Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

CHEMISTRY

(Heterocyclic Chemistry)

Paper Code							
B	0	2	1	0	0	2	T

Questions Booklet Series
C

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

1. Pyridine has a delocalized π-molecular orbital containing :

(A) $4\pi e^{\Theta}$

(B) $6\pi e^{\Theta}$

(C) $8\pi e^{\Theta}$

(D) $12\pi e^{\Theta}$

2. Triazines have :

(A) Two Nitrogen

(B) Three Nitrogen

(C) Four Nitrogen

(D) Five Nitrogen

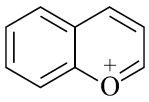
3. Thiazines contain :

(A) Nitrogen and Oxygen

(B) Oxygen and Sulphur

(C) Nitrogen and Sulphur

(D) Two Nitrogens

4.  Name of the compound is :

(A) Chromone

(B) Coumarin

(C) 1-benzopyrylium

(D) 2-benzopyrylium

5. In a fused bicyclic system, which ring is considered the parent ring ?

(A) The smaller ring

(B) The larger ring

(C) The ring with more heteroatoms

(D) Both rings are considered equal

6. What is the systematic name for a fused bicyclic system consisting of a benzene ring fused to a thiophene ring ?

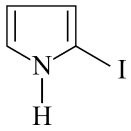
(A) Benzothiophene

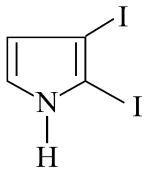
(B) Thiobenzene

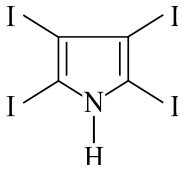
(C) Benzene thiophene

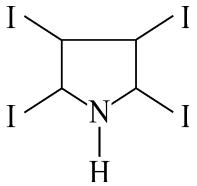
(D) Thiophenobenzene

7. Pyrrole reacts with iodine to give :

(A) 

(B) 

(C) 

(D) 

8. Pyrrole is less basic than pyridine because the lone pair of electrons of N-atom in pyrrole :

(A) In part of the delocalized π-molecular orbital

(B) Is not part of the delocalized π-molecular orbital

(C) Resides in sp^2 hybrid orbital

(D) Resides in *sp* hybrid orbital

9. The basicity order is :

(A) Pyrrole < Aniline < Pyridine < Piperidine

(B) Pyridine < Pyrrole < Piperidine < Aniline

(C) Piperidine < Pyridine < Aniline < Pyrrole

(D) Pyrrole < Pyridine < Aniline < Piperidine

10. The least basic compound among the following is :

(A) Pyridine

(B) Imidazole

(C) Pyrrole

(D) Piperidine

11. Indole is a fusion of :

(A) Benzene + Pyridine

(B) Benzene + Pyrrole

(C) Benzene + Furan

(D) Pyrrole + Pyridine

12. Which is the correction order of reactivity towards electrophilic substitution ?

(A) Pyridine > Benzene > Pyrrole

(B) Pyrrole > Furan > Thiophene

(C) Benzene > Pyrrole > Pyridine

(D) Thiophene > Pyrrole > Furan

13. N-Methyl piperidine shows :

(A) Slow inversion

(B) Rapid inversion

(C) No inversion

(D) Variable inversion rate

14. The anomeric effect is due to :

(A) Electrostatic interactions

(B) Orbital interactions

(C) Steric hindrance

(D) Bond length changes

15. Electrocyclization follows :

(A) Woodward-Hoffman rules

(B) Baldwin rules

(C) Markovnikov rule

(D) Zaitsev rules

16. The reaction of pyridazines with NH_2OH (hydroxylamine) in the presence of a base result in the formation of :

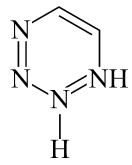
(A) Pyridazine N-Oxide

(B) Pyridazine-2, 3-dicarboxylic acid

(C) Pyridazine-2, 5-dicarboxylic acid

(D) Pyridazine-2, 3, 5, 6-tetra-carboxylic acid

17. The IUPAC name of the compound is :



(A) 3H - tetrazine

(B) 2H - tetrazine

(C) 1H - tetrazine

(D) 4H - tetrazine

18. Melamine is a :

(A) Triazine derivative

(B) Pyrimidine derivative

(C) Tetraazine derivative

(D) Pyrazine derivative

19. α-pyrones looses CO_2 upon photolysis and gives :

