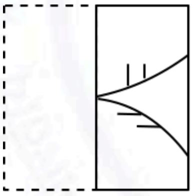
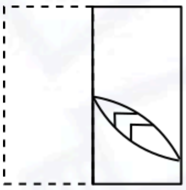
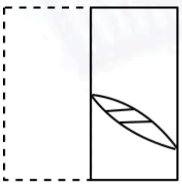
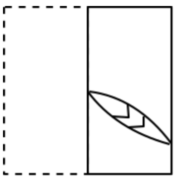
General Aptitude (GA)

Q.1 – Q.5 Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: – 1/3).

Q.1	**Gauri said that she can play the keyboard __________ her sister.**
(A)	as well as
(B)	as better as
(C)	as nicest as
(D)	as worse as

Q.2	 **A transparent square sheet shown above is folded along the dotted line. The folded sheet will look like ________.**
(A)	
(B)	
(C)	
(D)	

Q.3	**If θ is the angle, in degrees, between the longest diagonal of the cube and any one of the edges of the cube, then, cos $\theta =$**
(A)	$\frac{1}{2}$
(B)	$\frac{1}{\sqrt{3}}$
(C)	$\frac{1}{\sqrt{2}}$
(D)	$\frac{\sqrt{3}}{2}$

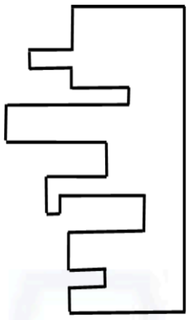
Q.4	**If $\left(x-\frac{1}{2}\right)^2-\left(x-\frac{3}{2}\right)^2=x+2$, then the value of x is:**
(A)	2
(B)	4
(C)	6
(D)	8

Q.5	**Pen : Write :: Knife : _________** **Which one of the following options maintains a similar logical relation in the above?**
(A)	Vegetables
(B)	Sharp
(C)	Cut
(D)	Blunt

Q. 6 – Q. 10 Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: – 2/3).

Q.6	**Listening to music during exercise improves exercise performance and reduces discomfort. Scientists researched whether listening to music while studying can help students learn better and the results were inconclusive. Students who needed external stimulation for studying fared worse while students who did not need any external stimulation benefited from music.** **Which one of the following statements is the CORRECT inference of the above passage?**
(A)	Listening to music has no effect on learning and a positive effect on physical exercise.
(B)	Listening to music has a clear positive effect both on physical exercise and on learning.
(C)	Listening to music has a clear positive effect on physical exercise. Music has a positive effect on learning only in some students.
(D)	Listening to music has a clear positive effect on learning in all students. Music has a positive effect only in some students who exercise.

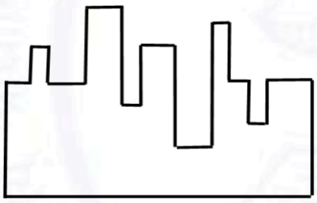
Q.7



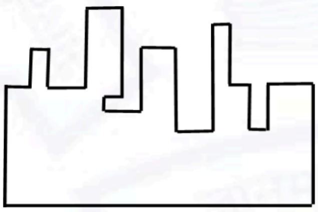
A jigsaw puzzle has 2 pieces. One of the pieces is shown above. Which one of the given options for the missing piece when assembled will form a rectangle? The piece can be moved, rotated or flipped to assemble with the above piece.

(A)

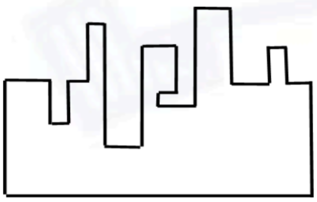
(B)



