

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

AMIETE – ET/CS/IT (Current & New Scheme)

Time: 3 Hours

JUNE 2018

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 $f(z)$ is analytic function and $f'(z)$ is continuous at each point within and on a simple closed curve C, then $\oint_C f(z) dz$ is
 (A) $2\pi i$ (B) 0
 (C) πi (D) $-\pi i$
- b. If $u = x^2 - y^2$, find the corresponding analytic function
 (A) $z^3 + C$ (B) $-z^2 + C$
 (C) $z^2 + C$ (D) None of these
- c. The residue at the poles of the function $f(z) = \cot z$ is equal to
 (A) 0 (B) -1
 (C) 1 (D) None of these
- d. The value of curl (grad f), where $f = 2x^2 - 3y^2 + 4z^2$ is
 (A) 0 (B) 3
 (C) $4xi - 6yj + 8zk$ (D) $4x - 6y + 8z$
- e. If $\vec{f} = ax\hat{i} + by\hat{j} + cz\hat{k}$, where a, b, c are constants, then $\iiint_S \vec{f} \cdot d\vec{s}$, where S is the surface of unit sphere is
 (A) 0 (B) $\frac{4}{3}\pi(a + b + c)$
 (C) $\frac{4}{3}\pi(a + b + c)^2$ (D) None of these
- f. The fluid motion given by $\vec{u} = (y + z)\hat{i} + (z + x)\hat{j} + (x + y)\hat{k}$ is
 (A) Solenoidal (B) Rotational
 (C) Irrotational (D) None of these
- g. The value of $\Delta^3 y_0$ is
 (A) $y_3 + y_2 - 3y_1 - y_0$ (B) $y_3 - 3y_2 + 3y_1 + y_0$
 (C) $y_3 - 3y_2 + 3y_1 - y_0$ (D) $y_3 + 3y_2 + 3y_1 + y_0$

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- h. The differential equation formed by the equation $z = (x + a)(y + b)$ is
 (A) $pq = z$ (B) $pz = q$
 (C) $p = qz$ (D) $pq + z = 0$
- i. An urn contains 10 black and 10 white ball. The probability of drawing two balls of same colour is
 (A) $9/19$ (B) $8/20$
 (C) $9/20$ (D) None of these
- j. The variance for a binomial distribution is
 (A) np (B) \sqrt{np}
 (C) npq (D) \sqrt{npq}

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

- Q.2** a. Show that the function $u = \frac{1}{2} \log(x^2 + y^2)$ is harmonic. Find its harmonic conjugate. (8)
- b. Examine the nature of the function

$$f(z) = \frac{x^2 y^5 (x + iy)}{x^4 + y^{10}} ; z \neq 0, \quad f(0) = 0$$
 in the region including the origin. (8)
- Q.3** a. Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along the real axis from $z = 0$ to $z = 2$ and then along a line parallel to y-axis from $z = 2$ to $z = 2 + i$. (8)
- b. With the help of residue theorem, evaluate $\int_C \frac{z^2 - 2z}{(z+1)^2(z^2+4)} dz$, where C is the circle $|z| = 10$. (8)
- Q.4** a. If $u = x + y + z, v = x^2 + y^2 + z^2, w = xy + yz + zx$. Prove that grad u , grad v and grad w are coplanar vectors. (8)
- b. Find the directional derivative of $\frac{1}{r}$ in the direction of \vec{r} , where $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$. (8)
- Q.5** a. Using Green's theorem, evaluate $\int_C (x^2 y dx + x^2 dy)$, where C is the boundary described counter clockwise of the triangle with vertices $(0,0), (1,0), (1,1)$. (8)
- b. If $\vec{F}(x, y, z) = x^3 i + yj + zk$ is the force field. Find the work done by \vec{F} along the line from $(1,2,3)$ to $(3,5,7)$. (8)
- Q.6** a. Find the polynomial $f(x)$ by using Lagrange's interpolation formula and hence find $f(3)$ from the following data (8)

x:	0	1	2	5
f(x):	2	3	12	147

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- b. Evaluate the integral $\int_0^1 \frac{x^2}{1+x^3} dx$ by using Simpson's $1/3^{\text{rd}}$ rule. Compare the error with the exact value. Divide range in four equal parts. (8)
- Q.7** a. Solve the partial differential equation $p(x^2 - y^2 - z^2) + q 2xy = 2xz$. (8)
- b. Using Charpit's method, find the complete integral of $pxy + pq + qy = yz$. (8)
- Q.8** a. From a bag containing 5 white, 7 red and 4 black balls a man draws 3 at random, find the probability of being all white. (8)
- b. A can hit a target 4 times in 5 shots; B three times in 4 shots; C twice in 3 shots. They fire a volley. What is the probability that they hit at least two shots. (8)
- Q.9** a. If X is a continuous random variable with probability density function given by
- $$f(x) = \begin{cases} kx & (0 \leq x < 2) \\ 2k & (2 \leq x < 4) \\ -kx + 6k & (4 \leq x < 6) \end{cases}$$
- Find k and mean value of X . (8)
- b. The probability that a pen manufactured by a company will be defective is $\frac{1}{10}$. If 12 such pens are manufactured, find the probability that
- exactly two will be defective.
 - at least two will be defective.
 - none will be defective.
- (8)