(A) Cyclopentadiene

(B) Cyclohexadiene

(C) Cyclotetradiene

(D) Cyclobutadiene

20. Pyrylium salts are prepared from :

(A) 1, 5-diketones and acids

(B) 1, 4-diketones and acids

(C) 1, 3-diketones and acids

(D) 1, 6-diketones and acids

21. Pyrylium salts have :

(A) Neutral charge

(B) Positive charge

(C) Negative charge

(D) Variable charge

22. The molecular formula of Oxetane in vibration is :

(A) C_2H_5N

(B) C_2H_4O

(C) C_3H_6O

(D) C_3H_6S

23. Which of the following solvents is a heterocyclic compound ?

(A) Diglyme

(B) THF

(C) DMF

(D) DMSO

24. Oxiranes are :

(A) 

(B) 

(C) 

(D) 

25. Ring Rearrangement Metathesis (RRM) involves :

(A) Breaking and forming C = C bonds

(B) Breaking and forming C – C bonds

(C) Breaking and forming C – N bonds

(D) Breaking and forming C – O bonds

26. The most reactive position in Furan for electrophilic substitution is :

(A) Position 2

(B) Position 3

(C) Position 4

(D) Position 5

27. The HOMO-LUMO gap in aromatic heterocycle is :

(A) Always large

(B) Always small

(C) Zero

(D) Variable depending on structure

28. Thiazepines find applications in which of the following fields ?

(A) Pharmaceuticals

(B) Agrochemicals

(C) Materials Science

(D) All of the above

29. What is the effect of introducing electron-donating groups on the reactivity of diazepine in electrophilic aromatic substitution reactions ?

(A) Increased reactivity

(B) Decreased reactivity

(C) No effect on reactivity

(D) Changes the regioselectivity

30. Which of the following is a common method for the functionlization of diazepines ?

(A) Alkylation

(B) Friedel-Crafts acylation

(C) Wittig reaction

(D) Diels-Alder reaction

31. Which functional group is commonly present in the core structure of diazepines ?

(A) Ketone

(B) Ester

(C) Amide

(D) Amino

32. How can thiepines be synthesized via in cyclization reaction ?

(A) Using a peracid

(B) Using a reducing agent

(C) Using a strong base

(D) Using sulfur dioxide

33. Which of the following functional groups can participate in nucleophilic addition reactions with oxepines ?

(A) Alcohols

(B) Alkenes

(C) Aldehydes

(D) Amines

34. Which of the following functional groups can easily undergo ring-opening reactions with azepines ?

(A) Alkynes

(B) Epoxide

(C) Aldehyde

(D) Amides

35. What type of reaction would convert an azepine into an N-substituted azepine ?

(A) Nucleophilic substitution
(B) Electrophilic substitution
(C) Elimination
(D) Oxidation

36. Azepines can be synthesized from which of the following starting materials ?

(A) Cyclopentanone and Ammonia
(B) Cyclohexanone and Hydrazine
(C) Cyclobutanone and Methylamine
(D) Cycloheptanone and Hydroxylamine

37. Which of the following reagents is commonly used in the synthesis of azepines via a reductive cyclization reaction ?

(A) $NaBH_4$
(B) $LiAlH_4$
(C) H_2-Ni/Pt
(D) Grignard Reagent

38. When halohydrins are get attached by (OH^-) ions, then the formation of epoxide is taking place. This occurs via :

(A) S_N^1 mechanism
(B) S_N^2 mechanism
(C) E_1 mechanism
(D) E_1cB mechanism

39. Thiamorpholine which is the derivative of thiazine is obtained by the reaction of ammonia with :

(A) Mustard gas
(B) Tear gas
(C) Mixture of ethylene glycol and monochlorobenzene
(D) All of the above

40. Pyridine reacts with H_2 in the presence of Pt to give :

(A) Pyridinium salt
(B) Pyridine
(C) Piperidine
(D) Picolines

41. What is the key step in the synthesis of benzothiazines involving the condensation of *o*-halophenols with thiourea ?

