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MATDIP301

**Third Semester B.E. Degree Examination, Dec.2017/Jan.2018**  
**Advanced Mathematics - I**

Max. Marks:100

Time: 3 hrs.

**Note: Answer any FIVE full questions, selecting atleast TWO questions from each part.**

PART - A

- 1 a. Find the modulus and amplitude of  $\frac{4+2i}{2-3i}$ . (06 Marks)
- b. Express the complex number  $2+3i+\frac{1}{1-i}$  in the form  $a+ib$ . (07 Marks)
- c. Simplify  $\frac{(\cos 3\theta + i \sin 3\theta)^4 (\cos 4\theta - i \sin 4\theta)^5}{(\cos 4\theta + i \sin 4\theta)^3 (\cos 5\theta + i \sin 5\theta)^{-4}}$ . (07 Marks)
- 2 a. Find the  $n^{\text{th}}$  derivative of  $e^{ax} \sin(bx + \ell)$ . (06 Marks)
- b. Find the  $n^{\text{th}}$  derivative of  $\frac{x^2}{2x^2 + 7x + 6}$ . (07 Marks)
- c. If  $y = e^{a \sin^{-1} x}$ , prove that  $(1-x^2) y_{n+2} - (2n+1)xy_{n+1} - (n^2 + a^2)y_n = 0$ . (07 Marks)
- 3 a. If  $\phi$  is the angle between the tangent and radius vector to the curve  $r = f(\theta)$  at any point  $(r, \theta)$ , prove that  $\tan \theta = \frac{rd\theta}{dr}$ . (06 Marks)
- b. Find the angle of intersection between the curves  $r^n = a^n \cos n\theta$  and  $r^n = b^n \sin n\theta$ . (07 Marks)
- c. Using Maclaurin's series, expand  $\tan x$  up to the term containing  $x^5$ . (07 Marks)
- 4 a. If  $Z = f(x+ct) + \phi(x-ct)$ , prove that  $\frac{\partial^2 z}{\partial t^2} = C^2 \frac{\partial^2 z}{\partial x^2}$ . (06 Marks)
- b. If  $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$  prove that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \tan u$ . (07 Marks)
- c. If  $u = f(x-y, y-z, z-x)$ , prove that  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ . (07 Marks)

PART - B

- 5 a. Obtain the reduction formula for  $\int \cos^n x dx$ . (06 Marks)
- b. Using reduction formula evaluate  $\int_0^a \frac{x^7}{\sqrt{a^2 - x^2}} dx$ . (07 Marks)
- c. Evaluate  $\int_0^1 \int_0^1 e^{x+y} dx dy$ . (07 Marks)

- 6 a. Evaluate  $\int_0^1 \int_0^2 \int_1^2 x^2 yz \, dx dy dz$ . (07 Marks)
- b. Prove that  $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ . (07 Marks)
- c. Prove that  $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ . (06 Marks)
- 7 a. Solve  $3e^x \tan y \, dx + (1-e^x) \sec^2 y \, dy = 0$ . (06 Marks)
- b. Solve  $(2x + 3y + 4)dx + (4x + 6y + 5) \, dy = 0$ . (07 Marks)
- c. Solve  $\frac{dy}{dx} + y \tan x = \cos x$ . (07 Marks)
- 8 a. Solve  $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = -2 \cos 3x$ . (06 Marks)
- b. Solve  $(D^2 - 4D + 3)y = \sin 3x \cos 2x$ . (07 Marks)
- c. Solve  $\frac{d^2y}{dx^2} + 4y = x^2 + \cos 2x$ . (07 Marks)

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