119

QUESTION PAPER SERIES CODE
A

Registration No. : | | | | | | |

Centre of Exam. : _____

Name of Candidate : _____

_____

Signature of Invigilator

COMBINED ENTRANCE EXAMINATION, 2018
M.Tech. BIOTECHNOLOGY

INSTRUCTIONS FOR CANDIDATES

The Question Paper consists of two Sections. Section—I is for those opting for Technology/Engineering Stream and Section—II is for those opting for Science Stream. Depending upon their backgrounds, candidates are required to **attempt** questions from **ONE of the Sections only**.

SECTION—I
TECHNOLOGY/ENGINEERING STREAM
(Part—A, Part—B, Part—C)
[Field of Study Code : MTB]

Time Allowed : 3 hours *Maximum Marks* : 120

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.

(ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

(iii) The Question Paper is organized and answers are valued as follows :

Part—A : Basic Engineering and Technology including Pharmacology (Marks : 45)
Answer any **45** questions out of 90 questions

Note : (In case any candidate answers more than the required 45 questions, the first 45 questions attempted will be evaluated)

Part—B : Physics, Chemistry and Mathematics (Marks : 40)
Answer **all** questions

Part—C : Fundamentals of Life Sciences and Informatics (Marks : 35)
Answer **all** questions

(iv) Each question carries *1* mark. **There will be negative marking and ¼ mark will be deducted for each wrong answer.**

(v) Answer the questions in the Answer Sheet provided separately by darkening the correct choice, i.e., (a) or (b) or (c) or (d) (as the case may be) against each question in the corresponding circle.

(vi) Answers written by the candidates inside the Question Paper will not be evaluated.

(vii) Calculators and Log Tables may be used.

(viii) Pages at the end have been provided for Rough Work.

(ix) Return the Question Paper and Answer Sheet to the Invigilator at the end of the entrance examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use Pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	Ⓐ ⓑ ⓒ ⓓ	Ⓐ ⓑ ⓒ Ⓓ	◉ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please don't do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

SECTION—I

(TECHNOLOGY/ENGINEERING STREAM)

PART—A

(*Marks* : 45)

(Basic Engineering and Technology including Pharmacology)

Answer *any* **forty-five** questions

1. In any given year, the probability of an earthquake greater than magnitude 6 occurring in North India is 0·04. The average time between successive occurrences of such earthquakes will be how many years?

(a) 25 years

(b) 5 years

(c) 15 years

(d) 20 years

2. The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?

(a) 3–4 years

(b) 4–5 years

(c) 5–6 years

(d) 6–7 years

3. 10% of the population in a town is diabetic positive. A new diagnostic kit for diabetes detection is available; this kit correctly identifies diabetes positive individuals 95% of the time, and diabetes negative individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is

(a) 0·28 to 0·39

(b) 0·48 to 0·49

(c) 0·75 to 0·85

(d) 0·10 to 0·20

4. In a batch culture of *Penicillium chrysogenum*, the maximum penicillin synthesis occurs during the

(a) lag phase

(b) exponential phase

(c) stationary phase

(d) death phase

5. Which of the following is employed for the repeated use of enzymes in bioprocesses?

(a) Polymerization

(b) Immobilization

(c) Ligation

(d) Isomerization

6. Since mammalian cells are sensitive to shear, scale-up of a mammalian cell process, must consider, among other parameters (given N = rotations/time, D = diameter of impeller)

(a) $ND\pi$

(b) $2\,ND\pi$

(c) $4\,ND\pi$

(d) isomerization

7. The degree of reduction of ethanol (C_2H_5OH) is

(a) 2

(b) 4

(c) 5

(d) 6

8. A bacterium belonging to cocci group has a diameter of 2 μm. The numerical value of the ratio of its surface area to volume in μm^{-1} is

(a) 3

(b) 2

(c) 1

(d) 10

9. The algorithm for BLAST is based on

(a) dynamic programming

(b) hidden Markov model

(c) k-tuple analysis

(d) neural network

10. Cohn fractionation is used for fractionation of

(a) human plasma proteins

(b) milk whey proteins

(c) soya proteins

(d) potato proteins

11. Cholera toxin increases cAMP levels by which one of the following mechanisms?

(a) Modifying Gi protein

(b) Modifying Gs protein

(c) Binding to adenylate cyclase

(d) Activating cAMP phosphodiesterase

12. The pungency of mustard seeds is primarily due to secondary metabolites such as isothiocyanate and nitrile. The pungency is usually felt only when the seeds are crushed. This is because

(a) the coat of the intact seeds blocks the pungent volatiles from being released

(b) the pungent chemicals are stored as inactive conjugates and compartmentalized from the enzymes that convert them into active chemicals

(c) the pungent chemicals are formed only after reaction with atmospheric oxygen

(d) the pungent chemicals are formed only after reaction with atmospheric carbon dioxide

13. Match the following immunoglobulin class in Group—I with its properties in Group—II :

Group—I	*Group—II*
A. IgG	1. Major antibody in external secretions such as bronchial mucus
B. IgA	2. Protects against parasites
C. IgE	3. Antibody that appears first in serum after exposure to an antigen
D. IgM	4. Antibody present in highest concentration in serum

(a) A B C D
4 1 2 3

(b) A B C D
3 2 1 4

(c) A B C D
4 3 1 2

(d) A B C D
1 4 3 2

14. Why is dose uniformity of dosage form tested on USP?

(a) To check bioequivalence

(b) To check the efficacy

(c) Both (a) and (b)

(d) For finding route of administration

15. The measuring instrument receiving temperature signal and converting it to electrical current signal is called

(a) bimetallic thermometer

(b) thermistor

(c) thermocouple

(d) variable resistivity thermometer

16. A soap bubble film (surface tension σ) is stretched to increase its area by ΔA at constant temperature. By the 1st law of thermodynamics it can be represented as

(a) $du = 0 = dq + dw$, where $dw = \sigma \Delta A$

(b) $du = dq + dw$, where $dw = \sigma \Delta A$

(c) $du = dw$, where $dw = \sigma \Delta A$

(d) $du = dq$

17. If the rheology of a liquid is given by shear stress = K (velocity gradient)$^{0.4}$, then the liquid is

(a) Newtonian liquid

(b) thixotropic liquid

(c) dilatant liquid

(d) pseudoplastic liquid

18. Height of packed absorber is estimated by

(a) $z = NTU^{(1/HTU)}$

(b) $z = NTU \cdot HTU$

(c) $z = HTU / NTU$

(d) $z = NTU + HTU$

19. A one cm cubical particle when crushed to ½ cm cubical particles produces a surface area of

(a) 6 cm^2

(b) 18 cm^2

(c) 24 cm^2

(d) 12 cm^2

20. A simple design approach to estimate number of stages in sieve tray distillation column is

(a) Ponchon-Savarit method

(b) Erbar-Maddox method

(c) Gilliland method

(d) McCabe-Thiele method

21. Mass balance for biomass in a batch fermenter is written as

(a) mass rate in – mass rate out = accumulation rate

(b) mass rate of growth – mass rate of death = accumulation rate

(c) mass rate in – mass rate out = 0

(d) mass rate of growth – mass rate of death = 0

22. A liquid and its vapour are in equilibrium, therefore which one of the following is true?

(a) $dg^L + dg^V = 0$

(b) $dg^L = 0$

(c) $dg^V = 0$

(d) $dg^L + dg^V < 0$

23. Power required to drive a centrifugal pump is directly proportional to _____ of its impeller.

(a) diameter

(b) square of diameter

(c) cube of diameter

(d) fourth power of diameter

24. The flow of incompressible fluid with no shear is called as

(a) creep flow

(b) boundary layer flow

(c) streamline flow

(d) potential flow

25. Arrange the following listed fatty acids in their decreasing order of unsaturation character :

(E) Stearic acid (F) Oleic acid (G) Linolenic acid (H) Linoleic acid

(a) E > F > G > H

(b) H > G > E > F

(c) G > H > F > E

(d) F > E > G > H

26. Which of the following ***does not*** give passive immunity?

(a) Antitoxin

(b) Antisera

(c) Monoclonal antibodies

(d) Live attenuated vaccines

27. In one molecule of human serum albumin, the number of amino acids is

(a) 510

(b) 585

(c) 590

(d) 650

28. Gasket in pharmaceutical industrial firings is made of

(a) Bune-N

(b) neoprene rubber

(c) Both (a) and (b)

