Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 09

B.Sc. (Hons) Aircraft Maintainance (2018 Batch) (Sem.–1)

MATHEMATICS

Subject Code : BSCARM-104-18

Paper ID : [75635]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. a) Find the sum and product of eigen values of matrix $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$

b) For what values of k for which the system of equations

$$(3k - 8)\,x + 3y + 3z = 0$$
$$3x + (3k - 8)y + 3z = 0$$
$$3x + 3y + (3k - 8)z = 0.$$

has non-trivial solution.

c) Find the value of $\sin\left(\frac{-11\pi}{3}\right)$

d) Prove that $2sin^2\frac{\pi}{6} + cosec^2\frac{7\pi}{6}cos^2\frac{\pi}{3} = \frac{3}{2}$.

e) if $u = x^y$, prove that $\frac{\partial^2 u}{\partial x^2 \partial y} = \frac{\partial^3 u}{\partial x \partial y \partial x}$

f) Expand e^{sinx} by Maclaurin's series.

g) Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)dxdydz$

h) Change the order of integration and evaluate $\int_0^1 \int_{x^2}^{2-x} xydxdy$

i) Find gradΦ when $\phi = 3x^2y - y^3z^2$ at the point (1,-2,-1).

j) Find div $\vec{F}$ and curl $\vec{F}$ where $\vec{F} = grad(x^3 + y^3 + z^3 - 3xyz)$.

SECTION-B

2. Find the values of a and b for which the equations

$$x + ay + z = 3$$

$$x + 2y + 2z = b$$

$x + 5y + 3z = 9$ are consistent. When will these equations have unique solution?

3. Prove that $\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right)$.

4. If $\theta = t^n e^{\frac{-r^2}{4t}}$,, what value of n will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{\partial \theta}{\partial r}\right) = \frac{\partial \theta}{\partial t}$?

5. Show that area between parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$.

6. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\,\hat{j}$ taken round the rectangle bounded by the lines $x = \pm a,\ y = 0,\ y = b$.

SECTION-C

7. Find the matrix P which transforms the matrix A = $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to diagonal form. Hence calculate A^4

8. State Euler theorem. Using euler theorem prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = sin2u$

And $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = (1 - 4sin^2 u)\,sin2u$ when $tan\,u = \frac{x^3 + y^3}{x - y}$.

9. Verify Divergence theorem for $\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{J} + (z^2 - xy)\hat{k}$ taken over the rectangular parallelepiped $0 \le x \le a, 0 \le y \le b, 0 \le z \le c$.