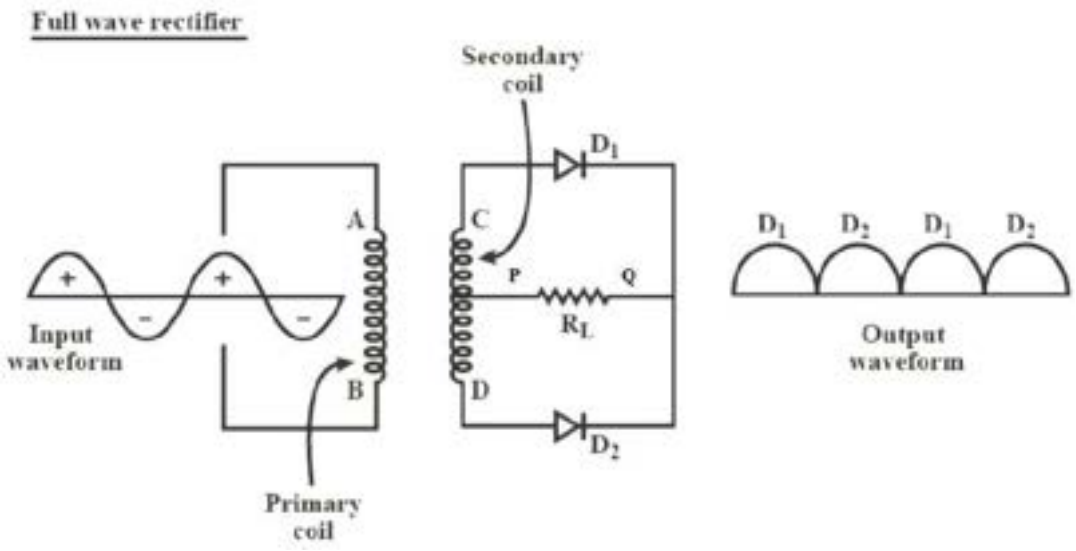
SECTION A		
Q.No	**Questions**	**Marks**
1.	**Answer: (A)** Both are having equal charges For two bodies to be in equilibrium, both should have same potential(V). As V=$\frac{C}{q}$ Where C of sphere is $4\pi\varepsilon_o r$. Which is independent of all the factors mentioned in options.	1
2.	**Answer: (A)** Diameter of copper wire d, Diameter of cylindrical iron is D No.of turns N,(D>>d) Length=N x Circumference of cylinder L= NπD R= $\frac{\rho L}{A} = \frac{\rho N \Pi D}{d^2\frac{\Pi}{4}}$ R=$\frac{4\rho ND}{d^2}$	1
3.	**Answer: (A)** When the frequency of the AC source is increased than the impedance of the device decreases. As in phasor diagram current leads the voltage, so given appliance is capacitor.	1
4.	**Answer: (D)** The energy of radio waves is lesser than that of the gamma rays. Since the frequency of radio waves is less than gamma waves. E = hν Hence, energy of radio waves is less than gamma waves	1

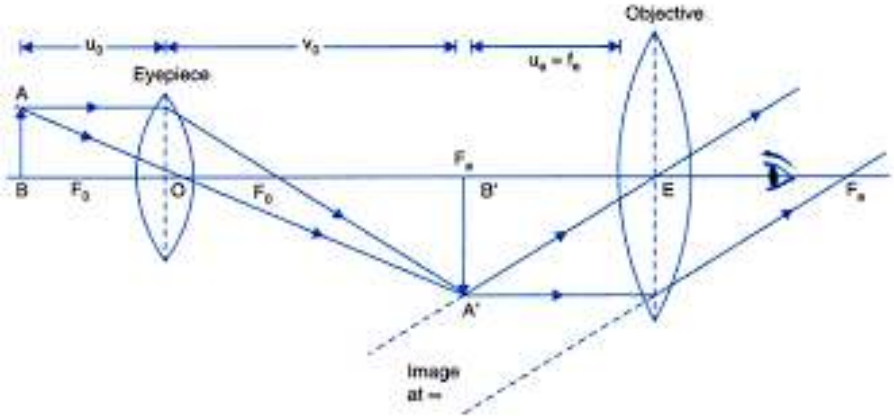
5.	**Answer: (A)** Total Internal reflection ***<u>For VI- Students</u>*** **Answer: (D)** $\frac{v_1}{c} = \frac{Sin\Theta_c}{sin\,90}$ cSinΘ	1
6.	**Answer: (D)** Slit width increases hence amplitude will increase, so intensity will also increase. ***<u>For VI- Students</u>*** **Answer: (B)** Interference	1 1
7.	**Answer: (C)** IV Transition III, V, VI corresponds to absorption of energy. Maximum emitted wavelength corresponds minimum energy difference. $\Delta E_I > \Delta E_{II} > \Delta E_{IV}$ Therefore, maximum emitted wavelength corresponds to transition IV. ***<u>For VI- Students</u>*** Transition III, V, VI corresponds to absorption of energy. Maximum emitted wavelength corresponds minimum energy difference. $\Delta E_{II} > \Delta E_I > \Delta E_{IV}$ Therefore, maximum emitted wavelength corresponds to transition IV.	1
8.	**Answer: (D)** The charged particle will move with constant velocity. As charge particle is moving parallel to magnetic field, there will be no acceleration.	1

