F - 4

Entrance Examinations 2026
Ph.D. Plant Sciences

Time: 2 hours **Maximum Marks: 70**

HALL TICKET NO.

INSTRUCTIONS

Please read carefully before answering the questions:

1. Write your Hall Ticket Number in the OMR answer sheet given to you. Also, write the Hall Ticket Number in the space provided above.

2. There is no negative marking.

3. Answers are to be marked on the **OMR answer sheet** following the instructions provided there upon.

4. Hand over the OMR answer sheet at the end of the examination to the Invigilator.

5. No additional sheets will be provided. Rough work can be done in the question paper itself/ space provided at the end of the booklet.

6. The question paper contains **70** questions. **Part-A**: Question Nos. **1-35** and **Part-B**: Questions Nos. **36-70** of multiple-choice printed in **12** pages, including this page. One OMR answer sheet is provided separately. **Please check**.

7. The marks obtained in **Part-A** will be used for resolving the tie cases.

8. Each question carries one mark.

9. Calculators and mobile phones are **NOT** allowed.

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Part A

Q1. What is ClustalW?

A. ClustalW is a software used for multiple sequence alignment
B. ClustalW is used to estimate photosynthetic efficiency in plants
C. ClustalW belongs to the water use efficiency of plants during drought conditions
D. ClustalW belongs to a weed, an undesirable wild plant growing in crop fields

Q2. Which among the following DNA markers is **not** a PCR-based genetic marker?

A. Random Amplified Polymorphic DNA
B. Amplified Fragment Length Polymorphism
C. Cleaved Amplified Polymorphic Sequence
D. Restriction Fragment Length Polymorphism

Q3. The technique that separates molecules according to their net charge in an electric field, usually on solid or semi-solid support media such as paper or agarose, is:

A. Autoradiography
B. Polymerase chain reaction
C. Electrophoresis
D. Immunofluorescence

Q4. A cross is made between two pure lines of sesame, one carrying black seed coat colour and the other carrying white seed coat colour. If the black seed coat colour is dominant over white seed coat colour, what would be the phenotypes of the resulting progeny in the F_2 generation?

A. All black
B. ½ black : ½ white
C. ¾ black : ¼ white
D. All white

Q5. In the backcross method of breeding, the hybrid and subsequent progeny are repeatedly backcrossed to one of the parents to transfer its genetic background to produce near-isogenic lines, and this parent is known as

A. Nonrecurrent parent
B. Recurrent parent
C. Adapted parent
D. Donor parent

Q6. Ethidium bromide is a mutagen. Which of the following is considered a safer, non-mutagenic alternative for visualizing DNA in agarose gels?

A. Acridine orange
B. SYBR Safe
C. Methylene blue
D. Crystal violet

Q7. The phenomenon of transfer of genetic material from one species into the gene pool of another species through natural hybridization and repeated backcrossing is known as

A. Introgression
B. Segregation
C. Ionization
D. Haploidization

Q8. A *pin1* mutant in Arabidopsis fails to form floral primordia. Which experimental approach best demonstrates that auxin maxima are disrupted in this mutant?

A. Southern blot analysis of auxin biosynthetic genes
B. Western blot of PIN1 protein
C. DR5::GFP reporter analysis
D. Ethylene response assays

Q9. Which of the following experimental approaches is most suitable to study cell lineage in plant development?

A. RNA-sequencing
B. Reporter gene fusions
C. CRISPR-Cas9 mutagenesis
D. Western blotting

Q10. Assertion (A): Oxford Nanopore sequencing can directly detect epigenetic modifications such as DNA methylation without prior chemical treatment.

Reason (R): Because different nucleotides and modified bases produce distinct disruptions in ionic current as they pass through the nanopore.

A. Both A and R are true, and R is not the correct explanation of A
B. Both A and R are true, but R is the correct explanation of A
C. A is true, but R is false
D. A is false, but R is true

Q11. Choose the reverse complementary sequence for the given sequence 5`-ATGCTGATCATGCCACTGCGTACGACTA-3`

A. ATGCTGATCATGCCACTGCGTACGACTA
B. TACGACTAGTACGGTGACGCATGCTGAT
C. ATCAGCATGCGTCACCGTACTAGTCGTA
D. TAGTCGTACGCAGTGGCATGATCAGCAT

Q12. Which of the following conditions is true for reverse-phase chromatography?

