

105

QUESTION PAPER
SERIES CODE
B

Registration No. :

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Centre of Exam. : _____

Name of Candidate : _____

Signature of Invigilator

ENTRANCE EXAMINATION, 2017
M.Sc. in MOLECULAR MEDICINE
[Field of Study Code : CMMM (233)]

Time Allowed : 3 hours

Maximum Marks : 70

INSTRUCTIONS FOR CANDIDATES

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 divided into two Parts : Part—A and Part—B. Both Parts have multiple-choice questions. All answers are to be entered in the Answer Sheet provided with the Question Paper for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with BLUE/BLACK BALLPOINT PEN only against each question in the corresponding Circle.
- (iv) Part—A consists of 30 questions and **all** are compulsory.
- (v) Part—B consists of 60 questions. **Answer any 40 questions.**
In case any candidate answers more than the required 40 questions, the first 40 questions attempted will be evaluated.
- (vi) Each correct answer carries 1 mark. **There will be negative marking and ½ mark will be deducted for each wrong answer.**
- (vii) Answer written by the candidate inside the Question Paper will not be evaluated.
- (viii) Calculators and Log Tables may be used. Cell phones and other internet devices are strictly prohibited.
- (ix) Pages at the end have been provided for Rough Work.
- (x) Return the Question Paper and Answer Sheet/OMR 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
<input type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/> (d)	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input checked="" type="radio"/> (d)	<input checked="" type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>	<input type="radio"/> (a) <input type="radio"/> (b) <input type="radio"/> (c) <input type="radio"/>

- 4. Once marked, no change in the answer is allowed.
- 5. Please do not make any stray marks on the Answer Sheet.
- 6. Please do not 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.**

/105-B

PART—A

Answer **all** questions

1. $^{23}\text{Na}_{11}$ is a more stable isotope of sodium. Find out the process by which $^{24}\text{Na}_{11}$ can undergo radioactive decay.
 - (a) β^- emission
 - (b) α -emission
 - (c) β^+ emission
 - (d) Neutrino emission
2. Which intermediate is not formed in Hoffmann's bromamide reaction?
 - (a) RCON
 - (b) RNCO
 - (c) RCONBr
 - (d) RCON₃
3. A man throws an object horizontally from the window of a building. The initial speed of the object is 20 m/s and it hits the leveled ground after 2 s. If air resistance is set to zero, what was the height from which the object was thrown?
 - (a) 4.9 m
 - (b) 9.8 m
 - (c) 10 m
 - (d) 19.6 m
4. On a hot summer day, a glass of cold coffee quickly becomes warm. This is because
 - (a) entropy increases in the glass
 - (b) entropy decreases in the glass
 - (c) entropy increases outside the glass
 - (d) entropy initially increases in the glass and then decreases

5. A 3 g cube of sugar (sucrose : $C_{12}H_{22}O_{11}$) is added to a cup containing 250 ml of water at 80 °C. If the density of water at 80 °C is 0.975 g/ml, what is the molality of the sugar solution?
- (a) 0.019 mol/kg
 - (b) 0.037 mol/kg
 - (c) 0.049 mol/kg
 - (d) 0.051 mol/kg
6. Nuclear receptors belong to which class of transcription factors?
- (a) Helix-loop-helix proteins
 - (b) Helix-turn-helix proteins
 - (c) Leucine zipper proteins
 - (d) Zinc finger proteins
7. Which one of the following assay techniques is used to map DNA-protein interactions *in vivo*?
- (a) Electrophoretic mobility assay (EMSA)
 - (b) DNase footprinting assay
 - (c) ChIP assay
 - (d) Both (a) and (c)