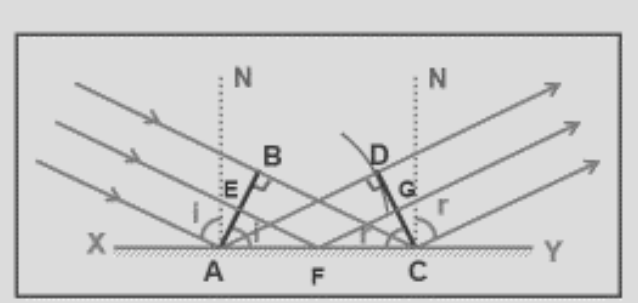
9.	**Answer: (C)** more for the magnet falling through the solenoid. Emf will be induced in solenoid due to motion of magnet through it. As per Lenz's law induced emf will oppose the motion of magnet.	1
10.	**Answer: (C)** $V=2V_o \sin 2\omega t$ As $V= NBA\omega \sin \omega t$	1
11.	**Answer: (D)** 1:1 Nuclear density does not depend on mass number.	1
12.	**Answer: (B)** The deflection of the magnetic needle at P and Q will be in the opposite directions. As magnetic field at equator is antiparallel to magnetic field at pole.	1
13.	**Answer: (B)** both Assertion and Reason are true but Reason is not the correct explanation of Assertion.	1
14.	**Answer: (C)** Assertion is true but Reason is false.	1
15.	**Answer: (D)** both Assertion and Reason are false	1
16.	**Answer: (B)** both Assertion and Reason are true but Reason is not the correct explanation of Assertion. If three point charges are in equilibrium then forces acting on each charges should be linearly opposite.	1

SECTION B		
17.	Given, $B_o = 510$ nT $= 510 \times 10^{-9}$ T $\omega = 60 \times 10^6$ rad/sec $E_o = cB_o = 153$ N/C $k = \omega/c = 20 \times 10^{-2}$ rad/m $E = E_o \sin(\omega t - kz)$ $E = 153 \sin(60 \times 10^6 t - 20 \times 10^{-2} x)$ N/C	1 1
18.	(I) E.m.f of the cell is 6V, As when load current is zero potential difference becomes equal to emf of the cell. (II) Explanation: The internal resistance of a cell can be determined as the negative slope of its voltage–current graph. First, we can determine the slope by choosing two points on the line: $\textbf{Slope} = \frac{0-6}{12-0} = -0.5$ This means that the internal resistance must be 0.50 ohm (Ω). **For VI-Candidates** E = V + v = IR + Ir (where V is potential drop in the external circuit and v is potential drop in the cell) Or, E = I (R + r) Or, I = E / (R + r) This is the relation.	1 1 1 1
19.	From Gauss's theorem $Ø = \frac{q}{\varepsilon_r \varepsilon_o}$ [Where ε_r is relative permittivity of medium inside Gaussian surface] For sphere, $Ø_{sphere} = \frac{q}{\varepsilon_{water} \varepsilon_o}$ ……..(i) For cube $Ø_{cube} = \frac{2q}{\varepsilon_o}$ ……(ii) Dividing (i) by (ii) $\frac{Ø sphere}{Ø cube} = \frac{1}{2\varepsilon_{water}} = \frac{1}{160}$	½ ½ 1

