Total No. of Questions—8] [Total No. of Printed Pages—4+2

BE-II/6(A)

212324

ENGINEERING MATHEMATICS-II—COURSE NO. MTH-201

Time Allowed—3 *Hours* *Maximum Marks*—100

Note : Attempt *five* questions in all, selecting at least *two* questions from each Section. *All* questions carry equal marks. Use of calculator is allowed.

Section A

1. Test the following series for convergence or divergence :

(*a*) $\Sigma\left[\sqrt{(n^2+} \quad n\right]$ [illegible]

(*b*) $\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x}{3.4}\;\frac{\quad}{4.5}+\ldots$ [illegible]

(*c*) $1+\frac{1}{2}x+\frac{1.3}{2.4}x^2+\frac{1.3.5}{2.4.6}x^3+\ldots$ 6,7,7

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2. (*a*) Draw the graph of the function :

$$f(x) = \begin{cases} 1, & -2 \le x \le -1 \\ |x|, & -1 < x < 1 \\ 1, & 1 \le x \le 2 . \end{cases}$$

Is it odd or even ? Also expand $f(x)$ as a Fourier series in $(-2, 2)$.

(*b*) Using Fourier sine series of the function

$$f(x) = \begin{cases} x, & 0 \le x \le \frac{\pi}{2} \\ \pi - x, & \frac{\pi}{2} < x \le \pi \end{cases},$$

show that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \dots$.

(*c*) Using Parseval's identity for Fourier series of $f(x) = x^2$ in $(-\pi, \pi)$, find the value of $\Sigma \frac{1}{n^4}$. 6,7,7

3. (*a*) Determine ordinary or singular points of the differential equation :

(b) Using Frobenius method, find two independent series solutions of Bessel's differential equation of order one.

(c) Find two independent power series solution of $(1 - x^2)y'' - xy' + p^2y = 0$, where p is a fixed constant. 6,7,7

4. (a) Find the indicial equation and recurrence relation of $(x^3 + x^2 + x)y'' + 3x^2y' - 2y = 0$.

(b) Expand $f(x) = x \sin x$ as a Fourier cosine series in $(0, \pi)$.

(c) Find the interval of convergence of the series :

$$x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \ldots$$ 6,7,7

Section B

5. (*a*) Obtain p.d.e. by eliminating arbitrary functions f and g from

$$z = f(\text{[illegible]} + 3y) + g(3x + 2y).$$

(*b*) Solve :

$$(y + z)p + (z + x)q = x + y.$$

(*c*) Solve :

$$2xz - x^2p - 2xyq + pq = 0.$$ 6,7,7

(*a*) Solve :

$$(D^2 + D'^2 - 2DD' - 5D - 5D' + 6)z = e^{x + 2y}.$$

(*b*) Solve :

$$(D^3 + 3DD'^2 - 4D'^3)z = e^{y + x} + \cos(y + x).$$

(*c*) Solve :

$$yzp^2 = q.$$ 6,7,7