Department of Mathematics

National Institute of Technology Kurukshetra
B.Tech. (II Semester) MID TERM-II Exam, MAY -2021

Subject: Integral Calculus and Difference Equations
Code: MAIR 12 **Max. Marks: 15**
Branch: CE, CS, EC, EE, IT, ME, PI
Timings: 9:30a.m-10:10 a.m.

Note: a) All questions are compulsory.
b) The question paper consists of 10 objective questions. First Five questions are of two marks each and rest are of one mark each.

1) The value of the constants a and b so that the surface $bx^2 - ayz = (b+2)x$ is orthogonal to the surface $4x^2y + z^3 = 4$ at the point $(1, -1, 2)$ are

(A) $a = \frac{5}{2}, b = 1$ (B) $a = 1, b = \frac{5}{2}$ (C) $a = -1, b = \frac{5}{2}$ (D) $a = -\frac{5}{2}, b = 1$

2)The directional derivative of $f(x, y, z) = xy\, e^{x^2+z^2-5}$ at the point $(1, 3, -2)$ in the direction of the vector $\vec{v} = (3, -1, 4)$ is

(A) -27/$\sqrt{26}$ (B) -27 (C) -20/$\sqrt{26}$ (D) -20

3) Complete solution for the difference equation $4y_n - y_{n+2} = 0; with\ y_0 = 0, y_1 = 2$ is

(A)$(2)^n + (-2)^n$ (B) $(2)^{n-1} + (-2)^{n-1}$ (C) $(2)^n + n(-2)^n$ (D) $(2)^{n-1} - n(-2)^n$

4) Apply Dirichlet's integral to find the volume of the solid $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} + \left(\frac{z}{c}\right)^{2/3} = 1$ in the positive octant.

(A)$\frac{\pi abc}{35}$ (B) $\frac{4\pi abc}{35}$ (C) $\frac{\pi abc}{70}$ (D) $\frac{4\pi abc}{27}$

5) What is the value of $\int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta . \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}}$

$(A)\ \pi$ $(B)1$ $(C)\sqrt{\pi}$ $(D)\ \frac{2}{\sqrt{\pi}}$.

6).The difference equation formed by eliminating the constant from $y_n = (A + Bn)2^n$ is

(A) $y_{n+2} + 6y_{n+1} + 4y_n = 0$ (B) $y_{n+2} + 4y_{n+1} + 4y_n = 0$ (C) $y_{n+2} - 4y_{n+1} + 4y_n = 0$

(D) $y_{n+2} - 6y_{n+1} + 4y_n = 0$

7). If $\vec{r} = xi + yj + zk, than\ \nabla r^n$ is

(A)$r^{n+2}\,\vec{r}$ (B) $nr^n\vec{r}$ (C) nr^{n-2} (D) $nr^{n-2}\vec{r}$

8). By Green's theorem the value of the line integral $\oint(x - y)dx + (x + y)dy$, where C is the circle $x^2 + y^2 = a^2$, is

(A) $\frac{3}{2}\,\pi\,a^2$ (B) $2\,\pi\,a^2$ (C) $\pi\,a^2$ (D) $4\,\pi\,a^2$

9). Using Dirichlet's integral , the triple integral $\iiint_V xyz\,dxdydz$ where the region V is complete ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} \leq 1\ is$

(A) $\frac{a^2b^2c^2}{8}$ (B) $\frac{a^3b^3c^3}{6}$ (C) $\frac{a^2b^2c^2}{48}$ (D) $\frac{a^3b^3c^3}{36}$

10). The value of $B(x+1, y)$ is equal to

$(A)\ \ B(x, y + 1)$ $(B)\ \frac{x}{x+y}B(x, y)$

$(C)\ \frac{x+y}{x}B(x, y)$ $(D) None\ of these.$