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 _____.
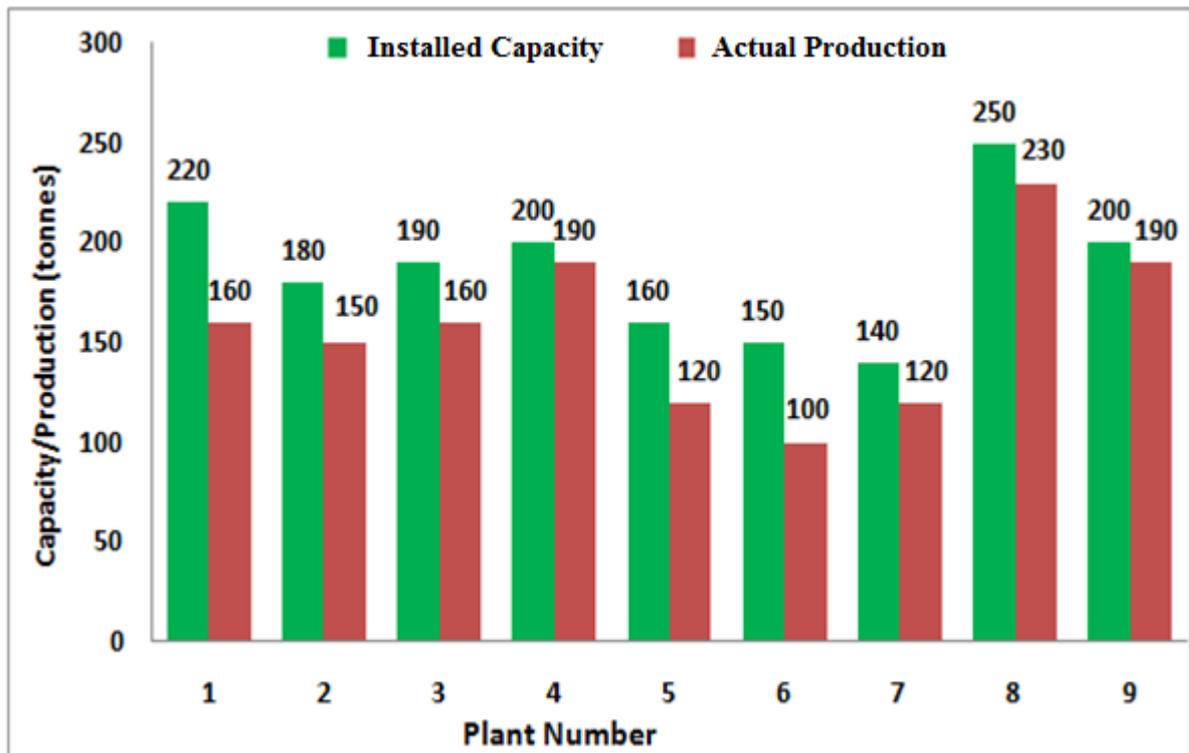
Q.7   A poll of students appearing for masters in engineering indicated that 60 % of the students believed that mechanical engineering is a profession unsuitable for women. A research study on women with masters or higher degrees in mechanical engineering found that 99 % of such women were successful 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

A : ENGINEERING MATHEMATICS (COMPULSORY)

Q. 1 – Q. 7 carry one mark each.

Q.1   A company records heights of all employees. Let X and Y denote the errors in the average height of male and female employees respectively. Assume that $X \sim N(0, 4)$ and $Y \sim N(0, 9)$ and they are independent. Then the distribution of $Z = (X + Y)/2$ is

      (A) $N(0, 6.5)$ (B) $N(0, 3.25)$ (C) $N(0, 2)$ (D) $N(0, 1)$

Q.2   The volume of the solid obtained by revolving the curve $y^2 = x$, $0 \le x \le 1$ around y-axis is

      (A) π (B) 2   (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{5}$

Q.3   Let $y(x)$ be the solution of the initial value problem $\frac{dy}{dx} + 2xy = x$; $y(0) = 0$. Find the value of $\lim_{x \to \infty} y(x)$.

Q.4   Which of the following is a quasi-linear partial differential equation?

      (A) $\frac{\partial^2 u}{\partial t^2} + u^2 = 0$

      (B) $\left(\frac{\partial u}{\partial t}\right)^2 + \frac{\partial u}{\partial x} = 0$

      (C) $\left(\frac{\partial u}{\partial t}\right)^2 - \left(\frac{\partial u}{\partial x}\right)^2 = 0$

      (D) $\left(\frac{\partial u}{\partial t}\right)^4 - \left(\frac{\partial u}{\partial x}\right)^3 = 0$

Q.5   Let $P(x)$ and $Q(x)$ be the polynomials of degree 5, generated by Lagrange and Newton interpolation methods respectively, both passing through given six distinct points on the xy-plane. Which of the following is correct?

      (A) $P(x) \equiv Q(x)$

      (B) $P(x) - Q(x)$ is a polynomial of degree 1

      (C) $P(x) - Q(x)$ is a polynomial of degree 2

      (D) $P(x) - Q(x)$ is a polynomial of degree 3

Q.6   The Laurent series of $f(z) = 1/(z^3 - z^4)$ with center at $z = 0$ in the region $|z| > 1$ is

(A) $\sum_{n=0}^{\infty} z^{n-3}$

(B) $-\sum_{n=0}^{\infty} \frac{1}{z^{n+4}}$

(C) $\sum_{n=0}^{\infty} z^n$

(D) $\sum_{n=0}^{\infty} \frac{1}{z^n}$

Q.7   The value of the surface integral $\iint_{\Gamma} \vec{F} \cdot \boldsymbol{n} \, dS$ over the sphere Γ given by $x^2 + y^2 + z^2 = 1$, where $\vec{F} = 4x\,\hat{i} - z\,\hat{k}$, and $\boldsymbol{n}$ denotes the outward unit normal, is

(A) π (B) $2\,\pi$ (C) $3\,\pi$ (D) $4\,\pi$

Q. 8 – Q. 11 carry two marks each.

Q.8   A diagnostic test for a certain disease is 90% accurate. That is, the probability of a person having (respectively, not having) the disease tested positive (respectively, negative) is 0.9. Fifty percent of the population has the disease. What is the probability that a randomly chosen person has the disease given that the person tested negative?

Q.9   Let $M = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$. Which of the following is correct?

(A) Rank of M is 1 and M is not diagonalizable

(B) Rank of M is 2 and M is diagonalizable

(C) 1 is the only eigenvalue and M is not diagonalizable

(D) 1 is the only eigenvalue and M is diagonalizable

Q.10   Let $f(x) = 2\,x^3 - 3x^2 + 69$, $-5 \le x \le 5$. Find the point at which f attains the global maximum.

Q.11   Calculate $\int_{C_1} \vec{F} \cdot d\vec{r} - \int_{C_2} \vec{F} \cdot d\vec{r}$, where $C_1: \vec{r}(t) = (t, t^2)$ and $C_2: \vec{r}(t) = (t, \sqrt{t})$, t varying from 0 to 1 and $\vec{F} = xy\,\hat{j}$.

END OF THE QUESTION PAPER