GATE ASSIGNMENT 3

EE1030 : Matrix Theory
Indian Institute of Technology Hyderabad

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1) Consider two functions $f(z) = z$ and $g(z) = \bar{z}$ (conjugate of z). Using Cauchy-Riemann conditions, choose the correct answer

   a) Both f and g are analytic
   b) f is analytic but g is not analytic
   c) g is analytic but f is not analytic
   d) Neither f nor g is analytic

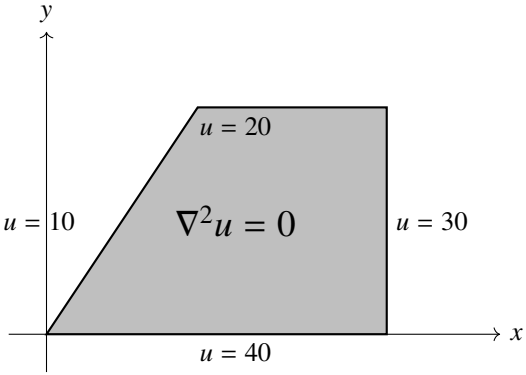
2) For $f(x) = x^4 - 5xy^2$ the direction of maximum increase of $f(x, y)$ at the point $(2, 2)$ is along

   a) $3\hat{i} + 10\hat{j}$ b) $-12\hat{i} - 40\hat{j}$ c) $3\hat{i} - 10\hat{j}$ d) $-12\hat{i} + 40\hat{j}$

3) Suppose 50% of the population of a village like oranges, 70% of the population like apples, and 40% like both. If a person is picked at random who likes at least one of these fruits, what is the probability that the person likes oranges?

   a) $\frac{1}{8}$ b) $\frac{5}{12}$ c) $\frac{1}{2}$ d) $\frac{5}{8}$

4) For the solution of $\nabla^2 u = 0$, the domain and boundary conditions are shown below.



Which of the following statements is TRUE?

a) The solution cannot be obtained using separation of variables because the governing equation is non-separable.
b) The solution cannot be obtained using separation of variables because all the boundary values are non-zero.
c) The solution cannot be obtained using separation of variables because not all the boundaries are along constant coordinate lines.
d) The solution can be obtained by separation of variables.

5) If $f(x) = x\sin(x)$ and $g(x) = |x|\sin(x)$, then
a) $g(x) = |f(x)|$
b) $g(x)$ is an even function
c) The x-coordinates corresponding to the various local maxima are identical for both $f(x)$ and $g(x)$
d) $g((x)$ is differentiable at $x = 0$

6) The general solution of $\frac{d^4y}{dx^4} - 2\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$ is

a) $c_1e^x + c_2xe^x + c_3\cosh(x) + c_4\sinh(x)$
b) $c_1e^x + c_2e^{-x} + c_3e^{ix} + c_4e^{-ix}$
c) $c_1e^x + c_2xe^x + c_3\cos(x) + c_4\sin(x)$
d) $c_1e^x + c_2xe^x + c_3e^{ix} + c_4e^{-ix}$

7) Evaluation of

$$\iint_S (e^x\hat{\imath} + 3y\hat{\jmath} - ze^x\hat{k}) \cdot \hat{n}\, dA$$

over a surface $S : x^2 + y^2 + z^2 = 1$, using Gauss divergence theorem, gives

a) 0
b) 4π
c) $\frac{4\pi}{3}$
d) 12π

8) The exact solution of the integral

$$\int_0^4 \left(x^2 - 4\right) dx$$

is denoted by I_E. The same integral evaluated numerically by the trapezoidal rule and the Simpson's 1/3 rule are denoted by I_T and I_S, respectively. The subinterval used in the numerical methods is $h = 2$. Then

a) $I_E = I_S > I_T$
b) $I_E = I_S < I_T$
c) $I_E < I_S < I_T$
d) $I_E > I_S > I_T$

9) In a two-dimensional flow field, the velocities in the x- and y- directions are u and v, respectively. The shear stress for a Newtonian fluid having dynamic viscosity μ is given by

a) $\mu\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right)$
b) $2\mu\frac{\partial v}{\partial y}$
c) $2\mu\frac{\partial u}{\partial x}$
d) $\mu\left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}\right)$

10) In a potential flow, the superposition of the stream functions of a uniform flow and a line source gives rise to a dividing streamline representing

a) Rankine's half-body
b) infinite circular cylinder
c) infinite rotating circular cylinder
d) infinite elliptical cylinder

11) Given that V, L, and g are the characteristic velocity, characteristic length, and acceleration due to gravity, respectively, the expression $\frac{V}{\sqrt{Lg}}$ represents

a) Weber number
b) Euler number
c) Cavitation number
d) Froude number

12) Match the devices in Column I with the characteristics in Column II.

Column I	**Column II**
P. orifice meter	1. high head loss and low cost
Q. venturi meter	2. high head loss and high cost
	3. low head loss and high cost
	4. low head loss and low cost

a) P - 2; Q - 4
b) P - 1; Q - 2
c) P - 3; Q - 1
d) P - 1; Q - 3

13) Identify the visualization method that shows a PATHLINE in an unsteady flow, assuming that the camera covers the required field of view.

a) A dye is continuously injected and a snap shot is taken
b) A dye is continuously injected and a long-exposure picture is taken
c) A blob (or drop) of dye is injected and a snap shot is taken
d) A blob (or drop) of dye is injected and a long-exposure picture is taken