(A) Hetero Diels-Alder reaction
(B) Biginelli reaction
(C) Fischer Indole synthesis
(D) Knorr Pyrrole synthesis

42. Pyramidal inversion refers to :

(A) Ring Flipping
(B) Nitrogen Inversion
(C) Carbon Inversion
(D) Oxygen Inversion

43. The ring strain in aziridine is :

(A) Less than cyclopropane

(B) Equal to cyclopropane

(C) Greater than cyclopropane

(D) Zero

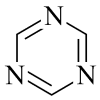
44. Most common heteroatoms found in heterocyclic compounds are :

(A) C, H, O

(B) C, H, N

(C) C, H, S

(D) N, O, S

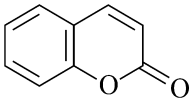
45.  Name of the compound is :

(A) 1, 2, 5-triazine

(B) 1, 5, 3-triazine

(C) 1, 3, 5-triazine

(D) 1, 4, 5-triazine

46.  is the structure of :

(A) Quinoline

(B) Isoquinoline

(C) Coumarin

(D) Indole

47. A bicyclic system with a shared edge is called :

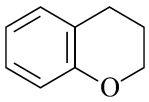
(A) Spiro system

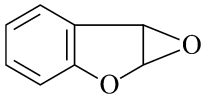
(B) Fused system

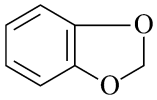
(C) Bridged system

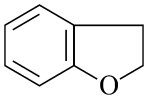
(D) Isolated system

48. Benzofuran reacts with peracid to give :

(A) 

(B) 

(C) 

(D) 

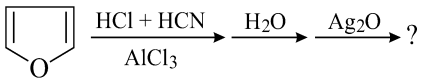
49. Fischer's indole synthesis involves :

(A) [2, 3] sigmatropic shift

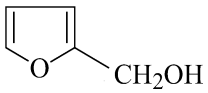
(B) [3, 3] sigmatropic shift

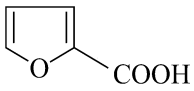
(C) [3, 2] sigmatropic shift

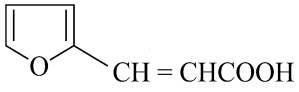
(D) [2, 2] sigmatropic shift

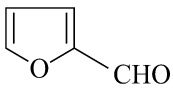
50. 

The product of above reaction series is :

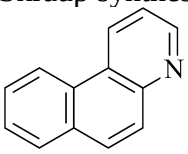
(A) 

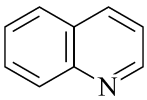
(B) 

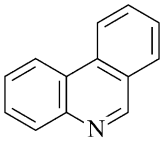
(C) 

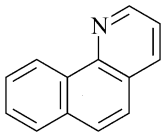
(D) 

51. Which of the following compounds is formed, when α-Napthylamine is used in the Skraup synthesis ?

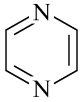
(A) 

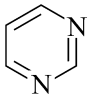
(B) 

(C) 

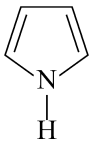
(D) 

52. The structure of Pyrazine is :

(A) 

(B) 

(C) 

(D) 

53. Trophin consists of :

(A) 3 Pyrrole ring
(B) 4 Pyrrole ring
(C) 5 Pyrrole ring
(D) 6 Pyrrole ring

54. Azetidine reacts with H_2O_2 to give :

(A) $CH_3CH = CH_2 + NH_3$
(B) $CH_3CH = CH_2 + N_2$
(C) $CH_3CH_2CH_3 + N_2$
(D) $CH_3CH_2CH_3 + NH_3$

55. Reaction of furfural with NaOH gives :

(A) Furoin
(B) Furoic acid
(C) Furfuryl alcohol and sodium salt of furane-2-carboxylic acid
(D) No reaction

