GENERAL APTITUDE

Q.No.1- 5 Carry One Mark Each

1. Choose the most appropriate word or phrase from the options given below to complete the following sentence.

The environmentalists hope _____ the lake to its pristine condition.

(A) in restoring   (B) in the restoration of

(C) to restore   (D) restoring

Answer: (C)

----

2. Choose the word from the options given below that is most nearly opposite in meaning to the given word:

Polemical

(A) imitative   (B) conciliatory   (C) truthful   (D) ideological

Answer: (B)

----

3. Choose the most appropriate word from the options given below to complete the following sentence.

Despite the mixture's _____ nature, we found that by lowering its temperature in the laboratory we could dramatically reduce its tendency to vaporize.

(A) acerbic   (B) resilient   (C) volatile   (D) heterogeneous

Answer: (C)

----

4. If m students require a total of m pages of stationery in m days, then 100 students will require 100 pages of stationery in

(A) 100 days   (B) m/100 days   (C) 100/m days   (D) m days

Answer: (D)

5.   Choose the most appropriate words from the options given below to complete the following sentence.

Because she had a reputation for _____ we were surprised and pleased when she greeted us so _____.

(A) insolence …… irately   (B) insouciance …… curtly

(C) graciousness …… amiably   (D) querulousness …… affably

Answer: (D)

Q.No. 6- 10 Carry Two Marks Each

6.   The number of solutions for the following system of inequalities is

$$X_1 \geq 0$$
$$X_2 \geq 0$$
$$X_1 + X_2 \leq 10$$
$$2X_1 + 2X_2 \geq 22$$

(A) 0   (B) infinite   (C) 1   (D) 2

Answer: (A)

---

7.   In a class of 300 students in an M.Tech programme, each student is required to take at least one subject from the following three:

M600: Advanced Engineering Mathematics

C600: Computational Methods for Engineers

E600: Experimental Techniques for Engineers

The registration data for the M.Tech class shows that 100 students have taken M600, 200 students have taken C600, and 60 students have taken E600. What is the maximum possible number of students in the class who have taken all the above three subjects?

(A) 20   (B) 30   (C) 40   (D) 50

Answer: (B)

8. Three sisters (R, S, and T) received a total of 24 toys during Christmas. The toys were initially divided among them in a certain proportion. Subsequently, R gave some toys to S which doubled the share of S. Then S in turn gave some of her toys to T, which doubled T's share. Next, some of T's toys were given to R, which doubled the number of toys that R currently had. As a result of all such exchanges, the three sisters were left with equal number of toys. How many toys did R have originally?

(A) 8   (B) 9   (C) 11   (D) 12

Answer: **(C)**

- -

9. The quality of services delivered by a company consists of six factors as shown below in the radar diagram. The dots in the figure indicate the score for each factor on a scale of 0 to 10. The standardized coefficient for each factor is given in the parentheses. The contribution of each factor to the overall service quality is directly proportional to the factor score and its standardized coefficient.
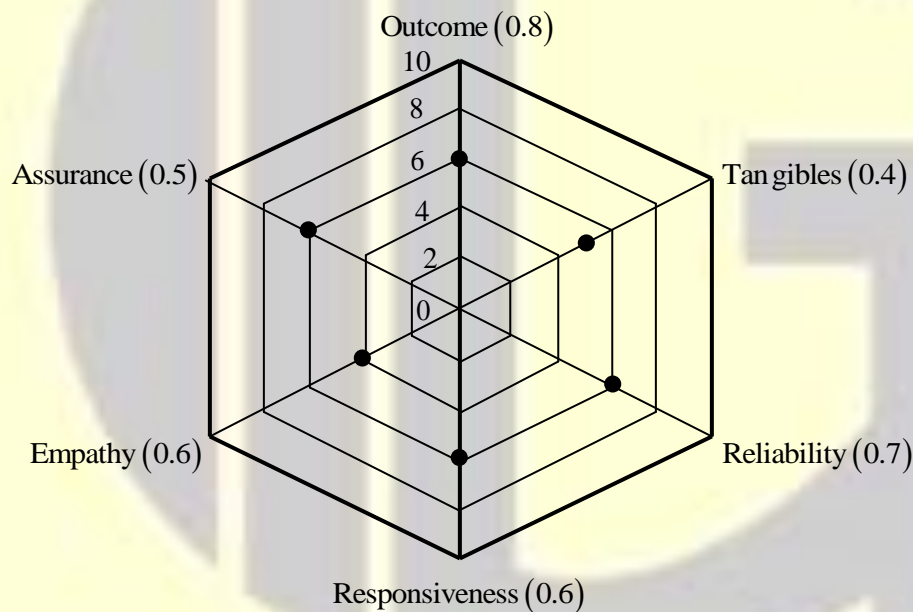
The lowest contribution among all the above factors to the overall quality of services delivered by the company is

