'Science)

(To be filled up by the candidate by blue/black ball point pen)

Roll No.

Roll No. (Write the digits in words) ....

Serial No. of OMR Answer Sheet ....

Day and Date ....

(Signature of Invigilator)

INSTRUCTIONS TO CANDIDATES

(Use only blue/black ball-point pen in the space above and on both sides of the Answer Sheet)

1. Within 30 minutes of the issue of the Question Booklet, Please ensure that you have got the correct booklet and it contains all the pages in correct sequence and no page/question is missing. In case of faulty Question Booklet, Bring it to the notice of the Superintendent/Invigilators immediately to obtain a fesh Question Booklet.

2. Do not bring any loose paper, written or blank, inside the Examination Hall *except the Admit Card without its envelope.*

3. *A separate Answer Sheet is given. It should not be folded or mutilated. A second Answer Sheet shall not be provided.*

4. Write your Roll Number and Serial Number of the Answer Sheet by pen in the space provided above.

5. *On the front page of the Answer Sheet, write by pen your Roll Number in the space provided at the top, and by darkening the circles at the bottom. Also, wherever applicable, write the Question Booklet Number and the Set Number in appropriate places.*

6. *No overwriting is allowed in the entries of Roll No., Question Booklet No. and Set No. (if any) on OMR sheet and Roll No. and OMR sheet no. on the Question Booklet.*

7. *Any change in the aforesaid entries is to be verified by the invigilator, otherwise it will be taken as unfair means.*

8. *This Booklet contains 40 multiple choice questions followed by 10 short answer questions. For each MCQ, you are to record the correct option on the Answer Sheet by darkening the appropriate circle in the corresponding row of the Answer Sheet, by pen as mentioned in the guidelines given on the first page of the Answer Sheet. For answering any five short Answer Questions use five Blank pages attached at the end of this Question Booklet.*

9. For each question, darken only **one** circle on the Answer Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as incorrect.

10. *Note that the answer once filled in ink cannot be changed. If you do not wish to attempt a question, leave all the circles in the corresponding row blank (such question will be awarded zero marks).*

11. For rough work, use the inner back pages of the title cover and the blank page at the end of this Booklet.

12. *Deposit both OMR Answer Sheet and Question Booklet at the end of the Test.*

13. You are not permitted to leave the Examination Hall until the end of the Test.

14. If a candidate attempts to use any form of unfair means, he/she shall be liable to such punishment as the University may determine and impose on him/her.

Total No. of Printed Pages : 24

Research Entrance Test-2017

No. of Questions : 50

प्रश्नों की संख्या : 50

Time : 2 Hours

समय : 2 घण्टे

Full Marks : 200

पूर्णांक : 200

Note: (1)   This Question Booklet contains **40** Multiple Choice Questions followed by **10** Short Answer Questions.

इस प्रश्न पुस्तिका में **40** वस्तुनिष्ठ व **10** लघु उत्तरीय प्रश्न हैं।

(2)   Attempt as many MCQs as you can. Each MCQ carries **3 (Three)** marks. **1 (One)** mark will be deducted for each incorrect answer. **Zero** mark will be awarded for each unattempted question. If more than one alternative answers of MCQs seem to be approximate to the correct answer, choose the closest one.

अधिकाधिक वस्तुनिष्ठ प्रश्नों को हल करने का प्रयत्न करें। प्रत्येक वस्तुनिष्ठ प्रश्न **3 (तीन)** अंकों का है। प्रत्येक गलत उत्तर के लिए **1 (एक)** अंक काटा जायेगा। प्रत्येक अनुत्तरित प्रश्न का प्राप्तांक शून्य होगा। यदि वस्तुनिष्ठ प्रश्नों के एकाधिक वैकल्पिक उत्तर सही उत्तर के निकट प्रतीत हों, तो निकटतम सही उत्तर दें।

(3)   Answer only **5** Short Answer Questions. Each question carries **16 (Sixteen)** marks and should be answered in **150-200** words. Blank **5 (Five)** pages attached with this booklet shall only be used for the purpose. Answer each question on separate page, after writing Question No.