8. The function of tRNA is
- (a) transfer of amino acid from cytoplasm to ribosome
 - (b) transfer of genetic information
 - (c) linking of amino acid
 - (d) transfer of RNA to ribosome
9. Euglena may be considered as a plant because it contains
- (a) photosynthetic pigment
 - (b) xylem
 - (c) phloem
 - (d) plant hormones
10. Which of the following are not transcribed by RNA polymerase II?
- (a) miRNA and some snRNA
 - (b) miRNA and snoRNA
 - (c) mRNA and snoRNA
 - (d) tRNA and 5S rRNA
11. Which of the following is not a chemical reaction?
- (a) Rusting of iron in the atmosphere
 - (b) Souring of milk into curd
 - (c) Emitting of light by a red-hot platinum wire
 - (d) Burning of magnesium ribbon in the air

12. Which of the following is the most basic in nature H_2O , CH_3O^- , OH^- , CH_3OH ?
- (a) OH^-
 - (b) H_2O
 - (c) CH_3O^-
 - (d) CH_3OH
13. Light-emitting diode (LED) is comprised of
- (a) gallium
 - (b) silicon
 - (c) germanium
 - (d) gallium arsenide
14. The ends of eukaryotic chromosomes, telomeres are comprised of short sequences of
- (a) guanine-rich repeats
 - (b) thymine-rich repeats
 - (c) adenine-rich repeats
 - (d) cytosine-rich repeats
15. HU protein found in bacteria helps to compact the nucleoid. It is a
- (a) histone-like protein
 - (b) helicase
 - (c) telomerase
 - (d) polymerase
16. Which of the following is not a part of probiotic formulations?
- (a) *Lactobacillus acidophilus*
 - (b) *Bifidobacterium bifidum*
 - (c) *Streptococcus thermophilus*
 - (d) None of the above

17. A bacterium is considered to be a prototroph, if it
- (a) can synthesize all necessary organic substances
 - (b) requires organic nutrients to be supplied
 - (c) requires carbon source to be added
 - (d) All of the above
18. The nuclear particles which are assumed to hold the nucleons together are
- (a) positrons
 - (b) neutrons
 - (c) electrons
 - (d) mesons
19. If the cost price is 25% of selling price, what is the profit percent?
- (a) 150%
 - (b) 200%
 - (c) 300%
 - (d) 350%
20. A is twice as good as workman as B and together they finish a piece of work in 18 days. In how many days can B alone finish the work?
- (a) 27 days
 - (b) 54 days
 - (c) 56 days
 - (d) 68 days

21. One byte equals to how many bits?
- (a) 4 bits
 - (b) 8 bits
 - (c) 12 bits
 - (d) 16 bits
22. Find the odd number out.
- 362, 482, 551, 263, 344, 284
- (a) 362
 - (b) 482
 - (c) 551
 - (d) 344
23. A person's present age is two-fifths of the age of his mother. After 8 years, he will be one-half of the age of his mother. How old is the mother at present?
- (a) 38 years
 - (b) 40 years
 - (c) 42 years
 - (d) 44 years
24. Three unbiased coins are tossed. What is the probability of getting at least 2 tails?
- (a) $1/3$
 - (b) $1/6$
 - (c) $1/2$
 - (d) $1/8$
25. The chemical used as a fixer in photography is
- (a) sodium thiosulphate
 - (b) sodium sulphate
 - (c) borax
 - (d) ammonium sulphate

26. Which of the following is used to produce artificial rain?
- (a) Copper oxide
 - (b) Carbon monoxide
 - (c) Silver iodide
 - (d) Silver nitrate
27. An artificial soft drink contains 11.0 g/L of tartaric acid $C_4H_6O_6$ and 20 g/L of its potassium salt $C_4H_5O_6K$. What is the pH of the drink? (Given : K_a , tartaric acid = 1.0×10^{-3})
- (a) 4.24
 - (b) 5.21
 - (c) 3.82
 - (d) 3.16
28. For gene probes to be useful, they must
- (a) be large enough to contain gene-specific sequences
 - (b) be labeled in some manner to allow detection
 - (c) Both (a) and (b)
 - (d) None of the above
29. Which gas does not contribute to global warming through its greenhouse effect?
- (a) Nitrous oxide
 - (b) Methane
 - (c) Carbon dioxide
 - (d) Nitric oxide
30. What is the relationship between wavelength and wave number?
- (a) Wave number = 1 / wavelength in centimeters
 - (b) Wave number - wavelength in nanometers = 1
 - (c) Wavelength in nanometers \times wave number = 1
 - (d) None of the above

