Total No. of Questions – [~~07~~] 10 Total No. of Printed Pages: 03

G.R. No.	

Paper Code - U128-101 (ESE)

MAY 2019 / END-SEM

F. Y. B.TECH. (COMMON) (SEMESTER - II)

COURSE NAME: Engineering Mathematics-II

COURSE CODE: ES12181

(PATTERN 2018)

Time: [2 Hours] [Max. Marks: 50]

(*) Instructions to candidates:

1) **Attempt Q.1, Q.2, Q.3, Q.4 Or Q.5, Q.6 Or Q.7, Q.8 Or Q.9 and Q.10**
2) **Q.10 is compulsory.**
3) **Figures to the right indicate full marks.**
4) **Use of scientific calculator is allowed.**
5) **Use suitable data where ever required.**

Q 1) a) $\frac{dy}{dx} + y\cot x = \sin 2x$ [4]

OR

b) In a circuit containing inductance L, resistance R, and voltage E, the current I is given by $E = RI + L\frac{dI}{dt}$. Given L= 640H, R=250 Ω and E=500volts. I=0 when t = 0.Find the time that elapses,before it reaches 90% of its maximum value. [4]

Q 2) a) Trace the curve $x^2y^2 = x^2 + 1$. [4]

OR

b) Find the total length of the of the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$. [4]

Q 3) a) Show that plane $2x - 2y + z + 12 = 0$ is tangential to the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ and find the point of contact. [6]

OR

b) Find the equation of the right circular cylinder of radius 2 and whose axis lies along the straight line $\frac{x-1}{2} = \frac{y+3}{-1} = \frac{z-2}{5}$. [6]

Q 4) a) Evaluate $\int_0^{\frac{\pi}{2}}\int_0^{y}\cos 2y\sqrt{1-a^2\sin^2 x}\,dx\,dy$ [6]

b) Find the volume of paraboloid of revolution of $x^2+y^2=4z$ cut off by the plane $z=4$. [4]

OR

Q 5) a) Evaluate $\iiint \frac{dx\,dy\,dz}{\sqrt{a^2-x^2-y^2-z^2}}$ over the volume the sphere $x^2+y^2+z^2=a^2$ in the positive octant. [6]

b) Find the total area of the curve $r^2=a^2\cos 2\theta$. [4]

Q 6) a) Find the constants a & b, so that the surface $ax^2-byz=(a+2)x$ will be orthogonal to the surface $4x^2y+z^3=4$ at the point $(1,-1,2)$. [6]

b) Find the directional derivative $\phi=x^2y+y^3z$ at $(2,-1,1)$ along the direction which makes an equal angle with co-ordinate axes. [4]

OR

Q 7) a) Show that the field given by $\overline{F}=(y\sin z-\sin x)\vec{i}+(x\sin z+2yz)\vec{j}+(xy\cos z+y^2)\vec{k}$ is irrotational and hence find the scalar potential 'ϕ' such that $\overline{F}=\nabla\phi$. [6]

b) If the directional derivative of $\phi=axy^2+byz+cz^2x^3$ at $(1,2,-1)$ has maximum magnitude '64' in a direction parallel to z-axis, find the values of a, b, and c. [4]

Q 8) a) Evaluate $\int_C \bar{F}.d\bar{r}$ for $\bar{F}=(2y+3)\hat{\imath}+xz\hat{\jmath}+(yz-x)\hat{k}$ along the straight line joining (0,0,0) and (3,1,1). [6]

b) Using Gauss Divergence theorem, evaluate

$\iint_S \bar{r}.\hat{n}\,dS$, where $\bar{r}=x\bar{\imath}+y\bar{\jmath}+z\bar{k}$ over the sphere $x^2+y^2+z^2=1$. [4

OR

Q 9) a) Using Stokes theorem, evaluate $\iint_S (\nabla\times\bar{F}).d\bar{S}$

where $\bar{F}=3(x-y)\hat{\imath}+3xz\hat{\jmath}+xy\,\hat{k}$ and S is the surface of the paraboloid $z=1-x^2+y^2, z\geq 0$. [6]

b) Using Green's Theorem evaluate the integral $\int_C \bar{F}.d\bar{r}$ for $\bar{F}=\sin y\,\hat{\imath}+x(1+\cos y)\hat{\jmath}$ where C is the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1, z=0$. [4]

Q 10) Attempt all the questions.(Each carry one mark) [6]

a) If $\phi = mx^2 + y + z$, $\bar{b} = 2\bar{i} - 3\bar{j} + \bar{k}$ and $\nabla\phi$ at the point$(1,0,1)$ is perpendicular to $\bar{b}$ then m=

a) 0 b) $\frac{3}{2}$ c) $\frac{1}{2}$ d) $-\frac{5}{2}$

b) The divergence of vector field $\bar{F} = 3xz\bar{i} + 2xy\bar{j} - yz^2\bar{k}$ at a point $(1,1,1)$ is

a) 3 b) 4 c) 7 d) 0 .

c) Angle between tangents to the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 2t - 5$ at $t = 0$ and $t = 1$ is

a) $\cos^{-1}\left(\frac{12}{\sqrt{6}\sqrt{5}}\right)$ b) $\cos^{-1}\left(\frac{3}{\sqrt{6}\sqrt{5}}\right)$ c) $\cos^{-1}\left(\frac{3}{\sqrt{5}}\right)$ d) $\tan^{-1}\left(\frac{3}{\sqrt{6}\sqrt{5}}\right)$

d) By Gauss Divergence theorem, value of $\iint_S (y^2z^2\,\bar{i} + z^2x^2\,\bar{j} + x^2y^2\,\bar{k}).d\bar{S}$ where S is the sphere $x^2 + y^2 + z^2 = 9$ is

a) $\frac{\pi}{3}$ b) 3 c) $\frac{4\pi}{3}$ d) 0

e) Value of $\int_C \bar{F}.d\bar{r}$ for $\bar{F} = y\hat{i} + x\hat{j}$ along parabolic arc $y = x^2$ from $(0,0)$ and $(1,1)$ is

a) 0 b) 1 c) 2 d) 3

f) Work done in moving a particle along a circle $x^2 + y^2 = a^2$ round once under force field $\bar{F} = x\hat{i} + y\hat{j} + z\hat{k}$ is

a) 0 b) 1 c) 2 d) 3