(d) aluminum

29. Anticoagulants interfere with which one of the following?

(a) Prothrombin

(b) Vitamin K

(c) Factor V

(d) Factor XII

30. The preferred route for administration of insulin is

(a) suppository

(b) sublingual

(c) subcutaneous

(d) enteric coated tablet

31. The spin quantum number is ***not*** zero for

(a) ^{12}C

(b) ^{32}S

(c) ^{160}D

(d) ^{14}N

32. Which one of the following is longer acting insulin preparation?

(a) Regular Insulin Injection

(b) Isophane Insulin Injection (NPH)

(c) Lente Insulin Injection

(d) Protamine Zinc Insulin Injection (PZI)

33. The binding capacity of ion-exchange resin is measured by

(a) Rf values

(b) Rm values

(c) meq/mL values

(d) Elution volume

34. The detector employed in ion chromatography is

(a) flame ionization

(b) flame photometer

(c) electron capture

(d) conductivity

35. An amphibolic pathway among the following is

(a) HMP shunt

(b) citric acid cycle

(c) glycolysis

(d) gluconeogenesis

36. Which of the following amino acids will provide the most energy when degraded?

(a) Glycine

(b) Alanine

(c) Isoleucine

(d) Valine

37. What is the effect of hydrogen bonding on frequency of IR?

(a) Increases wave number

(b) Decreases wave number

(c) No changes

(d) Decreases and then increases followed by remaining constant

38. Which one of the following is a positive sign of pregnancy when detected in urine?

(a) Corticotropic hormone

(b) Estrogen

(c) Progesterone

(d) Human Chorionic Gonadotropin (hCG)

39. Glucose is the only source of energy for which one of the following?

(a) RBCs

(b) Cardiac cells

(c) Nephrons

(d) Thrombocytes

40. Term C in Van Deemter equation describes

(a) parallel diffusion

(b) longitudinal diffusion

(c) mass transfer

(d) axial diffusion

41. Based on Handerson-Hasselbalch equation, at what pH a weak acid would be 99·9% ionized?

(a) At pH equivalent to pK + 3

(b) At pH equivalent to pK – 3

(c) At pH equivalent to pK + 1

(d) At pH equivalent to pK – 1

42. Which of the following statements is ***not*** true for SS316?

(a) It is also called as INOX steel.

(b) Due to presence of chromium it exhibits passivation phenomenon.

(c) It is not affected by acids.

(d) It contains 10·5% to 11% chromium.

43. Which of the following conditions favours formation of large size crystals with good density?

(a) Low nucleation rate

(b) High degree of supersaturation

(c) High stirring speed

(d) Rapid cooling of magma

44. Which one of the given polysaccharides is a polymer of galacturonic acid?

(a) Cellulose

(b) Chitin

(c) Pectin

(d) Amylopectin

45. Vinegar is a fermentation derived food product containing not less than

(a) 4% acetic acid

(b) 8% acetic acid

(c) 15% acetic acid

(d) 25% acetic acid

46. In soy sauce preparation, which microorganism is used as starter culture?

(a) *Aspergillus oryzae*

(b) *Aspergillus tamarii*

(c) *Aspergillus niger*

(d) *Aspergillus fumigatus*

47. The mineral whose deficiency is associated with goiter is

(a) calcium

(b) sodium

(c) iodine

(d) magnesium

48. At a certain temperature, the time (in min) required to reduce the microbial load by a factor of 10 is called as

(a) Z-value

(b) F-value

(c) Q-value

(d) D-value

49. Proteolytic enzyme derived from papaya latex is

(a) pepsin

(b) ficin

(c) papain

(d) bromelain

50. Which one of the following diseases is primarily associated with PCM?

(a) Xerophthalmia

(b) Scurvy

(c) Marasmus

(d) Osteoporosis

51. Of the given options, which one is an omega-3 fatty acid?

(a) Oleic acid

(b) α-linolenic acid

(c) Linoleic acid

(d) Arachidonic acid

52. Total protein content of a food sample is determined by

(a) DNSA method

(b) Kjeldahl method

(c) Biuret method

(d) Anthrone method

53. The lowering of muscle pH after slaughter of an animal is due to

(a) formation of acetic acid by bacteria

(b) formation of citric acid in Krebs' cycle

(c) formation of lactic acid from glycogen

(d) formation of amino acids due to proteolysis

54. Which one of the given food groups is represented at the apex of a food pyramid?

(a) Cereal based group

(b) Fruit and vegetable group

(c) Fats/oils and sweets group

(d) Meat and legume group

55. Given the composition of biscuits (per serving i.e., 34 g) to be 2 g protein, 8 g fat, 22 g available carbohydrates, what would be the calorific value of this product (per serving)?

(a) 170 cal

(b) 160 cal

(c) 168 cal

(d) 178 cal

56. For low temperature long time (LTLT) pasteurization of milk, the process condition is

(a) 71 °C, 15 sec

(b) 71 °C, 30 min

(c) 63 °C, 15 sec

(d) 63 °C, 30 min

57. Standardized milk contains minimum percent milk fat and minimum percent milk solids not fat (MSNF) respectively as

(a) 6·0 and 9·0

(b) 3·5 and 7·0

(c) 4·5 and 8·5

(d) 1·5 and 9·0

58. Which one of the given options is a carcinogen producing cancer of the liver and is found in agricultural commodities such as grains contaminated by fungus?

(a) Botulinum

(b) Aflatoxin

(c) Patulin

(d) Ricin

59. Adequacy of pasteurization of milk is judged by

(a) amylase test

(b) phosphatase test

(c) peroxidase test

(d) lipase test

60. The cofactor for the enzyme polyphenol oxidase is

(a) magnesium

(b) iron

(c) zinc

(d) copper

61. Which one of the given options is wrong with respect to malolactic fermentation in wine making?

(a) Tart-tasting malic acid naturally present in grape must is converted to softer-tasting lactic acid

(b) It is most often performed as a secondary fermentation shortly after the end of the primary fermentation

(c) It is mostly applied for red wine production and occasionally for white wine

(d) The reaction is undertaken by yeast *S. cerevisiae*

62. Which one of the following is ***not*** a fermented vegetable product?

(a) Kimchi

(b) Sauerkraut

(c) Natto

(d) Khalpi

63. Which one of the following foods would you recommend for a person suffering from gluten intolerance?

(a) Chapati

(b) Rye bread

(c) Oats cereal

(d) Idli

64. In Hydrophobic Interaction Chromatography (HIC), the stationary phase is

(a) non-polar

(b) ionic

(c) chiral

(d) chelating

65. The theoretical yield of ethanol from glucose is

(a) 0·5

(b) 0·4

(c) 1·0

(d) 0·1

66. Saccharification of rice straw and bagasse yields which of the following as major monosaccharides?

(a) Glucose and fructose

(b) Glucose and arabinose

(c) Glucose and xylose

(d) Glucose and mannose

67. Which one of the following is used as starting material for production of vanillin through fermentation?

(a) Acetic acid

(b) Ferulic acid

(c) Malic acid

(d) Lactic acid

68. Which of the following is a by-product of current edible oil processing agro industries?

(a) Ethanol

(b) Lecithin

(c) Deodorized distillates containing tocopherols

(d) Both (b) and (c)

69. Anaerobic fermentation followed by compression can be used for the production of

(a) nitrogen

(b) bio-oil

(c) bio-CNG

(d) proteins

70. Antisnake venom used to treat patients after snake-bite is prepared after injecting actual venoms to

(a) horses

(b) mice

(c) goats

(d) sheeps

71. Protein precipitation using isoelectric precipitation method works better at pH slightly away from pI of the proteins, and is due to

(a) proteins consist of hydrophobic amino acids

(b) non-uniform distribution of charges on the surface of proteins

(c) proteins are not stable at their pI

(d) proteins are highly soluble in water at their pI

72. The best example where kinetic chromatography like simulated moving bed (SMB) is used for the separation of

(a) sorbitol and mannitol

(b) glucose and fructose

(c) whey protein concentrates and soya protein isolate

(d) Both (a) and (b)

73. Biodiesel is obtained through conversion of

(a) terpene oils

(b) triglyceride oils

(c) mineral oils

(d) biogas

74. Currently industrial scale peptide purification which involves removal of related impurities involves which one of the following for their purification?