PART—B

Answer *any forty* questions

31. A radioactive sample with a half-life of 30 days has the label 'Activity = 2 μCi on 1-1-2017'. What was its activity 60 days earlier?
- (a) 0.5 μCi
 - (b) 0.05 μCi
 - (c) 8 μCi
 - (d) 16 μCi
32. A bacterium divides after 35 minutes. If a culture containing 10^4 cells/mL is grown, then after 2h 55 min the cell concentration /mL will be
- (a) 17.5×10^5
 - (b) 22.5×10^4
 - (c) 5×10^5
 - (d) 3.2×10^5
33. The detergent sodium dodecyl sulphate is used in SDS PAGE. If we do not use this detergent in protein electrophoresis, then
- (a) no protein will migrate in the polyacrylamide gel
 - (b) most proteins will migrate in the polyacrylamide gel
 - (c) proteins will migrate in the opposite direction
 - (d) None of the above
34. After running an agarose gel, the ethidium bromide stained band of a 9 kb DNA fragment was isolated and ethidium bromide intercalated with the band was estimated as 50 picogram. From the same gel, a research fellow isolated a 1.8 kb DNA fragment and estimated ethidium bromide as
- (a) 50 picogram
 - (b) 10 picogram
 - (c) 250 picogram
 - (d) 25 picogram

- 35.** An open reading frame is
- (a) all nucleotides of a gene that are transcribed to mRNA
 - (b) the amino acid sequence of a polypeptide
 - (c) the region of interest of a gene to be amplified by polymerase chain reaction
 - (d) the nucleotides of a gene that make up the codons for amino acids

- 36.** Following events are involved in protein synthesis

- I. Activation of amino acid
- II. Peptide bond formation
- III. Formation of aminoacyl-tRNA complex
- IV. Binding of aminoacyl-tRNA complex with mRNA


What is the correct sequence of the above events involved in protein synthesis?

- (a) I—III—II—IV
 - (b) III—I—IV—II
 - (c) III—I—II—IV
 - (d) I—II—IV—III
- 37.** While designing primers for PCR, it is NOT important to consider
- (a) the sequence information
 - (b) T_m
 - (c) 5'-sequence
 - (d) direction of primers
- 38.** Some evidences suggest that the autophagic process in cell starts by
- (a) interaction of targeted organelle with primary lysosome
 - (b) encapsulation of targeted organelle by ER derived membranes
 - (c) engulfment of targeted organelle by plasma membrane
 - (d) None of the above

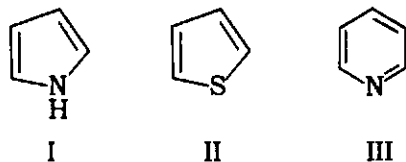
39. Specific protein molecules in cells can be localized by immunofluorescence microscopy. It is based on the principle that
- (a) the dye absorbs light of a given wavelength and then emits light of a shorter wavelength
 - (b) the dye absorbs light of a given wavelength and then emit lights of a longer wavelength
 - (c) fluorescence dye attached to the secondary antibody emit visible light continuously of a fixed wavelength
 - (d) None of the above
40. Genetic codes used by mitochondria are
- (a) same as that of all eukaryotic nuclear genes
 - (b) same as that are used by all bacteria
 - (c) different from the standard code in all prokaryotic and eukaryotic nuclear genes
 - (d) only same in mitochondria from different species
41. Interval between two successive cell divisions, once also known as resting phase, is actually a period of great biosynthetic activity and is termed as
- (a) interphase
 - (b) synthetic phase (S-phase)
 - (c) M-phase
 - (d) G2-phase
42. Which of the following is a true statement for gastrointestinal hormones?
- (a) They are either amino acids or their derivatives
 - (b) They are first released directly into the blood and then to the site of action
 - (c) They are peptide or polypeptide in nature and stimulate to secrete digestive juice
 - (d) They are also known as neurotransmitters
43. Viroids are the smallest known infectious pathogens and have a
- (a) double-stranded DNA enclosed by protein coat
 - (b) single-stranded DNA not enclosed by protein coat
 - (c) double-stranded RNA enclosed by protein coat
 - (d) single-stranded RNA not enclosed by protein coat