(A) 10%   (B) 20%   (C) 24%   (D) 40%

Answer: **(A)**

10. In order to develop to full potential, a baby needs to be physically able to respond to the environment.

It can be inferred from the passage that

(A) Full physical potential is needed in order for a baby to be able to respond to the environment.

(B) It is necessary for a baby to be able to physically respond to the environment for it to develop its full potential.

(C) Response to the environment of physically able babies needs to be developed to its full potential.

(D) A physically able baby needs to develop its full potential in order to respond to its environment.

Answer: **(B)**

BIOTECHNOLOGY ENGINEERING

Q.No. 1- 25 Carry One Mark Each

1. Embryonic stem cells are derived from

(A) Fertilized embryo   (B) Unfertilized embryo

(C) Sperm   (D) Kidney

Answer: **(A)**

----

2. Members of the antibody protein family that have common structural features are collectively known

(A) Haptens   (B) Allergens

(C) Antigens   (D) Immunoglobulins

Answer: **(D)**

----

3. Apoptosis is characterized by

(A) Necrosis   (B) Programmed cell death

(C) Membrane leaky syndrome   (D) Cell cycle arrest process

Answer: **(B)**

----

4. Yeast artificial chromosomes (YAC's) are used for cloning

(A) Large segments of DNA   (B) mRNA

(C) Bacterial DNA   (D) Yeast DNA

Answer: **(A)**

5.   The product commercially produced by animal cell culture is

(A) Insulin   (B) Tissue plasminogen activator

(C) Interferon   (D) Hepatitis B vaccine

Answer: (B)

----

6.   An alternative to glycolysis pathway is

(A) Glyoxylate pathway   (B) Pentose phosphate pathway

(C) Citric acid cycle   (D) Gluconeogenesis

Answer: (D)

----

7.   A cell in G_1 of interphase has 12 chromosomes. How many chromatids will be found per cell during metaphase II of meiosis?

(A) 6   (B) 12   (C) 18   (D) 24

Answer: (B)

----

8.   Diploid Drosophila has eight chromosomes. Which one of the following terms should NOT be used to describe Drosophila with sixteen numbers of chromosomes?

(A) Polyploid   (B) Aneuploid   (C) Euploid   (D) Tetraploid

Answer: (B)

----

9.   Hydrated synthetic seeds which are produced by ion exchange reaction involve mixing the somatic embryos in a solution of

(A) Sodium alginate and dropping it in a solution of calcium nitrate

(B) Calcium alginate and dropping it in a solution of sodium nitrate

(C) Calcium alginate and dropping it in a solution of ammonium nitrate

(D) Mannitol and dropping it in a solution of sodium nitrate

Answer: (A)

10. Shoot organogenesis by tissue culture results into

(A) A bipolar structure that has no vascular connection with the explant

(B) A monopolar structure that has a strong connection with the pre-existing vascular tissue of the explant

(C) A monopolar structure that has no vascular connection with the explant

(D) A bipolar structure that has a strong connection with the pre-existing vascular tissue