A. The mobile phase is polar, and the stationary phase is non-polar
B. The mobile phase is non-polar, and the stationary phase is polar
C. Both the mobile phase and the stationary phase are organic
D. Both the mobile phase and the stationary phase are inorganic

Q13. Which of the following techniques is primarily used to monitor changes in the tertiary environment of proteins rather than directly determining secondary structure?

A. NMR spectroscopy
B. Fluorescence spectroscopy
C. X-ray crystallography
D. Circular Dichroism

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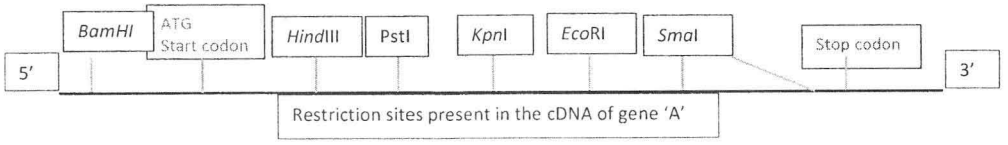
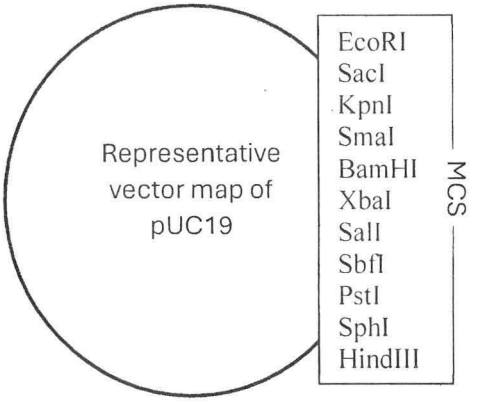
Q14: Let's assume that the coding sequence of a gene 'A', shown below (Image 1A), harbors internal restriction sites only for the given restriction endonucleases. It has to be cloned using the available restriction sites present in the multiple cloning sites (MCS) of the *pUC19* plasmid (Representative vector map with MCS given below) (Image 1B)

1A



1B



Which of the following sets of enzymes can be used in the restriction digestion-based cloning of the full coding sequence of gene 'A' in the *pUC19* cloning vector if all the resources are abundantly available in the laboratory?

A. *Hind*III and *Sma*I
B. *Bam*HI and *Sma*I
C. *Hind*III and SacI
D. *Bam*HI and SacI

Q15. A peptide segment rich in alanine, leucine, and glutamate adopts a stable α-helix in aqueous conditions. A mutation replaces a centrally located alanine residue with proline. Which of the following is the most likely structural consequence?

A. Increased α-helix stability due to proline's rigid structure
B. Disruption of the α-helix due to the inability of proline to participate in backbone hydrogen bonding
C. Conversion of the α-helix into a β-sheet due to altered side chain interactions
D. No significant change in structure because alanine and proline are both nonpolar

Q16. Which of the following statements about isoelectric focusing (IEF) is correct?

A. Proteins separated by IEF cannot be used for activity assays due to denaturation
B. Proteins separation in IEF depends primarily on molecular weight
C. Proteins separated by IEF can retain activity depending on experimental conditions
D. Proteins migrate fastest at their isoelectric point

Q17. The most common R- banding method involves

A. Heat-denaturing chromosomes in hot acidic saline, followed by Giemsa staining. This method is thought to preferentially denature AT-rich DNA and to stain the under-denatured GC-rich regions.
B. Heat-denaturing chromosomes in hot alkaline solution, followed by Giemsa staining. This method is thought to preferentially denature GC-rich DNA and to stain the under-denatured AT-rich regions.
C. Heat denaturation followed by degradation of chromosomes in hot acidic saline followed by Giemsa staining. This method is thought to preferentially denature GC-rich DNA and to stain the under-denatured AT-rich regions.
D. Heat denaturing chromosomes in hot acidic saline, followed by quinacrine staining. This method is thought to preferentially denature AT-rich DNA and to stain the under-denatured GC-rich regions.