(a) Gel filtration chromatography

(b) Reverse phase chromatography on C8 or C18 silica

(c) Precipitation

(d) Membrane filtration

75. A disease results in the poor expression of a protein in the diseased tissues. Which of the following blotting techniques may be applied to understand whether the defect is at the level of transcription or translation?

(a) Southern and Northern

(b) Northern and Western

(c) Southern and Western

(d) Western and South-Western

76. How a triplet code of CAT in DNA is represented in mRNA and in tRNA?

(a) GAA, CAT

(b) GUA, CAU

(c) CAT, CAT

(d) GTA, CAU

77. Which of the following descriptions of chromosome is ***not*** correctly matched?

(a) Acrocentric—chromosome arms are identical in size

(b) Metacentric—chromosome arms are almost equal in size

(c) Submetacentric—chromosome arms are slightly different in size

(d) Telocentric—there is only one chromosome arm

78. What will be the residence time in a continuous reactor which has the dilution rate of 0·5/h?

(a) 1 h

(b) 0·5 h

(c) 2 h

(d) 1·5 h

79. Which one of the following is true about the disengagement zone in a fluidized bed bioreactor?

(a) Create different flow patterns throughout the bioreactor

(b) Reduce downstream processing problems

(c) Separate the biomass from final product

(d) Reduce the velocity of the particles near the surface of the reactor

80. Which one of the following is galactofructose and used as a laxative?

(a) Lactulose

(b) Trehalose

(c) Lactose

(d) Sucrose

81. An enzyme with a K_m value of 10 mM has the reaction rate of 440 m-mol/min, at a substrate concentration of 1 m-mol. What is the maximum reaction rate achieved by this enzyme when saturated with its substrate?

(a) 4400 m-mol/min

(b) 2200 m-mol/min

(c) 8800 m-mol/min

(d) 1100 m-mol/min

82. Probiotics are

(a) cancer-inducing microbes

(b) safe antibiotics

(c) new kind of food allergen

(d) live microbial food supplement

83. Transgenic organism means an

(a) organism with desirable characters

(b) organism with a particular mutated gene

(c) organism with foreign gene by genetic engineering

(d) organism with a number of mutated characters

84. Gene cloning means

(a) production of mutated genes

(b) production of wild genes

(c) production of dominant genes

(d) production of large populations of desired DNA fragments

85. Monoclonal antibodies are

(a) specific towards a paratope

(b) specific towards an epitope

(c) specific towards an antigen

(d) specific towards polysaccharides

86. Disulphide bonds are formed between

(a) cysteine residues that are close together

(b) cystine residues that are interspaced with other amino acids

(c) proline residues that are close together

(d) histidine residues that are close together

87. Which one of the following is high resolution electrophoresis?

(a) Continuous gel electrophoresis

(b) Discontinuous gel electrophoresis

(c) Gradient gel electrophoresis

(d) Isoelectric focusing

88. The use of insulin hormone to purify its receptor is an example of which one of the following?

(a) Ion-exchange chromatography

(b) Affinity chromatography

(c) Gel filtration chromatography

(d) Ligand-mediated chromatography

89. In a mixture of the four proteins listed below, which should elute second in size-exclusion (gel filtration) chromatography?

(a) Cytochrome c Mr = 13000

(b) Immunoglobulin G Mr = 145000

(c) Ribonuclease A Mr = 13700

(d) RNA polymerase Mr = 450000

90. β-oxidation takes place in

(a) mitochondria

(b) cytoplasm

(c) chloroplasts

(d) nucleus

PART—B

(*Marks* : 40)

(Physics, Chemistry and Mathematics)

Answer **all** questions

91. A bomb of mass 16 kg at rest explodes into two pieces of masses of 4 kg and 12 kg. The velocity of the 12 kg mass is 4 ms^{-1}. The kinetic energy of the other mass is

(a) 122 J

(b) 288 J

(c) 144 J

(d) 24 J

92. The molarity of 15% NaCl is

(a) 25·6

(b) 0·256

(c) 2·56

(d) 0·025

93. Peptide bonds absorb light of which one of the following wavelengths?

(a) 280 nm

(b) 260 nm

(c) 205 nm

(d) 320 nm

94. For the following conversion, predict which metal is economical to use if the price of zinc is half the price of aluminum to produce hydrogen?

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$$

$$2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2 \uparrow$$

(a) Zn

(b) Al

(c) Zn and Al with same cost

(d) Insufficient data to predict

95. For the complete oxidation of 2 L of CO at NTP the required volume of oxygen at NTP is

(a) 2 L

(b) 1 L

(c) 4 L

(d) 0·5 L

96. When 2 L of benzene is completely oxidized, how much CO_2 and H_2O will be produced?

(a) 6 L of CO_2 and 3 L of H_2O

(b) 6 L of CO_2 and 6 L of H_2O

(c) 3 L of CO_2 and 1·5 L of H_2O

(d) 6 L of CO_2 and 9 L of H_2O

97. When 1·0 g of H_2O_2 is reacted with 50 ml of $KMnO_4$ (in the presence of H_2SO_4), the purity of H_2O_2 is

(a) 25%

(b) 85%

(c) 65%

(d) 95%

98. Which one of the following solutions of NaCl has the lowest value of equivalent conductance?

(a) 1·0 *M*

(b) $1{\cdot}0\times10^{-1}\,M$

(c) $1{\cdot}0\times10^{-2}\,M$

(d) $1{\cdot}0\times10^{-3}\,M$

99. Which one of the following is ***not*** a nucleophile involved in substitution reactions?

(a) Water

(b) Ammonia

(c) Ethanol

(d) Acetone

100. The conversion of chlorobenzene to phenol is an example of

(a) aromatic electrophilic reaction

(b) radical reaction

(c) aromatic nucleophilic reaction

(d) carbene reaction

101. Let A and B be two sets having 3 elements and four elements respectively. Let $A \times B$ be the set of Cartesian product of A and B. Then the number of elements in $A \times B$ is

(a) 7

(b) 34

(c) 12

(d) 43

102. What is the maximum value of the function $\sin x + \cos x$?

(a) 2

(b) 1

(c) $\sqrt{2}$

(d) $1/\sqrt{2}$

103. Suppose that the value of $\sin(x) = 0{\cdot}6$. What will be the value of $\sin(3x)$?

(a) 0·936

(b) 1·8

(c) 0·6

(d) 1

104. The correct value of the expression ${}^{n}C_{r} + {}^{n}C_{r-1}$ is

(a) ${}^{n}C_{r+1}$

(b) ${}^{n+1}C_{r}$

(c) ${}^{n+1}C_{r-1}$

(d) $\frac{n!}{(r-1)!\,(n-r)!}\left[\frac{1}{r}+\frac{1}{n-r+1}\right]$

105. The perpendicular from the origin to the line $y = mx + c$ meets at the point $(1, -2)$. Then which among the following are the values of m and c?