Answer: **(D)**

----

11. 'Hairy roots' induced in vitro by the infection of Agrobacterium rhizogenes, are characterized by

P. A high degree of lateral branching

Q. Genetic instability of culture

R. An absence of geotropism

S. Poor biomass production

(A) P and R only   (B) P and Q only   (C) Q and R only   (D) R and S only

Answer: **(B)**

----

12. In balanced growth phase of a cell

P. All components of a cell grow at the same rate.

Q. Specific growth determined by cell number or cell mass would be the same

R. The growth rate is independent of substrate concentration

S. The growth rate decreases with decreasing substrate concentration

(A) P, Q and S only   (B) Q, R and S only   (C) P, Q and R only   (D) P only

Answer: **(B)**

----

13. In N-linked glycosylation, the oligosaccharide chain is attached to protein by

(A) Asparagine   (B) Arginine   (C) Serine   (D) Threonine

Answer: **(A)**

----

14. Restriction endonucleases which recognize and cut same recognition sequences are known as

(A) Isoschizomers

(B) Isozyme

(C) Isoaccepting endonucleases

(D) Abzymes

Answer: **(A)**

----

15. Substrate consumption in lag phase of microbial growth in primarily used for

P. Turn over of the cell material

Q. Maintenance of intracellular pH

R. Motility

S. Increase in cell number

(A) P, Q and S Only

(B) Q, R, and S only

(C) P, Q and R only

(D) S only

Answer: **(C)**

----

16. Washout (as defined by $D = \mu_{max}$) of a continuous stirred tank fermenter is characterized by (X=biomass, S=substrate concentration in bioreactor, S_0=substrate concentration in feed, P=product concentration in bioreactor)

(A) X=0; S=0; P=0

(B) X=0; S=S_0; P=0

(C) X=0; S<0; P=0

(D) X<0; S<0; P<0

Answer: **(B)**

----

17. The study of evolutionary relationships is known as

(A) Genomics

(B) Proteomics

(C) Phylogenetics

(D) Genetics

Answer: **(C)**

18. The lipopolysaccharides present in bacterial cell wall has lipid A which is connected to

(A) O-polysaccharide

(B) Core polysaccharide

(C) Both with O-polysaccharide and core polysaccharide

(D) Rhamnose-mannose disaccharide

Answer: **(B)**

---

19. Molecular chaperones are class of proteins that facilitate

(A) The proper folding of newly synthesized proteins

(B) Unfolding of newly synthesized proteins

(C) Degradation of newly synthesized proteins

(D) Targeting of newly synthesized proteins

Answer: **(A)**

---

20. Gas vacuoles are present in

(A) Anabaena flos-aquae   (B) Bacillus subtilis

(C) Acanthurus nigrofuscus   (D) Mycobacterium tuberculosis

Answer: **(A)**

---

21. In ABO blood group system, antigenic determinants are

(A) Nucleic acid   (B) Carbohydrate   (C) Lipid   (D) Protein

Answer: **(B)**

---

22. The most widely used program for multiple sequence alignment is

(A) BLAST   (B) FASTA   (C) CLUSTAL   (D) Chime

Answer: **(C)**

---

23. Diphtheria toxin, tetracycline and streptomycin inhibit

(A) DNA repair   (B) DNA replication   (C) Transcription   (D) Translation

Answer: (D)

---

24. The polymorphic domains for Class II MHC proteins are

(A) α_1 and β_2 domains only   (B) β_1 and α_2 domains only

(C) α_1 and β_1 domains only   (D) α_2 and β_2 domains only

Answer: (C)

---

25. The protein in eukaryotes which is subjected to degradation undergoes

(A) Phosphorylation   (B) Carboxylation

(C) Ubiquitination   (D) Methylation

Answer: (C)

Q. No. 26 – 55 Carry Two Marks Each

26. Match the viruses in Group I with their host cell receptors in Group II

	Group I		**Group II**
P	Hepatitis A virus	**1**	Heparan sulphate
Q	Human immunodeficiency virus	**2**	Acetylcholine receptor
R	Rabies virus	**3**	CD4 protein
S	Herpes simplex virus type-I	**4**	Alpha-2 macroglobulin