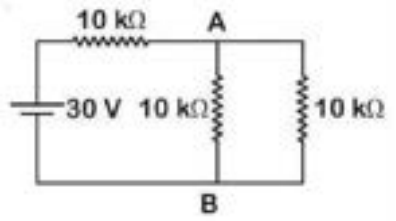
20. (I)	$\frac{F}{L} = \frac{\mu_0 I_1 I_2}{2\pi r}$ (I_1 is the current in first wire and I_2 is the current in second wire) Thus we define ampere as the current flowing in each conductor separated by a unit distance so that one conductor applies a force of 2×10^{-7} N on a unit length of another parallel conductor. **Or**	1 1
20 (II)	 (a)  (b) **<u>For VI-Candidates</u>** Gauss's law for magnetism is: The net magnetic flux through any closed surface is zero. Hence magnetic flux linked to given sphere will also be zero.	1 1 1 1
21A.	Smaller is the impact parameter, larger is the angle at which α – particles scatters. Larger is the impact parameter, α – particles scatter less keeping its original trajectory. For head on collision, the value of impact parameter is zero. **OR**	1 1

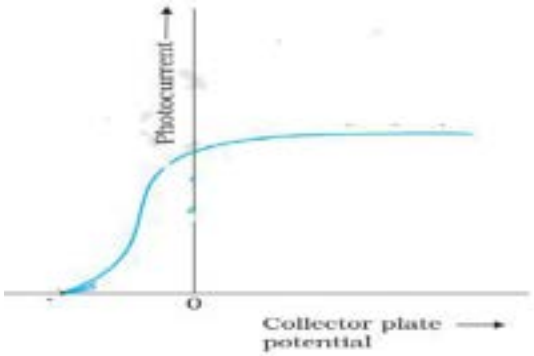
21B.	 $\lambda=\frac{h}{mv}$ $\lambda=\frac{h}{\sqrt{2mqV}}$, comparing this equation with y = mx slope= $\frac{h}{\sqrt{2mq}}$.	1 1
	SECTION C	
22.	In the full wave rectifier:D_1 and D_2 are pn junction diode which allow current to pass only in forward biasing. During odd half cycle the diode D_1 will be forward biased hence potential at the Q will be more then Potential at P and during this cycle D_2 will not permit current through it. During even half cycle the diode D_2 will be forward biased hence potential at the Q will be more then Potential at P and during this cycle D1 will not permit current through it. Hence we will get DC as output as shown in diagram. 	1 2
23.	(I) (A)Conservation of electric charge (B) KVL is obeys law of conservation of energy as it is supplied voltage is equal to the voltage across each component in the loop. (OR) algebraic sum of voltages equal to zero. (II) No change in balancing condition is observed.	1 1 1

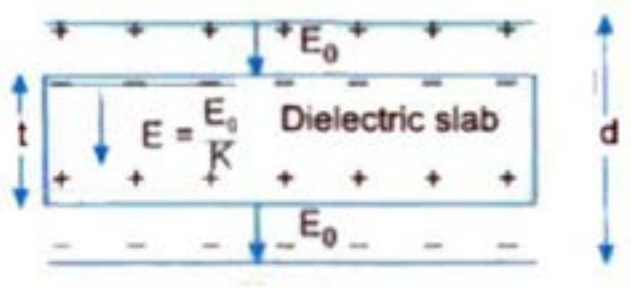
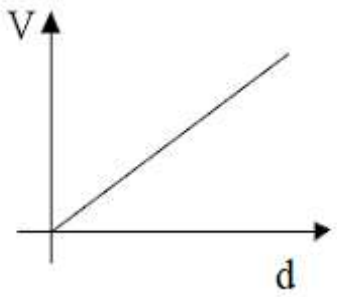
24.	A fast-moving neutron collides with the nucleus of Plutonium (Pu), thereby producing Xenon (Xe) and Zirconium (Zr) along with neutrons. (I) Nuclear fission reaction. $^{239}_{94}Pu + {}^{1}_{0}n \rightarrow {}^{134}_{54}Xe + {}^{103}_{40}Zr + 3\ {}^{1}_{0}n$ (II) Δm = [m ($^{239}_{94}Pu$) + m ($^{1}_{0}n$)] - [m ($^{134}_{54}Xe$) + m ($^{103}_{40}Zr$) + 3 m ($^{1}_{0}n$)] = [239.052157 + 1.00866] - [133.905040 + 102.926597 + 3 X 1.00866] = 240.060817 – 239.857617 = 0.2032 amu Q value = Δmc^2 = 0.2032 x 931.5 MeV = 189.2808 MeV	1 1 1
25.	(I) $\frac{1}{v_0} = \frac{1}{f_0} - \frac{1}{u_0}$ v_0= 8.3 cm Angular magnification M=m_0xm_e M= $\frac{v_0}{u_0}(\frac{D}{f_e}+1)$ M= $-\frac{8.3}{0.91}$ X $(\frac{25}{2.9}+1)$ M= -87.7 (II)  	1 1 1