(a) $m = 1,\ c = 2$

(b) $m = -1/2,\ c = -5/2$

(c) $m = 1/2,\ c = 5/2$

(d) $m = -1/2,\ c = 5/2$

106. Suppose $x = at^2$ and $y = 2at$. What is the value of dy/dx at $t = 1/2$?

(a) 1

(b) 1/2

(c) 2

(d) 0

107. Aggregation index of protein can be determined by which one of the following techniques?

(a) Titration

(b) UV spectrophotometer

(c) Colorimetric

(d) ELISA

108. The approximate molecular mass of a protein that consists of a single polypeptide chain with 682 amino acids is

(a) 68200 Da

(b) 75020 Da

(c) 62800 Da

(d) 70000 Da

109. What is the mode for following set of numbers?

2, 3, 4, 6, 7, 8, 2, 22, 33, 55, 66 and 54

(a) 2

(b) 54

(c) 32

(d) 4

110. A battery of 12 V is connected in series with resistors of 0·2 ohm, 0·3 ohm, 0·4 ohm, 0·5 ohm and 12 ohm. How much current would flow through the 0·3 ohm resistor?

(a) 0·1 A

(b) 1·11 A

(c) 0·5 A

(d) 0·895 A

111. The half-life of a radioactive material is 24 years. The activity of a sample falls to a fraction of its initial value after 72 years. What is the fraction?

(a) (1/6)

(b) (1/8)

(c) (1/4)

(d) (1/2)

112. Bicinchoninic acid method is used for the estimation of which one of the following?

(a) Proteins

(b) Lipids

(c) Carbohydrates

(d) Ash

113. Holiday junction is observed during

(a) mitosis

(b) interphase

(c) recombination

(d) DNA repair

114. Detector used in spectrophotometer is

(a) flame ionization

(b) photomultiplier tube

(c) bolometer

(d) electron capture

115. The reaction occurring with ethane is

(a) E1

(b) E2

(c) S_N1

(d) S_N2

116. Red pigment in tomato is

(a) chlorophyll

(b) carotene

(c) capsanthin

(d) lycopene

117. Which drug is approved by US FDA for alopecia?

(a) Atenolol

(b) Minoxidil

(c) Sufentanil

(d) Cyclosporin

118. Metallic elements are detected by

(a) NMR

(b) IR

(c) RP-HPLC

(d) ICP-MS

119. What will be O-H stretch in IR spectroscopy?

(a) 2900 cm^{-1}

(b) 3000-3300 cm^{-1}

(c) 800-1100 cm^{-1}

(d) 1400-1750 cm^{-1}

120. Fluorescence and phosphorescence are types of

(a) emission spectroscopy

(b) absorption spectroscopy

(c) Both (a) and (b)

(d) electrophoresis

121. Most commonly used HPLC technique is

(a) normal phase HPLC

(b) ion exclusion HPLC

(c) reverse phase HPLC

(d) chiral HPLC

122. The unit of delta (δ) in chemical shift is

(a) ppm

(b) tesla

(c) cm^{-1}

(d) μm

123. Hydrophobicity of molecule always from its electrical neutrality is expressed in terms of

(a) log P value

(b) log D value

(c) HLB value

(d) CMC value

124. The best alternative to gelatin for manufacture of hard shell capsules is

(a) starch

(b) hydroxypropyl methylcellulose

(c) protein

(d) lipid

125. Brontrager's test is used for identification of

(a) cinchona

(b) curcuma

(c) senna

(d) belladonna

126. In TLC, R_f value ranges from

(a) 0 to 10

(b) 1 to 10

(c) 1 to 100

(d) 0 to 1

127. Volatile oils on exposure to air and light are generally oxidized yielding

(a) resins

(b) hydrocarbons

(c) edible oils

(d) fatty acids

128. The efficiency of HEPA filter to remove particles from air is

(a) 99%

(b) 99·97%

(c) 97·99%

(d) 79·99%

129. Isoelectric point of protein dissolved in aqueous solution can be determined by which one of the following techniques?

(a) Dynamic light scattering

(b) FTIR

(c) Colorimetric

(d) ELISA

130. ELISpot Assay is used for measuring

(a) antibody titre in serum

(b) frequency of T cell responses

(c) frequency of B cell responses

(d) cytokine concentration in serum

PART—C

(*Marks* : 35)

(Fundamentals of Life Sciences and Informatics)

Answer **all** questions

131. Hexa-histidine tag of a protein can be used for

(a) affinity chromatography

(b) ion-exchange chromatography

(c) gel filtration chromatography

(d) chiral chromatography

132. Which is ***not*** the essential enzyme in DNA replication?

(a) Ligase

(b) Polymerase

(c) Topoisomerase

(d) Esterase

133. The most prevalent protein on earth is

(a) pepsin

(b) trypsin

(c) pea protein

(d) RuBisCo

134. Mycoplasmas are different from the other prokaryotes with respect to

(a) nucleus

(b) cell wall

(c) ribosome

(d) cytoplasm

135. The Ti plasmid is obtained from which of the following species?

(a) *E. coli*

(b) *Agrobacterium tumefaciens*

(c) *B. subtilis*

(d) *P. furiosus*

136. CO_2 acceptor in C_3 plants is

(a) phosphoglyceric acid

(b) ribulose monophosphate

(c) ribulose 1,5-bisphosphate

(d) phosphoenol pyruvate

137. How many purine bases are there in 'AGAGAGGATC'?

(a) 5

(b) 6

(c) 7

(d) 8

138. Which one of the following is the hydronium ion?

(a) H^+

(b) OH^-

(c) H_3O^+

(d) H_2O^+

139. As you go down into a well, your weight will

(a) increase slightly

(b) decrease slightly

(c) remain exactly the same

(d) increase and then decrease

140. Which one is ***not*** true about enzyme class lyases?

(a) Water is used

(b) Double bond formed into product

(c) Act on C—C and C—N bond

(d) Both (b) and (c)

141. A football is kicked into the air at an angle of 45 degree with the horizontal. At the very top of the ball's path, the net force acting upon it is (neglect the effects of air resistance)

(a) entirely vertical

(b) entirely horizontal

(c) in both directions

(d) Cannot be calculated

142. First generation biofuels are obtained from which one of the following?

(a) Agro wastes rich in cellulose

(b) Algae

(c) Corn starch

(d) Crude oil

143. The interconversion of UDP-glucose and UDP-galactose is catalyzed by

(a) a kinase

(b) an epimerase

(c) an oxidase

(d) a mutase

144. Which one of the following has its own self-replicating DNA?

(a) Golgi body

(b) Lysosomes

(c) Mitochondria

(d) Peroxisome

145. Which one of the following is ***not*** an intermediate of the TCA cycle?

(a) Citrate

(b) Oxalosuccinate

(c) Succinyl-CoA

(d) Acetoacetate

146. Highly cooperative binding of a ligand to multiple binding sites on a macromolecule is best demonstrated by which one of the following?

(a) Adair equation

(b) Hill plot

(c) Lineweaver-Burk plot

(d) Arrhenius plot

147. The monomeric unit of polysaccharides such as starch and cellulose is

(a) fructose

(b) ribose

(c) glucose

(d) lactose

148. A phospholipid contains

(a) three fatty acids bound to glycerol

(b) three fatty acids, a glycerol and a phosphate

(c) two fatty acids and a phosphate bound to glycerol

(d) three cholesterol molecules bound to glycerol

149. Which one of the following is present in eukaryotes but ***not*** in prokaryotes?

(a) Polygene mRNA

(b) Introns

(c) Stop codon

(d) AUG codon

150. ADP contains

(a) a furanose ring

(b) a ketose sugar

(c) two phosphoanhydride bonds

(d) a pyrimidine base

151. In the DNA sequencing by Sanger (dideoxy) method

(a) the template strand of DNA is radioactive

(b) enzymes are used to cut the DNA into pieces, which are then separated by electrophoresis

(c) ddTTP is added to each of four reaction mixtures prior to synthesis of complementary strands

(d) the sequence is read from the top of the gel to bottom

152. Consider a weak acid in a solution with a pH of 5. Which of the following statements is true?

(a) The weak acid is a proton acceptor.

