Q. 1 – Q. 5 carry one mark each.

Q.1   The chairman requested the aggrieved shareholders to _____ him.

   (A) bare with   (B) bore with   (C) bear with   (D) bare

Q.2   Identify the correct spelling out of the given options:

   (A) Managable   (B) Manageable   (C) Mangaeble   (D) Managible

Q.3   Pick the odd one out in the following:

   13, 23, 33, 43, 53

   (A) 23   (B) 33   (C) 43   (D) 53

Q.4   R2D2 is a robot. R2D2 can repair aeroplanes. No other robot can repair aeroplanes.

   Which of the following can be logically inferred from the above statements?

   (A) R2D2 is a robot which can only repair aeroplanes.

   (B) R2D2 is the only robot which can repair aeroplanes.

   (C) R2D2 is a robot which can repair only aeroplanes.

   (D) Only R2D2 is a robot.

Q.5   If $|9y-6| = 3$, then $y^2 - 4y/3$ is _____.

   (A) 0   (B) +1/3   (C) −1/3   (D) undefined

Q. 6 – Q. 10 carry two marks each.

Q.6 The following graph represents the installed capacity for cement production (in tonnes) and the actual production (in tonnes) of nine cement plants of a cement company. Capacity utilization of a plant is defined as ratio of actual production of cement to installed capacity. A plant with installed capacity of at least 200 tonnes is called a large plant and a plant with lesser capacity is called a small plant. The difference between total production of large plants and small plants, in tonnes is _____.
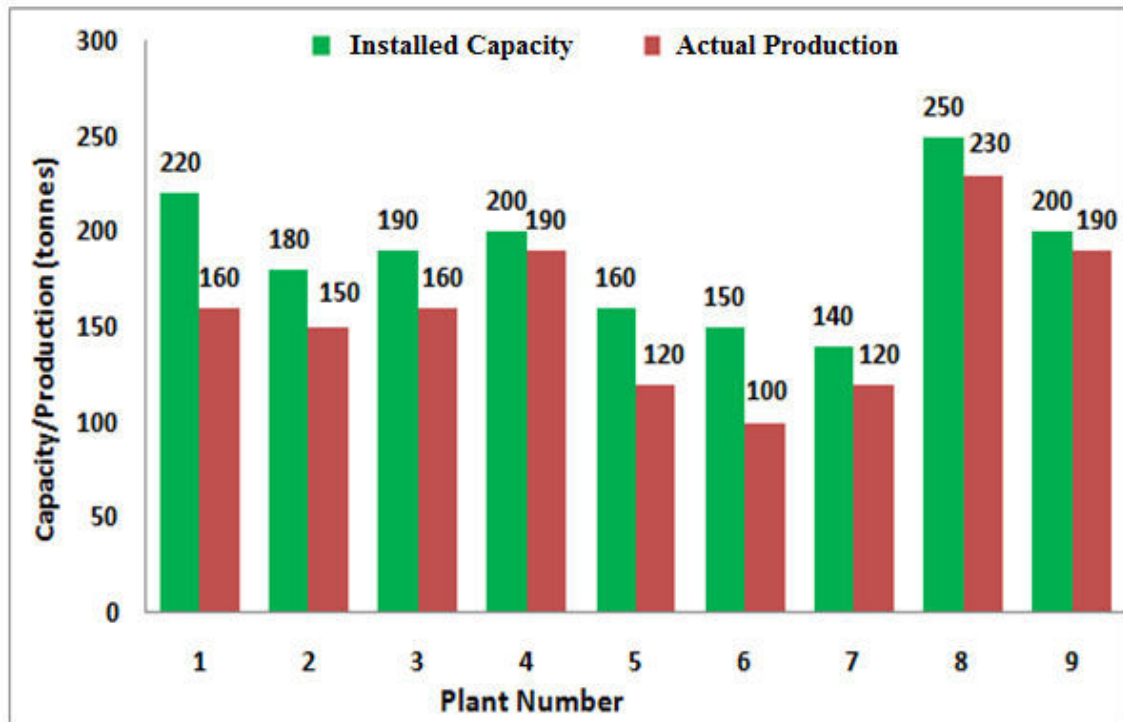
Q.7 A poll of students appearing for masters in engineering indicated that 60 % of the students believed that mechanical engineering is a profession unsuitable for women. A research study on women with masters or higher degrees in mechanical engineering found that 99 % of such women were successful in their professions.