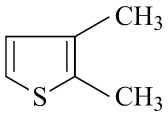
56. Pyrrole reacts with chloroform in presence of base to give pyrrole-2-carboxylaldehyde. This reaction is an example of :

(A) Reimer-Tiemann reaction
(B) Gomberg reaction
(C) Houben-Hoesch reaction
(D) Cannizzaro reaction

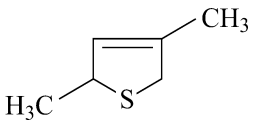
57. Pyridine undergoes electrophilic substitution with fuming H_2SO_4 at 350°C to give :

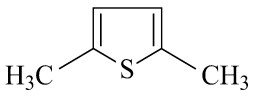
(A) 2-Pyridine sulphonic acid
(B) 4-Pyridine sulphonic acid
(C) 3-Pyridine sulphonic acid
(D) None of the above

58. An enolizable 1, 4-diketone on heating with P_2S_5 gives :

(A) 

(B) 

(C) 

(D) 

59. The order of aromaticity of furan, Thiophene and Pyrrole is :

(A) Thiophene > Furan > Pyrrole

(B) Furan > Pyrrole > Thiophene

(C) Thiophene > Pyrrole > Furan

(D) Pyrrole > Thiophene > Furan

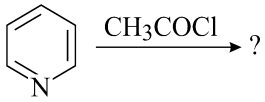
60. Nicotinic acid reacts with soda lime to give :

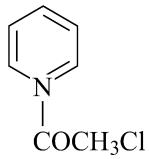
(A) Pyrrole

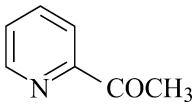
(B) Piperidine

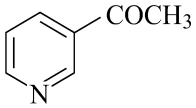
(C) Pyrrolidine

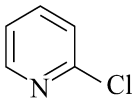
(D) Pyridine

61. 

(A) 

(B) 

(C) 

(D) 

62. Which of the following reagents will react with pyrrole to form 2-formyl pyrrole ?

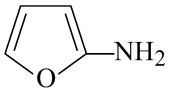
(A) HCOOH

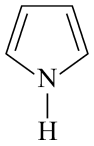
(B) $CHCl_3$/KOH

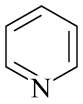
(C) H_2O_2

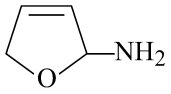
(D) $(CH_3CO)_2O/SnCl_4$

63. Which of the following products is formed on passing a mixture of furan, ammonia and steam over heated alumina ?

(A) 

(B) 

(C) 

(D) 

64. Azepines are generally prepared by :

(A) Electrophilic aromatic substitution

(B) Nucleophilic addition to alkenes

(C) Ring expansion of cyclohexane derivatives

(D) Decarboxylation of carboxylic acid

65. Which of the following is a seven-membered heterocycle ?

(A) Azepine

(B) Pyridine

(C) Pyrimidine

(D) Oxazole

66. Which compound contains two nitrogen atoms in a six-membered ring ?

(A) Pyrrole
(B) Pyrazine
(C) Thiazole
(D) Oxazole

67. Synthesis and reactions of quinolizinium benzopyrylium salts, coumarins and chromones coumarins are commonly formed by the :

(A) Fischer indole synthesis
(B) Sandmeyer reaction
(C) Wolf-kishner reduction
(D) Pechamann condensation

68. Which one of the following is a six-membered heterocycle with one heteroatom ?

(A) Furan
(B) Thiophene
(C) Azepine
(D) Pyridine

69. Four-membered heterocycles like oxetances are typically prepared by :

(A) Intramolecular Williamson ether synthesis
(B) Hydrogenation of furan
(C) Ring opening of epoxide
(D) Cycloaddition of ketenes with aldehyde