(b) The weak acid has a lower affinity for its proton than does a strong acid.

(c) At its pK_a, the weak acid will be totally dissociated.

(d) The $[H^+]$ is 10^{-5} M.

153. Out of the four bonds listed below, bonds that do not involve sharing, losing or gaining electrons but use attractive forces between nearby molecules or atoms are

1. Hydrogen bond
2. van der Waals' forces
3. Covalent bond
4. Ionic bond

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 4 and 5

154. Isotopes are variant forms of the same element that differ in the number of _____ and thus have different mass numbers.

(a) electrons

(b) protons

(c) neutrons

(d) photons

155. According to recent studies, which one of the following vitamins boosts antibiotic-like substances in the body?

(a) Vitamin D

(b) Vitamin E

(c) Vitamin H

(d) Vitamin B_{12}

156. Which of the following have highest precedence in Java?

(a) ++

(b) *

(c) >>

(d) ()

157. Which of the following is ***not*** a 'loop statement' in JAVA?

(a) While

(b) If–else

(c) For

(d) Do–while

158. Which of the following is a 'loop control statement' in JAVA?

(a) Reverse

(b) Goto

(c) Switch

(d) Break

159. Which of the following data types is used for storing 'unordered sets of key/value pairs' in Perl?

(a) Arrays

(b) Scalars

(c) Vectors

(d) Hashes

160. Which of the following is a relational operator for 'Not Equal' in Perl?

(a) !=

(b) <>

(c) ~=

(d) *=

161. Which of the following clauses is mandatory while using the SELECT clause in MySQL?

(a) WHERE

(b) FROM

(c) ORDER BY

(d) GROUP BY

162. Which data type is used to store date and time in MySQL?

(a) Char/Varchar

(b) Numeric

(c) Temporal

(d) Text

163. Which of the following is ***not*** a hierarchical data structure?

(a) Trees

(b) Linked Lists

(c) Graphs

(d) Heaps

164. A major organism used in commercial bioleaching for copper recovery is

(a) *Desulfovibrio desulfuricans*

(b) *Pseudomonas aeruginosa*

(c) *Thiobacillus ferrooxidans*

(d) *Aspergillus niger*

165. Template for the reverse transcriptase is

(a) DNA

(b) RNA

(c) Both (a) and (b)

(d) plasmids

119

QUESTION PAPER SERIES CODE
A

Registration No. : | | | | | | |

Centre of Exam. : _____

Name of Candidate : _____

_____

Signature of Invigilator

COMBINED ENTRANCE EXAMINATION, 2018
M.Tech. BIOTECHNOLOGY

INSTRUCTIONS FOR CANDIDATES
SECTION—II
SCIENCE STREAM
(Part—A, Part—B, Part—C)

[Field of Study Code : MTB]

Time Allowed : 3 hours *Maximum Marks* : 120

Candidates must read carefully the following instructions before attempting the Question Paper :

(i) Write your Name and Registration Number in the space provided for the purpose on the top of this Question Paper and in the Answer Sheet.

(ii) **Please darken the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

(iii) The Question Paper is organized and answers are valued as follows :

Part—A : Life Sciences (Marks : 50)
Answer any **50** questions out of 60 questions

Note : (In case any candidate answers more than the required 50 questions, the first 50 questions attempted will be evaluated)

Part—B : Physics and Chemistry (Marks : 40)
Answer **all** questions

Part—C : Mathematics, Computer and Information Sciences (Marks : 30)
Answer **all** questions

(iv) Each question carries *1* mark. **There will be negative marking and ¼ mark will be deducted for each wrong answer.**

(v) Answer the questions in the Answer Sheet provided separately by darkening the correct choice, i.e., (a) or (b) or (c) or (d) (as the case may be) against each question in the corresponding circle.

(vi) Answer written by the candidates inside the Question Paper will not be evaluated.

(vii) Calculators and Log Tables may be used.

(viii) Pages at the end have been provided for Rough Work.

(ix) Return the Question Paper and Answer Sheet to the Invigilator at the end of the entrance examination. **DO NOT FOLD THE ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1. Use only Blue/Black Ballpoint Pen (do not use Pencil) to darken the appropriate Circle.
2. Please darken the whole Circle.
3. Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ ⓒ ●	Ⓐ ⓑ ⓒ ⓓ	Ⓐ ⓑ ⓒ Ⓓ	◉ ⓑ ⓒ ●	ⓐ ⓑ ⓒ ●

4. Once marked, no change in the answer is allowed.
5. Please do not make any stray marks on the Answer Sheet.
6. Please don't do any rough work on the Answer Sheet.
7. Mark your answer only in the appropriate space against the number corresponding to the question.
8. **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the Answer Sheet.**

SECTION—II

(SCIENCE STREAM)

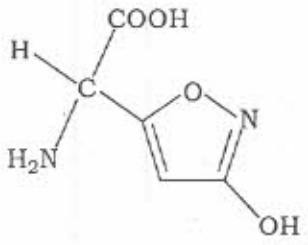
PART—A

(*Marks* : 50)

(Life Sciences)

Answer *any* **fifty** questions

1. The following compound is derived from the fungus *Amanita muscaria*. Identify the molecule :



(a) Fatty acid

(b) Antibiotic

(c) Amino acid

(d) Sugar

2. Which of the following properties of water explains its ability to dissolve acetic acid?

(a) The high surface tension of water, which is due to the formation of hydrogen bonds between adjacent water molecules

(b) The ability to serve as a buffer, absorbing the protons given off by acetic acid

(c) The ability to form covalent bonds

(d) The ability to form hydrogen bonds with the carbonyl and the hydroxyl groups of acetic acid

3. When two solutions differ from each other by 3 pH units, one solution has how many times more hydrogen ion concentration than another solution?

(a) 1

(b) 10

(c) 100

(d) 1000

4. The following is the list of amino acids placed in the order of neutral, acidic and basic. Choose the correct order :

(a) Serine, glutamic acid, arginine

(b) Arginine, glutamic acid, serine

(c) Aspartic acid, lysine, tyrosine

(d) Tyrosine, lysine, aspartic acid

5. A cell with a cell wall is placed in a solution and plasmolysis occurs. The solution in which the cell is, is

(a) isotonic

(b) hypotonic

(c) prototonic

(d) hypertonic

6. Which of the following is used in probiotics?

(a) *Campylobacter*

(b) *Nitrobacter*

(c) *Lactobacillus*

(d) *Staphylococcus*

7. Which of the following is true regarding bacterial cell walls?

(a) Lipopolysaccharides (LPS) is present in both gram negative and gram positive bacteria

(b) The two periplasmic spaces are present in gram negative bacteria

(c) The lipopolysaccharides (LPS) is present in gram positive bacterial cell walls

(d) The periplasmic space is absent in bacteria

8. Bacterial resistance to antibiotic is a genetic trait carried in the bacterial

(a) intron

(b) chromosome

(c) plasmid

(d) centromere

9. Which of the following ions is essential for the introduction of DNA into yeast cells?

(a) Sodium

(b) Potassium

(c) Iron

(d) Calcium

10. Antisense gene therapy involves blocking at the

(a) DNA level

(b) RNA level

(c) translational level

(d) post-translational level

11. Liquid biofuel widely used for blending with petrol is

(a) benzene

(b) ethyl alcohol

(c) biodiesel

(d) ether

12. The secondary metabolite shikonin is commercially produced by

(a) Eli Lilly and Company

(b) Mitsui Petrochemical Industries Ltd.