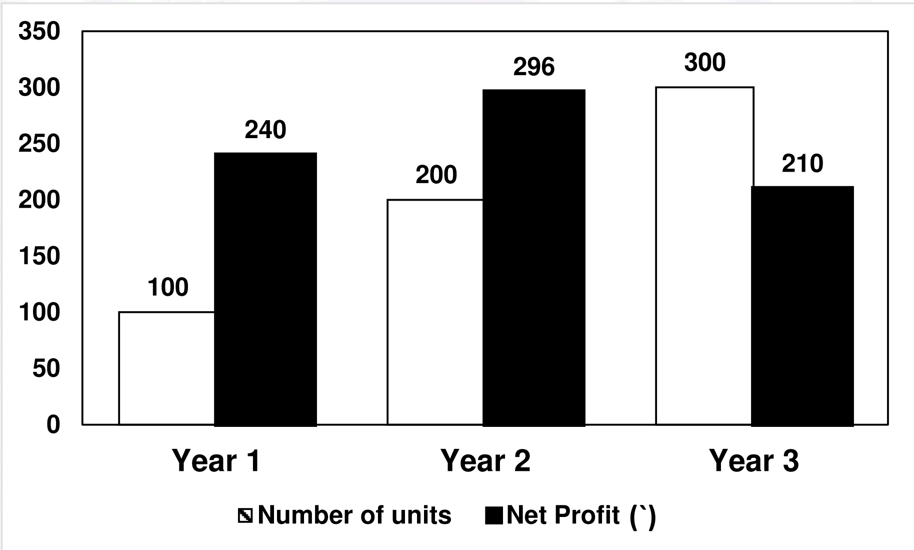
(C)



(D)



Q.8	**The number of students in three classes is in the ratio 3:13:6. If 18 students are added to each class, the ratio changes to 15:35:21.** **The total number of students in all the three classes in the beginning was:**
(A)	22
(B)	66
(C)	88
(D)	110

Q.9	 The number of units of a product sold in three different years and the respective net profits are presented in the figure above. The cost/unit in Year 3 was ` 1, which was half the cost/unit in Year 2. The cost/unit in Year 3 was one-third of the cost/unit in Year 1. Taxes were paid on the selling price at 10%, 13% and 15% respectively for the three years. Net profit is calculated as the difference between the selling price and the sum of cost and taxes paid in that year. The ratio of the selling price in Year 2 to the selling price in Year 3 is ________.
A)	4:3
(B)	1:1
(C)	3:4
(D)	1:2

Q.10	**Six students P, Q, R, S, T and U, with distinct heights, compare their heights and make the following observations.** **Observation I: S is taller than R.** **Observation II: Q is the shortest of all.** **Observation III: U is taller than only one student.** **Observation IV: T is taller than S but is not the tallest.** **The number of students that are taller than R is the same as the number of students shorter than ______.**
(A)	T
(B)	R
(C)	S
(D)	P

Engineering Mathematics (XE-A)

Q.1 – Q.3 Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: – 1/3).

Q.1	**Let** $$S = \left\{ AX \;:\; A = \begin{bmatrix} 2 & -4 \\ 1 & 1 \\ 1 & -1 \end{bmatrix} \text{ and } X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \right\}.$$ **If** $\begin{bmatrix} -1 \\ \alpha \\ 1 \end{bmatrix} \in S$**, then the value of** α **is**
(A)	-4
(B)	-2
(C)	2
(D)	4

Q.2	**Let C be the boundary of the region $R: \; 0 \le x \le \pi, 0 \le y \le \sin x$ in the xy-plane and α be the area of the region R. If C traverses once in the counter clockwise direction, then the value of the line integral $\oint_C (2y\,dx + 5x\,dy)$ is equal to**
(A)	α
(B)	2α
(C)	3α
(D)	4α

Q.3	**Given that $i = \sqrt{-1}$. The value of** $$\lim_{z \to e^{\frac{\pi i}{3}}} \frac{z^3 + 1}{z^4 + z^2 + 1}$$ **is**
(A)	$\frac{3}{4} + i\,\frac{\sqrt{3}}{4}$
(B)	$\frac{3}{4} - i\,\frac{\sqrt{3}}{4}$
(C)	$\frac{-3}{4} + i\,\frac{\sqrt{3}}{4}$
(D)	$\frac{-3}{4} - i\,\frac{\sqrt{3}}{4}$

Q.4 – Q.7 Numerical Answer Type (NAT), carry ONE mark each (no negative marks).