70. The principle of heterocyclic synthesis involving cyclization reaction is best explained by :

(A) Formation of aziridines from amino alcohol
(B) Died-Alder reaction
(C) Electrophilic Aromatic substitution
(D) Nucleophilic addition to carbonyls

71. Oxiranes are commonly synthesized by :

(A) Cycloaddition of alkenes with carbenes
(B) Oxidation of alkenes using peracid
(C) Reduction of carbonyl compounds
(D) Friedel-Crafts alkylation

72. The energy barrier for ring inversion in cyclohxane like heterocycles in influenced by :

(A) Only bond length
(B) Steric 1, 3-diaxial interaction and heteroatom size
(C) Resonance stablisation
(D) Hydrogen bonding

73. In six-membered heterocycles, the preferred conformation is usually :

(A) Planar

(B) Boat

(C) Chair

(D) Twisted

74. Strain in heterocyles (small) leads to :

(A) Increased stability

(B) Higher reactivity towards nucleophilic attack

(C) Lower boiling points

(D) Aromatic character

75. The major source of strain in three-membered heterocycles is :

(A) Torsional strain only

(B) Angle strain and bond angle distortion

(C) Steric hindrance between substituent

(D) Hyperconjugation

76. Non-aromatic heterocycles generally have :

(A) $(4n + 2)\pi$ electrons

(B) $4n\ \pi$ electrons

(C) Localised lone pairs on heteroatoms

(D) Planar conjugated systems

77. Diamagnetic susceptibility exaltation in heterocycles indicates :

(A) Increased aromatic character

(B) Presence of paramagnetic species

(C) Non-aromatic behavior

(D) High reactivity with nucleophiles

78. Heteroaromatic reactivity involves :

(A) Only electrophilic substitution

(B) Tautomerizm affecting reactivity patterns

(C) No Effect of heteroatoms on reactions

(D) Exclusive nucleophilic addition

79. Empirical resonance energy in heterocycles means :

(A) Stability due to delocalization

(B) Reaction rate with the electrophiles

(C) Molecular weight

(D) Viscosity of the compound

80. ^{1}H NMR chemical shifts in aromatic heterocyclic are influenced by :

(A) Ring current effects

(B) Presence of alkyl group only

(C) Temperature of the sample

(D) pH of the solvent

81. Aromatically in heterocyclic is determined by :

(A) Bond length and ring current

(B) Only electronegativity of heteroatoms

(C) Molecular symmetry

(D) Solubility in water

82. Classification of aromatic heterocycles depends on :

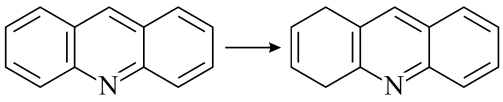
(A) Number of carbon atoms only

(B) Structure type (moncyclic, fused) and heteroatoms

(C) Molecular weight

(D) Boiling point

83. The reagent for the following transformation is :

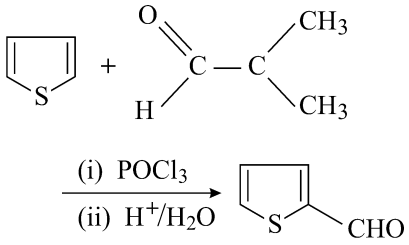


(A) H_2/Raney Ni

(B) Li/liquid NH_3

(C) H_2/PtO_2 in CF_3COOH

(D) All of the above

84. 