(c) Johnson and Johnson

(d) Merck

13. The microorganism used for the production of biobased polymer is

(a) *Coscinium fenestratum*

(b) *Ralstonia eutropha*

(c) *Acetobacter aceti*

(d) *Bacillus subtilis*

14. Map-based cloning in rice is done for

(a) *Xa21*

(b) *bph7*

(c) *Gm2*

(d) *DREB*

15. Alkaloids responsible for antioxidant property of curry leaf is

(a) carbazole

(b) caffeine

(c) piperine

(d) quinine

16. In suspension culture, secondary metabolites are predominantly produced during which of the following phases?

(a) Lag phase

(b) Log phase

(c) Stationary phase

(d) Decline phase

17. Crispr/Cas 9 is a technology for

(a) genome editing

(b) transfer of genes between genuses

(c) transfer of genes between species

(d) transfer of genes between family

18. AFLP amplicons are resolved by which of the following techniques?

(a) PAGE

(b) SDS-PAGE

(c) Agarose gel

(d) 2D gel

19. Targeted silencing of genes is possible through

(a) RNAi

(b) EMS treatment

(c) gene tagging

(d) back crossing

20. First GM crop permitted for commercial cultivation in India is

(a) cotton

(b) soyabean

(c) rice

(d) wheat

21. Where do the light independent reactions of photosynthesis occur?

(a) Thylakoids

(b) Cytoplasm

(c) Stroma

(d) Matrix

22. Fish that is widely used for transgenic studies is

(a) rainbow trout

(b) zebra fish

(c) tilapia

(d) salmon

23. In Gram's stain iodine is used as a

(a) primary stain

(b) decolouriser

(c) counter stain

(d) mordant

24. Pathogenic microbes are

(a) photolithotropic autotroph

(b) chemoorganotrophic heterotroph

(c) photoorganotrophic heterotroph

(d) chemolithotrophic autotroph

25. The bacteriophage $\phi \times 174$ contains

(a) ssRNA

(b) dsRNA

(c) ssDNA

(d) dsDNA

26. The another name of glycocalyx is

(a) slime layer

(b) periplasmic layer

(c) peptidoglycan layer

(d) polysaccharide layer

27. *Bacillus thuringiensis* is

(a) human pathogenic

(b) entomopathogenic

(c) non-pathogenic

(d) plant pathogenic

28. Which one of the following activates myosin light-chain kinase enzyme?

(a) Calcium

(b) Calcium-Calmodulin

(c) Sodium calcium exchanger

(d) Sodium-potassium pump

29. Which one of the following is ***not*** a second messenger in hormone action?

(a) Inositol

(b) cAMP

(c) cGMP

(d) Adenylate cyclase

30. In the fluid mosaic model, the phospholipid bilayer

(a) is sandwiched between two protein layers

(b) has proteins embedded in it

(c) lies on top of a single protein layer

(d) is covered by a single protein layer

31. Which of the following methods for transporting substances across a membrane ***does not*** involve a change in shape of the transport protein?

(a) Facilitated diffusion

(b) Active transport

(c) Simple diffusion

(d) Sodium-potassium pump

32. Sites where mutations occur at rates higher than normal are known as

(a) suppressor sites

(b) hot spots

(c) mutator sites

(d) cistrons

33. Mutations can be corrected by all ***except*** one, which is

(a) base excision repair

(b) damage reversal

(c) insertion of transposable genetic element

(d) nucleotide excision repair

34. DNA photolyase recognizes which of the following in order to repair pyrimidine dimers?

(a) The distortion in the double helix

(b) A free 3′ end on the affected DNA strand

(c) A specific palindromic sequence

(d) A specific origin for repair to initiate

35. What technique is ***not*** used for identification of DNA sequence that is bound by a protein?

(a) Footprinting

(b) Gel mobility shift assay

(c) Southern blotting

(d) ChIP assay

36. The end-labeling of a piece of DNA involves the activity of

(a) phosphatase

(b) T4 polynucleotide kinase

(c) both phosphatase and T4 polynucleotide kinase

(d) polymerase

37. The unique property of the Taq DNA polymerase enzyme that is absolutely essential for polymerase chain reaction is

(a) processivity

(b) ability to make phosphodiester bonds

(c) ability to repair mistakes

(d) thermostability

38. All the cells of an animal body contain the same genes. The cells are different in structure and function because they synthesize different

(a) tRNA molecules

(b) mRNA molecules

(c) histones

(d) ribosomes

39. The *trp* operator is

(a) a protein that binds at the *trp* promoter

(b) a protein that binds at the attenuator region and stops transcription

(c) the site where *trp* repressor binds

(d) the site where *trp* repressor is synthesized

40. What effect would the addition of lactose have on a repressed *lac* operon?

(a) The operator site on the operon would move

(b) It would reinforce the repression of that gene

(c) The *lac* operon would be transcribed

(d) It would have no effect whatsoever

41. Which of the following in genetic engineering is ***not*** correctly paired with its use?

(a) Restriction endonuclease—production of DNA fragments for gene cloning

(b) DNA ligase—enzyme that cuts DNA, creating sticky ends

(c) DNA polymerase—copies DNA sequences in the polymerase chain reaction

(d) Reverse transcriptase—production of cDNA from mRNAs

42. A key feature of insertional mutagenesis for the identification of plasmids containing recombinant DNA is the

(a) production of nutritional auxotrophs

(b) DNA sequencing of recombinant plasmids

(c) production of restriction endonuclease maps of recombinant plasmids

(d) disruption of a gene on the plasmid by the inserted recombinant DNA

43. Bacterial cells protect their own DNA from degradation by restriction endonucleases

(a) by deleting all recognition sites from the genome

(b) by degrading the endonuclease after formation

(c) by methylating the DNA at the sites that the enzyme recognizes

(d) by modifying the restriction endonuclease

44. One way in which a eukaryotic chromosome differs from a bacterial chromosome is in having

(a) reverse transcriptase

(b) introns

(c) start and stop signals

(d) thymine instead of uracil

45. Protein modification and targeting involves the activity of

(a) nucleus

(b) ribosome

(c) Golgi

(d) lysosome

46. The first human hormone produced by recombinant DNA technology was

(a) estrogen

(b) testosterone

(c) androgen

(d) insulin

47. DNA is vulnerable to damage from the following agents, ***except***

(a) alkylation

(b) oxidation

(c) phosphorylation

(d) radiation

48. The Ames test is used to test

(a) the incorporation of radioactivity in a probe

(b) the potential carcinogenic effect of chemicals

(c) the presence of a promoter in a given segment of DNA

(d) the level of uric acid in blood

49. Huntington's disease is caused by

(a) inability to metabolize maltose

(b) lack of vitamin C

(c) expansion of triplet repeats

(d) hormone imbalance

50. Enhancers may be located in the following regions, ***except***

(a) upstream of promoter of a gene

(b) heterochromatin

(c) within the open reading frame of a gene

(d) downstream of the open reading frame of a gene

51. Which of the following are ***not*** found in DNA binding protein?

(a) Homeodomains

(b) Zinc fingers

(c) Leucine zippers

(d) CpG islands

52. The approximate number of base pairs in a complete helical turn of DNA is

(a) 8

(b) 10

(c) 15

(d) 20

53. ABO blood group in human is an example of

(a) incomplete dominance

(b) codominance

(c) pseudodominance

(d) epistasis

54. A treatment often used to induce polyploidy experimentally in plants is

(a) colchicine

(b) gibberellic acid

(c) acridine dye

(d) X-rays

55. In mapping of gene using RFLP markers, which of the following techniques is used?

(a) Northern blotting

(b) Southern blotting

(c) Western blotting

(d) South-Western blotting

56. A → G change is an example of

(a) tautomerization

(b) transition

(c) transversion

(d) translocation

57. The regions of an antibody that determine its general role or effector function are its

(a) variable (*V*) regions

(b) constant (*C*) regions

(c) mutated (*M*) regions

(d) bifurcated (*B*) regions

58. An allergic reaction is initiated by antibodies of the

(a) IgG group

(b) IgM group

(c) IgA group

(d) IgE group

59. The symptoms of an allergic reaction develop in response to

(a) interferons

(b) interleukins

(c) histamine

(d) complement

60. Antigenic determinant sites bind to which portions of an antibody molecule?

(a) Light chains

(b) Heavy chains

(c) Intermediate chains

(d) Both light and heavy chains

PART—B

(*Marks* : 40)

(Physics and Chemistry)

Answer **all** questions

61. The number of moles of CO_2 that contains 8 g of O_2 is

(a) 0·25

(b) 2·0

(c) 0·50

(d) 2·25

62. A white ionic solid is dissolved in water. Addition of a solution of sodium chloride to this solution results in a white precipitate. The cation of the ionic solid is most likely to be

(a) K^+

(b) Ag^+

(c) Ba^{2+}

(d) Sr^{2+}

63. Which of the following processes would be non-spontaneous at 1 atm and 298 K?

(a) Corrosion of iron metal

(b) Neutralization of a weak acid by a weak base

(c) Freezing of water

(d) Evaporation

64. An indicator HIn is used in acid-base titration and the colour change is represented as below :

$$HIn(aq) = H^+(aq) + In^-(aq)$$

Colour A Colour B

Which of the following is correct?

