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MATDIP301

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017

**Advanced Mathematics - I**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions.**

- 1 a. Express the  $\frac{3}{1+i} - \frac{1}{2-i} + \frac{1}{1-i}$  in the form of  $a + ib$ . (06 Marks)
- b. Find the cube roots of  $1 - i$ . (07 Marks)
- c. Prove that  $\left(\frac{1 + \cos \theta + i \sin \theta}{1 + \cos \theta - i \sin \theta}\right)^n = \cos n \theta + i \sin n \theta$ . (07 Marks)
- 2 a. Find the  $n$ th derivative of  $e^{ax} \cos(bx + c)$ . (07 Marks)
- b. Find the  $n$ th derivative of  $\frac{x}{(x-1)(2x+3)}$ . (06 Marks)
- c. If  $y = a \cos(\log x) + b \sin(\log x)$  prove that  $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$ . (07 Marks)
- 3 a. With usual notations P.T  $\tan \phi = \frac{rd\theta}{dr}$ . (06 Marks)
- b. Find the angle between the pairs of curves  
 $r = a \log \theta$      $r = \frac{a}{\log \theta}$ . (07 Marks)
- c. Find the Pedal equation to the curve  $r = a(1 + \sin \theta)$ . (07 Marks)
- 4 a. State and prove Euler's theorem of Homogeneous functions. (06 Marks)
- b. If  $u = f(x-y, y-z, z-x)$   
P.T  $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$ . (07 Marks)
- c. If  $u = \tan^{-1}x + \tan^{-1}y$ ,  $V = \frac{x+y}{1-xy}$   
S.T  $\frac{\partial(u,v)}{\partial(x,y)} = 0$ . (07 Marks)
- 5 a. Obtain the Reduction formula for  $\int \sin^m x \cos^n x dx$ . Where  $m, n$  are positive integers. (07 Marks)
- b. Evaluate  $\int_1^2 \int_0^{2-y} xy dx dy$ . (06 Marks)
- c. Evaluate  $\int_0^3 \int_0^2 \int_0^1 (x+y+z) dz dx dy$ . (07 Marks)
- 6 a. Prove that  $\sqrt{\left(\frac{1}{2}\right)} = \sqrt{\pi}$ . (06 Marks)
- b. Prove that  $\int_0^\infty x^2 e^{-x^4} dx \times \int_0^\infty e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$ . (07 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any re-writing or identification, appear to evaluator and /or equations written e.g. +z = 8 - 30, will be treated as inappropriate.

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- c. Evaluate the Integral  $\int_0^1 x^5(1-x)^6 dx$ . (07 Marks)
- 7 a. Solve  $(D^3 - 3D - 2)y = 0$ . (06 Marks)  
b. Solve  $(y'' + y) = e^{-x} + \cos x + x^3$ . (07 Marks)  
c. Solve  $y'' - 2y' + y = xe^x \sin x$ . (07 Marks)
- 8 a. Solve  $\frac{dy}{dx} = \frac{x(2 \log x + 1)}{\sin y + y \cos y}$ . (06 Marks)  
b. Solve  $x \log x \frac{dy}{dx} + y = 2 \log x$ . (07 Marks)  
c. Solve  $(2xy + y - \tan y) dx + (x^2 - x \tan^2 y + \sec^2 y) dy = 0$ . (07 Marks)

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