44. Which term defines drug and body interaction connected with processes of absorption, biotransformation, distribution and excretion?
- (a) Pharmacodynamic interaction
 - (b) Physical and chemical interactions
 - (c) Pharmaceutical interaction
 - (d) Pharmacokinetic interaction

45. 2-phenyl ethanol may be prepared by the reaction of PhMgBr with

- (a) HCHO
- (b) CH₃CHO
- (c) CH₃COCH₃
- (d) 

46. The decreasing order of the reactivity of the following compounds towards electrophiles is



- (a) II > I > III
 - (b) II > III > I
 - (c) III > I > II
 - (d) I > II > III
47. The lac operon contains the *z*, *y* and structural genes
- (a) encoding p-galactosidase, galactose permeases and thiogalactosidase transacetylase respectively
 - (b) encoding p-galactosidase and galactose permeases
 - (c) encoding p-galactosidase only
 - (d) None of the above

48. A diet rich in butter, red meat and eggs for a long period may result in
- (a) kidney stones
 - (b) urine with ketone bodies
 - (c) weaker blood vessel
 - (d) hypercholesterolemia
49. What will happen if a gene encoding 50 amino acid residues is mutated in such a way that a UAA codon is generated after 72 bps?
- (a) A polypeptide of 49 amino acid residues will be generated
 - (b) A polypeptide of 25 amino acid residues will be generated
 - (c) A polypeptide of 24 amino acid residues will be generated
 - (d) No polypeptide will be generated
50. Other than AUG, occasionally in eukaryotes, CUG can be used for alternate initiation start site that codes for
- (a) leucine
 - (b) isoleucine
 - (c) valine
 - (d) serine
51. The most important constituent of plant cell wall, cellulose is made up of
- (a) branched chain of glucose molecules linked by alpha 1, 6 glycosidic bond at the site of branching
 - (b) unbranched chain of glucose molecules linked by beta 1, 4 glycosidic bond
 - (c) unbranched chain of glucose molecules linked by alpha 1, 4 glycosidic bond
 - (d) branched chain of glucose molecules linked by beta 1, 4 glycosidic bond at the site of branching

- 52.** The common feature among silver fish, scorpion crab and honeybee is
- (a) compound eyes
 - (b) jointed appendages
 - (c) poison glands
 - (d) metamorphosis
- 53.** The genetic disorder in Down's syndrome is characterized by an extra copy of chromosome
- (a) 20
 - (b) 21
 - (c) 22
 - (d) XX
- 54.** Which of the following properties cannot be used to separate proteins?
- (a) Solubility of the protein
 - (b) Viscosity of the protein
 - (c) Charge of the protein
 - (d) Binding affinity of the protein
- 55.** Which of the following sequences can produce a stem and loop structure?
- (a) Palindromic sequence
 - (b) Interrupted inverted repeat sequences
 - (c) Direct repeat sequences
 - (d) None of the above
- 56.** Which of the following gram-positive bacteria causes pharyngitis (sore throat)?
- (a) Neisseria
 - (b) Streptococcus
 - (c) Staphylococcus
 - (d) Mycobacterium

- 57.** The identification of bacteria by serologic tests is based on the presence of specific antigens. Which of the following bacterial components is least likely to contain useful antigens?
- (a) Ribosomes
 - (b) Cell wall
 - (c) Capsule
 - (d) Flagella
- 58.** Adaptive transfer of acquired immune responsiveness involves the transfer of
- (a) antibody
 - (b) complement
 - (c) phagocytes
 - (d) lymphocytes
- 59.** Opsonization refers to
- (a) adherence to mucosal epithelial cells
 - (b) antibody mediated viral inactivation
 - (c) coating of microorganisms or other particles by antibody and/or complement
 - (d) parasitic lysosomal degranulation
- 60.** Which type of antibody is most effective in activating complement?
- (a) IgG1
 - (b) IgG2
 - (c) IgG3
 - (d) IgM
- 61.** Which of the following substances will not stimulate an immune response unless they are bound to a larger molecule?
- (a) Antigen
 - (b) Virus
 - (c) Hapten
 - (d) Miligen

