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MATDIP301

Third Semester B.E Degree Examination, June/July 2017
Advanced Mathematics – I

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Express : $\frac{1}{(2+i)^2} - \frac{1}{(2-i)^2}$ in the form of $a + i b$. (07 Marks)
 b. Find the modulus and amplitude of the complex number $1 - \cos \alpha + i \sin \alpha$. (06 Marks)
 c. Express the complex number $\sqrt{3} + i$ in the polar form. (07 Marks)

- 2 a. Find the n^{th} derivative of $\log(ax + b)$. (07 Marks)
 b. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. (06 Marks)
 c. If $y = \sin^{-1} x$, prove that : $(1 - x^2)y_{n+2} - (2n + 1)x y_{n+1} - n^2 y_n = 0$. (07 Marks)

- 3 a. Using Taylor's theorem, expand $\sin x$ in power of $(x - \pi/2)$. (07 Marks)
 b. Obtain the Maclaurin's series expansion of the function $\sqrt{1 + \sin 2x}$ up to the term containing x^4 . (06 Marks)
 c. State and prove Euler's theorem. (07 Marks)

- 4 a. Find the total derivative of $z = xy^2 + x^2y$ where $x = at$, $y = 2at$, and also verify the result by direct substitution. (07 Marks)
 b. If $u = f(y - z, z - x, x - y)$ prove that : $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. (06 Marks)
 c. if $x = u(1 - v)$ and $y = uv$, find $J = \frac{\partial(x,y)}{\partial(u,v)}$ and $J' = \frac{\partial(u,v)}{\partial(x,y)}$ and also verify $J \cdot J' = 1$. (07 Marks)

- 5 a. Obtain the reduction formula for $\int \cos^n x \cdot dx$. (07 Marks)
 b. Evaluate : $\int_0^2 \frac{x^4}{\sqrt{4-x^2}} \cdot dx$. (06 Marks)
 c. Evaluate : $\int_1^2 \int_1^3 xy^2 dx dy$. (07 Marks)

- 6 a. Evaluate : $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} x y z dz dy dx$. (07 Marks)
 b. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. (06 Marks)
 c. Prove that $\beta(m,n) = \frac{\Gamma_m \Gamma_n}{\Gamma(m+n)}$. (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.

- 7 a. Solve : $\frac{dy}{dx} = e^{x-y} + x^2e^{-y}$. (07 Marks)
- b. Solve $x^2y dx - (x^3 + y^3) dy = 0$. (06 Marks)
- c. Solve $\frac{dy}{dx} + y \cot x = \cos x$. (07 Marks)
- 8 a. Solve : $\frac{d^2y}{dx^2} + \frac{4dy}{dx} + 4y = 0$. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} - \frac{6dy}{dx} + 9y = 3e^{-4x}$. (05 Marks)
- c. Solve : $y'' + 2y' + y = e^{-x} + \cos 2x$. (05 Marks)
- d. Solve : $\frac{d^2y}{dx^2} - 4y = x \sin 2x$. (05 Marks)

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