119

QUESTION PAPER SERIES CODE
B

Registration No. : | | | | | | |

Centre of Exam. : _____

Name of Candidate : _____

_____

Signature of Invigilator

COMBINED ENTRANCE EXAMINATION, 2016
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. The change of magnetic susceptibility with temperature is exploited in the measurement of

(a) carbon dioxide

(b) oxygen

(c) nitrogen

(d) carbon monoxide

2. As the degree of reduction of substrate γ increases, the heat of combustion of substrate $\Delta h_c^\circ / X_c$

(a) also increases

(b) decreases

(c) remains constant

(d) may increase or decrease based on C_p of substrate

3. Biomass with molecular formula weight of 25·9 and degree of reduction of 4·8 is combusted to CO_2, H_2O and N_2. Heat evolved per available electrons transferred to O_2 is – 115 kJ/g mol. The molar heat of combustion Δh_c° is given by

(a) –15·6 kJ/g

(b) –21·3 kJ/g

(c) –36·4 kJ/g

(d) 36·6 kJ/g

4. The average shear rate of pseudoplastic fluids in a fermentor is

(a) not a function of the stirrer speed

(b) a cubical function of stirrer speed

(c) a quadratic function of stirrer speed

(d) a linear function of stirrer speed

5. The centrifuge effect or g-number (Z) is given by ——, where ω is the angular velocity of the bowl and r is the radius of the centrifuge drum.

(a) $Z = \omega^2 r / g$

(b) $Z = \omega^3 r / g$

(c) $Z = \omega r^2 / g$

(d) $Z = \omega r^3 / g$

6. The slowest step in the mixing process is

(a) eddy formation

(b) diffusion

(c) dispersion

(d) distribution

7. In ungassed system, the power dissipated by the multiple-impeller system is approximately given by

(a) $(P)_n = n^3 (P)_1$

(b) $(P)_n = n^2 (P)_1$

(c) $(P)_n = n(P)_1$

(d) $(P)_n = (P)_1$

8. Polyethylene glycol dextran mixture is used to recover α-amylase from solution and partition coefficient is 4·2. If volume of the upper phase to lower phase is 5·0, the maximum possible recovery is

(a) 80%

(b) 85%

(c) 90%

(d) 95%

9. The product formed due to maintenance is a

(a) partially growth associated product

(b) growth associated product

(c) non-growth associated product

(d) product formed during stationary phase

10. The difference in the values of the activation energy E_d for thermal destruction of vitamins/amino acids (84–92 kJ g mol^{-1}) and proteins (165 kJ g mol^{-1}) is exploited in

(a) supercritical fluid extraction of vitamins

(b) high-temperature short-time sterilization

(c) the design of batch sterilization process

(d) concentration of vitamin and amino acid solution in falling film evaporator

11. In an immobilized system, external mass transfer effects decrease as the observable modulus Ω is reduced and this can be achieved by

(a) increasing the observed reaction rate

(b) increasing the size of the catalyst

(c) decreasing the mass transfer coefficient

(d) increasing the bulk concentration of substrate

12. Consider the steady-state flow of heat through a composite consisting of plates *A* and *B* of equal and uniform thickness, placed parallel to each other in the direction of heat flow. If thermal conductivity of plate *A* is greater than plate *B*, then

(a) the temperature gradient across plate *A* is greater than plate *B*

(b) the temperature gradient across plate *A* is less than plate *B*

(c) the temperature gradient across plate *A* is same as plate *B*

(d) the heat resistivity of plate *A* is greater than plate *B*

13. Match the following products with the corresponding organisms primarily used for synthesis of the product :

	Column—A		*Column—B*
P.	Citric acid	1.	*Brevibactrium flavum*
Q.	L-lysine	2.	*Aspergillus niger*
R.	Dextran	3.	*Propionibacterium shermanii*
S.	Vitamin B_{12}	4.	*Leuconostoc mesenteroides*

(a)	P	Q	R	S
	1	2	3	4
(b)	P	Q	R	S
	4	3	2	1
(c)	P	Q	R	S
	2	1	3	4
(d)	P	Q	R	S
	2	1	4	3

14. Diameter of globular proteins can be estimated from

(a) Stokes-Einstein equation

(b) Polson's equation

(c) Wilke-Chang correlation

(d) Nernst-Haskell correlation

15. Standard In-gold type pH electrode has

(a) glass electrode

(b) silver-silver chloride electrode

(c) combined glass and silver electrodes

(d) calomel electrode

16. The basic principle of temperature measurement using thermocouples is

(a) Peltier effect

(b) Curie effect

(c) Hall effect

(d) Seebeck effect

17. Which one of the following is ***not true*** of the polarographic DO sensors?

(a) Membrane covered

(b) Need an external bias voltage

(c) Have no lag in probe response

(d) Equipped with noble metal cathodes

18. The volume of distribution (V_d) of a particular drug will be

(a) greater for drugs that concentrate in tissues rather than in plasma

(b) independent of tissue concentration

(c) independent of plasma concentration

(d) approximately same for all drugs in a given individual

19. A highly ionized drug

(a) is excreted mainly by the kidney

(b) can cross the placental barrier

(c) is well-absorbed from the intestine

(d) accumulates in the cellular lipids

20. Colloidal silica added in the tablet formulation acts as

(a) lubricating agent

(b) disintegrating agent

(c) polishing agent

(d) solubilizing agent

21. Concentration of a drug in blood is 40 µg/mL. Dose of the drug is 200 mg. Volume of distribution of the drug is

(a) 0·5 L

(b) 3 L

(c) 5 L

(d) 2·5 L

22. Loading dose depends upon

(a) volume of distribution

(b) biological half-life

(c) plasma clearance

(d) route of administration

23. Aspirin is preferably prepared by which method of tablet manufacturing?

(a) Direct compression

(b) Wet granulation

(c) Direct wet compression

(d) Dry granulation

24. Burning feet syndrome which is also known as Grierson-Gopalan syndrome, is the result of the deficiency of which of the following?

(a) Biotin

(b) Valeric acid

(c) Pantothenic acid

(d) Isonicotinic acid

25. Select the macrolide drug derivative that is used in organ transplantation therapy.

(a) Tylosin

(b) Clarithromycin

(c) Ciclosporin

(d) Tacrolimus

26. The folate antagonist used in the treatment of psoriasis is

(a) methotrexate

(b) psoralen

(c) thiotepa

(d) trimethoprim

27. The volume in litre that can be produced of a 1:500 solution of chlorhexidine from 200 mL of a 4% solution of chlorhexidine is

(a) 4

(b) 0·4

(c) 2

(d) 0·2

28. The first orphan drug in the treatment of the first approved therapy for paroxysmal nocturnal hemoglobinuria is

(a) infliximab

(b) cetuximab

(c) eculizumab

(d) adalimumab

29. Which of the following materials is used as enteric coating material for tablets and capsules?

(a) Ethyl cellulose

(b) Polyvinyl acetate

(c) Cellulose acetate phthalate

(d) HPMC

30. The amount in gram of sodium bicarbonate that is contained in a 10 mL disposable syringe of 4·2% w/w sodium bicarbonate is

(a) 0·00042

(b) 0·0042

(c) 0·042

(d) 0·42

31. Which normal tissue is especially liable to be damaged by cytotoxic drugs?

(a) Brain

(b) Cartilage

(c) Muscle

(d) Intestinal mucosa

32. Which anti-infective drug is toxic for in-vivo use but is used for topical application?

(a) Mupirocin

(b) Terbinafine

(c) Ketoconazole

(d) Griseofulvin

33. The amount in milligram of hydrocortisone required to prepare 30 g of hydrocortisone 0·1% w/w cream is

(a) 0·0003

(b) 0·003

(c) 30

(d) 0·3

34. The injectable protein drug which is an incretin mimetic used in the diabetic therapy is

(a) exenatide

(b) repaglinide

(c) vildagliptin

(d) peglylated insulin

35. What equation describes the rate of drug dissolution from a tablet?

(a) Fick's law

(b) Henderson-Hasselbalch equation

(c) Law of mass action

(d) Noyes-Whitney equation

36. Which of the following blocks both alpha and beta receptors?

(a) Timolol

(b) Labetalol

(c) Propranolol

(d) Diazoxide

37. Gingival hyperplasia is associated with

(a) phenytoin

(b) digoxin

(c) enalapril

(d) captopril

38. Approximately how many moles of ATP will be generated as a result of the oxidation of one mole of $FADH_2$ in an actively respiring mitochondrion?

