Hall Ticket No | | | | | | | | | | Question Paper Code:AHSC11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Dundigal-500043, Hyderabad)

B.Tech IV SEMESTER END EXAMINATIONS (REGULAR) - JULY 2022

Regulation:UG20

COMPLEX ANALYSIS AND PROBABILITY DISTRIBUTIONS

Time: 3 Hours (ELECTRICAL AND ELECTRONICS ENGINEERING) **Max Marks: 70**

Answer ALL questions in Module I and II

Answer ONE out of two questions in Modules III, IV and V

(NOTE: Provision is given to answer TWO questions from among one of the Modules III / IV / V

All Questions Carry Equal Marks

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

MODULE – I

1. (a) Find the bilinear transform which maps the points $z = 0, -i, -1$ into the points $w = i, 1, 0$.
[BL: Understand| CO: 1|Marks: 7]

(b) Show that the function $f(z) = \begin{cases} \frac{(\overline{z})^2}{z} & z \neq 0 \\ 0 & z = 0 \end{cases}$ is not differentiable, even though Cauchy-Riemann equations are satisfied there. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) State Cauchy integral theorem and use it to evaluate the integral $\int_C \frac{e^z}{(z^2+\pi^2)^2} dz$ where $C\ is\ |z| = 4$.
[BL: Understand| CO: 2|Marks: 7]

(b) Evaluate $\oint_C (x+y)dx + (y-2x)dy$ along:
i) The parabola $y = 2x^2$ from (1, 2) to (2, 8)
ii) The straight lines from (1, 1) to (1, 8) and then from (1, 8) to (2, 8)
iii) The straight line from (1, 1) to (2, 8). [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Find the Maclaurin's series expansion of the function $\sin z$. [BL: Understand| CO: 3|Marks: 7]

(b) State Cauchy's residue theorem. Hence evaluate $\int_C \frac{e^z dz}{\sin z}$ where C is the circle |z|=1.
[BL: Understand| CO: 3|Marks: 7]

4. (a) Find the nature of singularities of the following functions [BL: Apply| CO: 4|Marks: 7]
i) $f_1(z) = \frac{z - \sin z}{z^4}$
ii) $f_2(z) = \frac{1-e^z}{1+e^z}$

(b) Give two Laurent series expansions in the power of z for the function $f(z) = \frac{1}{z^2(1-z)}$ and specify the regions in which those expansions are valid [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Let X be a random variable of sum of two numbers in throwing two fair dice. Find the probability distribution of X, mean, variance. [BL: Apply| CO: 5|Marks: 7]

   (b) A random variable X has the following probability distribution given in Table 1

Table 1

x	1	2	3	4	5	6
P(x)	k	3k	5k	7k	9k	11k

Determine i) k ii) P $(1 \leq x \leq 5)$ iii) P(x>3) [BL: Understand| CO: 5|Marks: 7]

6. (a) If X is a continuous random variable and $Y = aX + b$, prove that E(Y)=aE(X)+b and $V(Y) = a^2V(X)$, where V stands for variance and a, b are constants. [BL: Understand| CO: 5|Marks: 7]

   (b) A random variable X has probability density function $f_x(x) = \begin{cases} 5e^{-5x} & 0 \leq x \leq \infty \\ 0 & elsewhere \end{cases}$

   Find i) E(X) ii) $E[(X-1)^2]$ [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Write about the Binomial and Poisson distributions with their characteristics. [BL: Understand| CO: 6|Marks: 7]

   (b) A machine manufacturing bolts is known to produce 5% defective. In a random sample of 10 bolts, compute the probability that there are
   i) Exactly 3 defective bolts
   ii) Not more than 3 defective bolt [BL: Apply| CO: 6|Marks: 7]

8. (a) The marks obtained by 500 students is normally distributed with mean 65 % and standard deviation 8%. Determine how many get more than 80%. [BL: Understand| CO: 6|Marks: 7]

   (b) A missile can be accidentally launched if two relays A and B both have failed. The probabilities of A and B failing are known to be 0.01 and 0.03 respectively. It is also known that B is more likely to fail (probability 0.06) if A failed.
   i) What is the probability of an accidental missile launch?
   ii) What is the probability that A will fail if B has failed?
   iii) Are events “A fails” and “B fails” statistically independent? [BL: Apply| CO: 6|Marks: 7]

– ◦ ◦ ◯ ◦ ◦ –