Q18. Which of the following statement **not true** about phenylmethylsulfonyl fluoride (PMSF)

A. It inhibits mammalian acetylcholinesterase
B. Binds covalently to the active site serine residue in trypsin and chymotrypsin
C. Effective in most protein solutions at 0.1 to 1 mM final concentration
D. It has greater solubility and the highest stability in aqueous solutions

Q19. The 'A' locus and the 'B' locus are 10 map units apart. If a plant genotype Ab/aB is test-crossed to ab/ab, the proportion of progeny that are expected

A. 45% AaBb: 45% aabb: 5% Aabb: 5% aaBb
B. 45% AaBb: 45% aaBb: 5% Aabb: 5% aabb
C. 45% Aabb: 45% aaBb: 5% AaBb: 5% aabb
D. 45% Aabb: 45% aabb: 5% aaBb: 5% AaBb

Q20. Pyridoxal phosphate is generally bonded to the enzyme through the following reaction

A. Schiff base
B. Pyridine ring
C. Racemisation
D. Decarboxylation

Q21. In an enzyme-catalyzed reaction, it is known that k_{cat} is $600s^{-1}$,[Et] is 20 nM, [S] is 40μM, and V_0 is 9.6 μM/s. Find the K_m of the reaction

A. 0.1 μM
B. 1 μM
C. 10 μM
D. 100 μM

Q22: The ability of a cell to exchange substances through diffusion with its environment is proportional to its surface area. If the dimensions of the sides of a cubicle cell are increased from 1 cm to 2 cm, the exchange of substances in the bigger cell than the smaller cell is expected to be

A. 25% faster
B. 25% slower
C. 50% faster
D. 50% slower

Q23: Which of the following methods is not used to study protein-protein interactions

A. Yeast-1-Hybrid
B. Isothermal titration calorimetry
C. Immunoprecipitation-Mass spectrometry
D. Bimolecular fluorescence complementation

Q24. Which of the following tools/technologies **cannot** be used for targeted suppression of the transcripts of a candidate gene in a plant cell

A. RNA Interference
B. Clustered Regularly Interspaced Short Palindromic Repeats
C. Chimeric Repressor Gene Silencing Technology
D. Confocal Laser Scanning Microscopy

Q25. What is the molarity of a solution prepared by dissolving 5.8 grams of NaCl (Molar mass = 58.5g/mol) in 500 mL of solution?

A. 0.05 M
B. 0.1 M
C. 0.2 M
D. 0.5 M

Q26. In a probability experiment, three coins are tossed simultaneously. What is the probability of getting 3 heads or 3 tails together at a time?

A. 1/2
B. 1/8
C. 1/16
D. 1/4

Q27. If a 100 mL stock solution of 0.1 M sucrose is given to students for preparing a working solution. How much stock solution will be required to prepare 500 mL of 0.01 M sucrose solution?

A. 2.5 mL
B. 25 mL
C. 5 mL
D. 50 mL

Q28. To transfer a given deoxyribose nucleotide fragment from an agarose gel to a nitrocellulose membrane, which one of the following techniques is used

A. Northern blotting
B. Western blotting
C. Southern blotting
D. Thin-layer chromatography

Q29. Which of the following staining methods is **not** used to test cell viability in plant research

A. Giemsa staining
B. Propidium Iodide staining
C. Trypan Blue staining
D. Calcein staining

Q30. Which of the following assays is **not** used for the detection of Reactive Oxygen Species in plants

A. Nitroblue tetrazolium assay
B. Electrophoretic mobility shift assay
C. 3,3-diaminobenzidine assay
D. 2',7'-dichlorodihydrofluorescein diacetate assay

Q31. If a flaccid plant cell with a solute potential (Ψ_s) of -0.8 MPa is placed in a beaker of pure water ($\Psi = 0$ MPa), what will be the pressure potential (Ψ_p) of the cell at dynamic equilibrium?

A. + 0.8 MPa
B. 0 MPa
C. +1.6 MPa
D. -0.8 MPa

Q32. Pollen exine wall ornamentation can be visualised by using _____.

A. Transmission Electron Microscopy
B. Scanning Electron Microscopy
C. Confocal microscope
D. Simple microscope

Q33. What would happen if a student accidentally forgot to add β-mercaptoethanol or Dithiothreitol to their protein sample buffer before running a standard SDS-PAGE?