(a) 1

(b) 2

(c) 3

(d) 4

39. The only drug given through IV for the treatment of arrhythmia is

(a) lidocaine

(b) tocainide

(c) flecainide

(d) propafenone

40. The mechanism of antibacterial action of tetracycline involves

(a) binding to a component of the 50S ribosomal subunit

(b) inhibition of translocase activity

(c) blockade of binding of aminoacyl-tRNA to bacterial ribosomes

(d) selective inhibition of ribosomal peptidyl transferases

41. Which is ***not*** a synthetic estrogen?

(a) Estradiol

(b) Benzestrol

(c) Dienestrol

(d) Diethylstilbestrol

42. Bisacodyl frequently can cause

(a) dizziness

(b) skin rashes

(c) constipation

(d) abdominal cramps

43. A drug that is useful in glaucoma and high-altitude sickness is

(a) demeclocycline

(b) amiloride

(c) acetazolamide

(d) desmopressin

44. Clobazam is a benzodiazepine used as

(a) hypnotic

(b) muscle relaxant

(c) anxiolytic

(d) antiepileptic

45. The primary mechanism of action of benzodiazepines is

(a) dopamine antagonism

(b) facilitation of GABA-mediated chloride influx

(c) opening of neuronal chloride channels

(d) adenosine antagonism

46. Cotrimoxazole is a mixture of

(a) sulphadiazine and trimethoprim

(b) sulphasoxazole and trimethoprim

(c) sulphamethoxazole and trimethoprim

(d) silver sulphadiazine and trimethoprim

47. Which kind of flow is observed with shear thinning system?

(a) Plastic flow

(b) Pseudoplastic flow

(c) Dilatant flow

(d) Newtonian flow

48. The cohesive strength, cross-linking of gelatin is determined by using which one of the following parameters?

(a) Cracking strength

(b) Crushing strength

(c) Bloom strength

(d) Tensile strength

49. For an ideal gas, $\int_{T1}^{T2} C_p . dt$ represents

(a) change in free energy

(b) change in internal energy

(c) change in enthalpy

(d) change in entropy

50. If an ideal gas undergoes isothermal process, then

(a) pressure × density = constant

(b) pressure / density = constant

(c) pressure / volume = constant

(d) pressure / temperature = constant

51. If two containers having the same gas are mixed together, then

(a) change in entropy will be small

(b) change in entropy will be zero

(c) change in entropy will be large

(d) change in entropy is not determinable

52. For an exothermic reversible reaction, if temperature of reaction is increased

(a) kinetics and equilibrium constant will be favorable

(b) kinetics will be unfavorable but equilibrium constant will be favorable

(c) kinetics will be favorable but equilibrium constant will be unfavorable

(d) kinetics and equilibrium constant will be unfavorable

53. The first-order reaction represented by $(-dg/dt) = k.C_A$

(a) will never attain full conversion

(b) will quickly attain full conversion

(c) will reach equilibrium conversion

(d) will reach intermediate conversion

54. If Michaelis-Menten equation for an enzyme reaction of substrate (s) is $Y_S = (0 \cdot 2C_S / 1 + 2C_S)$, then Michaelis-Menten constant is

(a) 5

(b) 1

(c) 0·5

(d) 0·2

55. Two liquid reactants *A* and *B* are fed at 100 L/hr and 150 L/hr to a 1000 L CSTR. The residence time is

(a) 4 hr

(b) 10 hr

(c) 6·6 hr

(d) 0·25 hr

56. A liquid is flowing through a circular pipe with Re = 1500. The velocity of flow at the centre of pipe is 2 m/s. The average velocity of flow is

(a) 0·5 m/s

(b) 1 m/s

(c) 2 m/s

(d) 4 m/s

57. For a power-law fluid $\tau = K\left(\frac{du}{dy}\right)^n$, its apparent viscosity is given by

(a) $K\left(\frac{du}{dy}\right)^{n-1}$

(b) K

(c) $K\left(\frac{du}{dy}\right)$

(d) $K / \left(\frac{du}{dy}\right)^{n-1}$

58. In heat transfer, Stanton number = (friction factor/2) is called

(a) Chilton analogy

(b) Colburn analogy

(c) Reynolds analogy

(d) Nusselt analogy

59. If a body has emissivity of unity, then it is

(a) a gray body

(b) a black body

(c) a reflecting body

(d) an opaque body

60. An enzyme containing spherical porous catalyst has a volume of $5\,cm^3$ while its solid content is $4\,cm^3$. Its porosity is

(a) 0·5

(b) 0·2

(c) 0·8

(d) 0·4

61. In aerobic fermentation, the major resistance lies in

(a) transfer of O_2 to liquid phase

(b) transfer of medium to the cell

(c) transfer of O_2 from liquid to cell

(d) transfer of O_2 in gas phase

62. Which pump can be called the workhorse of a process industry?

(a) Diaphragm pump

(b) Reciprocating pump

(c) Centrifugal pump

(d) Gear pump

63. When suction pressure of a pump is less than vapour pressure of the liquid being pumped

(a) cavitation will occur in the pump

(b) agitation will occur in the pump

(c) rotation of the pump will stop

(d) pump motor will burn

64. Knudsen diffusion plays an important role in

(a) gas phase reactions

(b) gas-liquid reactions

(c) heterogeneous catalytic reactions

(d) liquid phase reactions

65. Gas absorption with chemical reaction enhances

(a) heat transfer coefficient

(b) mass transfer coefficient

(c) liquid film thickness

(d) equilibrium concentration

66. The reaction

$$A + B \rightarrow C$$
$$C + B \rightarrow D$$
$$D + B \rightarrow E$$

is a series reaction with respect to

(a) B

(b) D

(c) A

(d) C

67. Under unaerated condition in a fermentor, the power consumed by a single impeller is 10 kW and upon changing the agitation rate 200 to 600 r.p.m., the new power consumption would be

(a) 270 kW

(b) 90 kW

(c) 30 kW

(d) 10 kW

68. The power consumption in a reactor $(P) \propto N^3D^5$ and the power consumption/unit volume $(P/V) \propto N^3D^2$. If scale-up is done based on keeping the tip velocity (ND) constant, then

(a) P will increase and P/V will decrease with scale-up

(b) P will decrease and P/V will increase with scale-up

(c) P and P/V will both decrease with scale-up

(d) P and P/V will both increase with scale-up

69. In a fed batch cultivation of *E.coli*, feeding of concentrated substrate is done based on the equation $F(t) = KX(t)$. K is a constant and $X(t)$ is the biomass concentration at any given time. V, the volume of the broth, is assumed to be constant and all the substrates are consumed. The feeding rate with time is