केवल **5 (पाँच)** लघुउत्तरीय प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **16 (सोलह)** अंकों का है तथा उनका उत्तर **150-200** शब्दों के बीच होना चाहिए। इसके लिए इस पुस्तिका में लगे हुए सादे **5 (पाँच)** पृष्ठों का ही उपयोग आवश्यक है। प्रत्येक प्रश्न का उत्तर एक नए पृष्ठ से, प्रश्न संख्या लिखकर शुरू करें।

P.T.O.

01. Booklungs are found in :

(1) Amoeba

(2) Polystomella

(3) Euglypha

(4) Arachnids

02. Silk is obtained from :

(1) Adult moth

(2) Caterpillar stage

(3) Egg

(4) Cocoon

03. Neurogenic heart is found in :

(1) Human beings

(2) Rat

(3) Rabbit

(4) Invertebrates

04. Epiphysis is also known as :

(1) Pineal

(2) Pituitary

(3) Thyroid

(4) Hypothalamus

05. Simplest and smallest form of amino acid is :

(1) Glycine

(2) Proline

(3) Lysine

(4) Argenine

06. PCOS is related to :

(1) Ovary

(2) Uterus

(3) Testes

(4) Oviduct

07. Seminogelin is secreted by :

(1) Epididymis

(2) Seminal Vesicle

(3) Thecal cells

(4) Oviduct

14. What will be the E value at the equivalence point of titration of Fe^{2-} against $KMnO_4$? ($E^0_{Fe^{2+}/Fe^{3+}} = 0.77$ V and $E^0_{MnO_4^-/Mn^{2+}} = 1.52$ V)

(1) 1.52 V

(2) Between 0.77 V and 1.52 V

(3) 0.77 V

(4) Much less than 0.77 V

15. If an isotope $^{218}_{84}Po$ undergoes one alpha and one beta emission in successive stages, the number of neutrons in the resulting nucleus would be :

(1) 215

(2) 134

(3) 131

(4) 82

16. The *ionic strength* of a solution containing. 0.1 M KCl in presence of 0.01 M $BaCl_2$ is :

(1) 0.43

(2) 0.33

(3) 0.23

(4) 0.13

17. Which one of the following is the correct expression for chemical potential of constituent i in a multicomponent system ?

(1) $\mu_i = \left(\dfrac{\partial G}{\partial T}\right)_{P,n_i}$

(2) $\mu_i = \left(\dfrac{\partial G}{\partial n_i}\right)_{T,n_j}$

(3) $\mu_i = \left(\dfrac{\partial G}{\partial n_i}\right)_{T,P,n_j}$

(4) $\mu_i = \left(\dfrac{\partial G}{\partial P}\right)_{T,n_i}$

08. First cleavage in frog is :

(1) Horizontal

(2) Meridional

(3) Equatorial

(4) Latitudinal

09. Which of the following is nuclear receptor ?

(1) AR

(2) GPCR

(3) IR

(4) MT1

10. Cryptorchidism is related to :

(1) Testes

(2) Thyroid

(3) Ovary

(4) Pancreas

11. Which of the following set of values is correct for the isothermal free expansion of an ideal gas into vacuum ?

(1) $\Delta U = 0, q > 0, w < 0$

(2) $\Delta U > 0, q > 0, w = 0$

(3) $\Delta U = 0, q = 0, w = 0$

(4) $\Delta U < 0, q = 0, w < 0$

12. If a sol is saturated with silver acetate ($K_{sp} = 1.9 \times 10^{-3}$), which of the following reagents will increase the solubility of silver acetate

