

DAE/IIA-2018/06 FIRST YEAR

MATH-113 APPLIED MATHEMATICS – I

COMMON WITH AUTO-MOBILE & DIESEL, AUTO & FARM MACHINERY,
AUTOMATION, ARCHITECTURE, CAST METAL & FOUNDRY, CHEMICAL,
CIVIL, CMT, DIE & MOULD, FOUNDRY & PATTERN MAKING, FOOTWEAR, GLASS & CERAMICS
HEAT VENTILATION, AIR CONDITIONING & REFRIGERATION, LEATHER,
LAND & MINE SURVEYING, MINING, MECHANICAL, METALLURGY & WELDING,
MECHATRONICS, PRECISION MECHANICAL & INSTRUMENT, PGA, PETROLEUM,
PETROCHEMICAL, QUANTITY SURVEY, RAC, SUGAR, TEXTILE SPINNING, TEXTILE DYEING &
PRINTING & TEXTILE WEAVING TECHNOLOGIES.

PAPER 'B' (Subjective)

Time: 2:30 Hours

SECTION – I

Marks: 60

Q.1: Write short answer to any Eighteen (18) questions: -

18 × 2 = 36

1. If $\cos\alpha$, $\cos\beta$, $\cos\gamma$ are direction cosines of a vector $\vec{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$
2. Define scalar product of two vectors.
3. For what value of λ , the vectors $2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ & $3\mathbf{i} + 2\lambda\mathbf{j}$ are perpendicular.
4. If $\vec{a} = 3\mathbf{i} - 2\mathbf{j} + 5\mathbf{k}$ and $\vec{b} = -2\mathbf{i} - \mathbf{j} + \mathbf{k}$. Find $2\vec{a} - 3\vec{b}$ and also its unit vectors.
5. If $\vec{a} = 2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ & $\vec{b} = \mathbf{i} - \mathbf{j} + \mathbf{k}$ Find $|\vec{a} \times \vec{b}|$.
6. Define rectangular matrix.
7. Without expansion, show that:
$$\begin{vmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{vmatrix} = 0$$
8. Find 'k' if $A = \begin{bmatrix} 4 & k & 3 \\ 7 & 3 & 6 \\ 2 & 3 & 1 \end{bmatrix}$ is a singular matrix.
9. Without expansion, verify that:
$$\begin{vmatrix} \alpha & \beta + \gamma & 1 \\ \beta & \gamma + \alpha & 1 \\ \gamma & \alpha + \beta & 1 \end{vmatrix} = 0$$
10. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$, then find $A + B$.
11. Find the area of right triangle if base and altitude are 20m and 10m respectively.
12. What is the side of the equilateral triangle whose area is $9\sqrt{3}$ sq.cm.
13. A wire rectangle of original size 2cm by 3 cm is passed to form a parallelogram. The included angle is reduced to 30° . Find the reduction in area.
14. The sides of a cyclic quadrilateral are 75, 55, 140 and 40m, find its area.
15. Define circumscribed polygon.
16. A regular octagon circumscribes a circle of 2cm radius. Find the area of the octagon.
17. Define diameter of circle.
18. The minute hand of a clock is 12cm long. Find the area which is described on the clock face between 6 A.M to 6.20 A.M.
19. The inside measurement of a room are 8.5m, 6.4 and 4.5m height. How many men should sleep in the room, if each man is allowed 13.6 cu. m of air?
20. An open rectangular tank of length 16cm, width 9cm and height 13cm contains. Water up to a height of 8cm. calculate: **[a]** volume in liters **[b]** total surface area of the tank.
21. Write the formula for Area of irregular figure by Trapezoidal Rule.
22. Define Hollow Circular Cylinder.
23. Write formula of volume of elliptic cylinder and total area.
24. Find the whole surface of a pyramid whose base is an equilateral triangle of side 3m and its slant height is 6m.
25. The height of pyramid with square base is 12cm, and its volume is 100cu.cm. Find length of side of square base.
26. A right triangle of which the sides are 3cm and 4cm length is made to turn around the longer side. Find the volume of the cone thus formed.
27. Write the formula for surface area of segment area of segment of a sphere.

SECTION - II

Note: Attempt any three (03) questions.

3 × 8 = 24

Q.2. (a) Find the length of the sides of a triangle, whose vertices are A (2, 4, -1), B(4, 5, 1), C(3, 6, -3) and show that the triangle is right angled.

(b) Find sine of the angle and the unit vector perpendicular to $\vec{a} = i + j + k$ and $\vec{b} = 2i + 3j - k$

Q.3. (a) Show that:
$$\begin{bmatrix} \cos\theta & 0 & -\sin\theta \\ 0 & 1 & 0 \\ +\sin\theta & 0 & \cos\theta \end{bmatrix} \begin{bmatrix} \cos\theta & 0 & +\sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(b) Find the inverse, if it exists, of the matrix $A = \begin{bmatrix} 0 & -2 & -3 \\ 1 & 3 & 3 \\ -1 & -2 & -2 \end{bmatrix}$

Q.4. (a) The sides of a triangular lawn are proportional to the numbers 5, 12 and 13. The cost of fencing it at the rate of Rs.2 per meter is Rs.120. Find the sides. Also find the cost of turfing the lawn at 25 paisa per square meter.

(b) The inner diameter of a circular building is 54m and the base of the wall occupies a space of 352sq.m. Find the thickness of the wall.

Q.5. (a) Find the area of an irregular plane figure whose ordinates are 20, 23, 28, 32, 34, 37 and 40m respectively and the width of each strip is 7 meter.

(b) Find the cost of painting the outside of a rectangular box whose length is 64cm, breadth is 45cm and height is 51cm, at the rate of 37 paisa per sq.m.

Q.6. (a) Find the cost of the canvas for 50 conical tents, the height of each being 45cm and the diameter of the base 36cm at the rate of Rs.9.40sq.m.

(b) The core for a cast iron piece has the shape of a spherical segment of two bases. The diameters of the upper and lower bases are 2ft. and 6ft. respectively, and the distance between the bases is 2ft. If the average weight of a cu.ft. of core is 100 Lbs. Find the weight of the core.

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