Which of the following can be logically inferred from the above paragraph?

(A) Many students have misconceptions regarding various engineering disciplines.

(B) Men with advanced degrees in mechanical engineering believe women are well suited to be mechanical engineers.

(C) Mechanical engineering is a profession well suited for women with masters or higher degrees in mechanical engineering.

(D) The number of women pursuing higher degrees in mechanical engineering is small.

Q.8   Sourya committee had proposed the establishment of Sourya Institutes of Technology (SITs) in line with Indian Institutes of Technology (IITs) to cater to the technological and industrial needs of a developing country.

Which of the following can be logically inferred from the above sentence?

Based on the proposal,
   (i)   In the initial years, SIT students will get degrees from IIT.
   (ii)   SITs will have a distinct national objective.
   (iii)   SIT like institutions can only be established in consultation with IIT.
   (iv)   SITs will serve technological needs of a developing country.

(A) (iii) and (iv) only.   (B) (i) and (iv) only.

(C) (ii) and (iv) only.   (D) (ii) and (iii) only.

Q.9   Shaquille O' Neal is a 60% career free throw shooter, meaning that he successfully makes 60 free throws out of 100 attempts on average. What is the probability that he will successfully make <u>exactly</u> 6 free throws in 10 attempts?

(A) 0.2508   (B) 0.2816   (C) 0.2934   (D) 0.6000

Q.10   The numeral in the units position of $211^{870} + 146^{127} \times 3^{424}$ is _____.

END OF THE QUESTION PAPER

XL-K: MICROBIOLOGY

Q. 1 – Q. 10 carry one mark each.

Q.1   Which one of the following is the most appropriate technique to determine the relatedness of two bacterial species?

(A) DNA hybridization   (B) Doubling time measurement
(C) Biochemical characterization   (D) Plasmid profiling

Q.2   Which one of the following phages undergoes non-integrative lysogenic phase?

(A) λ   (B) P1   (C) T7   (D) M13

Q.3   Which one of the following is **NOT** a part of human microbiome?

(A) *Propionibacterium acnes*   (B) *Lactobacillus casei*
(C) *Streptococcus suis*   (D) *Bacteroides fragilis*

Q.4   Resident macrophages of _____ are called Kupffer cells.

(A) brain   (B) liver   (C) lung   (D) kidney

Q.5   The enzyme responsible for generation of hypochlorous ions during phagocytosis is

(A) NADPH oxidase   (B) catalase
(C) myeloperoxidase   (D) superoxide dismutase

Q.6   Teichoic acid is composed of repetitive units of

(A) keto-deoxy octanoic acid   (B) glucose
(C) *N*-acetyl glucosamine   (D) glycerol

Q.7   Biofilm produced by bacteria is detected by

(A) Saffranin   (B) Malachite green   (C) Basic fuchsin   (D) Congo red

Q.8   The precursor for the synthesis of aromatic amino acids is

(A) phosphoenolpyruvate   (B) pyruvate
(C) oxaloacetate   (D) α-ketoglutarate

Q.9   The net yield of NADH in the Embden-Meyerhof pathway in *E. coli* is_____.

Q.10   *E. coli* ribonuclease contains 124 amino acids. The number of nucleotides present in the gene encoding the protein is _____.

Q. 11 – Q. 20 carry two marks each.

Q.11   Which of the following infectious agents cross the blood-brain barrier?

(P) *Streptococcus pneumoniae*   (Q) Coxsackie virus
(R) Rotavirus   (S) *Streptococcus pyogenes*

(A) P & S   (B) R & S   (C) P & Q   (D) Q & R

Q.12   At OD_{540nm}= 0.5, which one of the following bacterial mono-dispersed cell suspensions will have (i) maximum and (ii) minimum number of cells?

(P) *Mycoplasma pneumoniae*   (Q) *Micrococcus luteus*
(R) *Bacillus subtilis*   (S) *Escherichia coli*

(A) P & Q   (B) P & R   (C) Q & R   (D) R & S

Q.13 Which one of the following enzyme combinations allows some bacteria to utilize acetate through glyoxylate pathway?