(1) Ammonia

(2) Silver nitrate

(3) Sodium acetate

(4) Sodium chloride

13. Which compound is least soluble (mol/L) in water ?

(1) $CaCO_3$ $K_{sp} = 2.8 \times 10^{-9}$

(2) PbI_2 $K_{sp} = 8.7 \times 10^{-9}$

(3) $AgBr$ $K_{sp} = 5.0 \times 10^{-13}$

(4) $Fe(OH)_2$ $K_{sp} = 8.0 \times 10^{-16}$

18. Entropy of a system in terms of molecular partition function (q) is given by :

    (1) $S = NkT \left(\dfrac{\partial \ln q}{\partial T} \right)_V + Nk \ln q$

    (2) $S = NkT \left(\dfrac{\partial \ln q}{\partial P} \right)_T + Nk \ln q$

    (3) $S = NkT \left(\dfrac{\partial \ln q}{\partial P} \right)_V - Nk \ln q$

    (4) $S = NkT \left(\dfrac{\partial \ln q}{\partial P} \right)_P + Nk \ln q$

19. The weight average molecular weight of a polymer is given by

    (1) $M = \dfrac{\sum_i n_i M_i^2}{\sum_i n_i}$

    (2) $M = \dfrac{\sum_i n_i M_i}{\sum_i n_i M_i^2}$

    (3) $M = \dfrac{\sum_i n_i M_i}{\sum_i n_i}$

    (4) $M = \dfrac{\sum_i n_i M_i^2}{\sum_i n_i M_i}$

20. Which one of the following statement is correct ? For a reversible adiabatic expansion of an ideal gas, the plot of log P versus log V is a straight line $\left(\gamma = \dfrac{C_p}{C_v} \right)$:

    (1) of slope, γ

    (2) parallel to log P axis

    (3) of slope, $-\gamma$

    (4) of slope, -1

21. B.E.T. equation applicable for multilayer adsorption is given by :

    (1) $\dfrac{p}{v(p^0 - p)} = \dfrac{1}{v_m.c} + \left(\dfrac{c-1}{v_m.c} \right) \dfrac{p}{p^0}$

    (2) $\dfrac{p}{v(p^0 - p)} = \dfrac{1}{v_m.c} - \left(\dfrac{c-1}{v_m.c} \right) \dfrac{p}{p^0}$

    (3) $\dfrac{v(p^0 - p)}{p} = \dfrac{1}{v_m.c} + \left(\dfrac{c-1}{v_m.c} \right) \dfrac{p}{p^0}$

    (4) $\dfrac{p}{v(p^0 - p)} = \dfrac{1}{v_m.c} + \left(\dfrac{v_m.c}{c-1} \right) \dfrac{p}{p^0}$

22. The following are the fluorescence intensity values of a blank determination. The readings are 0.002, 0.000, 0.008, 0.006 and 0.003. A standard 1.0 ppm analyte solution gives a reading of 0.051. What is the limit of detection ?

(1) 2.00 ppm

(2) 2.0 mg L^{-1}

(3) 0.02 ppm

(4) 0.2 ppm

23. In normal pulse polarography, how many time (s) the current is measured during the life time of a Hg drop.

(1) Continuously measured during the whole life time of the Hg drop

(2) One time only

(3) Two times

(4) Four times

24. The shape of the curve during the amperometric titration of Pb^{2+} with potassium dichromate at an applied potential of -0.8 V (vs. SCE) is :

(1) V shaped curve

(2) L shaped curve

(3) Reverse L shaped curve

(4) Linear line

25. Predict the equilibrium (among the following) which is not generally possible in gas chromatography.

(1)   Partition between gas and liquid

(2)   Partition between liquid and bonded surface

(3)   Adsorption

(4)   Partition between immiscible liquids

26. Examine the following two structures for the anilinium ion and choose the correct statement from the ones given below :
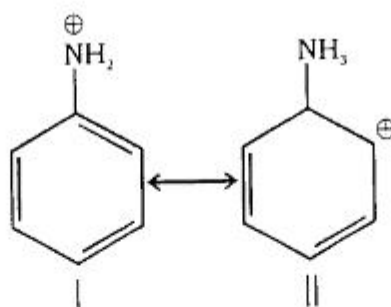
(1)   II is not acceptable canonical structure because carbocation are less stable than ammonium ion