(a) constant

(b) increasing linearly

(c) increasing exponentially

(d) sigmoid as in batch culture

70. In an anaerobic cultivation of broth in a lab-scale fermentor, the circulation time is found to be 20 s. Therefore mixing time would be near

(a) 50 s

(b) 60 s

(c) 70 s

(d) 80 s

71. *L. lactis* is cultured by inoculating 5 g of cells into 1 L of broth containing 10 g/L of glucose. The μ_m of the culture is 1·0/hr and the biomass yield from glucose is 0·3 g/g. If the residual glucose concentration left out is 2 g/L, the cell concentration achieved is

(a) 6·2 g/L

(b) 7·4 g/L

(c) 8·2 g/L

(d) 9·4 g/L

72. In continuous cultivation of *E. coli*, if the substrate feed concentration is increased

(a) cell concentration increases and residual substrate concentration remains constant

(b) cell concentration increases and residual substrate concentration decreases

(c) cell concentration remains constant and substrate concentration increases

(d) cell concentration increases and residual substrate concentration also increases

73. Which one of the following statements is true with respect to Rushton turbine used in fermentors?

(a) Shear and turbulence is created due to axial flow

(b) Shear and turbulence is high near impeller and very less on the walls of reactor

(c) Uniform shear and turbulence is created throughout the reactor

(d) Least power is consumed compared to other impellers

74. The maximum volumetric output of product for a given size of reactor is obtained in

(a) batch culture

(b) repeated batch culture

(c) fed-batch culture

(d) partial cell recycle mode

75. In shake flask cultivation, the size and composition of a bacterial culture would remain constant during

(a) acceleration phase

(b) logarithmic phase

(c) deceleration phase

(d) death phase

76. Which one of the following reactor configurations is used for animal cell culture which minimizes metabolite accumulation?

(a) CSTR

(b) Perfusion bioreactor

(c) Airlift bioreactor

(d) Wave bioreactor

77. *E. coli* culture grown in glucose medium was found to obey Monod kinetics of growth. The low k_S value of this strain for glucose enable the organism to achieve

(a) considerable specific growth rate even at low glucose concentrations

(b) μ_m even at low glucose concentrations

(c) high biomass yield

(d) high cell density

78. In an enzyme-immobilized system, if the maximum enzymatic reaction rate is much smaller than the maximum rate of mass transfer to the surface, then dimensionless group Damkohler number

(a) $Da \ll 1$

(b) $Da = 1$

(c) $Da > 1$

(d) $Da \gg 1$

79. Optimum bead loading for cell disruption in bead mill should ideally be

(a) less than 25%

(b) less than 50%

(c) between 50%–80%

(d) between 80%–90%

80. In continuous cultivation at steady state, growth of the culture is

(a) diauxic

(b) declining

(c) synchronous

(d) nonsynchronous

81. In ultrafiltration at constant transmembrane pressure, as the feed concentration is increased, the permeate flux

(a) decreases

(b) increases

(c) remains constant

(d) increases initially and then decreases

82. The ratio of total mass transfer to diffusive mass transfer is

(a) Sherwood number

(b) Schmidt number

(c) Peclet number

(d) Froude number

83. Which one of the following types of impeller has least susceptibility for flooding?

(a) Rushton turbine

(b) Curved-blade disc turbine

(c) Marine propeller

(d) Hydrofoil impeller

84. The particle velocity in a given centrifuge is ***not*** a function of

(a) centrifuge speed

(b) the particle diameter

(c) diffusivity of the particle

(d) viscosity of the suspending liquid

85. Which one of the following statements is correct with respect to increasing the scale of operation?

(a) Agitation power input per unit volume decreases

(b) Agitation power input per unit volume increases

(c) Mixing time decreases

(d) Oxygen transfer rate increases

86. Which one of the following is ***not*** used for the cleaning of membranes in aseptic processing?

(a) Formaldehyde

(b) Hypochlorite

(c) Hydrogen peroxide

(d) Sodium bisulphite

87. The value of Hill coefficient for negative cooperativity is

(a) 1

(b) 0

(c) 0·5

(d) −1

88. Which one of the following is the correct order of increasing degree of reduction?

(a) Glucose > Glycerol > Methanol > Methane

(b) Glycerol > Methanol > Glucose > Methane

(c) Methane > Methanol > Glycerol > Glucose

(d) Methanol > Glycerol > Methane > Glucose

89. The most often used selection criterion for a flocculent is

(a) Debye radius

(b) Stokes radius

(c) equivalent radius

(d) Feret diameter

90. Which one of the following is a high-volume low-value product?

(a) tPA

(b) Docosahexaenoic acid

(c) Paclitaxel

(d) Lactic acid

PART—B

(*Marks* : 40)

(Physics, Chemistry and Mathematics)

Answer **all** questions

91. The correct geometry around oxygen in dimethyl ether is

(a) linear

(b) bent

(c) tetrahedral

(d) trigonal planar

92. Which of the following properties differs for each of the pair of enantiomers?

(a) Solubility in ethanol

(b) Direction of rotation of plane polarized light

(c) Boiling point and melting point

(d) Refractive index

93. Which of the following compounds has the ***most*** de-shielded protons?

(a) Methyl chloride

(b) Methyl iodide

(c) Methyl bromide

(d) Methane

94. Coloured glass, coral, ruby glass, metal alloys are colloidal solutions of

(a) solid in liquid

(b) solid in gas

(c) gas in solid

(d) solid in solid

95. Magnetron is used in the production of

(a) X-rays

(b) cathode rays

(c) microwaves

(d) positive rays

96. The fertilizer essential for the growth of tobacco is

(a) superphosphate of lime

(b) urea

(c) potassium nitrate

(d) ammonium sulphate

97. Ore of manganese is

(a) pentlandite

(b) bauxite

(c) carninerite

(d) pyrolusite

98. The drugs caffeine, tannin and nicotine are

(a) steroids

(b) mild alkalis

(c) alkaloids

(d) cortisones

99. The degree of the differential equation $xy\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} = 0$ is

(a) 2

(b) 3

(c) 1

(d) 4

100. A unit normal vector of the cone of revolution $z^2 = 4(x^2 + y^2)$ at (1, 0, 2) is

(a) $\frac{2\hat{i} - \hat{k}}{\sqrt{5}}$

(b) $\frac{\hat{i} - \hat{k}}{\sqrt{5}}$

(c) $\frac{\hat{i} - 2\hat{k}}{\sqrt{5}}$

(d) $\frac{2\hat{i} - 2\hat{k}}{\sqrt{5}}$

101. The absolute value of the volume of the tetrahedron that is determined by three edge vectors (2, 0, 3), (0, 4, 1) and (5, 6, 0) is