- 62.** Most soil protozoa are flagellates or amoebas which have their dominant source of nitrogen as
- (a) ingestion of bacteria
 - (b) ingestion of virus
 - (c) ingestion of fungi
 - (d) soil particles
- 63.** The heat energy produced when the human body metabolises 1 gram of fat is
- (a) 30 kJ
 - (b) 1 kJ
 - (c) 39 kJ
 - (d) 29 kJ
- 64.** Which graphical method is used to determine X degree of cooperativity in an enzymatic reaction?
- (a) Hill plot
 - (b) Koshland curve
 - (c) Michaelis-Menten hyperbola
 - (d) Sigma plot
- 65.** Movement of genes from one population to another is called
- (a) gene transfer
 - (b) genetic drift
 - (c) genetic movement
 - (d) gene flow/migration
- 66.** The letters 'RYAN' will stand for the amino acid residues
- (a) arginine, tyrosine, alanine and asparagine respectively
 - (b) arginine, tryptophan, asparagine and alanine respectively
 - (c) arginine, glycine, aspartate and alanine respectively
 - (d) aspartate, tryptophan, alanine and arginine respectively

67. Eicosanoic acid is a saturated fatty acid that has
- (a) one carbon-carbon double bond
 - (b) two carbon-carbon double bonds
 - (c) three carbon-carbon double bonds
 - (d) no carbon-carbon double bond
68. Saline drip is given to patients suffering from cholera because
- (a) Na^+ ions help in the retention of water in the body tissues
 - (b) NaCl is an important component of energy supply
 - (c) Na^+ ions help in stopping nerve impulses and sensation of pain
 - (d) NaCl supplies fuel required for cellular activity
69. A batch of *E. coli* bacteria about to replicate was transferred to a medium containing radioactive thymidine for five minutes, followed by transfer to the normal medium. Which of the following statements will be correct?
- (a) Both the DNA strands will be radioactive
 - (b) Each DNA strand will be half-radioactive
 - (c) One strand will be radioactive
 - (d) None is radioactive
70. Mitochondria and chloroplast perform diverse functions. They
- (a) import proteins exclusively from the nuclear encoded genes
 - (b) encode their organeller proteins
 - (c) import proteins from the nucleus as well as encode their own proteins
 - (d) do not encode their proteins
71. Biological membranes are valuable because they
- (a) separate the aqueous interior of the cell from its environment
 - (b) segregate intracellular events from one another
 - (c) store entrapped energy
 - (d) All of the above

- 72.** You have raised antibodies against a protein 'A' from *E. coli* in rabbit for your study. What kind of secondary antibodies will you need for Western blotting?
- (a) An antibody raised against a different *E. coli* protein in rabbit
 - (b) An antibody raised against a different *E. coli* protein in mice
 - (c) An antibody raised against IgG of rabbit in goat or other animal
 - (d) An antibody raised against IgG of mice in goat or other animal
- 73.** Natural rubber is a polymer derived from
- (a) ethylene
 - (b) propylene
 - (c) isoprene
 - (d) butadiene
- 74.** Which of the following signaling molecules enters the cell to initiate its action?
- (a) Transferrin
 - (b) Insulin
 - (c) Glucagon
 - (d) Thyroxine
- 75.** Which one of the following neurotransmitters is secreted by the pre-ganglionic neurons of sympathetic nervous system?
- (a) Epinephrine
 - (b) Acetylcholine
 - (c) Dopamine
 - (d) Norepinephrine
- 76.** When the amino acid alanine (R-group is CH_3) is added to a solution with a pH of 7.3, alanine becomes
- (a) a cation
 - (b) non-polar
 - (c) a zwitterion
 - (d) an isotope