(2)   II is not an acceptable canonical structure because it is non-aromatic

(3)   II is not an acceptable canonical structure because the nitrogen has 10 valence electrons

(4)   II is an acceptable canonical structure

27. When nitrobenzene is treated with Br_2 in presence of $FeBr_3$, the major product formed is meta bromo nitrobenzene. Statements which are related to obtain meta isomer are :

(1) The intermediate0000 arenium ion formed after initial attack of Br^- at *meta* position is least stabilized

(2) Loss of aromaticity when Br^- attacks at the *ortho* and *para* position and not at *meta* position

(3) Easier loss of H^- to regain aromaticity

(4) The electron density on *meta* carbon is more than that on *ortho* and *para* positions

28. Among the following statements on the nitration of aromatic compounds the false one is :

(1) The rate of nitration of benzene is almost the same as that of hexa deuterobenzene

(2) The rate of nitration of toluene is greater than that of benzene

(3) The rate of nitration of benzene is greater than that of hexa deuterobenzene

(4) Nitration is an Electrophilic reaction

29. The reaction between X and Y to give Z proceeds via :

(X)   (Y)   (Z)
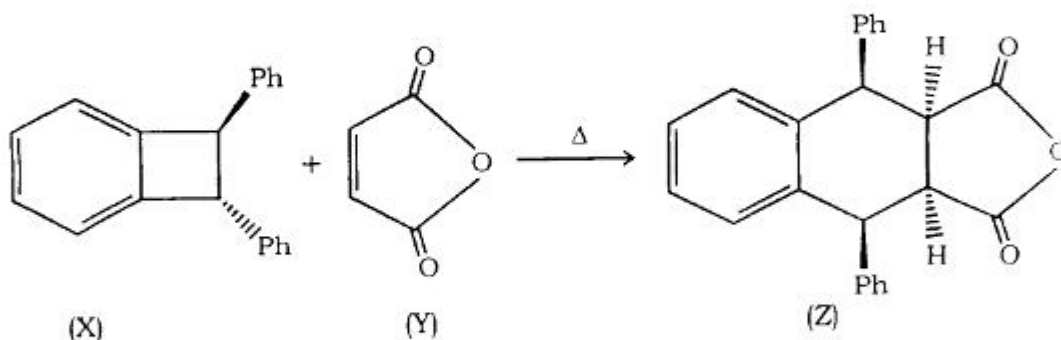
(1) 4π-conratatory opening of X followed by endo Diels-Alder cycloaddition

(2) 4π-disrotatory opening of X followed by endo Diels-Alder cycloaddition

(3) 4π-conrotatory opening of X followed by exo Diels-Alder cycloaddition

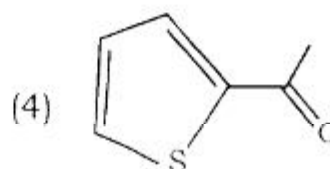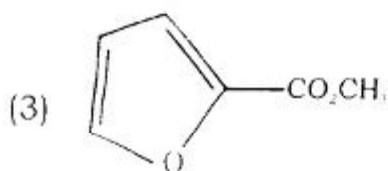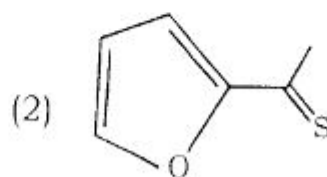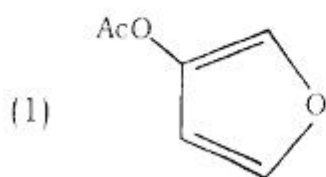(4) 4π-disrotatory opening of X followed by exo Diels-Alder cycloaddition

30. The major product of the following reaction is :

(1)

(2)

(3)