(A) P-1; Q-3; R-2; S-4   (B) P-3; Q-4; R-1; S-2

(C) P-4; Q-3; R-2; S-1   (D) P-2; Q-3; R-1; S-4

Answer: (C)

---

27. Match the microbial growth characteristics in Group I with the corresponding features in Group II

	Group I		Group II
P	Growth associated product formation	**1**	Specific growth rate decreases with increasing product concentration.
Q	Non growth associated product formation	**2**	Specific product formation rate is constant.
R	Product inhibition	**3**	Specific product formation rate is proportional to specific growth rate
S	Substrate inhibition	**4**	Specific growth rate decreases with increasing substrate concentration.

(A) P-1; Q-2; R-4; S-3   (B) P-3; Q-2; R-1; S-4

(C) P-2; Q-1; R-3; S-4   (D) P-2; Q-3; R-4; S-1

Answer: (B)

----

28. Match the items in Group I with Group II

	Group I		Group II
P	Circular dichroism	**1**	Concentration
Q	X-ray crystallography	**2**	Sedimentation coefficient
R	Freeze-drying	**3**	Secondary structure determination
S	Ultracentrifugation	**4**	Tertiary structure determination

(A) P-4; Q-1; R-2; S-3   (B) P-1; Q-4; R-3; S-2

(C) P-2; Q-3; R-4; S-1   (D) P-3; Q-4; R-1; S-2

Answer: (D)

29.   Match the products in Group I with their respective organisms in Group II

	Group I		**Group II**
P	Glycerol	**1**	Corynebacterium glutamicum
Q	Glutamic acid	**2**	Alcaligenes faecalis
R	Curdlan	**3**	Dunaliella salina
S	Amphotericin B	**4**	Streptomyces nodosus

(A) P-2; Q-1; R-3; S-4   (B) P-4; Q-2; R-1; S-3

(C) P-3; Q-1; R-2; S-4   (D) P-2; Q-1; R-4; S-3

Answer: (C)

----

30.   Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: I_gM is found in serum as a pentameric protein consisting of five I_gM monomers.

Reason: The pentameric form of I_gM is due to cross-linking of I_gM monomers via peptide bond.

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

Answer: (C)

----

31.   Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: N-methyl-N-nitro-N-nitrosoguanidine (NTG) is an effective chemical mutagen.

Reason: Mutations induced by NTG mainly are the GC $\rightarrow$ AT transitions

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

Answer: (A)

32.   Determine the correctness of the following statements:

I: Enhancer sequences are those DNA sequences that are involved in increasing the rate of   DNA replication.

II: Enhancer sequences work by binding with eukaryotic gene activator factors.

(A) Only I is true   (B) Only II is true

(C) Both I and II are true   (D) Both I and II are false

Answer: **(B)**

----

33.   In a well aerated and agitated microbial culture, the 'supply' of oxygen is equal to demand (uptake) of the growing culture. The $K_L a$ for such a system will be

$K_L a$ = volumetric mass transfer coefficient

C^* = dissolved oxygen concentration in liquid in equilibrium with gaseous oxygen

C = instantaneous value of dissolved oxygen concentration.

r = specific oxygen uptake rate per unit weight of cells

X = dry weight of the cells per unit volume

(A) $(rX)/(C^*-C)$ (B) $(r)/X(C^*-C)$

(C) $(C^*-C)/(rX)$ (D) $(X)/r(C^*-C)$

Answer: **(A)**

----

34.   Structured William's model

P.   Can describe the changes in intracellular components of the cell during growth

Q.   Cannot describe the death phase of the cells

R.   Can describe the variation of size of cells in different phases of growth

S.   Cannot describe the lag period of growth

Which one of the following is CORRECT?

