

Code No: 07A4BS04

R07**Set No. 2**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
II B.TECH II SEM-REGULAR/SUPPLEMENTARY EXAMINATIONS MAY – 2010
MATHEMATICS FOR AEROSPACE ENGINEERS

Aeronautical Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) A random variable X has the following distribution

X=x	0	1	2	3	4	5	6	7	8
P(X=x)	a	3a	5a	7a	9a	11a	13a	15a	17a

Determine a and find $P(x < 3)$, $P(X < 3) < P(0 < x < 5)$. and the smallest value of x for which $P(x \leq x) > 0.5$

- (b) If X is a normal variate show that $E(X) = \mu$, and $\text{Var}(X) = \sigma^2$ [8+8]

2. (a) If $w = u + iv = z^3$, prove that the curves $u = c_1$, and $v = c_2$ where C_1 and C_2 are constants, cut each other orthogonally.

- (b) If $u = x^2 - y^2$, $v = -\frac{y}{x^2 + y^2}$, then show that both u and v are harmonic but $u + iv$ is not analytic. [8+8]

3. (a) Evaluate the equation $\int_c \frac{(z^2 - z - 1)}{z(z-1)^2} dz$ with $c : |z - \frac{1}{2}| = 1$ using Cauchy's integral formula.

- (b) Using Cauchy's integral formula, evaluate $\int_c \frac{e^{2z}}{(z^2 + \pi^2)^3} dz$ where c is $|z| = 4$

- (c) Evaluate $\int_{(0,0)}^{(1,1)} (3x^2 + 4XY + ix^2) dz$ along $y = x^2$ [5+6+5]

4. (a) Two dice, one green and the other red, are thrown. Let A be the event that the sum of the points on the faces is odd and B the event of at least one ace (number 1 on the face of die). Find the probabilities of the events

i. $A \cup (A^c \cap B)$

ii. $(A|B)$

iii. $(A^c|B^c)$

iv. $A \cup (A^c \cup B)$

- (b) A vendor has 25 gas filled balloons tied to strings. 10 balloons are yellow, 8 are red and 7 are green. Find the probability that two balloons selected at random by a boy are both yellow. [8+8]

5. (a) Find the expansion of by Taylor's series about $z=1$.

- (b) Expand $f(z) = \frac{z}{(z-1)(2-z)}$ in a Laurent's series for $1 < |z| < 2$

- (c) Expand $f(z) = ze^{2z}$ in a Taylor's series about $z=-1$. [5+6+5]

6. (a) Show that the transformation $w = z + 1/z$ maps the circle $r = c$ into an ellipse. Discuss the case when $c = 1$. Draw rough sketches in each case.

- (b) Show that $w = (i/4) [(z+2)/(z+1)]$ transforms the real axis in z -plane to a circle in w -plane. Find the pre-image of the center of such circle. [8+8]
7. (a) Evaluate $\int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}} dx$ using β and Γ s.
- (b) Prove that $\int_0^1 (1-x^n)^{\frac{1}{n}} dx = \frac{[\Gamma(\frac{1}{n})]^2}{2n\Gamma(\frac{2}{n})}$
- (c) Show that

$$\beta(m, n) = 2 \int_0^{\frac{\pi}{2}} \sin^{2m-1}(\theta) \cos^{2n-1}(\theta) d\theta$$

 Deduce that $\int_0^{\frac{\pi}{2}} \sin^n(\theta) d\theta = \int_0^{\frac{\pi}{2}} \cos^n(\theta) d\theta = \frac{\Gamma(\frac{n+1}{2})\Gamma(\frac{1}{2})}{2\Gamma(\frac{n+2}{2})}$ [5+5+6]
8. Define covariant tensor of order one. Give an example. A covariant tensor has components $2x - z, x^2y, yz$ in rectangular coordinates. Find its covariant components spherical coordinates. [16]

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