Code No: RT21024 **R13** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
COMPLEX VARIABLES AND STATISTICAL METHODS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Show that $w = z^n$ (n, a positive integer) is analytic and find its derivative (4M)

   b) Evaluate $\int_0^{2+i} z^2 dz$ along the real axis to 2 and then vertically to (2+i) (3M)

   c) Find the residue of f(z) = cotz at each pole. (4M)

   d) Find the image of the region x > 1 under w = 1/z (3M)

   e) Calculate a 99% confidence interval for the true mean weight loss if 16 persons on diet control after one month had a mean weight loss of 3.42 kgs with S.D of 0.68kgs. (4M)

   f) Experience had shown that 20% of a manufactured product is of the top quality. In one day's production of 400 articles only 50 are of top quality .Test the hypothesis at 0.05 level. (4M)

PART –B

2. a) Show that the function $f(z) = \sqrt{|xy|}$ is not analytic at the origin, although Cauchy-Riemann equations are satisfied at the point. (8M)

   b) Show that $u(x, y) = x^3 - 3xy^2$ is harmonic and find its harmonic conjugate and corresponding analytic function f(z) in terms of z. (8M)

3. a) Evaluate using Cauchy's integral formula. (8M)
   $\int_c \frac{z^3 e^{-z}}{(z-1)^3} dz$ where C is $|z-1| = \frac{1}{2}$

   b) Expand the Laurent series of $\frac{z^2 - 1}{(z+2)(z+1)}$ for $(i) 1 < |z| < 2$ $(ii)\ |z| > 2$ (8M)
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4. a) Evaluate $\int_0^{\infty} \frac{\cos x}{(1+x^2)^2} dx$ (8M)

   b) Show that $\int_0^{\pi} \frac{d\theta}{(a+b\cos\theta)^2} = \frac{\pi a}{(a^2-b^2)^2}, a > b > 0.$ (8M)

5. a) Determine the Bilinear transformation which maps $z = 0, -i, 2i$ into $w = 5i, \infty, -i/3$ (8M)

   b) Prove that the transformation w=sin z maps the families of lines x = constant and y =constant in to two families of confocal central conics. (8M)

6. a) If a random variable has the standard normal distribution, find the probability that will take on value (i) Less than 1.75, (ii) greater than 2.06 (iii) lies between 1.22 and 2.43 (iv) greater than 2.43 (8M)

   b) Samples of size 2 are taken from the population 4,8,12,16,20,24 without replacement. Find (i) Mean of the sampling distribution of means (ii) The standard deviation of the sampling distribution of means (8M)

7. a) Sample of students were drawn from two universities and from their weights in kilograms, mean and standard deviations are calculated and shown below. Make a large sample test to test the significance of the difference between the means at 5% level of significance. (8M)

	Mean	S.D	Size of Sample
University A	55	10	400
University B	57	15	100

   b) In a one sample of 10 observations the sum of squares of deviations from mean was 90 and other sample of 12 observations it was 108. Test whether the difference is significant at 5% level of significance. (8M)

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PART –A

1. a) Verify whether $f(z) = z^2$ is analytic or not (4M)
   b) Evaluate $\int_0^{2+i} z^2 dz$ along the imaginary axis to i and then horizontally to 2+i (3M)
   c) Find the residue of (4M)
   $f(z) = \frac{Z^2 - 2Z}{(Z+1)^2(Z^2+1)}$ at $z = i$
   d) Find the fixed point of $w = \frac{2i - 6z}{iz - 3}$ (3M)
   e) A random sample of 400 items is found to have mean 82 and S.D of 18.Find the maximum error of estimation at 95% confidence interval (4M)
   f) If 80 patients are treated with an antibiotic59 got cured. Test at 99% confidence limits to the true population of cure is 50%. (4M)

PART –B

2. a) If f(z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ (8M)
   b) Find the imaginary part whose real part is $e^x(x\cos y - y\sin y)$ (8M)

3. a) Using Cauchy's integral formula, evaluate $\int_c \frac{z}{(z-1)(z-2)^2} dz$ where (8M)
   c: $|z-2| = \frac{1}{2}$
   b) Find Taylor's expansion of $f(z) = \frac{2z^3 + 1}{z^2 + z}$ about the point (i) z = i (ii) z = 1 (8M)

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4. a) Show that $\int_0^{\pi} \frac{Cos2\theta}{1-2aCos\theta+a^2} d\theta = \frac{\pi a^2}{1-a^2}$, ($a^2 < 1$) (8M)

   b) Evaluate $\int_0^{\infty} \frac{\cos mx}{(x^2+a^2)^2} dx$ By residue theorem (8M)

5. a) Find the bilinear transformation that maps the points $(\infty, i, 0)$ into the points $(0, i, \infty)$ (8M)

   b) Find the image of the triangle with vertices $i, 1+i, 1-i$ in the z-plane under the transformation w=3z+4-2i. (8M)

6. a) Samples of size 2 are taken from the population 3, 6.9, 15, 27 with replacement. Find i) Mean of the sampling distribution of means
   ii) The standard deviation of the sampling distribution of means (8M)

   b) Determine the expected member of random sample having their means
   (i) between 22.39 and 22.41(ii) Greater than 22.42
   (iii) less than 22.47 for population size(N)=1500, sample size (n)=36, standard deviation of the population is 0.48 and population mean (μ) = 22.4 (8M)

7. a) The means of two large samples of sizes 1000 and 2000 members are 67.5 inches and 68.0 inches respectively. Can the samples be regarded as drawn from the same population of S.D 2.5 inches? (8M)

   b) From the following data, find whether there is any significant liking in the habit of taking soft drinks among the categories of employees at 5% level of significance (8M)