(A) P, Q, and S only   (B) P, Q and R only

(C) Q, R and S only   (D) P, R and S only

Answer: **(B)**

35. Match items in Group I with Group II

	Group I		**Group II**
P	Glycolytic pathway	**1**	Chloroplast
Q	Eukaryotic oxidative metabolism	**2**	Glyoxysomes
R	Glyoxylate cycle	**3**	Mitochondria
S	Calvin cycle	**4**	Cytosol

(A) P-1; Q-2; R-3; S-4   (B) P-2; Q-3; R-4; S-1

(C) P-4; Q-3; R-2; S-1   (D) P-3; Q-4; R-1; S-2

Answer: **(C)**

----

36. Match items in Group I with Group II

	Group I		Group II
P	Alzheimer's disease	**1**	H1N1
Q	Mad cow disease	**2**	Hemoglobin
R	Sickle cell anaemia	**3**	Prions
S	Swine flu	**4**	Amyloid

(A) P-4; Q-3; R-2; S-1   (B) P-3; Q-4; R-1; S-2

(C) P-2; Q-1; R-4; S-3   (D) P-1; Q-2; R-3; S-4

Answer: **(A)**

----

37. Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: The elucidation of ribosome structure helps in the development of new generation drugs.

Reason: The high resolution of macromolecular structure has enabled in structure-based drug esign.

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

Answer: **(A)**

38. Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: A very low amount of inhibitor can act as an activator for allosteric enzymes.

Reason: Allosteric enzymes follow Michaelis-Menten kinetics

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

39. Match the terms in Group I with Group II

	Group I		**Group II**
P	Shine-Dalgarno sequences	**1**	Aminoacylation of tRNA
Q	Leucine zipper	**2**	Gene silencing
R	Aminoacyl tRNA synthetase	**3**	Ribosome binding and facilitation of translation initiation
S	RNA interference (RNAi)	**4**	Transcription factors

(A) P-3; Q-4; R-1; S-2   (B) P-4; Q-3; R-2; S-1

(C) P-2;Q-3;R-1;S-4   (D) P-3;Q-2;R-4;S-1

Answer: **(A)**

- -

40. Protein-protein interactions are studied by

P. DNA foot printing

Q. Yeast two hybrid system

R. Ligase chain reaction

S. Mass spectrometry

(A) P and S only   (B) Q and S only

(C) P and R only   (D) Q and R only

Answer: **(B)**

- -

41. Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: Isopropylthiogalactoside (IPTG) is a gratuitous inducer of lactose operon.

Reason: Gratuitous inducers are chemical analogs which behave like natural inducer but they do not serve as substrate for the enzymes that are subsequently synthesized.

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

Answer: (A)

---

42. Determine the correctness or otherwise of the following Assertion (a) and the Reason (r).

Assertion: In synchronous culture, majority of the cells move to next phase of the cell cycle simultaneously.

Reason: Synchronous culture could be obtained by starving cells for essential nutrient components.

(A) Both (a) and (r) are true and (r) is the correct reason for (a)

(B) Both (a) and (r) are true but (r) is not the correct reason for (a)

(C) (a) is true but (r) is false

(D) (a) is false but (r) is true

Answer: (B)

---

43. Which of the following characteristics with respect to bacterial DNA polymerase III are TRUE?

P. Initiation of chain synthesis

Q. 5'-3' polymerization

R. 3'-5' exonuclease activity

S. 5'-3' exonuclease activity

(A) P and Q only   (B) Q and R only   (C) Q and S only   (D) P and S only

Answer: (C)

44.   Maximum specific growth rate $\left(\mu_{max}\right)$ of a microorganism is calculated by taking the
        ($ln = \log_e$; X=biomass; t=time)

        (A) Slope of ln X vs. t of the growth cycle

        (B) Slope of ln X vs. t during the exponential growth phase

        (C) Slope of X vs. t

        (D) Slope of X vs. t during the exponential phase of growth

Answer: (B)