A. The proteins will not be coated with a negative charge by the SDS
B. The proteins will fail to enter the stacking gel due to high viscosity
C. Multimeric proteins held together by disulfide bonds will not break into individual subunits
D. The gel will overheat because these reducing agents act as coolants

Q34. A student wanted to prepare 500 mL buffer containing 100 mM Tris pH 8.0, 1.0 mM $MgCl_2$ and 0.1% NaCl. He has stocks of 2 M Tris pH 8.0, 1 M $MgCl_2$, and 10% NaCl. What volumes of the given stock solutions does the student have to mix in distilled water?

A. 100 mL of Tris; 50 mL of $MgCl_2$ and 1 mL of NaCl
B. 25 mL of Tris; 0.5 mL of $MgCl_2$ and 5 mL of NaCl
C. 25 mL of Tris; 5.0 mL of $MgCl_2$ and 1.0 mL of NaCl
D. 50 mL of Tris; 0.5 mL of $MgCl_2$ and 10 mL of NaCl

Q35. A mixture of proteins is passed through a column in gel filtration chromatography with an exclusion limit of 150,000 MW. The following is the molecular weight (kDa) of protein A: MW = 30,000, protein B: MW = 200,000, protein C: MW = 90,000, protein D: MW = 50,000, protein E: MW = 250,000. What will be the order of elution of these proteins?

A. Protein E, Protein B, Protein C, Protein D, Protein A
B. Protein A, Protein D, Protein C, Protein B, Protein E
C. Protein E + Protein B, Protein A, Protein D, Protein C
D. Protein E + Protein B, Protein C, Protein D, Protein A

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Part B

Q36. Microsatellites are

A. Names of micropipettes of different volumes used in molecular biology labs
B. Short multiple repeat units of DNA sequence often found in non-coding regions
C. Unique sequences present in the euchromatin region of a genome
D. Names of the bioinformatics tools used in DNA sequence assembly

Q37. Match the following

(p) Mendelian population	(i) A squared standard deviation
(q) Continuous variation	(ii) Each gamete has an equal opportunity to unite with any other gametes
(r) Variance	(iii) A group of organisms sharing a common gene pool
(s) Random mating	(iv) Phenotyping of quantitative traits

A. p (iii), q (iv), r (i) s (ii)
B. p (iv), q (iii), r (ii), s (i)
C. p (i), q (iii), r (ii), s (iv)
D. p (iv), q (ii), r (iii), s (i)

Q38. If a cell successfully completes DNA replication in the S phase but a segment of the DNA is found to be damaged, which checkpoint will primarily prevent the cell from entering Mitosis?

A. G1 Checkpoint
B. S Checkpoint
C. G2 Checkpoint
D. Cytokinesis Checkpoint

Q39. The type of mutation most commonly induced by ultraviolet radiation is

A. Transitions
B. Transversions
C. Substitutions
D. Thymine dimers

Q40. The proportion of total phenotypic variance that is due to its genotype is known as

A. Heredity
B. Heritability
C. Heterogeneity
D. Heterozygosity

Q41. In the lac operon regulation, allolactose acts as a

A. Corepressor
B. Activator
C. Inducer
D. Repressor

Q42. In competitive inhibition

A. V_{max} remains unchanged and K_m increases
B. V_{max} decreases and K_m remains unchanged
C. Both V_{max} and K_m decrease
D. Both V_{max} and K_m increase

Q43. Histone modifications are involved in gene regulation. Which histone modification is generally associated with gene activation?

A. Methylation
B. Deacetylation
C. Ubiquitination
D. Acetylation

Q44. In biological nitrogen fixation, the primary role of leghemoglobin is to bind to

A. O_2
B. CO_2
C. N_2
D. NH_3

Q45. Which of the following best describes the role of auxin gradients in plant development?

A. Regulate stomatal aperture
B. Establish polarity in embryogenesis
C. Control chlorophyll biosynthesis
D. Induce senescence

Q46. The photoreceptor phototropin primarily regulates

A. Chloroplast movement and stomatal opening
B. Circadian rhythm entrainment
C. Flowering time
D. Shade avoidance response

Q47. A loss-of-function mutation in AGAMOUS (AG) results in

A. Conversion of stamens and carpels into petals and sepals
B. Loss of leaf polarity
C. Reduced auxin transport in the inflorescence
D. Premature fruit ripening

Q48. A researcher overexpresses a constitutively active cytokinin receptor in roots. Unexpectedly, lateral root formation decreases. Which reasoning best explains this observation?

