ROLL NO. ____________________

Code: AE56/AC56/AT56/ AE107/AC107/AT107 **Subject: ENGINEERING MATHEMATICS-II**

AMIETE – ET/CS/IT *{CURRENT & NEW SCHEME}*

Time: 3 Hours **JUNE 2015 - SPECIAL** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. If y = 0, $z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$, then the solution of $\frac{\partial^2 z}{\partial y^2} = z$ is equal to

(A) $z = e^{-x}\sinh y + e^{-x}\cosh y$ **(B)** $z = e^{x}\sinh y + e^{x}\cosh y$

(C) $z = e^{-x}\sinh y + e^{x}\cosh y$ **(D)** $z = e^{x}\sinh y - e^{x}\cosh y$

b. The value of the integral $\int_C \frac{e^z}{\cos \pi z} dz$, where C is the unit circle $|z| = 1$

(A) $-4i\cosh\left(\frac{1}{2}\right)$ **(B)** $-4i\sinh\left(\frac{1}{2}\right)$

(C) $4i\cosh\left(\frac{1}{2}\right)$ **(D)** $4i\sinh\left(\frac{1}{2}\right)$

c. If $\vec{A}(t) = (3t^2 - 2t)i + (6t-4)j + 4tk$, the value of $\int_2^3 \vec{A}(t)\,dt$ is equal to

(A) 14i + 11j +10k **(B)** 11i +10j +14k
(C) 10i +11j +14k **(D)** 7i +11j+15k

d. If $F = 3xyI - y^2J$, then the value of $\int F.dR$, where C is the curve in the xy-plane $y = 2x^2$ from (0,0) to (1, 2), is

(A) $-7/6$ **(B)** $-7/5$
(C) $-7/3$ **(D)** $-7/2$

e. The value of $(\nabla + \Delta)^2 (x^2 + x)$, if h = 1, is

(A) 4 **(B)** 8
(C) 6 **(D)** 2

f. The value of $\nabla^2 y_5$, if

X	1	2	3	4	5
Y	2	5	10	17	26

is:

(A) -1 **(B)** 1
(C) 2 **(D)** -2

g. If a bag contains 8 white and 6 red balls, then the probability of drawing two balls of the same colour is,

(A) $\frac{-43}{91}$ **(B)** $\frac{91}{43}$
(C) $-\frac{91}{43}$ **(D)** $\frac{43}{91}$

h. If x is a normal variable with mean 30 and S.D. 5 then the probability of $|x - 30| > 5$ is,

(A) -0.3174 **(B)** 1.3174
(C) 0.3174 **(D)** -1.3174

i. Mean and variance of a poission distribution are

(A) equal **(B)** not equal
(C) multiple **(D)** not multiple

j. A machine which produces mica insulating washers for use in electric devices is set to turn out washers having a thickness of 10 mm. A simple of 10 washers has an average thickness 9.52 mm with a standard deviation of 0.6 mm. Then the value of t is:

(A) 2.528 **(B)** -2.528
(C) 3.528 **(D)** -3.528

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Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Show that the function $f(z) = e^{-z^{-4}} (z \neq 0)$ and $f(0) = 0$ is not analytic at $z = 0$ although the Cauchy-Riemann equations are satisfied at that point. **(8)**

b. Find the bilinear transformation which maps the point z = 1, i,-1 into the points w = i, 0, -i . Hence find the image of $|z| < 1$. **(8)**

Q.3 a. For the function $f(z) = \frac{4z-1}{z^4-1} + \frac{1}{z-1}$, find all Taylor or Laurent series about the centre zero. **(8)**

b. Find the residue of $f(z) = \frac{z^2-2z}{(z+1)^2(z^2+4)}$ and $f(z) = e^z \operatorname{cosec}^2 z$ at all its poles in the finite plane. **(8)**

Q.4 a. If $f(x, y) = \frac{1}{2}\log(x^2+y^2)$, show that grad f = $\dfrac{\bar{r} - \left(\hat{k}.\bar{r}\right)\hat{k}}{\left\{\bar{r} - \left(\hat{k}.\bar{r}\right)\hat{k}\right\}.\left\{\bar{r} - \left(\hat{k}.\bar{r}\right)\hat{k}\right\}}$ **(8)**

b Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1,2). **(8)**

Q.5 a. Verify Green's theorem for $\int_C \left[(xy + y^2)\, dx + x^2 dy\right]$, where C is bounded by y = x and $y = x^2$ **(8)**

b. Verify Stoke's theorem for $\bar{f} = xy^2\,\hat{i} + y\,\hat{j} + z^2 x\,\hat{k}$ for the surface of a rectangular lamina bounded by x = 0, y = 0, x =1, y = 2, z = 0. **(8)**

Q.6 a. The values of a function f(x) are given below for certain values of x:

x	0	1	3	4
f(x)	5	6	50	105

Find the value of f(2) using Langrange's interpolation formula. **(8)**

b. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using **(8)**

(i) Simpson's $\frac{1}{3}$ rule taking h = $\frac{1}{4}$

(ii) Simpson's $\frac{1}{8}$ rule taking h = $\frac{1}{6}$

Hence compute an approximate value of π in each case.

Q.7 a. Apply Charpit's method to solve $(p^2 + q^2)y = qz$. **(8)**

b. Use the method of separation of variables to solve the equation $\frac{\partial^2 v}{\partial x^2} = \frac{\partial v}{\partial t}$ given that v = 0 when $t \to \infty$, as well as v = 0 at x = 0 at x = 0 and x = 1 **(8)**

Q.8 a. There are 6 positive and 8 negative numbers. Four numbers are chosen at random, without replacement and multiplied. What is the probability that the product is a positive number? **(8)**

b. An underground mine has 5 pumps installed for pumping out storm water, the probability of any one of the pumps failing during the storm is $\frac{1}{8}$. What is the probability that (a) at least 2 pumps will be working, (b) all the pumps will be working during a particular storm? **(8)**

Q.9 a. In a certain factory producing cycle tyres, there is a small chance of 1 in 500 tyres to be defective. The tyres are supplied in lots of 10. Using Poisson distribution, calculate the approximate number of lots containing no defective, one defective and two defective types respectively in a consignment of 10,000 lots. **(8)**

b. A manufacturer of envelopes knows that the weight of the envelopes is normally distributed with mean 1.9 gm and variance 0.01 gm. Find how many envelopes weighting (i) 2 gm or more, (ii) 2.1 gm or more, can be expected in a given packet of 1000 envelopes?
[Given: if t is the normal variable then, $\phi(0 \le t \le 1) = 0.3413$ and $\phi(0 \le t \le 2) = 0.477$] **(8)**