(a) -27

(b) 7^2

(c) 72

(d) 27

102. If $f(z)$ is an analytic function at $z = z_0$, then

(a) $f(z)$ is not infinitely many times continuous at $z = z_0$

(b) $f(z)$ is infinitely many times differentiable at $z = z_0$

(c) $f(z)$ is only one time differentiable at $z = z_0$

(d) $f(z)$ is only one time continuous but not differentiable at $z = z_0$

103. The value of $(1+i)^{24}$ is

(a) 2

(b) 2^2

(c) 2^{12}

(d) 2^{121}

104. The series $\sum_{n=0}^{\infty} r^n$ is convergent, if

(a) $|r| = 3/2$

(b) $|r| \geq 1$

(c) $|r| \leq 1/2$

(d) $|r| > 3/2$

105. Choose the correct statement.

(a) Every convergent sequence has a unique limit

(b) Every convergent sequence is unbounded

(c) Every convergent sequence has minimum two limits

(d) Every bounded sequence is convergent

106. The value of $\int_0^\infty e^{-x^2} dx$ is

(a) $\sqrt{\pi}$

(b) $\sqrt{\pi}/2$

(c) $\sqrt{(\pi/2)}$

(d) $2\sqrt{\pi}$

107. If $z = f(y/x)$, then

(a) $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 0$

(b) $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = -1$

(c) $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 1$

(d) $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 2$

108. If A is an $n \times n$ invertible matrix whose eigenvalues are $\lambda_1, \cdots, \lambda_n$, then eigenvalues of A^{-1} are

(a) $\lambda_1, \cdots, \lambda_n$

(b) $\lambda_1^{-1}, \cdots, \lambda_n^{-1}$

(c) $\frac{\lambda_1}{|\det(A)|}, \cdots, \frac{\lambda_n}{|\det(A)|}$

(d) $\frac{|\det(A)|}{\lambda_1}, \cdots, \frac{|\det(A)|}{\lambda_n}$

109. A small electric car has a maximum constant acceleration of 1 m/s^2, a maximum constant deceleration of 2 m/s^2 and a maximum speed of 72 km/hr. The amount of time it would take to drive this car one kilometer starting from rest and finishing at rest is

(a) 15 s

(b) 50 s

(c) 35 s

(d) 65 s

110. A uniform spring of spring constant k is cut into pieces whose lengths are in the ratio 1 : 2. The ratio of frequencies of oscillations in the vertical direction when mass m each is suspended from the smaller and the larger pieces of the spring is

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

(b) $\sqrt{2}$

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

(d) 2

111. A thermodynamic cycle of diesel engine works at

(a) constant pressure

(b) constant volume

(c) constant temperature

(d) constant heat

112. A radioactive substance has a half-life of four months. Three-fourth of the substance will decay in

(a) 3 months

(b) 4 months

(c) 8 months

(d) 12 months

113. Water in a thermally insulated vessel at 0 °C is frozen by pumping out water vapour. The maximum fraction (percentage) of water that can be solidified in this manner is

(a) 73·4%

(b) 40·2%

(c) 87·0%

(d) 13·8%

114. A copper ball 2 cm in radius is heated in a furnace to 400 °C. If its emissivity is 0·3, then the rate at which the heat energy is radiated in watt is ($\sigma = 5{\cdot}67 \times 10^{-8}$ W m^{-2} K^{-4})

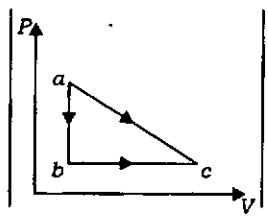
(a) 17·4

(b) 14·7

(c) 174

(d) 1·74

115. A gas can be taken from state a to state c by two different reversible processes, $a \rightarrow c$ or $a \rightarrow b \rightarrow c$. During the direct process $a \rightarrow c$, 20 J of work is done by the system and 30 J of heat is added to the system. During the process $a \rightarrow b \rightarrow c$, 25 J of heat is added to the system. How much work is done by the system during $a \rightarrow b \rightarrow c$?



(a) 5 J

(b) 10 J

(c) 15 J

(d) 20 J

116. Copper has an FCC structure. If the atomic radius is $1{\cdot}273 \times 10^{-10}$ m, then the lattice parameter is

(a) 1·8 Å

(b) 0·9 Å

(c) 2·7 Å

(d) 3·6 Å

117. An electric lamp is marked 220 V and 100 W. The resistance of its filament is

(a) 48·4 ohms

(b) 4·84 ohms

(c) 484 ohms

(d) 0·484 ohm

118. A diffraction pattern is obtained using a beam of red light. What happens if the red light is replaced by the blue light?

(a) No change

(b) Diffraction bands become narrower and crowded together

(c) Bands become broader and farther apart

(d) Bands disappear

119. Electrons with de Broglie wavelength λ fall on the target in an X-ray tube. The cutoff wavelength of the emitted X-rays is

(a) $\lambda_0 = 2mc\lambda^2 / h$

(b) $\lambda_0 = 2h / mc$

(c) $\lambda_0 = 2m^2c^2\lambda^3 / h^2$

(d) $\lambda_0 = \lambda$

120. Six protons and six neutrons are brought together to form the carbon nucleus. But the mass of the carbon nucleus is a little less than the combined masses of its protons and neutrons. This difference, called the mass defect, is due to

(a) conversion to the binding energy of the nucleus

(b) given off in a radioactive decay process

(c) conversion into energy for holding the electrons in an orbit

(d) emission in the form of photons

121. The degeneracy of quantum states with $(n_x^2 + n_y^2 + n_z^2) = 6$ is

(a) 8

(b) 12

(c) 24

(d) 48

122. The Miller indices of the plane parallel to the x and y axes are

(a) (1 0 0)

(b) (0 1 0)

(c) (0 0 1)

(d) (1 1 1)

123. The metallic iron changes from BCC structure to FCC structure at 910 °C with an increase in the atomic radii. The density of iron in this structural change

(a) remains constant

(b) increases

(c) decreases

(d) becomes zero

124. ^{222}Rn is unstable and decays by losing 6 neutrons and 2 protons. What is the final decay product?

(a) ^{218}Bi

(b) ^{216}Bi

(c) ^{216}Pb

(d) ^{214}Po

125. Which one of the following describes the major intermolecular force in $I_2(s)$?

(a) Covalent bond

(b) Dipole-dipole force

(c) Dispersion force

(d) Hydrogen bond

126. If the equation is rewritten as $CO(g) + \frac{1}{2}O_2(g) \leftrightarrow CO_2(g)$ with an equilibrium constant K_c'. What is the relationship between K_c and K_c'?

(a) $K_c' = K_c$

(b) $K_c' = K_c^{1/2}$

(c) $K_c' = \frac{1}{2}K_c$

(d) $K_c' = K_c^{-1}$

127. Which one of the following species contains an unpaired electron?

(a) N_2

(b) N_2O

(c) NO_2

(d) NO_3^-

128. Which one of the following sets of substances is ranked in order of increasing boiling point at 1 atm?

(a) $CH_4 < CF_4 < CH_3OH < CH_3CH_2OH$

(b) $He < Ar < Kr < Ne$

(c) $HF < HCl < HBr < HI$

(d) $SbH_3 < AsH_3 < PH_3 < NH_3$

129. Which one of the following statements about an *sp*-hybridized carbon is ***false***?

(a) It is divalent

(b) It forms linear bonds

(c) It has two *p* orbitals

(d) It always forms triple bonds to carbon

130. Which molecule has the largest dipole moment?

(a) HCl

(b) CCl_4

(c) H_2S

(d) CO_2

PART—C

(*Marks* : 35)

(Fundamentals of Life Sciences and Informatics)