This reaction is known as :

(A) Vilsmier-Haack reaction

(B) Friedlander reaction

(C) Pfitzinger reaction

(D) Dobereiner's-Miller reaction

85. Consider the following statements :

I. Furan undergoes electrophilic substitution at the 2-position.

II. Thiophene ring occurs in the vitamin C molecule.

III. Thiophene is more aromatic than furan.

IV. Pyrrole is more basic than pyridine.

Select the correct statement :

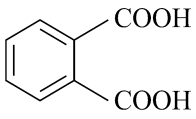
(A) I, III

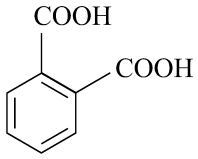
(B) I, III, IV

(C) I, II, III

(D) III, IV

86. Isoquinoline on oxidation with alkaline $KMnO_4$ gives :

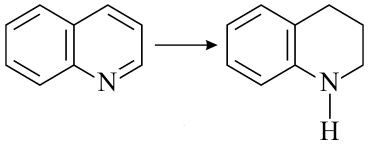
(A) 

(B) 

(C) Both of these

(D) None of the above

87. The suitable reagent for the following transformation is :



(A) Na/liq. NH_3

(B) H_2/Pt

(C) Sn/HCl

(D) All of the above

88. Match the following :

Column I	Column II
(a) Pyrrole	(1) Pictet-Spengler
(b) 1, 4-dihydro-pyridine	(2) Chichibabin
(c) Isoquinoline	(3) Paal-Knorr
	(4) Hantzsch

Code :

	(a)	(b)	(c)
(A)	(1)	(2)	(3)
(B)	(2)	(3)	(4)
(C)	(4)	(1)	(2)
(D)	(3)	(4)	(1)

89. Pyridine undergoes nucleophilic substitution with $NaNH_2$ at 100°C to give :

(A) 3-aminopyridine

(B) 2-aminopyridine

(C) 3, 5-diaminopyridine

(D) 2, 5-diaminopyridine

90. Quinoline undergoes nucleophilic substitution on heating with $NaNH_2$ to give :

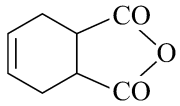
(A) 2-aminoquinoline

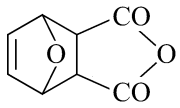
(B) 4-aminoquinoline

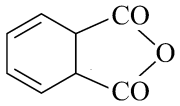
(C) 3-aminoquinoline

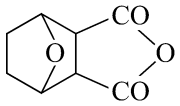
(D) 8-aminoquinoline

91. Furan reacts with maleic an hydride to give :

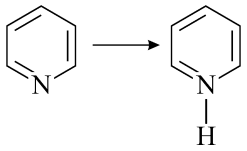
(A) 

(B) 

(C) 

(D) 

92. The following reaction is brought about by :



(A) Na/liq. NH_3

(B) Na/C_2H_5OH

(C) $LiAlH_4$

(D) HI/Δ

93. The nitrogen atom in pyridine is :

(A) sp^2 hybridized

(B) sp^3 hybridized

(C) *sp* hybridized

(D) Cannot be predicted

94. What is the correct IUPAC name for Furan ?

(A) Azole

(B) Oxole

(C) Oxirene

(D) Oxete

95. According to IUPAC rules, how is a 4-membered ring with a sulfur atom (saturated) named ?

(A) Thietane

(B) Thiophene

(C) Thietene

(D) Thiolane

96. What does the suffix '-irane' signify in Hantzsch-Widman nomenclature ?

(A) 3-membered ring, saturated

(B) 3-membered ring, unsaturated

(C) 4-membered ring, saturated

(D) 5-membered ring, unsaturated

97. What is the common name for the 6-membered aromatic heterocycle containing one nitrogen atom ?

(A) Piperidine

(B) Pyridazine

(C) Pyridine

(D) Pyrimidine

98. In a heterocyclic ring containing both oxygen and nitrogen, which hetero-atom gets the lower number ?

(A) Nitrogen

(B) Oxygen

(C) Both get equal priority

(D) Depends upon the size of the ring

99. What is the correct systematic name for a 5-membered ring containing one nitrogen atom (unsaturated) ?

(A) Pyrrolidine

(B) Pyrrole

(C) Pyridine

(D) Piperidine

100. Which prefix is used for a nitrogen atom in the Hantzsch-Widman system ?

(A) Oxa–

(B) Thia–

(C) Aza–

(D) Phospha–

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।