- 77.** The peptide, Val-Lys-Glu-Met-Ser-Trp-Arg-Ala, was digested with cyanogen bromide (CNBr) to produce
- (a) Val-Lys + Glu-Met-Ser + Trp-Arg-Ala
 - (b) Val-Lys - Glu-Met-Ser-Trp + Arg-Ala
 - (c) Val-Lys-Glu-Met. + Ser-Trp-Arg-Ala
 - (d) Val-Lys-Glu + Met-Ser-Trp-Arg-Ala
- 78.** Malate-aspartate shuttle operates in
- (a) lungs and liver
 - (b) heart and liver
 - (c) pancreas and liver
 - (d) None of the above
- 79.** The DNA of a deletion mutant of a lambda bacteriophage has a length of 15 micrometer instead of 17 micrometer. How many base pairs are missing from this mutant? (Hint : 1 bp of DNA = 340 Angstroms)
- (a) 20000 bp
 - (b) 5880 bp
 - (c) 680000 bp
 - (d) 588 bp
- 80.** Reverse transcriptase which is found in retroviruses is a type of
- (a) DNA polymerase
 - (b) RNA polymerase
 - (c) nuclease
 - (d) protease
- 81.** DNA length associated with a protein can be determined by
- (a) SDS
 - (b) DNA printing
 - (c) DNA footprinting
 - (d) DNA fingerprinting

82. Match the membrane channels and pumps with their open/close mechanism :

- | | |
|------------------------------------|-----------------------------|
| A. Acetylcholine receptor | 1. Action potential/voltage |
| B. Sodium channel | 2. Ionic gradient |
| C. $\text{Na}^+ - \text{K}^+$ pump | 3. Ligand-gated |
| D. Na-Ca exchanger | 4. ATP-dependent |

- (a) A—1, C—2, B—3, D—4
(b) C—1, A—2, D—3, B—4
(c) D—1, C—2, A—3, B—4
(d) C—1, D—2, B—3, A—4

83. Which of the following features of enzymes is always true?

- (a) All enzymes are proteins
(b) Enzymes decrease the free energy of activation of reactions
(c) Enzymes are not highly specific to their substrates and reactions
(d) Enzymes alter reaction equilibrium

84. Biochemically, starvation of body is characterized by

- (a) shifting the fuel being used from glucose to fatty acids and ketone bodies
(b) reduction in haemoglobin levels in the body
(c) decreased secretion of glucagon
(d) All of the above

85. The following is the ascending order representation of the number of disulfide bonds in one's hair type

- (a) curly > wavy > straight
(b) straight > wavy > curly
(c) wavy > curly > straight
(d) wavy > straight > curly

- 86.** DNA polymerase activity does not require
- (a) a template
 - (b) ADP
 - (c) Mg^{2+}
 - (d) dATP, dCTP, dGTP and dTTP
- 87.** Which amino acid can stabilize protein structures by forming covalent cross-links between polypeptide chains?
- (a) Met
 - (b) Cys
 - (c) Ser
 - (d) Gly
- 88.** The approximate mass of a polypeptide of 400 amino acid residues will be
- (a) 11000 daltons
 - (b) 44000 daltons
 - (c) 22000 daltons
 - (d) 88000 daltons
- 89.** Which of the following statements about prokaryotic translation is correct?
- (a) Peptide bond formation is an exogenic reaction
 - (b) The protein grows in the amino-to-carboxyl direction
 - (c) Translation converts a single-stranded DNA into an amino acid sequence
 - (d) ATP hydrolysis powers the movement of peptidyl-tRNA on the ribosome
- 90.** A proton in a cyclotron changes its velocity from 30 km/s east to 45 km/s south in 20 s. What is the magnitude of average acceleration during this time?
- (a) 0.5 km/s^2
 - (b) 1.5 km/s^2
 - (c) 2.5 km/s^2
 - (d) 3.5 km/s^2

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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