A. Cytokinin converts pericycle cells into xylem vessels
B. Cytokinin directly increases cell death in pericycle founder cells
C. High cytokinin levels antagonize auxin-mediated lateral root initiation
D. Cytokinin blocks sucrose transport needed for lateral root growth

Q49. A plant overexpressing FLOWERING LOCUS T (FT) in leaves shows extremely early flowering, even under non-inductive photoperiods. What does this reveal about FT's role in plant development?

A. FT acts only in the shoot apex and cannot be produced in leaves
B. FT is a mobile signal that moves from leaves to the meristem to trigger flowering
C. FT directly controls root meristem size independently of flowering
D. FT functions primarily as a chlorophyll biosynthesis enzyme

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Q50. Which of the following best describes a key developmental difference between primary growth and secondary growth in plants?

A. Primary growth forms wood and bark, while secondary growth produces leaves and flowers
B. Primary growth increases organ thickness, while secondary growth extends roots and shoots in length
C. Primary growth occurs only in roots, while secondary growth occurs only in stems
D. Primary growth is driven by the activity of apical meristems, while secondary growth is driven by lateral meristems such as vascular cambium

Q51. Plants encounter various pathogens, including those with biotrophic and necrotrophic lifestyles. Which hormone is primarily involved in defense against biotrophic pathogens?

A. Jasmonic acid
B. Gibberellic acid
C. Salicylic acid
D. Abscisic acid

Q52. What is the second most abundant biopolymer on Earth after cellulose?

A. Lipid
B. Chitin
C. Lignin
D. Pectin

Q53. Microbe-associated molecular patterns (MAMPs) play a crucial role in recognizing pathogens and initiating plant responses. Which of the following is a fungal MAMP?

A. Flg22
B. Pep13
C. Elf18
D. Chitin

Q54. Choose the correct answer for the following statements regarding the T-strand transfer during *Agrobacterium tumefaciens* infection.

(i) VirD1 and VirD2 introduce a nick at the right border of T-DNA
(ii) VirD2 covalently attaches to the 3′ end of the T-strand
(iii) VirE2 is a single-stranded DNA-binding protein that coats the T-strand
(iv) VirD1 and VirD4 together form a Type IV secretion system

A. (i), (ii)
B. (i), (iii)
C. (i), (iv)
D. (ii), (iv)

Q55. Pathogenic bacteria use IAM pathway to synthesize auxin, and this pathway involves ___ and ___ enzymes.

A. Tryptophan transaminase and IAM hydrolase
B. Tryptophan transaminase and amine oxidase
C. Tryptophan monooxygenase and IAM hydrolase
D. Tryptophan monooxygenase and Nitrilase

Q56. A sterile hybrid becomes fertile after chromosome doubling. This indicates ___.

A. Mutation repair
B. Autopolyploidy
C. Allopolyploidy
D. Gene silencing

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Q57. Which of the following CRISPR/Cas proteins preferably cleaves an RNA molecule

A. Cas3
B. Cas9
C. Cas12a
D. Cas13a

Q58. Which of the DNA polymerases is active in the nucleolus and produces the Christmas tree transcript

A. DNA Pol I B. RNA Pol I C. RNA Pol II D. RNA Pol III

Q59. Which of the following amino acids is part of the two highly conserved amino acid motifs involved in the formation of a selective water gate in aquaporins

A. Aspartic acid B. Arginine C. Asparagine D. Glutamine

Q60. Which of the following complexes is present only at the stromal surface of the unstacked region of thylakoids

A. PS I B. PS II C. Cytb6f D. ATP synthase

Q61. Which of the following conserved amino acid sequences present in endoplasmic reticulum (ER)-resident proteins facilitates their retrieval back to the ER?