(a) In a strong alkaline solution, colour B will be observed

(b) In a strong acidic solution, colour B will be observed

(c) [In] is higher than [HIn] at the equivalence point

(d) In a weak acidic solution, colour B is observed

65. Among the following, the species that contains three bond pairs and one lone pair on the central atom is

(a) PCl_3

(b) H_2O

(c) BF_3

(d) NH_2

66. Which separation technique is based on differences in the volatility of the substances to be separated?

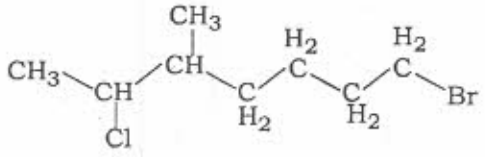
(a) Filtration

(b) Distillation

(c) Solvent extraction

(d) Column chromatography

67. The IUPAC name of the molecule



is

(a) 2-chloro-7-bromo-3-methylheptane

(b) 1-bromo-6-chloro-5-methylheptane

(c) 1-bromo-5-methyl-6-chloroheptane

(d) 7-bromo-2-chloro-3-methylheptane

68. The boiling point of diethyl ether is 34·6 °C. Which of the following is true for ether at 25 °C and 1 atm?

(a) $\Delta G^\circ_{vap} > 0$

(b) $\Delta H^\circ_{vap} < 0$

(c) $K_{vap} = 1$

(d) $\Delta S^\circ_{vap} < 0$

69. In the reaction of HBr with propene ($CH_3CH{=}CH_2$) in presence of H_2O_2

(a) the electrophile is H^+ and the major product is $CH_3CH_2CH_2Br$

(b) the electrophile is Br^+ and the major product is $CH_3CHBrCH_3$

(c) the electrophile is Br^+ and the major product is $CH_3CH_2CH_2Br$

(d) the electrophile is H^+ and the major product is $CH_3CHBrCH_3$

70. Which of the following is a Bronsted base?

(a) NH_4^+

(b) H_3O^+

(c) CH_3OH

(d) NO_3^-

71. Which of the following statements is true for the given electrochemical cell?

$$Ag\,|Ag^+||\,NO_3^-,\ NO,\ Pt$$

(a) NO undergoes oxidation at the anode.

(b) Pt acts as a catalyst.

(c) The mass of the Ag electrode decreases.

(d) The voltage of the cell is doubled when the size of the Ag electrode is doubled.

72. Which of the following is optically active?

(a) Heptane

(b) 3-Methylhexane

(c) 2-Methylhexane

(d) Cyclohexane

73. Which of the following is correct?

(a) Wavelength is directly proportional to energy

(b) Wave number is directly proportional to wavelength

(c) Wave number is directly proportional to energy

(d) Intensity is inversely proportional to wavelength

74. Among the following, the pair in which the nitrogen atoms have the same oxidation state is

(a) HNO_3 and N_2O_5

(b) NO and HNO_2

(c) N_2 and N_2O

(d) HNO_2 and HNO_3

75. Water is

(a) a good conductor of electricity as it is highly ionised

(b) a poor conductor of electricity as it is poorly ionised

(c) a poor conductor of electricity due to hydrogen bonding

(d) a good solvent for non-polar substances

76. The rate equation for the gas phase reaction $A + B \rightarrow C$ is experimentally found to be $v = k[A]^2[B]$ at a given set of concentrations of A and B. If the reaction repeated in a solution in which the concentration of A is tripled and the concentration of B is halved, v would change by a factor of

(a) 6

(b) 9

(c) 4·5

(d) 1·5

77. Which of the following statements is ***not*** correct regarding physisorption?

(a) It occurs because of van der Waals' forces.

(b) More easily liquefiable gases are physisorbed readily.

(c) Under high pressure multilayer adsorption is possible.

(d) Enthalpy change for physisorption is low and positive.

78. For the exothermic reaction $4\ NH_3(g) + 7O_2(g) = 4\ NO_2(g) + 6H_2O(g)$, which change will increase the quantity of NO_2?

(a) Increasing the temperature

(b) Decreasing the volume of the reactor

(c) Adding N_2 gas to the reaction mixture

(d) Adding H_2O to the reaction mixture

79. Which of the following ***does not*** increase with increase in intermolecular forces?

(a) Boiling point

(b) Enthalpy of vapourization

(c) Viscosity

(d) Vapour pressure

80. The potential energy of an electron that is at a distance r from the nucleus of charge Ze is

(a) Ze^2/r

(b) $-Ze^2/r$

(c) $-Ze^2/r^2$

(d) Ze^2/r^2

81. Which of the following is correct for a spontaneous process in a system at constant temperature and pressure?

I. $\Delta S_{sys} + \Delta S_{surr} > 0$

II. $\Delta G_{sys} < 0$

III. $\Delta S_{sys} + \Delta S < 0$

IV. $\Delta G_{surr} = 0$

(a) I and IV

(b) I and II

(c) III and IV

(d) II only

82. Which of the following molecules has zero dipole moment?

(a) CO

(b) CH_3OH

(c) H_2O

(d) CO_2

83. Which one of the following ***cannot*** act as an oxidizing agent?

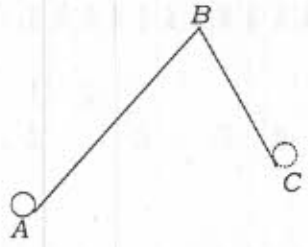
(a) S^{-2}

(b) SO_3^{2-}

(c) SO_4^{2-}

(d) $S_2O_8^{2-}$

84. An object starts from position *A* and travels from position *A* to position *C* through position *B*. What is the displacement of the object in the following diagram?



(a) 0

(b) $\overrightarrow{AC}$

(c) $\overrightarrow{CA}$

(d) $\overrightarrow{AB} + \overrightarrow{BC}$

85. A proton and an electron are placed in a uniform magnetic field. Which one of the given options is correct?

(a) The electric forces' action on them will be equal

(b) The magnitude of the forces will be equal

(c) Their acceleration will be equal

(d) The magnitude of the acceleration will be equal

86. A stone is thrown with an initial speed of 4·9 m/s from a bridge in vertical upward direction. It falls down in the water after 2 seconds. The height of the bridge is

(a) 4·9 m

(b) 9·8 m

(c) 19·8 m

(d) 24·7 m

87. The linear momentum of a body is increased by 10%. What is the percentage of change in its KE?

(a) 10%

(b) 20%

(c) 21%

(d) No change

88. A rubber ball falls on floor from a height of 19·6 m. It loses 25% of its energy on striking the ground. To what height will the ball bounce back?

