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Total number of printed pages – 2

B. Tech  
BSCM 2201

**Third Semester (Special) Examination – 2013**

**MATHEMATICS – III**

**BRANCH : AEIE, BIOTECH, CIVIL, CSE, EC, EEE,  
ELECTRICAL, ETC, IEE, IT, MECH**

**QUESTION CODE : D 184**

**Full Marks – 70**

**Time : 3 Hours**

*Answer Question No. 1 which is compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2×10
- Find the solution of partial differential equation  $y^2 x u_x = x^2 y u_y$ , using variable separation.
  - Write the formula for the potential on the x-axis.
  - Express Laplace equation in cylindrical co-ordinates.
  - Find out whether  $f(z) = \frac{\text{Re}(z^2)}{|z|}$ ,  $z \neq 0$  and  $f(0) = 0$  is continuous or not.
  - Check the function  $f(z) = z^6$  is analytic or not.
  - Find the fixed pts of a linear fractional transformation.
  - Define radius of convergence of a series. Give an example.
  - What is Taylor's series expansion ?
  - Define removal singularity and essential singularity.
  - State Cauchy Residue theorem. Write its importance.



P.T.O.

2. Derive D'Alembert's solution of the wave equation. Hence, find the deflection of the string of length  $2\pi$ , initial velocity is zero and initial deflection  $f(x) = x(\pi^2 - x^2)$ . 10
3. Derive heat equation. Find the solution of heat equation when both ends of the bar are insulated. 10
4. Explain two dimensional wave equation with initial and boundary conditions. Derive the solution of it. 10
5. (a) Check the differentiability of  $f(z) = z^3$  5  
 (b) State and prove Cauchy Integral theorem. 5
6. (a) Evaluate the Integral  $I = \int_C \operatorname{Re} z^2 dz$ , where C the boundary of the square with vertices  $0, i, 1+i, 1$  clockwise. 5  
 (b) Evaluate  $\oint \frac{e^z}{(z-2)(z-1)} dz$ , where C is a circle having center at  $z=0$  and radius 3 unit. 5
7. (a) Find the Laurent series expansion of  $f(z) = \frac{z+4}{(z+3)(z-1)^2}$  in the region. 5  
 (i)  $1 < |z-1| < 4$   
 (ii)  $|z-1| > 4$   
 (b) Check the nature of singularity of the following function : 5  
 (i)  $f(z) = \frac{1 - \cos z}{z^3}$   
 (ii)  $f(z) = e^z$   
 (iii)  $f(z) = e^{1/(z-2)}$
8. (a) Evaluate  $\oint \frac{z^2 \sin z}{4(z^2-1)} dz$ ,  $C : |z| = 2$  5  
 (b) Evaluate  $\int_0^\infty \frac{dx}{(x^2-1)^2}$  using contour integration technique. 5