A. KDEL
B. KSDL
C. KADL
D. KSEL

Q62. The asymmetry of membrane lipids is caused by

A. More exoplasmic Phosphatidylcholine, cytosolic Phosphatidylserine and Cholesterol
B. More exoplasmic Phosphatidylserine, cytosolic Phosphatidylcholine and Cholesterol
C. More exoplasmic Phosphatidylcholine, cytosolic Phosphatidylethanolamine and Phosphatidylserine
D. More exoplasmic Phosphatidylserine, cytosolic Phosphatidylethanolamine and Phosphatidylcholine

Q63. Raphanobrassica is an example of

A. The classic example of a fertile allotetraploid, obtained from hybrids between radish and cabbage.
B. The classic example of a non-fertile allotetraploid, obtained from hybrids between radish and cauliflower.
C. The classic example of a fertile allopentaploid, obtained from hybrids between radish and cabbage.
D. The classic example of a non-fertile allopentaploid, obtained from hybrids between radish and cabbage.

Q64. Light-sensitive seeds are exposed to the following sequence of light treatments: Red → Far-red → Red → Far-red. What will be the final effect on germination?

A. Germination promoted
B. Germination inhibited
C. No effect on germination
D. Germination independent of light

Q65. Coat color in rabbits is governed by a series of multiple alleles viz., C+ (Agouti), Cch (Chinchilla), Ch (Himalayan) and c at the 'C' locus. The dominance hierarchy is C > Cch > Ch > c. In the cross of C+ Cch × Cch Ch, the percentage of the progeny that will be Chinchilla is

A. 100
B. 75
C. 50
D. 25

Q66. A cross is made between arg+ leu- and arg- leu+ strains in yeast and tetrads are isolated. Which of the following represents the spore genotypes that are tetratypes?

A. arg+ leu-: arg+ leu-: arg- leu+: arg- leu+
B. arg+ leu-: arg- leu+: arg+ leu+: arg- leu-
C. arg+ leu+: arg+ leu+: arg- leu-: arg- leu-
D. arg+ leu+: arg- leu-: arg- leu-: arg- leu-

Q67. Which of the following is **not** an assumption of the Hardy-Weinberg law?

A. Populations should be of large size and random mating should occur among the individuals of the population
B. No mutations should occur in the population
C. All the genotypes should have an equal probability of survival and reproduction
D. There should be movement of individuals and gene flow into and out of the populations

Q68. The UPGMA (Unweighted Pair Group Method with Arithmetic Mean) method for constructing phenograms relies on a specific evolutionary assumption. What is this assumption?

A. Only morphological data can be used for distance matrix calculations
B. Every character state change is weighted by its functional importance
C. The molecular clock is constant and identical across all branches of the tree
D. Rates of molecular evolution vary significantly across different lineages

Q69. In cladistics, which of the following terms describes a character state that is shared by two or more taxa and their most recent common ancestor, but is **not** found in earlier ancestors?

A. Symplesiomorphy
B. Plesiomorphy
C. Homoplasy
D. Synapomorphy

Q70. Identify the **incorrect** statement about glutathione, a powerful antioxidant

A. It is converted to GSSG after reaction with ROS
B. It is involved in the protection of protein cysteines from irreversible oxidation
C. Elevated levels of H_2O_2 increase the GSH/GSSG ratio
D. Reduced levels of GSH are associated with increased oxidative stress

University of Hyderabad
Entrance Examinations - 2026
Ph.D. Admissions – July Session

School/Department/Centre :
Course : Ph.D. Subject : Ph.D. Plant Sciences (Code No. F – 4)

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	A	26	B	51	C
2	D	27	D	52	D
3	C	28	C	53	D
4	C	29	A	54	B
5	B	30	B	55	C
6	B	31	A	56	C
7	A	32	B	57	D
8	C	33	C	58	B
9	B	34	B	59	C
10	B	35	D	60	D
11	D	36	B	61	A
12	A	37	A	62	C
13	B	38	C	63	A
14	D	39	D	64	B
15	B	40	B	65	C
16	C	41	C	66	B
17	A	42	A	67	D
18	D	43	D	68	C
19	C	44	A	69	D
20	A	45	B	70	C
21	C	46	A		
22	D	47	A		
23	A	48	C		
24	D	49	B		
25	C	50	D		

Note/Remarks :

R. Kumar
Signature
08/08/2026 School/Department/Centre