---

45.   Identify the CORRECT statements

        P. 5' and 3' ends of the transcripts can be mapped by utilizing polymerase chain reaction

        Q. S_1 nuclease can cleave the DNA strand of a DNA-RNA hybrid

        R. T_4 polynucleotide kinase is used for labeling 3' end of DNA

        S. Baculovirus (Autographa californica) can be used as an insect expression vector

        (A) P and Q only   (B) R and S only   (C) P and S only   (D) Q and R only

Answer: (C)

---

46.   Value of determinant mentioned below is

$$\begin{vmatrix} 1 & 0 & -1 & 0 \\ 4 & 7 & 0 & 2 \\ 1 & 1 & -1 & 1 \\ 2 & 0 & 2 & 1 \end{vmatrix}$$

        (A) 24   (B) −30   (C) −24   (D) −10

Answer: (C)

---

47. HAT (hypoxanthine, aminopterin and thymidine) is used for selecting the hybridomas based on the following

I. Only hybridoma will grow since it inherited the HGPRT genes from B-cells and can synthesize DNA from hypoxanthine.

II. Myeloma cells will not grow in cultures since de novo synthesis is blocked by aminopterin and due to the lack of HGPRT enzyme

(A) Only I is true   (B) Only II is true

(C) Both I and II are true   (D) I is true and II is false

Answer: **(C)**

Common Data Questions: 48 & 49

Red green colour blindness is inherited as a recessive X-linked trait

48. What will be the probability of having the colour-blind son to a woman with phenotypically normal parents and a colour-blind brother, and married to a normal man? (Assume that she has no previous children)

(A) 100%   (B) 50%   (C) 25%   (D) 12.5%

Answer: **(C)**

---

49. What will be the probability of having the colour-blind daughter to a phenotypically normal woman, who already had one colour-blind son, and is married to a colour-blind man?

(A) 75%   (B) 50%   (C) 25%   (D) 15%

Answer: **(B)**

Common Data Questions: 50 & 51

A microorganism grows in a continuous chemostat culture of $60m^3$ working volume with sucrose as the growth limiting nutrient at dilution rate, $D=0.55h^{-1}$. The steady state biomass concentration is 4.5kg dry biomass m^{-3} and the residual sucrose concentration is 2.0kg m^{-3}. The sucrose concentration in the incoming feed medium is 10.0Kg m^{-3}.

50. What would be the yield $Y_{X/S}$ $(Kg\ biomass\ /\ Kg\ substrate)$?

(A) 0.562   (B) 0.462   (C) 0.362   (D) 0.162

Answer: (A)

- -

51. What would be the sucrose concentration in the input feed for the output to be 45kg biomass h^{-1}?

(A) 3.225 kgm^{-3} (B) 4.425 kgm^{-3} (C) 5.115 kgm^{-3} (D) 6.525 kgm^{-3}

Answer: (B)

- -

Statement for Linked Answer Questions: 52 & 53

The abdomen length (in millimeters) was measured in 15 male fruit flies, and the following data were obtained: 1.9, 2.4, 2.1, 2.0, 2.2, 2.4, 1.7, 1.8, 2.0, 2.0, 2.3, 2.1, 1.6, 2.3 and 2.2.

52. Variance (V_X) for this population of fruit flies as calculated from the above data shall be

(A) 0.85   (B) 0.25   (C) 0.061   (D) 0.08

Answer: (C)

- -

53. The value of standard deviation (SD) will be

(A) 0.061   (B) 0.25   (C) 0.61   (D) 0.85

Answer: (B)

- -

Statement for Linked Answer Questions: 54 & 55

A $200\,\mu l$ of polymerase chain reaction has 100 template DNA molecules and the reaction was performed for 10 cycles.

54. How many molecules of amplicons will be generated?

(A) 1.024×10^4 (B) 1.024×10^5 (C) 2.048×10^4 (D) 2.048×10^5

Answer: **(B)**

- -

55. How many molecules amplicons will be present in $0.1\mu l$ of reaction?

(A) 102.4   (B) 1024   (C) 51.2   (D) 512

Answer: **(C)**