4E1218

Roll No. ____

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B. Tech. IV-Sem. (Back) Exam., Oct.-Nov. - 2020
Electronic Inst. & Control Engg.
4EI2-01 Advanced Engineering Mathematics-II
EC,EI

Time: 2 Hours **Maximum Marks: 82**

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Min. Passing Marks: 29

Instructions to Candidates:

Attempt all ten questions from Part A, four questions out of seven questions from Part B and two questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 Write the necessary conditions for f(z) to be analytic.

Q.2 What is Isolated and Removable singularity?

Q.3 Find the points in the z-plane where the mapping w = f(z) fails to be conformal, when $f(z) = z^4 - z^2$.

Q.4 Evaluate $\int_C \frac{dz}{z^2-1}$, where C is the circle $x^2+y^2 = 4$.

Q.5 State Residue theorem.

Q.6 Compute the residue at each pole for the function –

$$F(z) = \frac{z^2}{z^2 - 2z + 2}$$

Q.7 Write the orthogonality of Legendre Polynomials.

Q.8 Find the value of $J_{3/2}(x)$.

Q.9 Define vector space with examples.

Q.10 What is Gram-Schmidt orthogonalization process.

PART – B

(Analytical/Problem solving questions) **[4x8=32]**

Attempt any four questions

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Q.1 Determine the analytic function $w = u + iv$, if $u = e^{2x}(x\cos 2x - y\sin 2y)$.

Q.2 Expand $\frac{z-1}{z+1}$, by Taylor's series about the point $z = 0$; $z = 1$.

Q.3 Evaluate $\int_0^{2\pi} \frac{d\theta}{5+4\sin\theta}$ by contour integration.

Q.4 Express $P(x) = x^4 + 2x^3 + 2x^2 - x - 3$ in terms of Legendre's polynomial.

Q.5 Show that $\int x J_0^2(x)dx = \frac{x^2}{2}[J_0^2(x) + J_1^2(x)] + c$.

Q.6 Show that S_1 is a vector subspace, where –

$S_1 = \{(x_1, x_2, x_3) : x_1 + x_2 = x_3\}$

Q.7 Use Gram Schmidt process to obtain an orthogonal basis from the basis set $\{(1,0,1), (1,1,1), (1,3,4)\}$ of the Euclidean space R^3 with standard inner product.

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[2×15=30]**

Attempt any two questions

Q.1 (a) Show that under the transformation $w = \frac{z-i}{z+i}$, real axis in the z-plane is mapped into the circle $|w| = 1$. What portion of the z-plane corresponds to the interior of the circle?

(b) Find the bilinear transformation which maps the points $z = 0, -i, -1$ into $w = i, 1, 0$

Q.2 (a) Expand the function $\frac{1}{(z-1)(z-2)}$ for –

(i) $|z|<1$ (ii) $1< |z| < 2$ (iii) $|z| > 2$ (iv) $0 < |z - 1| < 1$

(b) Evaluate the integral $\int_c \frac{\sin\pi z^2+\cos\pi z^2}{(z-1)^2(z-2)} dz$; $|z|=3$

Q.3 Construct an orthonormal basis from E^4 with $\frac{1}{2}$ (1,1,1) as the starting basis.

Q.4 Show that $\int_{-\infty}^{\infty} \frac{dx}{(x^2+a^2)(x^2+b^2)^2} = \frac{\pi(a+2b)}{2ab^3(a+b)^2}$ where $b > 0$ and $c > 0$

Q.5 (a) Prove that $\int_{-1}^{+1} (P_n')^2 dx = n(n + 1)$

(b) Prove that $\frac{d}{dx} [J_n^2(x) + J_{n+1}^2(x)] = 2 \left[\frac{n}{x} J_n^2(x) - \frac{n+1}{x} J_{n-1}^2(x)\right]$

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