Answer **all** questions

131. The cyclic pathway converts lactic acid to glucose is

(a) TCA cycle

(b) Cori cycle

(c) ornithine cycle

(d) Calvin cycle

132. Which one of the following are examples of thiol-based antioxidant?

(a) Ascorbic acid and vitamin E

(b) Ascorbic acid and lipoic acid

(c) Glutathione and lipoic acid

(d) Glutathione and vitamin E

133. Which of the following hormones is ***not*** involved in metabolism of carbohydrate?

(a) Insulin

(b) Antidiuretic hormone

(c) Epinephrine

(d) Glucagon

134. Chitin is made up of a linear chain of

(a) *N*-acetylmuramic acid

(b) acetylglucosamine

(c) β-galactose

(d) β-D-xylose

135. Insulin decreases

(a) glycolysis

(b) glycogenesis

(c) lipogenesis

(d) gluconeogenesis

136. The catabolic pathways of lipid, carbohydrate and protein are integrated into a final common pathway which is

(a) TCA cycle

(b) Cori cycle

(c) ornithine cycle

(d) Calvin cycle

137. The complementary determining regions are

(a) restricted to light chain

(b) in the constant part of the Ig molecule

(c) concerned in antigen recognition

(d) found in *C* terminal region end of the Ig peptide chains

138. The role of adjuvant is to

(a) cross-link the antigen

(b) increase the size of antigen

(c) avoid inflammation

(d) prolong persistence of antigen

139. The circulation of a two-month old breast-fed baby will contain maternal

(a) IgA

(b) IgD

(c) IgE

(d) IgG

140. Which one of the following antibodies is of most use for pernicious anemia diagnosis?

(a) Anti-thyroid peroxidase

(b) Anti-parietal cell

(c) Anti-nuclear

(d) Anti-Ig Fc

141. A special kind of Java program that is designed to be transmitted over the Internet is called as

(a) Script

(b) Application

(c) XML

(d) Applet

142. In Java, a method that calls itself is called as

(a) renaming

(b) recall

(c) recursive

(d) redefine

143. Which one of the following statements is ***not true*** with respect to inheritance in Java?

(a) It is a concept of reusing something that already exists

(b) Old class is known as subclass

(c) It is a mechanism of deriving a new class from old class

(d) New class is called as derived class

144. Which one of the following statements is ***not true*** in Java?
StringBuffer

(a) is a class of string

(b) creates strings of flexible length

(c) helps to insert characters in the middle of a string

(d) is just a variable name

145. Which one of the following statements is ***not true***?
Transmission control protocol is a protocol that

(a) provides host-to-host connectivity at the transport layer of the Internet mode

(b) carries out the basic operations of the Web

(c) is residing in data-link layer of Open Systems Interconnection (OSI) model

(d) provides a communication service at an intermediate level between an application program and the Internet Protocol

146. The most common protocol for sending mail is

(a) file transfer protocol

(b) simple mail transfer protocol

(c) user datagram protocol

(d) hypertext transfer protocol

147. Which of the following fields is/are displayed as output when the SQL statement "Select * from protein where resdcount > 100 and proteinid = P234;" is executed?

(a) All fields of protein relation

(b) resdcount

(c) proteinid

(d) resdcount and proteinid

148. Which one of the following is ***not true***?
In Perl

(a) array variables are preceded by at the rate symbol (@)

(b) dollar sign ($) is used to refer to a single element of an array

(c) square brackets are used for indexing in arrays

(d) hash symbol (#) is used to refer to a single element of an array

149. The Perl statement pop @protein; will

(a) remove and return the first value of the protein array

(b) add and return the last value of the protein array

(c) remove and return the last value of the protein array

(d) add and return the first value of the protein array

150. Which of the following is a bitwise operator?

(a) >>

(b) &&

(c) +=

(d) >=

151. Isotope used to determine the semi-conservative mode of DNA replication is

(a) ^{3}H

(b) ^{35}S

(c) ^{15}N

(d) ^{12}C

152. Histones are

(a) acidic proteins

(b) basic proteins

(c) neutral proteins

(d) fibrous proteins

153. Centrifugation of a tissue homogenate in a succession of increasing gravitational fields separates organelles of differing sizes and/or relative densities is called as

(a) density gradient centrifugation

(b) differential centrifugation

(c) isopycnic centrifugation

(d) ultracentrifugation

154. —— activity of *Taq* DNA polymerase is useful for direct cloning of PCR products (i.e., TA cloning).

(a) Terminal transferase

(b) Polymerase

(c) Exonuclease

(d) Endonuclease

155. Blunt end is converted into sticky end by using

(a) DNA polymerase

(b) adaptors

(c) DNA methylase

(d) Exonuclease

156. Lactose induces the *lac* operon by

(a) inactivating the repressor gene

(b) binding to the operator region

(c) inactivating the repressor

(d) binding to the promoter region

157. —— technique is used to identify protein binding sites in DNA.

(a) DNA footprinting

(b) DNA fingerprinting

(c) DNA editing

(d) DNA polymorphism

158. —— site of *lac* operon is targeted by cAMP.

(a) Operator

(b) Promoter

(c) Leader region

(d) CRP

159. Double-stranded DNA molecules contain 30, 40, 50 and 60 percentage of A = T base pair respectively. The T_m value is high for dsDNA that has —— percentage of A = T base pair.

(a) 30

(b) 40

(c) 50

(d) 60

160. The synthesis of full-length cDNA molecules is limited by —— activity of reverse transcriptase.

(a) RNase

(b) polymerase

(c) proofreading

(d) nick translation

161. Ras protein is associated with which of the following?

(a) ATPase

(b) Adenylyl cyclase

(c) Phosphodiesterase

(d) GTPase

162. LDL uptake by the cell is an example of

(a) receptor-mediated endocytosis

(b) simple diffusion

(c) antiporter

(d) pinocytosis

163. The glucose units in cellulose are linked by

(a) alpha 1-4

(b) beta 1-4

(c) alpha 1-2

(d) beta 1-2

164. The identification test to differentiate reducing monosaccharide and reducing disaccharide is

(a) rapid furfural test

(b) Molisch's test

(c) Benedict's test

(d) Barfoed's test

165. Which one of the mammalian cells does not have aerobic glycolysis pathway?

(a) Brain cell

(b) Hepatocyte

(c) Matured RBC

(d) Renal cell

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

119

QUESTION PAPER SERIES CODE
B

Registration No. : | | | | | | |

Centre of Exam. : _____

Name of Candidate : _____

_____

Signature of Invigilator

COMBINED ENTRANCE EXAMINATION, 2016

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. Which type of enzyme is responsible for unwinding of DNA?