Q.4	**Let $f(x)$ be a non-negative continuous function of real variable x. If the area under the curve $y = f(x)$ from $x = 0$ to $x = a$ is $\frac{a^2}{2} + \frac{a}{2}\sin a + \frac{\pi}{2}\cos a - \frac{\pi}{2}$, then the value of $f\left(\frac{\pi}{2}\right)$ is ________________ (*round off to one decimal place*).**

Q.5	**If the numerical approximation of the value of the integral $\int_0^4 2^{\alpha x}\, dx$ using the Trapezoidal rule with two subintervals is 9, then the value of the real constant α is ________________ (*round off to one decimal place*).**

Q.6	**Let the transformation $y(x) = e^x v(x)$ reduce the ordinary differential equation** $$x\frac{d^2y}{dx^2} + 2(1-x)\frac{dy}{dx} + (x-2)\,y = 0;\quad x > 0$$ **to** $$\alpha x\frac{d^2v}{dx^2} + 2\beta\frac{dv}{dx} + 3\gamma v = 0,$$ **where α, β, γ are real constants. Then, the arithmetic mean of α, β, γ is ______________ (*round off to three decimal places*).**

Q.7	**A person, who speaks the truth 3 out of 4 times, throws a fair dice with six faces and informs that the outcome is 5. The probability that the outcome is really 5 is ________________ (*round off to three decimal places*).**

Q. 8 – Q. 9 Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: – 2/3).

Q. 8	**Let $f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2 + \alpha$ be a real valued function. Then, which one of the following statements is TRUE for all α ?**
(A)	$(0,0)$ is not a stationary point of f
(B)	f has a local maxima at $(0,0)$
(C)	f has a local minima at $(0,0)$
(D)	f has a saddle point at $(0,0)$

Q. 9	**Let $u(x,y) = (x^2 - y^2)v(x,y)$ be such that both $u(x,y)$ and $v(x,y)$ satisfy the Laplace equation in a domain Ω of the xy-plane. Then, which one of the following is TRUE in Ω ?**
(A)	$x\frac{\partial v}{\partial x} - y\frac{\partial v}{\partial y} = 0$
(B)	$x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} = 0$
(C)	$x\frac{\partial v}{\partial y} - y\frac{\partial v}{\partial x} = 0$
(D)	$x\frac{\partial v}{\partial y} + y\frac{\partial v}{\partial x} = 0$

Q. 10 – Q. 11 Numerical Answer Type (NAT), carry TWO marks each (no negative marks).

Q. 10	**Let I denote the identity matrix of order 7, and A be a 7×7 real matrix having characteristic polynomial $C_A(\lambda) = \lambda^2(\lambda - 1)^\alpha(\lambda + 2)^\beta$, where α and β are positive integers. If A is diagonalizable and $rank(A) = rank(A + 2I)$, then $rank(A - I)$ is ____________ (*in integer*).**

Q. 11	**Let C_1 be the line segment from $(0, 1)$ to $\left(\frac{4}{5}, \frac{3}{5}\right)$, and let C_2 be the arc of the circle $x^2 + y^2 = 1$ from $(0, 1)$ to $\left(\frac{4}{5}, \frac{3}{5}\right)$. If** $$\alpha = \int_{C_1} \left(\frac{2x}{y}\,\hat{\imath} + \frac{1 - x^2}{y^2}\hat{\jmath}\right) \cdot d\vec{r} \quad \text{and} \quad \beta = \int_{C_2} \left(\frac{2x}{y}\,\hat{\imath} + \frac{1 - x^2}{y^2}\hat{\jmath}\right) \cdot d\vec{r},$$ **where $\vec{r} = x\,\hat{\imath} + y\,\hat{\jmath}$, then the value of $\alpha^2 + \beta^2$ is ____________________ (*round off to two decimal places*).**

END OF THE QUESTION PAPER