Department of Mathematics
National Institute of Technology Kurukshetra
B.Tech. (II Semester) MID TERM-1 Exam, April -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 indicial roots of the differential equation: $8x^2y'' + 10xy' - (1+x)y = 0$ about point $x = 0$ are –

(A) real and equal (B) distinct and not differ by an integer
(C) distinct and differ by an integer (D) None

2) The recurrence relation for the differential eqn $y' - ky = 0$ about point $x = 0$ is –

(A) $C_n = \frac{k^n}{n!}C_0$ (B) $C_n = \frac{k^{n+2}}{n!}C_0$
(C) $C_n = \frac{k^n}{(n+1)!}C_0$ (D) $C_n = \frac{k^{n+2}}{(n+1)!}C_0$

3) On changing the order of integration, double integration $\int_0^a \int_{y^2/a}^{2a-y} xy\, dxdy$ becomes –

(A) $\int_0^{2a}\int_0^{\sqrt{ax}} xy\, dxdy$ (B) $\int_0^{a}\int_0^{\sqrt{ax}} xy\, dxdy + \int_a^{2a}\int_0^{2a-x} xy\, dxdy$
(C) $\int_0^{2a}\int_0^{2a-x} xy\, dxdy$ (D) $\int_0^{a}\int_0^{\sqrt{2ax}} xy\, dxdy + \int_a^{2a}\int_0^{2a+x} xy\, dxdy$

4) The evaluation of integral $\iint_R \sqrt{x^2+y^2}\, dx\, dy$ by changing to polar coordinates where R is the region in xy- plane bounded by the circles $x^2 + y^2 = 4$ and $x^2 + y^2 = 9$ is-

(A) $\frac{38\pi}{5}$ (B) $\frac{38\pi}{3}$ (C) $\frac{34\pi}{3}$ (D) $\frac{34\pi}{5}$

Statement for Q5, Q6, Q7: The eigenvalue problem in interval (0, 2c) is:

$$X'' + \lambda X = 0; \quad X(0) = X(2c), \quad X'(0) = X'(2c)$$

5) If n = +ve integers, then the eigenfunctions corresponding to $\lambda = \mu^2$ is –

(A) $X(x) = cos\frac{nx}{c} + sin\frac{nx}{c}$ (B) $X(x) = log\frac{nx}{c}$

(C) $X(x) = cos\frac{n\pi x}{c} + sin\frac{n\pi x}{c}$ (D) No eigenfunction

6) The eigenfunction corresponding to $\lambda = 0$ is –

(A) $X(x) = 1$ (B) $X(x) = x$

(C) $X(x) = x + 1$ (D) No eigenfunction

7) The set of orthogonal eigenfunctions in the interval (0, 2c) is –

(A) $\left\{cos\frac{n\pi x}{c}, sin\frac{n\pi x}{c}\right\}$ (B) $\left\{cos\frac{nx}{c}, sin\frac{nx}{c}\right\}$

(C) $\left\{1, cos\frac{n\pi x}{c}, sin\frac{n\pi x}{c}\right\}$ (D) $\left\{1, cos\frac{nx}{c}, sin\frac{nx}{c}\right\}$

8) The differential eqn. $x^2(x^2 - 4)y'' + 2x^3y' + 3y = 0$ has ……point at $x = 1$.

(A) Regular singular (B) Irregular singular

(C) Ordinary (D) Cannot be predicted

9) The differential eqn. $2x^2y'' - xy' + (x - 5)y = 0$ has a regular singular point at–

(A) $x = 1$ (B) $x = 0$ (C) $x = -1$ (D) $x = -2$

10) The indicial roots of 'Bessel equation of order *n*' are –

(A) $\pm n$ (B) $\pm n^2$ (C) $\pm\frac{n^2}{2}$ (D) $\pm\frac{n}{2}$