(a) Telomerase

(b) Primase

(c) DNA polymerase

(d) Helicase

2. What is the distance between two base pairs in double-helix model of DNA?

(a) 0·034 nm

(b) 0·34 nm

(c) 3·4 nm

(d) 34 nm

3. Which of the following enzymes is responsible for transcription?

(a) Amino acid synthetase

(b) RNA decarboxylase

(c) RNA polymerase

(d) DNA polymerase

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

(a) exons

(b) introns

(c) tandem repeats

(d) microsatellites

5. Which of the following repair pathways involves MutH protein?

(a) Base excision repair

(b) Nucleotide excision repair

(c) Mismatch repair

(d) Photoreversal

6. 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

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

(a) deleting all recognition sites from the genome

(b) degrading the endonuclease after formation

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

(d) not producing any restriction endonucleases

8. The most primitive extant eukaryotes belong to the genus

(a) *Plasmodium*

(b) *Tetrahymena*

(c) *Giardia*

(d) *Chlamydomonas*

9. The metabolite that bridges the gap between glycolysis and the Krebs cycle is

(a) oxaloacetate

(b) pyruvate

(c) acetyl CoA

(d) citrate

10. A protein structure on eukaryotic chromosomes to which spindle fibres (microtubules) bind is

(a) telomere

(b) centromere

(c) kinetochore

(d) centriole

11. Which of the following chemical mutagens is likely to cause frameshift mutations?

(a) 5-Bromouracil

(b) 2-Aminopurine

(c) Acridine orange

(d) Hydroxylamine

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

(a) suppressor sites

(b) hot spots

(c) mutator sites

(d) cistrons

13. Which one of the following is ***not*** a member of the immunoglobulin supergene family?

(a) Antibody

(b) Lymphokine

(c) MHC glycoprotein

(d) T-cell receptor

14. T cells mature in the

(a) thyroid gland

(b) spleen

(c) bone marrow

(d) lymph nodes

15. Which one of the following enzyme activities has an RNA component?

(a) Telomerase

(b) Gyrase

(c) Peptidyltransferase

(d) Primase

16. Which one of the following sequences is present in tRNAs at 3′-terminus?

(a) CCA

(b) GCA

(c) CCT

(d) GCT

17. RNAs that catalyze biological reactions, such as self-splicing introns, are called

(a) spliceosomes

(b) ribozymes

(c) enzymes

(d) endonuclease

18. Men suffer from hemophilia far more frequently than women as hemophilia is a/an

(a) sex-linked trait

(b) sex-influenced trait

(c) Y-linked trait

(d) autosomal recessive trait

19. Gene bank is the name of

(a) DNA sequence database

(b) DNA depository

(c) DNA structure institute

(d) DNA storage facility

20. Muscle fatigue occurs due to the accumulation of

(a) pyruvic acid

(b) lactic acid

(c) oxaloacetic acid

(d) uric acid

21. One strand of telomeric DNA consists of repeated units of

(a) AAAAAA

(b) TTGGGG

(c) TATATA

(d) ATATAT

22. Which antibiotic resembles the 3′-end of charged tRNA molecule?

(a) Puromycin

(b) Streptomycin

(c) Neomycin

(d) Penicillin

23. Klenow fragment of DNA Pol I lacks which one of the following activities?

(a) 5′ → 3′ Exonuclease

(b) 3′ → 5′ Exonuclease

(c) 5′ → 3′ Polymerase

(d) 3′ → 5′ Polymerase

24. Huntington's disease is caused by

(a) inability to metabolize maltose

(b) lack of vitamin C

(c) expansion of triplet repeats

(d) frameshift mutation

25. Ethidium bromide is a/an

(a) intercalating agent

(b) base analogue

(c) alkylating agent

(d) chelating agent

26. Thymine dimer is caused by

(a) ultraviolet light

(b) infrared light

(c) X-rays

(d) δ-rays

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

(a) Homeodomains

(b) Zinc fingers

(c) Leucine zippers

(d) CpG islands

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

(a) Thylakoids

(b) Cytoplasm

(c) Stroma

(d) Matrix

29. The major plant hormone important in regulating plant's response towards salt stress is

(a) auxin

(b) abscisic acid

(c) gibberellin

(d) cytokinin

30. The alpha helix of a protein might be disrupted if a missense mutation introduces —— within the alpha helical structure.

(a) alanine

(b) tyrosine

(c) glycine

(d) aspartic acid

31. The guanine content in RNA normally is not equal to its cytosine and adenine content might not be equal to its uracil content as it is

(a) stable molecule

(b) single-stranded molecule

(c) unstable molecule

(d) double-stranded molecule

32. The scientist who developed cytochemical technique for the identification of DNA was

(a) McClintock

(b) Feulgen and Rossenbeck

(c) Abbe

(d) Waldeyer

33. The phenotypically silent DNA sequences that are not expressed during the normal life cycle of an organism are called

(a) pseudogenes

(b) overlapping genes

(c) cryptic genes

(d) split genes

34. Taylor demonstrated the semiconservative mode of DNA replication in

(a) *Vicia faba*

(b) mouse liver cells

(c) HeLa cells

(d) peanut

35. What would happen, if the 25th codon UAU is mutated to UAA, in a gene coding for a polypeptide of 50 amino acids?

(a) A polypeptide of 24 amino acids will be formed

(b) Two polypeptides of 24 and 25 amino acids would be formed

(c) A polypeptide of 49 amino acids will be formed

(d) A polypeptide of 25 amino acids will be formed

36. —— is used to separate more than one protein with same molecular weight.

(a) SDS-PAGE

(b) Isoelectric focusing

(c) Density gradient centrifugation

(d) Thin-layer chromatography

37. Polyacrylamide gels are prepared by cross-linking acrylamide with

(a) TEMED

(b) 3,6-anhydro-1-galactose

(c) guanidinium chloride

(d) *N, N'*-methylene-*bis*-acrylamide

38. Clones are identified by hybridizing them with

(a) vector

(b) antibody

(c) virus

(d) probe

39. An inhibitor of protein synthesis which acts as an analogue of aminoacyl tRNA is

(a) streptomycin

(b) nalidixic acid

(c) rifampicin

(d) puromycin

40. The lipid component that functions as lung surfactant is

(a) palmitic acid

(b) phospholipid

(c) ceramide

(d) esterified cholesterol

41. Disulphide bonds in the proteins are broken by

(a) 2-mercaptoethanol

(b) triton X-100

(c) sodium dodecyl sulphate

(d) nonidet P-40

42. The separation technique that uses ligand to purify its receptor protein is

(a) ion-exchange chromatography

(b) expanded bed adsorption chromatography

(c) size-exclusion chromatography

(d) affinity chromatography

43. Which is the major form of lipid component existing in the vegetable oil?

(a) Free fatty acid

(b) Triglyceride

(c) Phospholipid

(d) Lysophospholipid

44. Lack of bile acid secretion associates with

(a) steatorrhoea

(b) folic acid deficiency

(c) protein malnutrition

(d) mineral deficiency

45. Most proteins are less soluble at high salt concentration due to an effect called

(a) salting out

(b) zwitterion formation

(c) salting in

(d) ionic dissociation

46. Which one of the following is ***not true*** about cholesterol?

(a) It provides fluidity for cell membrane

(b) It is the precursor of ceramide

(c) It is the precursor of vitamin D

(d) It can be esterified with fatty acid

47. Which one of the following is an inhibitor of the cytochrome c oxidase?

(a) Quinolone

(b) Rotenone

(c) Methanol

(d) Cyanide

48. Production of monoclonal antibody by hybridoma technology requires

(a) splenocytes

(b) osteocytes

(c) hepatocytes

(d) thymocytes

49. Interferon β is being produced by

(a) bacteria-infected cell

(b) virus-infected cell

(c) both virus- and bacteria-infected cells

(d) fungi-infected cell

50. Defect in neutrophil NADPH oxidase deficiency produces

(a) chronic granulomatous disease

(b) Chediak-Higashi syndrome

(c) leukocyte adhesion deficiency

(d) streptococcal infection

51. Based on heavy chain, which one of the following antibodies has multiple subtypes?

(a) IgM

(b) IgG

(c) IgD

(d) IgE

52. Initiation of new strand of DNA during replication requires

(a) DNA primer

(b) RNA primer

(c) both DNA and RNA primers

(d) DNA polymerase

53. A purified protein sample from a plant is injected into a rabbit to raise antibody against it. Blood is drawn from the immunized rabbit. Mention which part of the blood will be used to get the antibody.