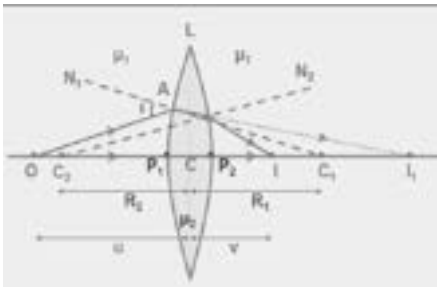
26.	 AB – Incident wavefront CD – Reflected wavefront XY – Reflecting surface	1
	If c be the speed of light, t be the time taken by light to go from B to C or A to D or E to G through F, then $t=\frac{EF}{C}+\frac{FG}{C}$ $t=\frac{AF\ Sin\ i}{C}+\frac{FC\ Sin r}{C}$ $t=\frac{AC\ Sin\ r+AF(Sin\ i-Sin\ r)}{C}$	
	For rays of light from different parts on the incident wavefront, the values of AF are different. But light from different points of the incident wavefront should take the same time to reach the corresponding points on the reflected wavefront. So, t should not depend upon AF. This is possible only if sin i – sin r = 0. i.e. sin i = sin r or i = r Hence proved.	1 1
	<u>For VI candidates</u> (i) A wavefront is the locus of points (wavelets) having the same phase of oscillations (ii) Each point on a wavefront acts as a fresh source of disturbance of light known as wavefront. (iii) Planer.	1 1 1
27. (I)	As charge particle is moving perpendicular to magnetic field it will follow circular trajectory in clock wise direction. Magnetic force will act as centripetal force. Given: Q=1C; $M=10^{-3}$kg; v=2m/s & $B=-0.1T\hat{k}$	

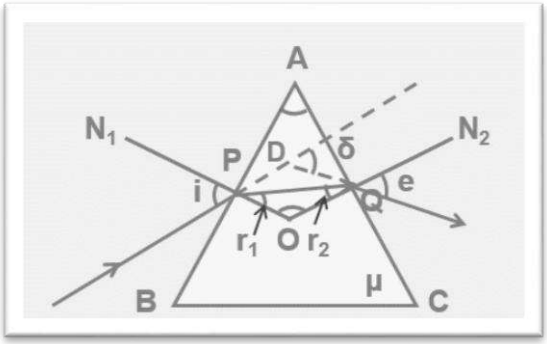
	Radius of trajectory is given by R= $\frac{mv}{qb}$ = 2cm (A) Quarter Circle (B) It will cross the X axis at 2cm. (C) As work done by B is on charge particle is zero it's kinetic energy(K) will remain same K= $\frac{1}{2}mv^2$ Or, K = $\frac{1}{2}x10^{-3}x2^2J = 2 \times 10^{-3}J$	 1 1 1
27 (II)	Given: μ_r=200 I=1A N=200turn/m (A) H=nI Or,H=2000/m X 1A=2 X 10^3A/m (B) B= $\mu_o\mu_r$H Or, B=200 x 4π x 10^{-7}x 2 X 10^3A/m Or, B= 0.50T (C) Magnetisation is given by M=(μ_r -1)H=199 x 10^3 A/m Or,M = 1.99 x 10^5 A/m	 1 1 1
28.	Given: No of turns of coil N_c=50 Area of coil= $\frac{5}{\pi}$ cm^2=$\frac{5}{\pi}$ x $10^{-4}m^2$ For solenoid: N_s=2000, L=0.5m, n = N/L=4000turns/m, I= 5A	

	Magnetic field due to solenoid 'B'=μ_onI Or,B=4000 x 4π x 10^{-7} x 5 T Or,B= 8π x 10^{-2} T Flux linked to coil $\emptyset_B$=$N_c\vec{B}.\vec{A}$ Or, $\emptyset_B$=N_cBA cosωt Emf $\varepsilon = \frac{d\emptyset_B}{dt}$ = N_cBAω sin ωt *Or,* ε_{max} = N_cBA *Or,* ε_{max} = 50 x 8π x 10^{-2} T x $\frac{5}{\pi}$ x $10^{-4}m^2$ *Or,* ε_{max} = 2Mv	1 1 1
	SECTION - D	
29.	(I) (B) Voltage drop across diode will change from 0.3 to 0.7 V. Value of V_0 changes by 0.4 V. (II) (D) 11V, 1.96Ma $V_0 = E - V_{si} - V_{Ge} = 12.07 - 0.3 = 11V$ $I_d = V_0/R = 11/5.6 \times 10^{-3} = 1.96$ Ma (III) (B) $I = \frac{6}{50+150+100} = \frac{6}{300}$ A = 0.02 A (IV) (C)  Here the diode is in forward bias. So we replace it by a connecting wire. $V_a - V_b = \frac{l}{2} \times 10$ $= \frac{30}{15 \times 2} \times 10$ V = 10 V	1 1 1 1

