Barkelwy-

Total No. of Questions – [10]

Total No. of Printed Pages: 02

G.R. No.	

Paper code- U119-109 (BE-FS)

DECEMBER 2019 / ENDSEM

F. Y. B.TECH. (COMMON) (SEMESTER – I)

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) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed.**
4) **Use suitable data wherever required.**

Q.1) a) In a circuit containing inductance 'L' resistance 'R' and voltage 'E', the current 'I' is given by $E = RI + L\frac{dI}{dt}$, where $I(0) = 0$. If $L = 640\,H$, $R = 250\Omega$ and $E = 500$ units, find the times that elapses before the current reaches 90% of its maximum value. [4]

OR

b) Solve $x\frac{dy}{dx} + \frac{y^2}{x} = y$. [4]

Q.2) a) Trace the curve $r = a\cos 3\theta$. [4]

OR

b) Trace the curve $3y^2 = x(x-1)^2$. [4]

Q.3) a) Find the equation of the right circular cone which passes through the point $(1,1,2)$ and has its axis the line $6x = -3y = 4z$ and vertex at origin. [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 $\iint_R \frac{x^2y^2}{x^2+y^2}\,dxdy$, where R is annulus between $x^2+y^2=4$ and $x^2+y^2=9$. [5]

b) Find the total area of the cardioid $r = a(1+\cos\theta)$. [5]

OR

Q.5) a) Find the volume bounded by the sphere $x^2 + y^2 + z^2 = 4$ above XoY-plane. [5]

b) Evaluate $\iiint (x^2y^2 + y^2z^2 + z^2x^2)dxdydz$ throughout the volume of the sphere $x^2 + y^2 + z^2 = a^2$ [5]

Q.6) a) 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. [5]

b) Show that the vector field given by [5]

$\overline{F} = (y\sin z - \sin x)\overline{i} + (x\sin z + 2yz)\overline{j} + (xy\cos z + y^2)\overline{k}$

is irrotational and hence find the scalar potential 'ϕ' such that $\overline{F} = \nabla\phi$.

OR

Q.7) a) Find the directional derivative of the function $\phi = e^{2x-y-z}$ at $(1,1,1)$ in the direction of tangent to the curve $x = e^t\cos t,\ y = e^t\sin t,\ z = e^t$ at $t = 0$ [5]

b) A curve is given by the equation $x = t^2 + 1,\ y = 4t - 3,\ z = 2t^2 - 6t$, find the angle between tangents at $t = 2$ and $t = 3$. [5]

Q.8) a) Evaluate $\int_C \overline{F}.\overline{dr}$ for $\overline{F} = (2x + y^2)\hat{i} + (3y - 4x)\hat{j}$ along the parabolic arc $y = x^2$ joining $(0, 0)$ and $(1, 1)$. [5]

b) Verify Green's Theorem for the field: [5]

$\overline{F} = x\hat{i} + y^2\hat{j}$ over the first quadrant of the circle $x^2 + y^2 = a^2$.

OR

Q.9) a) Find the work done under the field of the force : [5]

$\overline{F} = (2x - y + z)\hat{i} + (x + y - z^2)\hat{j} + (3x - 2y + 4z)\hat{k}$ in moving a particle once rounds the circle, $x^2 + y^2 = a^2$.

b) Evaluate the surface integral $\iint_S \left(y^2z^2\hat{i} + z^2x^2\hat{j} + x^2y^2\hat{k}\right).\,d\overline{S}$, where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$. [5]

Q.10) a) If a vector field $\overline{v} = (x + 3y)\overline{i} + (y - 2z)\overline{j} + (x + az)\overline{k}$ is solenoidal then value of a is [1]

a. 0 b. 3 c. 2 d. -2

b) Unit vector along the line equally inclined with coordinate axes is [1]

a. $\frac{1}{\sqrt{3}}(\overline{i} + \overline{j} + \overline{k})$ b. $\frac{1}{\sqrt{3}}(\overline{i} - \overline{j} - \overline{k})$ c. $\frac{1}{3}(\overline{i} + \overline{j} + \overline{k})$ d. $\frac{1}{3}(-\overline{i} + \overline{j} - \overline{k})$

c) If $\overline{F}$ is irrotational vector field then there exist a scalar potential ϕ such that [1]

a. $\overline{F} = \nabla^2\phi$ b. $\overline{F} = \nabla\phi$ c. $\phi = \nabla.\overline{F}$ d. $\nabla \times \overline{F} = \nabla\phi$

d) A field in which test charge around any closed surface in static path is zero is called [1]

a. Solenoidal b. Rotational c. Irrotational d. Conservative

e) Line integral is used to calculate [1]

a. Area b. Volume c. Length d. Density

f) Surface integral is used to compute [1]

a. Area b. Volume c. Length d. None of these