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MATDIP301

Third Semester B.E. Degree Examination, Dec.2014/Jan.2015
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express : $\dfrac{(3+i)(1-3i)}{2+i}$ in the form x + iy. **(05 Marks)**

b. Find the modulus and amplitude of the complex number $1+\cos\alpha + i\sin\alpha$. **(05 Marks)**

c. If $(3x-2iy)(2+i)^2 = 10(1+i)$, then find the values of x and y. **(05 Marks)**

d. Prove that $(\cos\theta_1 + i\sin\theta_1)(\cos\theta_2 + i\sin\theta_2) = \cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2)$. **(05 Marks)**

2 a. Find the n^{th} derivative of $e^{ax}\cos(bx+c)$. **(06 Marks)**

b. If $y = a\cos(\log x) + b\sin(\log x)$ prove that $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(07 Marks)**

c. Compute the n^{th} derivatives of $\sin x \sin 2x \sin 3x$. **(07 Marks)**

3 a. With usual notations prove that $\dfrac{1}{p^2} = \dfrac{1}{r^2} + \dfrac{1}{r^4}\left(\dfrac{dr}{d\theta}\right)^2$. **(06 Marks)**

b. Prove that the curves cuts $r^n = a^n\cos n\theta$, and $r^n = b^n \sin n\theta$ orthogonally. **(07 Marks)**

c. Expand $\log(1+\sin x)$ in powers of x by Maclaurin's theorem up to the terms containing x^3. **(07 Marks)**

4 a. If $u = x^2y + y^2z + z^2x$, prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = (x+y+z)^2$. **(06 Marks)**

b. If $u = f(x-y, y-z, z-x)$, prove that $\dfrac{\partial u}{\partial x} + \dfrac{\partial u}{\partial y} + \dfrac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $u = e^x\cos y$, $v = e^x\sin y$, find $J = \dfrac{\partial(u,v)}{\partial(x,y)}, J' = \dfrac{\partial(x,y)}{\partial(u,v)}$ and verify $JJ' = 1$. **(07 Marks)**

5 a. Obtain a reduction formula for $\int \sin^n x \; dx$. **(06 Marks)**

b. Evaluate : $\displaystyle\int_0^1\int_x^{\sqrt{x}}(x^2+y^2)dxdy$. **(07 Marks)**

c. Evaluate : $\displaystyle\int_0^a\int_0^x\int_0^{x+y} e^{x+y+z}\, dz\, dy\, dx$. **(07 Marks)**

6 a. Define Gamma function. Prove that $\Gamma(n+1) = n\Gamma(n)$. **(06 Marks)**

b. With usual notation prove that : $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

c. Prove that $\beta\left(m,\frac{1}{2}\right) = 2^{2m-1}\beta(m,m)$. **(07 Marks)**

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7 a. Solve : $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$. **(05 Marks)**

b. Solve : $\dfrac{dy}{dx} = 1 + \dfrac{y}{x} + \left(\dfrac{y}{x}\right)^2$. **(05 Marks)**

c. Solve : $\dfrac{dy}{dx} + y \cot x = \sin x$. **(05 Marks)**

d. Solve : $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

8 a. Solve : $\dfrac{d^3y}{dx^3} - 6\dfrac{d^2y}{dx^2} + 11\dfrac{dy}{dx} - 6y = 0$. **(06 Marks)**

b. Solve : $y'' - 6y' + 9y = e^x + 3^x$. **(07 Marks)**

c. Solve : $\dfrac{d^2y}{dx^2} + 4y = x^2 + \sin 3x$. **(07 Marks)**

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