(a) Red blood cells

(b) Serum

(c) Blood platelets

(d) White blood cells

54. The Northern technique involves the detection of

(a) RNA fragments on membranes by specific radioactive DNA probe

(b) DNA fragments on membranes by a radioactive DNA probe

(c) proteins on membranes using a radioactive DNA probe

(d) proteins on membranes using specific radioactive antibodies

55. Restriction endonuclease generated DNA fragments separated by gel electrophoresis and blot transferred onto a membrane filter are probed with a radioactive DNA fragment. This procedure is called

(a) gene cloning

(b) the Southern technique

(c) the polymerase chain reaction

(d) recombinant DNA

56. 'Gene library' is a term used to describe

(a) a computerized listing of known DNA sequences

(b) bacteria with plasmids containing DNA fragments representing the majority of the genetic information from a plant or animal

(c) a collection of books about recombinant DNA technology

(d) a compilation of the amino acid sequences of protein coding genes

57. One of the most significant discoveries, which allowed the development of recombinant DNA technology, was

(a) the discovery of antibiotics used for selecting transformed bacteria

(b) the identification and isolation of restriction endonucleases permitting specific DNA cutting

(c) the discovery of DNA and RNA polymerase allowing workers to synthesize any DNA sequence

(d) the Southern technique for separation and identification of DNA sequences

58. The net number of ATPs generated from one molecule of glucose by the process of glycolysis is

(a) 16

(b) 8

(c) 32

(d) 2

59. Which one of the following amino acids is coded by only one codon during protein synthesis?

(a) Glycine

(b) Alanine

(c) Arginine

(d) Methionine

60. In DNA replication, the Okazaki fragments on the lagging strand are joined together by

(a) DNA ligase

(b) DNA polymerase

(c) primase

(d) helicase

PART—B

(*Marks* : 40)

(Physics and Chemistry)

Answer **all** questions

61. Which of the following cyclohexane conformations has the ***most*** energy (is the ***least*** stable)?

(a) Chair

(b) Half chair

(c) Boat

(d) Twist boat

62. Which compound has the highest melting point?

(a) Decane

(b) 2,2,3,3-tetramethylbutane

(c) 2,2,3-trimethylpentane

(d) 4-methylnonane

63. Which of the following occurs during the initiation stage of a radical mechanism?

(a) Non-radicals are formed from radicals

(b) Radicals are formed from other radicals

(c) Radicals are formed from non-radicals

(d) Non-radicals are formed from other non-radicals

64. Which version of the radical halogenations of an alkane is ***most*** selective?

(a) Fluorination

(b) Chlorination

(c) Bromination

(d) Iodination

65. Which is ***not*** correctly matched?

(a) Kekule—Structure of benzene

(b) Contact—Synthesis of process of sulphur

(c) Haworth—Synthesis of anthracene

(d) van't Hoff—Dilute solutions

66. Heavy water is the name given to

(a) T_2O

(b) water with magnesium and calcium salts

(c) hydrogen peroxide

(d) deuterium oxide

67. Stannous chloride gives what color with colloidal gold?

(a) Green

(b) Indigo

(c) Purple

(d) No color

68. Kjeldahl's method is used for estimation of

(a) sulphur

(b) colloidal platinum

(c) Raney's nickel

(d) nitrogen

69. The chemical name of bleaching powder is

(a) calcium tetrachloride

(b) calcium carbonate

(c) calcium oxychloride

(d) calcium oxalate

70. An electrophile is a

(a) Lewis acid

(b) Lewis base

(c) poor leaving group

(d) carbonium ion

71. Which of the following is a symmetrical reagent?

(a) Hg

(b) Br_2

(c) HCl

(d) $CH_3 - C \equiv C - H$

72. Rancid odour of butter left in bright light for a week at room temperature is due to

(a) diacetyl

(b) oxalic acid

(c) butyric acid

(d) ethyl propionate

73. Sodium acetyl salicylate is

(a) paracetamol

(b) alkane

(c) ester

(d) aspirin

74. Which one of the following is a volatile compound?

(a) Ethyl formate

(b) Glycine

(c) Phenol

(d) Toluene

75. A condenser of capacitance 5 microfarads is charged to a voltage of 1000 volts. The stored energy is

(a) 25×10^{-3} J

(b) 5×10^{-3} J

(c) $2 \cdot 5$ J

(d) 5×10^{-9} J

76. Which of the following materials ***does not*** have permanent magnetic dipoles?

(a) Paramagnetic

(b) Diamagnetic

(c) Ferrimagnetic

(d) Antiferromagnetic

77. The first reflection of free electron in a BCC crystal occurs at which value of k ?

(a) $2/a$

(b) $\pi a/\sqrt{2}$

(c) π/a

(d) $\sqrt{2}\pi/a$

78. Ionic polarization

(a) decreases with temperature

(b) increases with temperature

(c) is independent of temperature

(d) may increase or decrease with temperature

79. The ratio of the specific charge of a proton to that of an alpha particle is

(a) 1 : 2

(b) 1 : 1

(c) 2 : 1

(d) 1 : 4

80. If r is the radius of the atom in a crystal, crystallizing in a simple cubic structure, then the nearest neighbor distance is

(a) $r/2$

(b) $4r$

(c) $2r$

(d) r^2

81. Pure silicon at 0 K is

(a) intrinsic semiconductor

(b) extrinsic semiconductor

(c) metallic

(d) insulator

82. Total internal reflection occurs when light

(a) travels from air to water

(b) travels from water to air

(c) is reflected by a mirror

(d) travels in air after being reflected by the water surface

83. A thick rope of rubber of density $1 \cdot 5\ kg/m^3$, Young's modulus $5 \times 10^6\ N/m^2$ and 8 m in length is hung from the ceiling of a room. The increase in length due to its own weight is

(a) $9 \cdot 6 \times 10^{-5}$ m

(b) $19 \cdot 2 \times 10^{-5}$ m

(c) $9 \cdot 6$ m

(d) $19 \cdot 2$ m

84. Magnetic lines of force prefer to pass through ferromagnetic substances than air, because

(a) $\mu > 1$ for ferromagnetic substances

(b) $\mu < 1$ for ferromagnetic substances

(c) $\mu = 1$ for ferromagnetic substances

(d) $\mu = 0$ for ferromagnetic substances

85. Electrons behave as a wave because they can be

(a) deflected by an electric field

(b) diffracted by a crystal

(c) deflected by a magnetic field

(d) ionized by a gas

86. The energy of the lowest state in a one-dimensional box of length a is

(a) one

(b) $2h^2/8ma^2$

(c) $h^2/8ma^2$

(d) $h/8ma^2$

87. X-rays consist of

(a) negatively charged particles

(b) electromagnetic radiation

(c) positively charged particles

(d) a stream of neutrons

88. The capacitance of a capacitor with a layer of Al_2O_3 ($\varepsilon_r = 8$) of $0 \cdot 5\,\mu m$ thick and $1000\,mm^2$ area is

(a) $0 \cdot 283\,\mu F$

(b) $0 \cdot 142\,\mu F$

(c) $17\,nF$

(d) $3540\ pF$

89. Impedance is the measure of

(a) resistance to flow of an alternating current

(b) resistance to flow of direct current

(c) extent of magnetization of the sample

(d) thermal conductivity

90. The packing factor of the FCC structure is

(a) 52%

(b) 68%

(c) 92%

(d) 74%

91. Interaction between the neighboring dipoles is negligible in the case of a/an

(a) diamagnetic material

(b) paramagnetic material

(c) antiferromagnetic material

(d) ferromagnetic material

92. Magnetic materials which can be readily magnetized in either direction are called

(a) soft magnetic materials

(b) hard magnetic materials

(c) low hysteresis loss materials

(d) high hysteresis loss materials

93. A ray of light passes through an equilateral prism ($\mu = 1 \cdot 5$) such that the angle of incidence is equal to the angle of emergence and the latter is equal to 3/4 the angle of prism. Find the angle of deviation.