30.	(I) If infrared radiation is used as incident radiation, determine the reading $W_o = h\nu_o$ Threshold frequency, $\nu_o = \frac{Wo}{h} = \frac{6.35 \times 1.6 \times 10^{-19}}{6.63 \times 10^{-34}} = 1.5 \times 10^{15}$ hz Frequency of infrared radiation $<$ threshold frequency (ν_o) , hence no emmision of photoelectrons will take place, therefore reading of the microammeter = 0 (II) Photoelectric current decreases with decrease in potential. At some stage, for a certain potential of plate A, all the emitted electrons are stopped by the plate A and the photoelectric current becomes zero. (III)  **(for V.I. candidates)** No change in Kinetic Energy.	1 1 1 1 1
	SECTION E	
31. (I)	(A) In absence of dielectric slab, the capacitance of parallel plate capacitor is given by $C = \frac{A\varepsilon_0}{d}$ When a dielectric slab of thickness t(t < d) is introduced between the plates without touching the plates , the electric field in air $E_o = \frac{\sigma}{\varepsilon_0}$ (σ *is charge density given by* $\frac{q}{A}$) but on account of polarisation of dielectric the electric field inside the dielectric changes to $E = \frac{Eo}{K}$ If potential difference between the plates of capacitor be V. now , then clearly	½

	V= E_o(d-t) + Et; Or, V= E_o(d-t) + $\frac{Eo}{K}$ t; Or, V= E_o(d-t+$\frac{t}{k}$)= $\frac{\sigma}{\varepsilon_0}$ (d-t+$\frac{t}{k}$) Or, V=$\frac{q}{A\varepsilon_0}$ (d-t+$\frac{t}{k}$)	1 ½
		
	(B) Capacitance of sphere will Increase. Justification: As C=$\frac{q}{V}$ & V=$\int \vec{E}.\vec{dl}$ As, electric field will decrease, due to polarization of water. Resulting in decrease in potential. Hence, capacitance of sphere will increase	1 1
	(C) 	1
	For VI Candidates (C) energy stored in capacitor will decrease. Justification Energy=$\frac{Q^2}{2C}$ When separation is increased capacitance will increase and charge will remain same.	

	Or	
31 (II)	(A) $U=\frac{Kq_1q_2}{r_{12}}+q_1V(r_1)+ q_2V(r_2)$ Or, $U=\frac{Kq_1q_2}{r_{12}}+q_1 (E\ r_{1-0})+ q_2(E\ r_{2-0})$ Or, $U=(\frac{9X10^9X10^{-6}X3X10^{-6}}{20} + 0 +3 \times 10^{-6} \times 40x20)$ J Or, $U=37.5 \times 10^{-4}$J (B) Work done will be same for both paths, as electric field is conservative in nature. (C) As electric field inside the conductor is zero so there will be no work needed in moving unit positive charge inside or on the surface.	1 1 1 1 1
32. (I)	(A) Lens Maker's Formula: For refraction at LP_1N, $\frac{\mu_1}{CO}+\frac{\mu_2}{CI1}=\frac{\mu_2-\mu_1}{CC1}$ (as if the image is formed in the denser medium) For refraction at LP_2N $\frac{\mu_2}{-CI_1}+\frac{\mu_1}{CI}=\frac{\mu_2-\mu_1}{CC_2}$ (as if the object is in the denser medium and the image is formed in the rarer medium) Combining the refractions at both the surfaces. $\frac{\mu_1}{CO}+\frac{\mu_2}{CI}= \mu_2-\mu_1(\frac{1}{CC_1}+\frac{1}{CC_2})$ Substituting the values with sign convections, $\frac{1}{-u}+\frac{1}{v}=\frac{\mu_2-\mu_1}{\mu_1}(\frac{1}{R_1}-\frac{1}{R_2})$  Since $\frac{\mu_2}{\mu_1}=\mu$ $\frac{1}{-u}+\frac{1}{v}=\frac{\mu_2-\mu_1}{\mu_1}(\frac{1}{R_1}-\frac{1}{R_2})$ (or)	1 1