(a) 19·6 m

(b) 4·9 m

(c) 14·7 m

(d) 19·6 cm

89. What would be the length of the day, if earth were to shrink suddenly to 1/64th of its original volume?

(a) 24 h

(b) 12 h

(c) 6 h

(d) 1·5 h

90. During the reflection of light from a mirror surface, its speed and wavelength will

(a) increase

(b) decrease

(c) either increase or decrease

(d) remain same

91. If the r.m.s. velocity of molecule is doubled, then the pressure of the gas in a container will be

(a) doubled

(b) halved

(c) four times

(d) same as before

92. On a rainy day, a small oil film on water show brilliant colours due to

(a) dispersion of light

(b) interference of light

(c) absorption of light

(d) scattering of light

93. Which logic gate produces 'LOW' output when any of the input is 'HIGH'?

(a) AND

(b) OR

(c) NAND

(d) NOR

94. If three bulbs 60 W, 100 W and 200 W are connected, which bulb will glow more in parallel connection and in series connection?

(a) 200 W and 60 W, respectively

(b) 60 W and 200 W, respectively

(c) 100 W and 100 W, respectively

(d) All will glow with equal brightness

95. The drift velocity ***does not*** depend upon

(a) cross-section of the wire

(b) length of the wire

(c) number of free electrons

(d) magnitude of the current

96. Choose the correct statement from the following :

(a) Polar molecules have permanent electric dipole moment.

(b) CO_2 is a polar molecule.

(c) H_2O is a non-polar molecule.

(d) The dipole field at large distances falls of as $\frac{1}{r^2}$.

97. If T is the half life of a radioactive material, then the fraction that would remain after a time $T/2$ is

(a) $\frac{1}{2}$

(b) $\frac{3}{4}$

(c) $\frac{1}{\sqrt{2}}$

(d) $\sqrt{2} - \frac{1}{\sqrt{2}}$

98. The dimensional formula of surface tension is

(a) MT^{-2}

(b) MLT^{-2}

(c) ML^2T^{-2}

(d) MLT^{-1}

99. The magnitude of the resultant of two vectors having equal magnitudes is $\sqrt{3}$ times the magnitude of the vectors. The angle between the vectors is

(a) 30°

(b) 60°

(c) 90°

(d) 120°

100. Which of the following statements is wrong?

(a) Area under velocity-time graph gives the distance travelled.

(b) Slope of velocity-time graph gives the acceleration.

(c) Area under position-time graph gives the velocity.

(d) Slope of position-time graph gives the velocity.

PART—C

(*Marks* : 30)

(Mathematics, Computer and Information Sciences)

Answer **all** questions

101. What is the output of relational operator in JAVA?

(a) Character

(b) Integer

(c) Double

(d) Boolean

102. Which of the following is ***not*** an operator type in JAVA?

(a) Bitwise

(b) Logical

(c) Rational

(d) Arithmetic

103. In Perl, 'scalars' are preceded by a

(a) @

(b) $

(c) #

(d) %

104. In Perl, 'hashes' are preceded by a

(a) @

(b) $

(c) #

(d) %

105. In Perl, 101%10 would yield

(a) 1

(b) 10

(c) 10·1

(d) 100

106. Which command is used to see the table's file formats in MySQL?

(a) DESCRIBE

(b) SHOW FORMATS

(c) SHOW TABLES

(d) SELECT

107. Which command is used to remove duplicate rows from the result set of SELECT in MySQL?

(a) UNIQUE

(b) DISTINCT

(c) REMOVE DUPLICATES

(d) SHOW UNIQUE

108. Which command is used to add a record to a table in MySQL?

(a) ALTER

(b) ADD

(c) INSERT

(d) UPDATE

109. Which clause is used to restrict the rows returned by a query in MySQL?

(a) WHERE

(b) RESTRICT

(c) HAVING

(d) FROM

110. Which of the following is ***not*** true about the 'primary key' in relational databases?

(a) It must contain a unique value for each row of data

(b) It uniquely identifies all table records

(c) It can contain NULL values

(d) It is a table column

111. In Linux, the command 'ls-a' is used

(a) for listing all folders starting with 'a'

(b) to know the hidden files in the present directory

(c) for listing all files starting with 'a'

(d) to know the files in the present directory

112. Which command is used for checking the connection to the server in Linux?

(a) ping

(b) chmod

(c) locate

(d) touch

113. Which command can be used to create a new file in Linux?

(a) mkdir

(b) cd

(c) make

(d) touch

114. In Linux, which command is used for printing the working directory?

(a) pwd

(b) wd

(c) dir

(d) print dir

115. Which of the following is ***not*** a text editor in Linux?

(a) vi

(b) opera

(c) emacs

(d) gedit

116. The answer of the binary subtraction 1010110–101010 is

(a) 1100

(b) 111100

(c) 101100

(d) 1101100

117. The answer of the binary addition 101101+11001 is

(a) 1000110

(b) 1000101

(c) 1100101

(d) 1001101

118. If storing one base-pair (bp) of data requires 1 bit of memory storage, approximately how much memory would be required for digitally storing 3 billion base pairs?

(a) 300 GB

(b) 3 MB

(c) 3 GB

(d) 30 GB

119. The '=rand' formula in Excel generates random numbers in which of the following range?

(a) Between 1 and 100

(b) Between 0 and 1

(c) Between 1 and 1000

(d) Between 0 and 10

120. In Excel, the formula used to compute arithmetic mean is

(a) AMEAN()

(b) AVERAGE()

(c) MEAN()

(d) ARMEAN()

121. Let A and B be two sets having 3 elements and four elements respectively. Let $A \times B$ be the set of Cartesian product of A and B. Then the number of elements in $A \times B$ is

(a) 7

(b) 34

(c) 12

(d) 43

122. What is the maximum value of the function $\sin x + \cos x$?

(a) 2

(b) 1

(c) $\sqrt{2}$

(d) $1/\sqrt{2}$

123. Suppose that the value of $\sin(x)$ is 0·6. What will be the value of $\sin(3x)$?

(a) 0·936

(b) 1·8

(c) 0·6

(d) 1

124. The correct value of the expression ${}^{n}C_{r} + {}^{n}C_{r-1}$ is

(a) ${}^{n}C_{r+1}$

(b) ${}^{n+1}C_{r}$

(c) ${}^{n+1}C_{r-1}$

(d) $\frac{n!}{(r-1)!\,(n-r)!}\left[\frac{1}{r}+\frac{1}{n-r+1}\right]$

125. The perpendicular from the origin to the line $y = mx + c$ meets at the point $(1, -2)$. Then which among the following are the values of m and c?

(a) $m = 1,\ c = 2$

(b) $m = -1/2,\ c = -5/2$

(c) $m = 1/2,\ c = 5/2$

(d) $m = -1/2,\ c = 5/2$

126. Suppose $x = at^2$ and $y = 2at$. What is the value of dy/dx at $t = 1/2$

(a) 1

(b) 1/2

(c) 2

(d) 0

127. The indefinite integral $\int \ln(x)/x\,dx$ has the value

(a) $1/2(\ln x)^2 + c$

(b) $x \ln x + c$

(c) $x^2 \ln x + c$

(d) $(1/x^2) + c$

128. The mean (μ) and variance (σ^2) of a binomial random variable with parameter n and $1 - p$ ($0 < p < 1$) are

(a) $\mu = n(1-p),\ \sigma^2 = n(1-p)^2$

(b) $\mu = np,\ \sigma^2 = np(1-p)$

(c) $\mu = np,\ \sigma^2 = n(1-p)^2$

(d) $\mu = n(1-p),\ \sigma^2 = np(1-p)$

129. A box contains 1000 light bulbs. The probability that there is at least 1 defective bulb in the box is 0·1 and the probability that there are at least 2 defective bulbs is 0·05. What is the probability that the box contains exactly 1 defective bulb?

(a) 0·05

(b) 0·02

(c) 0·1

(d) 0·025

130. If A and B are two skew-symmetric matrices of order $n \times n$, then which of the following is always true?

(a) $A - B$ is a symmetric matrix

(b) $A + B$ is a skew-symmetric matrix

(c) AB is a skew-symmetric matrix

(d) AB is a symmetric matrix

★★★