(4)
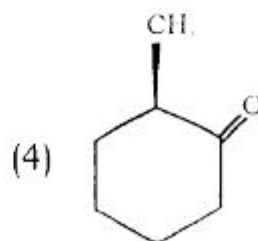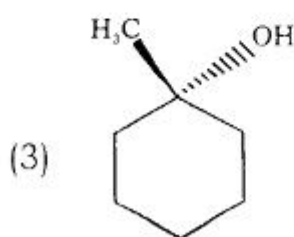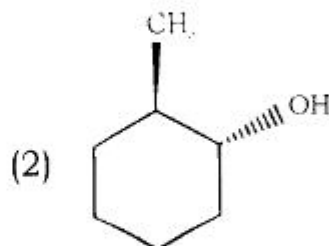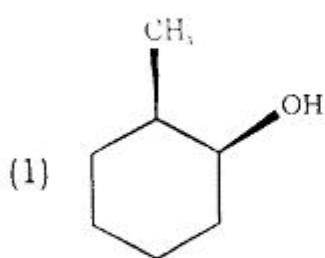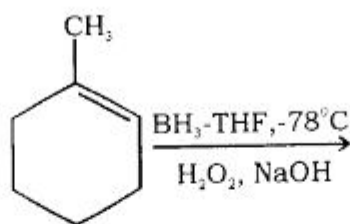
31. An organic compounds show following information in spectral analysis

IR (cm^{-1}): 1680, ^{1}H NMR (CDCl$_3$) : δ 7.66 (m, 1H), 7.60 (m, 1H), 7.10 (m, 1H), 2.50 (s, 3H), ^{13}C NMR (CDCl$_3$) = δ 190, 144, 134,132,128.28; m/z (EI) : 126 (M, 100%), 128 (M + 2, 4.9%)

The structure of the compound is :

(1)

(2)

(3)

(4)

32. For elctrophilic addition with HCl which pair is correctly matched :

(A) CH$_3$-CH=CH$_2$, Alkyl Carbocation

(b) (2) CH$_3$-CH≡CH, Vinyl Carbocation

(c) CH$_2$=CH-CH=CH$_2$, Allyl Carbocation

(d) C$_6$H$_5$-CH=C(CH$_3$)$_2$, Alkyl carbocation

Select the correct answer from the codes given below :

(1) A,C and D

(2) B,C and D

(3) A,B and C

(4) A,B and D

33. Among the following, the correct statement (s) about ribose is (are)

   (A) On reduction with $NaBH_4$ it gives optically inactive product

   (B) On reaction with methanolic HCl it gives a furanoside

   (C) On reaction with Br_2-$CaCO_3$- water it gives optically inactive product

   (D) It gives positive Tollens test

   Correct option is :

   (1) A,B & D

   (2) A,B & C

   (3) B & C

   (4) D only

34. In case of transition metal alkyls, most facile decomposition pathway is :

   (1) Reductive elimination   (2) Reductive extrusion

   (3) β–Hydrogen elimination   (4) Disproportionation

35. When Fe(II) of an iron-porphyrine complex binds with dioxygen the final product is precipitatied as hematin. Such a precipitation in blood is mainly prevented by :

   (1) Inability of Fe(II) to get oxidized

   (2) Steric hindrance by globin part

   (3) Hematin is formed but remains dissolved in blood

   (4) None of these

36. The reaction $CH_3Mn(CO)_5 + CO \rightarrow CH_3COMn(CO)_5$ is an example of :

   (1) Intramolecular CO insertion

   (2) Intermolecular CO insertion

   (3) alkyl migration

   (4) a complex multistep reaction sequence

37. Considering the steric effects only, which of the following statement is false ?

   (1) Square planar geometry is more stable than tetrahedral geometry for coordination no 4

   (2) Octahedral geometry is more stable than trigonal prismatic for coordination no. 6

