

DipIETE – ET/CS (Current Scheme)

Time: 3 Hours

DECEMBER 2015

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 $\left(\frac{1+i}{1-i}\right)^n = 1$, then n is equal to

- (A) -1 (B) 1
(C) 2 (D) 4

b. The two non zero vectors \vec{a} and \vec{b} are parallel if

- (A) $\vec{a} \times \vec{b} = \vec{0}$ (B) $|\vec{a} \times \vec{b}| = 1$
(C) $\vec{a} \cdot \vec{b} = 0$ (D) $|\vec{a}| = |\vec{b}|$

c. If $x + iy = \sqrt{2} + 3i$, then $x^2 + y$ is

- (A) 7 (B) 5
(C) 13 (D) $\sqrt{2} + 3$

d. The solution of the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^{3x}$ is given by

- (A) $y = c_1e^x + c_2e^{2x} + \frac{1}{2}e^{3x}$ (B) $y = c_1e^{-x} + c_2e^{-2x} + \frac{1}{2}e^{3x}$
(C) $y = c_1e^{-x} + c_2e^{2x} + \frac{1}{2}e^{3x}$ (D) $y = c_1e^{-x} + c_2e^{2x} + \frac{1}{2}e^{-3x}$

e. If $f(x) = f(2a - x)$, then $\int_0^{2a} f(x)dx$ is equal to

- (A) $\int_a^0 f(2a - x)dx$ (B) $2\int_0^a f(x)dx$
(C) $-2\int_0^a f(x)dx$ (D) 0

- f. The inverse Laplace transform of $\frac{1}{s(s+2)}$ is
- (A) $\frac{1-e^{-2t}}{2}$ (B) $\frac{1+e^{-2t}}{2}$
 (C) $\frac{1-e^{2t}}{2}$ (D) $\frac{1+e^{2t}}{2}$
- g. The Laplace transform of $e^{2t} \sin t$ is
- (A) $\frac{s-2}{(s-2)^2+1}$ (B) $\frac{1}{(s+2)^2+1}$
 (C) $\frac{1}{(s-2)^2+1}$ (D) $\frac{s+2}{(s+2)^2+1}$
- h. For the Fourier series of the function $f(x)=x^2$ in the interval $(-\ell, \ell)$, b_n is equal to
- (A) $\frac{\pi\ell^2}{2}$ (B) $-\frac{\pi\ell^2}{2}$
 (C) 0 (D) $2\pi\ell^2$
- i. The current in a circuit is $10 - 2j$ and voltage across the circuit is $60+20j$, then the admittance will be equal to
- (A) $\frac{7}{50} + \frac{2}{25}j$ (B) $\frac{-7}{50} + \frac{2}{25}j$
 (C) $\frac{7}{50} - \frac{2}{25}j$ (D) $\frac{-7}{50} - \frac{2}{25}j$
- j. The value of definite integral $\int_{-a}^a |x| dx$ is
- (A) a (B) a^2
 (C) 0 (D) $2a$

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

Q.2 a. Evaluate $\lim_{x \rightarrow 1} \frac{x^x - x}{x-1-\log x}$ (8)

b. Find the area bounded by $y^2 = 9x$ and $x^2 = 9y$ (8)

Q.3 a. Prove that $(1 + \cos \theta + i \sin \theta)^n + (1 + \cos \theta - i \sin \theta)^n = 2^{n+1} \cos^n \frac{\theta}{2} \cos \frac{n\theta}{2}$ (8)

Code: DE55/DC55 Subject: ENGINEERING MATHEMATICS - II

- b. Forces of magnitudes 5 and 3 units acting in the directions $6i + 2j + 3k$ and $3i - 2j + 6k$ respectively act on a particle which is displaced from the point $(2, 2, -1)$ to $(4, 3, 1)$. Find the work done by the forces. (8)
- Q.4** a. Find a Fourier series to represent $x - x^2$ from $x = -\pi$ to $x = \pi$. (8)
- b. The differential equation for a circuit in which self-inductance neutralizes each other is $L \frac{d^2 i}{dt^2} + \frac{i}{C} = 0$. Find the current i as a function of t given that I is the maximum current, and $i = 0$ when $t = 0$. (8)
- Q.5** a. Find the Laplace transform of $t^2 \cos at$. (8)
- b. Evaluate $L^{-1} \left[\frac{s-1}{s^2-6s+25} \right]$ (8)
- Q.6** a. Solve using Laplace transform the equation $(D^3 - 3D^2 + 3D - 1)y = t^2 e^t$, given that $y(0) = 1, y'(0) = 0, y''(0) = -2$. $\left(D = \frac{d}{dx} \right)$ (8)
- b. Solve $\frac{d^2 y}{dx^2} - \frac{3dy}{dx} + 2y = x e^x$ (8)
- Q.7** a. Using Maclaurin's series expand $\tan x$ upto the term containing x^5 . (8)
- b. Using Laplace transforms evaluate the integral $\int_0^{\infty} t e^{-2t} \sin t \, dt$ (8)
- Q.8** a. Two circuits of impedances $2 + j4$ ohms and $3 + j4$ ohms are connected in parallel and a.c. voltage of 100 volts is applied across the parallel combination. Calculate the magnitude of the current as well as power factor for each circuit and the magnitude of the total current for the parallel combination. (8)
- b. Express $f(x) = x$ as a Fourier series in the interval $-\pi < x < \pi$. (8)
- Q.9** a. If $(x^2 y - 2) + i(x + 2xy - 5) = 0$, find the value of x and y . (8)
- b. Evaluate $\int_0^{\pi/6} \cos^4 3\theta \sin^3 6\theta \, d\theta$ (8)