

FACULTY OF ENGINEERING

B.E. II – Semester (CBCS) (Supple.) Examination, Nov./Dec. 2018

Subject: Engineering Mathematics – II

Time: 3 Hours

Max. Marks: 70

Note: Answer all questions from Part A and Five questions from Part B.

PART – A (10x2 = 20 Marks)

- 1) Solve $\frac{dy}{dx} = \frac{1}{e^{-y} - x}$
- 2) Find the orthogonal trajectories of the family of curves $r = c\theta^2$
- 3) Solve $x^2 y'' + xy' - y = 0$
- 4) Find a particular integral of $(D^3 + D)y = x^2$
- 5) Using power series method, find the general solution of $y' = xy$ about the origin.
- 6) Evaluate $\int_{-1}^1 x^3 P_3(x) dx$
- 7) Prove that $B(m, n) = 2 \int_0^{\frac{\pi}{2}} x^m \cos^{2n-1} q \sin^{2n-1} q dq$
- 8) Evaluate $\int x^5 J_4(x) dx$ in terms of Bessel's functions
- 9) Find $L\{\sin 2t \cosh 2t\}$
- 10) Obtain the inverse Laplace transform of $\frac{e^{-ps}}{s^2 + 1}$

PART – B (50 Marks)

11. a) Solve $xy dx + (x^2 + 2y^2 + 2) dy = 0, y(0) = 1$ 5
b) Find the general solution of the Riccati's equation
 $\frac{dy}{dx} = 3y^2 + (1 + 6x)y + 3x^2 + x + 1$ if $y = x$ is a particular solution 5
12. a) Solve the initial problem $y''' + 4y'' - 2y = 0, y(0) = 2, y'(0) = 2, y''(0) = -3$ 5
b) Solve $y'' + 4y' + 4y = e^{-2x} \sin x$ by the method of variation of parameters 5

contd...2

13. a) Prove that $P_n(x) = \frac{1}{2^n n!} \frac{d^n (x^2 - 1)^n}{dx^n} (x^2 - 1)^n$ 5

b) Using the generating function of Legendre polynomial, prove that

$P_{2n}(0) = (-1)^n \frac{1, 3, 5, \dots, (2n-1)}{2, 4, 6, \dots, 2n}$ and $P_{2n+1}(0) = 0$ 5

14. a) Prove that $\int_{-1}^1 (1-x^2)^n dx = \frac{2^{2n+1} (n!)^2}{(2n+1)!}$, n is a positive integer. 5

b) Express $J_{\frac{5}{2}}(x)$ in terms of sine and cosine functions. 5

15. a) Evaluate $\int_0^{\infty} \frac{e^{-t} - e^{-3t}}{t} dt$ 5

b) Find $L^{-1} \left\{ \frac{1}{s^2(s^2 - 4)} \right\}$ using convolution theorem. 5

16. a) If the temperature of the air is 30°C and the substance cools from 100°C to 70°C in 15 minutes, then find the time at which the temperature will be 40°C. 5

b) Solve $(D-1)^2 y = e^x (x^2 + \cos 2x)$ 5

17. a) Prove that $\frac{d}{dx} [x^{-n} J_n(x)] = -x^{-n} J_{n+1}(x)$ 5

b) Find $L\{f(t)\}$, where $f(t) = \begin{cases} 1, & 0 < t < 1 \\ 0, & 1 < t < 2 \end{cases}$ and $f(t+2) = f(t), t > 0$ 5

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