Soft drinks	Clerks	Teachers	officers
Pepsi	10	25	65
Thump up	15	30	65
Fanta	50	60	30

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Show that both real and imaginary parts of an analytic functions are harmonic (4M)

b) Evaluate $\int_0^{3+i} z^2 dz$ along the line $x = 3y^2$ (3M)

c) Find the residue of $\frac{Ze^z}{(Z-1)^3}$ at its pole. (4M)

d) Find the image of the domain in the z-plane to the lines x = -3 under the transformation $w = z^2$. (3M)

e) A random sample of size 81 was taken whose variance is 20.25 and means is 32, construct 98% confidence interval (4M)

f) A sample of 26 bulbs gives a mean life of 990 hrs with S.D of 20hrs. The manufacturer claims that the mean life of bulbs 1000 hrs. Is the sample not up to the standard at 5% level? (4M)

PART -B

2. a) If f(z) = u + iv is analytic and $v = \frac{2\sin x \sin y}{\cos 2x + \cosh 2y}$,find u. (8M)

b) Show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)\log\left|f'(z)\right| = 0$, where f(z) is analytic function. (8M)

3. a) Evaluate $\int_c \frac{z+4}{z^2+2z+5} dz$ where c is the circle i) $|z+1-i| = 2$ ii) $|z+1+i| = 2$ (8M)

b) Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the region (i) |z|<1 (ii) 1<|z|<2 (iii) |z|>2. (8M)

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4. a) Evaluate $\int_0^{\infty} \frac{dx}{x^6+1}$. Using Residue theorem (8M)

   b) Evaluate $\int_0^{2\pi} \frac{1}{(5-3Cos\theta)^2} d\theta$ Using Residue theorem (8M)

5. a) Under the transformation $w = \frac{1}{z}$ find the image of the circle $|z-2i| = 2$. (8M)

   b) Find the bilinear transformation whose fixed points are 1, 1 and maps 0 to -1 (8M)

6. a) The mean of certain population is equal to the standard error of the mean of the samples of 64 from that distribution. Find the probability that the mean of the sample size 36 will be negative. (8M)

   b) Of a large group of mean 5% are under 60 inches in height and 40% are between 60 and 65 inches. Assuming a normal distribution, find the mean height and standard deviation. (8M)

7. a) A cigarette manufacturing firm claims that brand A line of cigarettes outsells its brand B by 8% .if it is found that 42 out of a sample of 200 smokers prefer brand A and 18 out of another sample of 100 smokers prefer brand B. Test whether 8% difference is a valid claim. (8M)

   b) A die is thrown 264 times with the following results .show that the die is unbiased (8M)

No appeared on die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Prove that an analytic function with constant real part is constant (4M)
   b) Evaluate $\int_0^{3+i} z^2 dz$ along the line $y = \frac{x}{3}$ (3M)
   c) Find the residue of (4M)
   f(z) = $\frac{Z^2 - 2Z}{(Z+1)^2(Z^2+1)}$ at Z = -1
   d) Find the image of the straight line x = c under the transformation w = 4/z (3M)
   e) Define unbiased estimator and Show that x/n is an un biased estimator of binomial parameter p (4M)
   f) A sample of 11 rats from a central population had an average blood Viscosity of 3.92 with a S.D of 0.61. Test for the mean blood Viscosity of the population is 3.5 with 5% level of significance (4M)

PART -B

2. a) Find an analytic function whose real part is $v\, e^{-x}(x\sin y - y\cos y)$. (8M)
   b) Show that for the function $f(z) = \begin{cases} \frac{z^5}{|z|^4}, z \neq 0 \\ 0, z = 0 \end{cases}$ Cauchy- Riemann equation are satisfied at z = 0, but $f(z)$ is not differentiable at 0. (8M)

3. a) Evaluate $\int_c \frac{e^z}{(z^2+\pi^2)^2} dz$ where C is $|z| = 4$. Using Cauchy's integral formula (8M)

   b) Find the Laurent series expansion of the function $f(z) = \frac{z^2 - 6z - 1}{(z-1)(z-3)(z+2)}$ in the region $3 < |z+3| < 5$. (8M)
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Code No: RT21024 **R13** SET - 4

4. a) Evaluate $\int_0^{2\pi} \frac{\cos 2\theta}{(5+4Cos\theta)} d\theta$ Using Residue theorem (8M)

   b) Evaluate $\int_0^{\infty} \frac{\cos x}{(1+x^2)^2} dx$ Using Residue theorem (8M)

5. a) Show that the transformation $w = \frac{5-4z}{4z-2}$ maps the unit circle $|z| = 1$ into a circle of radius unity and center $\frac{-1}{2}$ (8M)

   b) Determine the bilinear transformation that maps the points (1-2i,2+i,2+3i), into the points (2+i,1+3i,4) (8M)

6. a) A population consists of six numbers 4,8,12,16,20,24 consider all samples of size two. Which can be drawn without placement from this population? Find (8M)
   i) The mean of the sampling distribution of means.
   ii) The standard deviation of the sampling distribution of means

   b) Find the mean and standard deviation of a normal distribution in which 7% of items are under 35 and 89% are under 63. (8M)

7. a) In an investigation on machine performance the following results are obtained

	No. of units inspected	No. of defectives
Machine I	375	17
Machine II	450	22

   Test whether there is any significance performance of two machines at α = 0.05.

   b) The no. of automobile accidents per week in a certain area as follows: 12,8,20,2,14,10,15,6,9,4 . Are these frequencies in agreement with the belief that accidents were same in the during last 10 weeks. (8M)

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