   (3) Square anti-prismatic geometry is more stable than cubic geometry

   (4) None of the above

38. Aqueous solutions of Mn^{2+} salts are usually colourless because electronic transitions in these complexes are :

   (1) Spin forbidden, Laporte allowed

   (2) Laporte forbidden and spin allowed

   (3) Both Laporte and spin forbidden

   (4) Both Laporte and spin allowed

39. For the electronic configuration d^2, the ground state term for the free ion and the terms in an octahedral field respectively are :

   (1) ^2D and $E_g + T_{2g}$ (2) ^2F and $E_g + T_{2g} + T_{1g}$

   (3) ^3F and $E_g + T_{2g}$ (4) ^3F and $T_{1g} + T_{2g} + A_{2g}$

40. Oxidation of a non-metallic element A in strongly acidic systems produces polyatomic cationic species of the type A_n^{m+}. The structure of A_4^{2+} is square planar. A is :

   (1) B   (2) Si

   (3) S   (4) Cl

14

ROUGH WORK
रफ़ कार्य

Short Answer Questions

Note: Attempt any **five** questions. Write answer in **150-200** words. Each question carries **16** marks. Answer each question on separate page, after writing Question Number.

01. What are the consequences of ion-ion interations with regard to equilibrium properties of electrolyte solutions ?

02. Explain the following terms in relation to electrode reaction :

(i) Symmetry factor (β)

(ii) Exchange current density (i_0)

(iii) Overpotential (η)

03. What are excess thermodynamic functions for non-ideal solutions ? Show that they really provide a quantitative idea about molecular interaction in the system.

04. Explain the formation of metal-metal quadruple bond giving an appropriate example.

05. Differentiate between outer-sphere and inner-sphere mechanisms of redox reactions giving suitable examples.

06. How boranes are classified ? Draw the structures of one molecule/ion from each class.

07. Differentiate among atomic absorption spectroscopy, atomic emission spectroscopy and atomic fluorescence spectroscopy.

08. Discuss the structural conditions required for substrate and reagents for the stereoselective generation of Z and E enolates. Give the mechanism of the Aldol reaction with achiral aldehyde and achiral enolate (Z & E).

09. Why disocamphenylborane is more stereoselective hydroborating reagent to cis-2-butene than trans ? Explain.

10. Identify the following reactions, write the product (S) and discuss its mechanism :
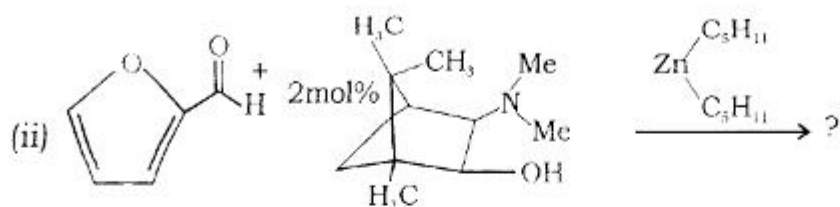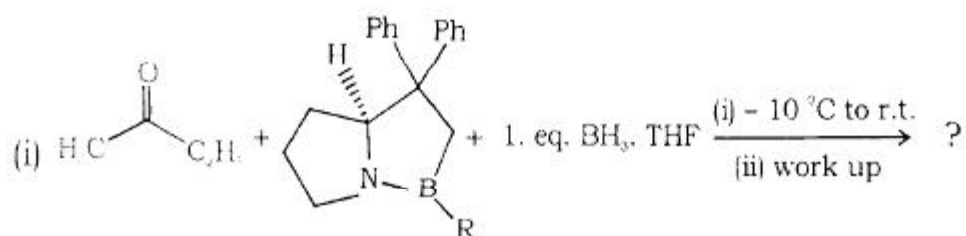
Question No.

