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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech II Semester End Examinations (Regular/Supply) - May, 2018

Regulation: IARE – R16

COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTIONS

Time: 3 Hours

(ECE)

Max Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. (a) Show that $f(z)=|z|^2$ is differentiable only at $z=0$, hence it is nowhere analytic. [7M]
- (b) Construct the analytic function $f(z)$ whose real part is $u(x, y)=e^x(x \cos y - y \sin y)$. [7M]
2. (a) For the function $f(z) = xy^2 + ix^2y$, determine the points where the Cauchy-Reimann equations are not satisfied. [7M]
- (b) If $w = \Phi + i\psi$ represents the complex potential for an electric field and the stream function $\psi = (x^2 - y^2) + \frac{x}{x^2+y^2}$. Determine the function Φ . [7M]

UNIT – II

3. (a) Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along the line $y=x/2$. [7M]
- (b) Evaluate $\int_C \frac{z^3 - 2z + 1}{(z-i)^2} dz$ where C is $|z|=2$, using Cauchy integral formula. [7M]
4. (a) Evaluate $f(3)$ whenever $f(a) = \int_C \frac{2z^2 - z - 2}{(z-a)} dz$, where C is $|z|=2.5$. [7M]
- (b) Apply Cauchy's integral formula to evaluate $\int_C \frac{\sin^2 z}{(z-\pi/6)^3} dz$, where C is the circle $|z|=1.5$. [7M]

UNIT – III

5. (a) Express $f(z) = \frac{z^2-1}{z^2+5z+6}$, in a series of positive and negative powers of z in the region $2 < |z| < 3$. [7M]
- (b) Apply the calculus of residues to evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$. [7M]
6. (a) Determine the residues at each of the poles for the function $f(z) = \frac{z+1}{z^2-3z+2}$. [7M]
- (b) Find the bilinear transformation that maps the points $z_1=\infty$, $z_2=i$, $z_3=0$ into the points $w_1=0$, $w_2=i$, and $w_3=\infty$. [7M]

UNIT – IV

7. (a) A shipment of 8 similar microcomputers to a retail outlet contains 3 defectives. If a school makes a random purchase of 2 of these computers, find the [7M]

- i. Discrete probability distribution for the number of defectives
 - ii. Expectation
 - iii. Variance
- (b) Calculate the first three moments of the following distribution about the mean: [7M]

Table 1

x:	0	1	2	3	4	5	6	7	8
f:	1	8	28	56	70	56	28	8	1

8. (a) Consider the density function [7M]
- $$f(x) = \begin{cases} k\sqrt{x}, & 0 < x < 1 \\ 0, & elsewhere \end{cases}$$
- i. Evaluate k.
 - ii. Evaluate $P(0.3 < X < 0.6)$ using the density function
 - iii. Find mean of the density function.
- (b) The first four moments about the working mean 28.5 of a distribution are 0.294, 7.144, 14.409 and 454.98. Calculate the moments about the mean. [7M]

UNIT – V

9. (a) It has been claimed that in 60% of all solar-heat installations the utility bill is reduced by at least one third. Accordingly, what are the probabilities that the utility bill will be reduced by at least one third in [7M]
- i. Four of five installations
 - ii. At least four of five installations
 - iii. At the most of two of five installations.
- (b) An automobile manufacturer is concerned about a fault in the breaking mechanism of a model. The fault can, on rare occasions, cause a catastrophe at high speed. The distribution of the number of cars per year that will experience the fault as a Poisson random variable with $\lambda=5$.
- i. What is the probability that at most three cars per year will experience a catastrophe?
 - ii. What is the probability that more than one car per year will experience a catastrophe. [7M]
10. (a) Given a Standard normal distribution, find the area under the curve which lies [7M]
- i. To the left of $z=1.43$
 - ii. To the right of $z=-0.89$
 - iii. Between $z=-2.16$ and $z=-0.65$
 - iv. To the left of $z=-1.39$.
- (b) If a bank received on the average 6 bad checks per day, what are the probabilities that it will receive [7M]
- i. 4 bad checks on any given day
 - ii. No bad check on any given day.