	$\frac{1}{-u}+\frac{1}{v}=(\mu-1)(\frac{1}{R_1}-\frac{1}{R_2})$ When the object is kept at infinity, the image is formed at the principal focus. i.e. u = - ∞, v = + f. $\frac{1}{f}=(\mu-1)(\frac{1}{R_1}-\frac{1}{R_2})$ This equation is called 'Lens Maker's Formula'. (B) Refractive index of glass, μ = 1.55 Focal length of the convexo-concave lens, f = 10 cm Radius of curvature of one face of the first Convex surface = R_1 Radius of curvature of the other face of the second convex surface = $-R_1$ Therefore, R_1 = R and R_2 = -R The value of R can be calculated from Lens – Maker formula: (1/f) = (μ – 1) [(1/ R_1) – (1/ R_2)] (1/10) = (1.55 -1) [(1/R) + (1/R)] (1/10) = 0.55 x (2/R) Therefore R = (0.55 x 2 x10) =11cm Hence, the radius of curvature of the convexo-concave is 11cm **(OR)**	1 1 1
32 (II)	(A)The **angle of deviation** represents the angle by which a light ray is deviated after passing through a prism. (B) Refraction of light through prism :  In quadrilateral APOQ, A + O = 180° …….(1) In triangle OPQ, $r_1 + r_2$ + O = 180° …….(2)	1 1

	In triangle DPQ $\delta = (i - r_1) + (e - r_2)$ $\delta = (i + e) - (r_1 + r_2)$ …….(3) From (1) and (2), $A = r_1 + r_2$ From (3), $\delta = (i + e) - (A)$ $i + e = A + \delta$ Sum of angle of incidence and angle of emergence is equal to the sum of angle of prism and angle of deviation. (C) When angle of incidence increases, the angle of deviation decreases. At a particular value of angle of incidence the angle of deviation becomes minimum and is called 'angle of minimum deviation'. At δ_m, • $i = e$ and $r_1 = r_2 = r$ (say) • At minimum deviation, refracted ray become parallel to incident ray. (Award full marks if either of condition is mentioned)	1 1 1
33. (I)	(A) Torque due to current carrying coil. Modification in designing of galvanometer are (i) Poles of magnet are made spherical (ii) Iron ore is placed inside the coil. (B) Given: $R_g = 49.5\Omega$; Range=0.05A For ammeter let resistance needed be R_a. As per requirement Range x $R_g = R_a(5-0.05)$ $R_a = \frac{0.5\ X\ 49.5}{4.95} = 0.5\ \Omega$ (C) R_a will be connected in series & R_v is connected in parallel. **Or**	1 ½ ½ 1 1 1
33 (II)	(A)Given: In load circuit, $R=4\Omega$, $X_c=2\ \Omega$, $X_l=6\ \Omega$, $N_p=1000$,	

	N_s=100, V_{in}=200V$\sin 100\pi t$ (i) Output voltage Across Load Circuit $\frac{V_{out}}{V_{in}} = \frac{N_s}{N_p}$=0.1 Or, V_{out}=0.1 x 200V$\sin 100\pi t$, Or, V_{out}=20V$\sin 100\pi t$. (ii) Current flowing through load circuit As, I=$I_m\sin(\omega t+Ø)$ Where, $I_m = \frac{V_m}{Z}$, $Z=\sqrt{R^2 + ({X_c}^2 - {X_L}^2)}$ Or,$Z=4\sqrt{2}$ Ω,& $I_m = \frac{20}{4\sqrt{2}}A = \frac{5\sqrt{2}}{2}A$; $Ø = \tan^{-1}\frac{X_C - X_L}{R} = \tan^{-1} 1 = \frac{\pi}{4}$ $I=\frac{5\sqrt{2}}{2}A\sin(100\pi t+\frac{\pi}{4})$' (iii) Find the Power supplied to load circuit By the transformer. $P= \frac{V_m I_m}{2}\cos Ø$ Where, $\cos Ø=\cos\frac{\pi}{4} = \frac{1}{\sqrt{2}}$ P=20V x $\frac{5\sqrt{2}}{2}$ Ax$\frac{1}{\sqrt{2}}$ =50W (B) Ac transformer works on the principal of ' Mutual Induction' A.C transformer can increase output potential. As P=V/I So increase in output potential results in decrease in output current, resulting in significant decrease in power loss in transmission wires between power plants and Cities. In respective cities they are stepped down.	1 1 1 1 1