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Question No.   **Page for Short Answer**

Question No.   Page for Short Answer

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ROUGH WORK

रफ़ कार्य

अभ्यर्थियों के लिए निर्देश

(इस पुस्तिका के प्रथम आवरण पृष्ठ पर तथा उत्तर-पत्र के दोनों पृष्ठों पर
केवल नीली-काली बाल-प्वाइंट पेन से ही लिखें)

1. प्रश्न पुस्तिका मिलने के 30 मिनट के अन्दर ही देख लें कि प्रश्नपत्र में सभी पृष्ठ मौजूद हैं और कोई प्रश्न छूटा नहीं है। पुस्तिका दोषयुक्त पाये जाने पर इसकी सूचना तत्काल कक्ष-निरीक्षक को देकर सम्पूर्ण प्रश्नपत्र की दूसरी पुस्तिका प्राप्त कर लें।

2. परीक्षा भवन में *लिफाफा रहित प्रवेश-पत्र के अतिरिक्त*, लिखा या सादा कोई भी खुला कागज साथ में न लायें।

3. *उत्तर-पत्र अलग से दिया गया है। इसे न तो मोड़ें और न ही विकृत करें। दूसरा उत्तर-पत्र नहीं दिया जायेगा। केवल उत्तर-पत्र का ही मूल्यांकन किया जायेगा।*

4. अपना अनुक्रमांक तथा उत्तर-पत्र का क्रमांक प्रथम आवरण-पृष्ठ पर पेन से निर्धारित स्थान पर लिखें।

5. *उत्तर-पत्र के प्रथम पृष्ठ पर पेन से अपना अनुक्रमांक निर्धारित स्थान पर लिखें तथा नीचे दिये वृत्तों को गाढ़ा कर दें। जहाँ-जहाँ आवश्यक हो वहाँ प्रश्न-पुस्तिका का क्रमांक तथा सेट का नम्बर उचित स्थानों पर लिखें।*

6. ओ० एम० आर० पत्र पर अनुक्रमांक संख्या, प्रश्नपुस्तिका संख्या व सेट संख्या (यदि कोई हो) तथा प्रश्नपुस्तिका पर अनुक्रमांक और ओ० एम० आर० पत्र संख्या की प्रविष्टियों में उपरिलेखन की अनुमति नहीं है।

7. *उपर्युक्त प्रविष्टियों में कोई भी परिवर्तन कक्ष निरीक्षक द्वारा प्रमाणित होना चाहिये अन्यथा यह एक अनुचित साधन का प्रयोग माना जायेगा।*

8. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार वैकल्पिक उत्तर दिये गये हैं। प्रत्येक प्रश्न के वैकल्पिक उत्तर के लिए आपको उत्तर-पत्र की सम्बन्धित पंक्ति के सामने दिये गये वृत्त को उत्तर-पत्र के प्रथम पृष्ठ पर दिये गये निर्देशों के अनुसार पेन से गाढ़ा करना है।

9. प्रत्येक प्रश्न के उत्तर के लिए केवल एक ही वृत्त को गाढ़ा करें। एक से अधिक वृत्तों को गाढ़ा करने पर अथवा एक वृत्त को अपूर्ण भरने पर वह उत्तर गलत माना जायेगा।

10. *ध्यान दें कि एक बार स्याही द्वारा अंकित उत्तर बदला नहीं जा सकता है। यदि आप किसी प्रश्न का उत्तर नहीं देना चाहते हैं, तो संबंधित पंक्ति के सामने दिये गये सभी वृत्तों को खाली छोड़ दें। ऐसे प्रश्नों पर शून्य अंक दिये जायेंगे।*

11. रफ कार्य के लिए प्रश्न-पुस्तिका के मुखपृष्ठ के अंदर वाला पृष्ठ तथा उत्तर-पुस्तिका के अंतिम पृष्ठ का प्रयोग करें।

12. परीक्षा के उपरान्त *केवल ओ एम आर उत्तर-पत्र* परीक्षा भवन में जमा कर दें।

13. परीक्षा समाप्त होने से पहले परीक्षा भवन से बाहर जाने की अनुमति नहीं होगी।

14. यदि कोई अभ्यर्थी परीक्षा में अनुचित साधनों का प्रयोग करता है, तो वह विश्वविद्यालय द्वारा निर्धारित दंड का/की, भागी होगा/होगी।