

B.TECH. BIO MEDICAL ENGINEERING- ASSIGNMENT

Course Code: Math106C

Course title-Mathematics

Semester: IInd

UNIT-I

Q.1. Evaluate $\iint (a^2 - x^2 - y^2)^{1/2} dx dy$ over the semi-circle $x^2 + y^2 = a^2$ in the positive quadrant.

Q.2. Show that the cylindrical and spherical co-ordinates are self-reciprocal.

Q.3 Find the work done in moving a particle in a force field

$$f = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$$

along the line joining the points (0,0,0) to (2,1,3).

Q.4. Evaluate $\iint \vec{f} \cdot \hat{n} ds$; where $\vec{f} = y\hat{i} + 2x\hat{j} + z\hat{k}$ and S is the surface of the plane $2x+y=6$ in the first octant cut off by the plane $z=2$.

UNIT-II

Q.1. Verify that the differential equation

$$x dx + y dy = \frac{a^2(x dy - y dx)}{x^2 + y^2} \text{ is exact and solve it'}$$

Q.2. Solve the differential equations

$$(i) \quad x^2 \left(\frac{dy}{dx}\right)^2 + xy \left(\frac{dy}{dx}\right) - 6y^2 = 0$$

$$(ii) \quad \left(\frac{dy}{dx}\right)^3 + 2x \left(\frac{dy}{dx}\right)^2 - y^2 \left(\frac{dy}{dx}\right)^2 - 2xy^2 \left(\frac{dy}{dx}\right) = 0$$

Q.3. Obtain the power series solution of

$$y'' + (x - 1)y' + y = 0 \text{ in powers of } (x-2).$$

Q.4. Solve by the method of variation of parameters

$$\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + ay = \frac{e^{3x}}{x^2}$$

UNIT-III

Q.1. Define the following

- (1) Derivative
- (2) Analytic function
- (3) Cauchy Riemann equation
- (4) Harmonic function
- (5) Harmonic conjugate

Q.2. Prove the product of two Mobius transformation is a Mobius transformation.

Q.3. Verify the Cauchy Riemann equation are satisfied by the following functions

- (i) e^{z^2} (ii) $\cos 2z$ (iii) $\sinh 4z$

Q.4. Prove that function $u = x^2 - y^2 - 2xy - 2x + 3y$ is harmonic and find a function v such that $f(z) = u + iv$ is analytic. Express $f(z)$ in terms of z .

UNIT-IV

Q.1. Define the following

- (1) Cauchy theorem
- (2) Cauchy goursat's theorem
- (3) Cauchy integral formula
- (4) Cauchy integral formula for higher derivatives
- (5) Cauchy goursat's for multiconnected domain

Q.2. Evaluate each of the following

- (i) $\int e^{-2z} dz$ (ii) $\int z \sin z^2 dz$ (iii) $\int \frac{z^2+1}{z^3+3z+2} dz$

Q.3. Determine poles of the following function and residue at each pole

$$\frac{z^2}{(z-1)(z-2)^2}$$

Q.4. Evaluate

$$\oint \frac{\sin z^2}{(z - \frac{\pi}{4})^3} dz$$

where C is $|z|=1$