Max. Marks: 75

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FACULTY OF ENGINEERING & INFORMATICS

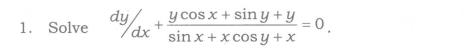
B.E. I Year (Common to all branches) Examination, May/June 2012

MATHEMATICS - II

Time: 3 Hours

Answer **all** questions from Part-A Answer any **five** questions from Part-B.

Part A — (Marks : 25)



2. I.F of
$$xy(1+xy^2) \frac{dy}{dx} = 1$$
 is ______.

3. Solve
$$(D^4 + D^2 + 1) y = 0$$
.

4. Solve
$$(D^2 + 9) y = \sin 3x$$
.

5. Find the value of
$$P_{n^{(-x)}}^1$$
.

6. Show that
$$J_{\frac{-1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \cdot \cos x$$
.

7. Prove that
$$T_{n+1}(x) = 2x T_n(x) - T_{n-1}(x)$$
.

8. Show that
$$\int_{0}^{1} \log \left(\frac{1}{y}\right)^{n-1} dy = \ln n.$$

10. Find the inverse Laplace transform of
$$\log \left(\frac{s+1}{s-1} \right)$$
.

Part B - (Marks: 50)

11. (a) Solve
$$x \frac{dy}{dx} + y = x^3 y^6$$
.

(b) Show that the differential equation for the current i is an electrical circuit containing an inductance L and a resistance R in series and acted on by an

electromotive force
$$E \sin Wt$$
 satisfies the equation $L \frac{di}{dt} + Ri = E \sin wt$. 5 [P.T.O.

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- 12. (a) Solve $(D^2 3D + 2)$ $y = x e^{3x} + \sin 2x$.
 - (b) Using the method of variation of parameters, solve $y'' 2y' + y = e^x \log x$.
- 13. Solve by series solution method of the equation

$$x\frac{d^2y}{dx^2} + \frac{dy}{dx} + xy = 0, \text{ about } x = 0.$$

14. (a) Prove
$$(2n+1)x P_n(x) = (n+1) P_{n+1}(x) + n P_{n-1}(x)$$
.

(b) Show that
$$(1-2xz+z^2)^{-1/2} = \sum_{n=0}^{\infty} P_n(x).z^n$$
.

- 15. (a) State and prove orthogonal properties of chebyshev polynomials of the first kind.
 - (b) Prove that $[T_n(x)]^2 T_{n+1}(x)T_{n-1}(x) = 1-x^2$.

16. (a) Evaluate
$$\int_{0}^{1} \frac{dx}{(1-x^n)^{\frac{1}{n}}}$$
.

(b) Prove that
$$J_2^1(x) = \left(1 - \frac{4}{x^2}\right)J_1(x) + \frac{2}{x}J_0(x)$$
.

17. (a) Apply convolution theorem to evaluate
$$L^{-1}\left(\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right)$$
.

(b) Apply the method of Laplace transform to solve $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with x = 2,

$$\frac{dx}{dt} = -1 \text{ at } t = 0.$$