



KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE

Answer any FIVE Questions

(5 X 20 = 100 Marks)

1. a) Find if $\phi = (x - y)(x^2 + 4xy + y^2)$ can represent the equipotential for an electric field. Find the corresponding complex potential $f(z) = \phi + i\psi$ and also ψ . [10]
- b) Determine the regular function $f(z) = P + iQ$, given that $P - Q = \frac{\cos x + \sin x - e^{-y}}{2\cos x - e^y - e^{-y}}$ and $f\left(\frac{\pi}{2}\right) = 0$. [10]
2. a) Find the image of the region of the z -plane bounded by the straight lines $x = 1$, $y = 1$ and $x + y = 1$ under the transformation $w = z^2$. [10]
- b) Find the bilinear transformation that maps the points $z_1 = 0$, $z_2 = 1$ and $z_3 = \infty$ into the points $w_1 = i$, $w_2 = -1$, and $w_3 = -i$. [10]
3. a) If $0 < |z - 1| < 2$ then express the function $f(z) = \frac{z}{(z-1)(z-3)}$ in a series of positive and negative powers of $(z - 1)$. [10]
- b) Evaluate $\int_C \frac{\cos \pi z^2 + \sin \pi z^2}{(z+1)(z+2)} dz$ $C: |z| = 3$ using Cauchy's integral formula. [5]
- c) Find the residue of $f(z) = \tan z$ at each of its poles inside the circle $|z| = 2$. [5]
4. a) Evaluate $\int_0^{2\pi} \frac{d\theta}{5 - 4\sin \theta}$ by contour integration. [10]
- b) Evaluate $\int_{-\infty}^{\infty} \frac{1}{(x^2+1)^3} dx$ by contour integration. [10]
5. a) Form the partial differential equation by eliminating the arbitrary function ϕ from the relation $\phi(x^2 + y^2 + z^2, xyz) = 0$. [5]
- b) Solve $z = px + qy + \frac{p}{q} - q$. [5]
- c) Solve $(y - z)p + (x - y)q = (z - x)$. [10]
6. a) Solve $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x + 2y)$. [8]
- b) A string is stretched and fastened to two points $x = 0$ and $x = 60$ apart. Motion is started by displacing the string into the form $y(x, 0) = 60x - x^2$ while the initial velocity is zero, find the displacement $y(x, t)$. [12]
7. a) Find the Fourier Transform of $f(x) = \begin{cases} 1 & \text{in } |x| < a \\ 0 & \text{in } |x| > a \end{cases}$. Hence deduce that $\int_0^{\infty} \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$. [10]
- b) Find the Fourier sine transform of e^{-ax} and hence find the Fourier sine transform of $\frac{x}{x^2 + a^2}$. [10]

14 + 10 + 15 + 10 + 10 + 10



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