(a) 45°

(b) 60°

(c) 90°

(d) 30°

94. The temperature of the antiferromagnetic to paramagnetic transition is called

(a) Curie temperature

(b) Neel temperature

(c) transition temperature

(d) Weiss temperature

95. Which one of the following species has the same electronic configuration as the Al^{3+} cation?

(a) F^-

(b) Cl^-

(c) S^{2-}

(d) Mg^+

96. What is the oxidation number of phosphorus in KH_2PO_4?

(a) – 6

(b) – 2

(c) 0

(d) + 5

97. What happens when the catalyst is added for a system in equilibrium?

(a) The reaction follows an alternative pathway of lower activation energy

(b) Heat of the reaction decreases

(c) Rate of chemical reaction decreases

(d) Potential energy of products decreases

98. How does the volume of one mole of an ideal gas change if the temperature and the pressure are both decreased by a factor of 4?

(a) Decreases by four times

(b) Increases by four times

(c) Remains unchanged

(d) Increases by eight times

99. How many bonding and non-bonding electron pairs are found in the BF_3 molecule?

(a) 1 bonding and 3 non-bonding

(b) 2 bonding and 2 non-bonding

(c) 3 bonding and 1 non-bonding

(d) 3 bonding and 0 non-bonding

100. Which one of the following may be separated by ordinary physical methods?

(a) A pair of identical molecules

(b) A pair of enantiomers

(c) A pair of diasteriomers

(d) A pair of identical atoms

PART—C

(*Marks* : 30)

(Mathematics, Computer and Information Sciences)

Answer **all** questions

101. The Linux command 'ls *' will

(a) list all the files in long list format

(b) list all the files start with *

(c) list all the files and directories in the current directory

(d) list all the directories

102. The Perl statements '$protein='3tgl:4lgt:3gal';@arr=split(':',$protein); print $arr[1] will

(a) print 3tgl

(b) print 4lgt

(c) print 3gal

(d) give a syntax error

103. In Perl, a set of key/value pairs, which is also a complex list data is called as

(a) hash

(b) scalar

(c) pair

(d) string

104. Devices which forward packets between interconnected networks are called as

(a) bus

(b) network cables

(c) graphical cards

(d) routers

105. The SQL command to remove a relation from a database is

(a) Delete

(b) Remove

(c) Drop

(d) Kill

106. Which one of the following statements is ***not true***?

XML is

(a) a markup language

(b) an assembly language

(c) designed to store and transport data

(d) designed to define a set of rules for encoding documents to be both human- and machine-readable

107. Which one of the following statements is ***not true***?

In Java, a class is a

(a) basic data type

(b) description of how to make an object that contains fields and methods

(c) sort of template

(d) user-defined data type

108. In Java, a special type of method that enables an object to initialize itself is called as

(a) destructor

(b) converter

(c) allocator

(d) constructor

109. Which keyword will be used to rename the field name in SQL?

(a) Rename

(b) Move

(c) As

(d) Copy

110. Small files that Web sites put on user system to store information about users is named as

(a) user database

(b) Internet cookies

(c) user files

(d) Internet database

111. In Java programming language, the mechanism by which data and functions are bound together in a class is called

(a) overloading

(b) binding

(c) inheritance

(d) encapsulation

112. In Perl programming language, key value pairs are held in which data type?

(a) Array

(b) Scalar

(c) Hash

(d) Number

113. A database table named employee has four attributes : empno, ename, department and salary. It has details of five employees. The degree and cardinality of this table are

(a) 4 and 5 respectively

(b) 5 and 4 respectively

(c) 9 and 1 respectively

(d) 9 and 20 respectively

114. A database table named protein has the attributes : proteinid, name and length. In order to add another attribute named function to this table, which command in SQL should be used?

(a) Update

(b) Alter

(c) Rename

(d) Insert

115. In which of the following computer network topologies, all nodes are connected to a central node?

(a) Star

(b) Ring

(c) Bus

(d) Mesh

116. If $Y = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ and $2X + Y = \begin{bmatrix} 1 & 0 \\ -3 & 2 \end{bmatrix}$, then find the value of X.

(a) $\begin{bmatrix} -1 & -1 \\ -2 & -1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & 1 \\ 1 & 1 \end{bmatrix}$

(d) $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$

117. If A and B are symmetric matrices of same order, then $AB - BA$ is a/an

(a) skew-symmetric matrix

(b) symmetric matrix

(c) zero matrix

(d) identity matrix

118. $\int_0^2 e^x dx$ is equal to

(a) $e^2 - 1$

(b) $e^4 - 1$

(c) $e^3 - e^2$

(d) $e - 1$

119. $\int_0^{\pi/2} \frac{\tan^2 x}{1+\tan^2 x}\, dx$ is equal to

(a) ∞

(b) 0

(c) $\pi/4$

(d) $\pi/2$

120. $\int_{-2}^{2} |x \cos \pi x| dx$ is equal to

(a) $8/\pi$

(b) $4/\pi$

(c) $2/7$

(d) $1/\pi$

121. The area lying in the first quadrant and bounded by the circle $X^2 + Y^2 = 4$ and the lines $X = 0$, $X = 2$ is

(a) π sq units

(b) $\pi/2$ sq units

(c) $\pi/3$ sq units

(d) $\pi/4$ sq units

122. The three vectors a, b and c with magnitudes 3, 4 and 5 respectively and $a+b+c=0$, then the value of $a\cdot b+b\cdot c+c\cdot a$ is

(a) -23

(b) -25

(c) 30

(d) 26

123. If the vectors a, b, c and d are coplanar, then $(a\times b)\times(c\times d)$ is equal to

(a) $a+b$

(b) $a+b+c+d$

(c) 0

(d) $a+b+c$

124. Suppose $AB=A$ and $BA=B$, where A and B are square matrices, then which one of the following options is/are ***correct*** ?

(a) $B=B^2$ and $A^2=A$

(b) $A^2=B$ and $B^2=A$

(c) $AB=BA$

(d) $A^2=B^2$

125. The line $y=mx-1$ is a tangent to the curve $y^2=4x+1$ at $(0,-1)$, if the value of m is

(a) 1

(b) 2

(c) -2

(d) -1

126. The package that allows to analyze create and manipulate images on a computer is

(a) word processing package

(b) spreadsheet package

(c) presentation package

(d) graphics package

127. Which one of the following is ***true***?
ROM is a memory device which will be

(a) used as a temporary memory

(b) loosing data when system get switched off

(c) programmed at the time of manufacturing

(d) used as cache memory

128. The octal equivalent of binary number 101101 is

(a) 66

(b) 55

(c) 44

(d) 33

129. The Linux command 'grep' is used to

(a) count the number of occurrences of a given pattern in a file

(b) concatenate two files

(c) rename a file

(d) generate a file

130. The Linux command 'head-15 protein.txt>>log.txt' will

(a) store the last 15 lines of protein.txt file to log.txt

(b) display the first 15 lines of protein.txt file

(c) display the last 15 lines of protein.txt file

(d) store the first 15 lines of protein.txt file to log.txt

SPACE FOR ROUGH WORK

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★ ★ ★