(P) Isocitrate lyase (Q) Isocitrate dehydrogenase
(R) Succinyl CoA synthetase (S) Malate synthase

(A) P & S   (B) P & R   (C) Q & S   (D) Q & R

Q.14 The decimal reduction time (D_{121}) for *Clostridium botulinum* spores is 0.2 min. The time required to reduce the spore count from 10^{12} to one spore at 121°C is_____ minutes.

Q.15 *E. coli* requires three genes, *galK* (kinase), *galT* (transacetylase) and *galE* (epimerase) to utilize galactose. If there is a mutation in any one of these genes, the mutant cannot utilize galactose. Which one of the following combinations of merodiploids will support the growth of mutants on galactose?

(P) $galK^+ galT^+ galE^- / galK^- galT^+ galE^-$
(Q) $galK^- galT^+ galE^- / galK^+ galT^- galE^+$
(R) $galK^+ galT^- galE^- / galK^- galT^- galE^+$
(S) $galK^+ galT^+ galE^- / galK^+ galT^- galE^+$

(A) P & Q   (B) P & R   (C) R & S   (D) Q & S

Q.16 Nitrogenase reduces N_2 to NH_3. Metal co-factors required for this activity are _____.

(A) Fe & Cu   (B) Mo & Fe
(C) Mo & Mn   (D) Cu & Mn

Q.17 If a bacterial cell contains 5,000 genes and if the average mutation frequency per gene is 2×10^{-4} per generation, the average number of new mutations per generation is _____.

Q.18 The growth profile of *E. coli* on glucose plus lactose is shown below. The specific growth rate of the second exponential phase is_____h^{-1}.
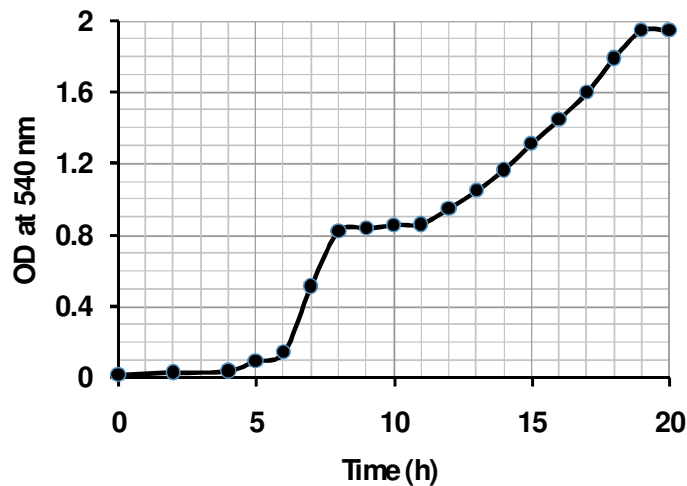
Q.19 Match the cell structure components given in **Group I** with appropriate functions from **Group II**.

Group I
(P) Cell membrane
(Q) Purple membrane
(R) Cisternae
(S) Outer membrane

Group II
(I) Nutrient transport
(II) Photosynthesis
(III) Active transport
(IV) Protein glycosylation
(V) Light-driven proton transport

(A) P-I, Q-V, R-II, S-III
(B) P-I, Q-II, R-IV, S-III
(C) P-III, Q-II, R-V, S-I
(D) P-III, Q-V, R-IV, S-I

Q.20 Match the antibiotics given in **Group I** with appropriate targets from **Group II**.

Group I
(P) Nalidixic acid
(Q) Tetracycline
(R) Erythromycin
(S) Rifampin

Group II
(I) RNA polymerase
(II) DNA gyrase
(III) DNA polymerase
(IV) 50S ribosomal subunit
(V) Aminoacyl tRNA

(A) P-III, Q-IV, R-V, S-I
(B) P-V, Q-I, R-IV, S-II
(C) P-II, Q-V, R-IV, S-I
(D) P-II, Q-V, R-I, S-IV

END OF THE QUESTION PAPER

Space for Rough Work

Space for Rough Work