Total No. of Questions : 9]

SEAT No. :

P9100

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[6179]-225

S.E. (Electronics/E & TC) (Electronics & Computer Engineering)
ENGINEERING MATHEMATICS-III
(2019 Pattern) (Semester-III) (207005)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Q.1 is compulsory.*
2) *Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of electronic pocket calculator is allowed.*
6) *Assume suitable data, if necessary.*

Q1) Write the correct option for the following multiple choice questions.

a) Given equation is $\frac{dy}{dx} = x + y$ with initial condition x=0, y=1 and step size h=0.2. By Euler's formula y_1 at x=0.2 is equal to 1.2 first approximation at $y_1^{(1)}$ at x=0.2 calculated by modified Euler's formula is given by ______ **[2]**

i) 1.24 ii) 1.26

iii) 1.22 iv) 1.28

b) If $f(x) = x^2 - 2$, h=1, first backward difference $\nabla f(x)$ is given by ____ **[1]**

i) $2x-1$ ii) $3x+2$

iii) $x-5$ iv) $2x-5$

c) The divergence of vector field $\overline{F} = x^2 y\overline{i} + y^2\overline{j} + z^2 x\overline{k}$ at a point (1,2,1) is ________ **[2]**

i) 5 ii) 8

iii) 10 iv) 12

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d) For $\overline{F} = x^2\overline{i} + xy\overline{j}$, the value of $\int_C \overline{F}.d\overline{r}$ for the curve $y = x$ joining the points (0,0) and (1,1) is _______ **[2]**

i) 1 ii) $\frac{1}{3}$

iii) $\frac{3}{2}$ iv) $\frac{2}{3}$

e) If f(z) is analytic on and within a closed curve C then by cauchy's integral theorem $\oint_C f(z)$ is _______ **[1]**

i) $2\pi i$ ii) πi

iii) 0 iv) 1

f) If $f(z) = \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$ then residue of f(z) at the pole z=2 is ________ **[2]**

i) 0 ii) –1

iii) 1 iv) π

Q2) a) Find polynomial passing through the points by using newton's forward difference formula. Hence find $\frac{dy}{dx}$ at 1.5. **[5]**

x	0	2	4	6	8
y	5	29	125	341	725

b) Evaluate $\int_0^3 \frac{dx}{1+x}$ with 7 ordinates by using Simpson's $\left(\frac{3}{8}\right)^{th}$ rule **[5]**

c) Use modified Euler's Method to solve $\frac{dy}{dx} = x - y^2, y(0) = 1$ to calculate x=0.2 take h=0.2 **[5]**

OR

Q3) a) Find f (5) by using Lagrange's interpolation formula given that **[5]**
$f(1) = 2, f(2) = 4, f(3) = 8, f(4)=16, f(7)=128$

b) Find area bounded by curve $f(x)$ and x-axis and x=7.47 to x=7.52 from the following data using trapezoidal rule. **[5]**

x	7.47	7.48	7.49	7.50	7.51	7.52
y	1.92	1.95	1.98	2.01	2.03	2.06

c) Using fouth order Runge Kutta method solve equation $\frac{dy}{dx} = \sqrt{x+y}$ with $y(0)=1$ and find $y(0.2)$ taking h=0.2. **[5]**

Q4) a) Find the directional derivative, of $\phi = e^{2x}.\cos(yz)$ at (0,0,0) in the direction tangent to the curve x=a sin t, y = a cos t, z = at $t = \frac{\pi}{4}$ **[5]**

b) Show that $\overline{F} = r^2\overline{r}$ is conservative and obtain the scalar potential associated with it. **[5]**

c) Show that $\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r}\frac{df}{dr}$ **[5]**

OR

Q5) a) If the directional derivative of $\phi = axy + byz + czx$ at (1,1,1) has maximum magnitude 4 in a direction parallel to X-axis, find the values of a,b,c **[5]**

b) Show that $\overline{F} = \frac{\overline{a}\times\overline{r}}{r^n}$ is solenoidal. **[5]**

c) Show that $\nabla^4 e^r = e^r + \frac{4}{r}e^r$ **[5]**

Q6) a) Evaluate $\int_c \overline{F}.d\overline{r}$ for $\overline{F} = (2x+y)\overline{i} + (3y-x)\overline{j}$ and C is the straight line joining the points (0,0) and (3,2) **[5]**

b) By using Gauss divergence theorem. Find the value of $\iint_s \frac{x\overline{i} + y\overline{j} + z\overline{k}}{r^2}.d\overline{s}$ where s is the surface of sphere $x^2 + y^2 + z^2 = a^2$ **[5]**

c) Evaluate $\iint_s (\nabla \times \overline{F}).\hat{n}\, ds$ where s is the curved surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane $z=2$ where $\overline{F} = 3(x-y)\overline{i} + 2xz\overline{j} + xy\overline{k}$ **[5]**

OR

Q7) a) Using Green's theorem, find the value of $\int_C (xy - x^2)dx + x^2 dy$ along the curve C formed by $y = 0$, $x = 1$, $y=x$ **[5]**

b) Show that $\iiint_v \frac{2}{r} dv = \iint_s \frac{\overline{r}.\hat{n}}{r} ds$ **[5]**

c) Evaluate by $\int_C \overline{F}.d\overline{r}$ by using stoke's theorem for $\overline{F} = 4y\overline{i} - 4x\overline{j} + 3\overline{k}$ where s is a disk of radius 1 lying on the plane $z=1$ and C is the boundary of the disk. **[5]**

Q8) a) If $v = -\frac{y}{x^2+y^2}$ then find u such that $f(z) = u + iv$ is analytic. **[5]**

b) Evaluate $\oint_C \frac{z^2+2z}{(z+1)(z^2-9)} dz$, where 'C' is the circle $|z-3|=5$ by cauchy's Residue theorem. **[5]**

c) Find the bilinear transformation, which maps the points $0, -1, i$ of the Z-plane on to the points $2, \infty, \frac{1}{2}(5+i)$ of the w-plane. **[5]**

OR

Q9) a) If $u = 3x^2 - 3y^2 + 2y$ then find v such that $f(z)$ is analytic. **[5]**

b) Evaluate $\oint_C \frac{4z^2+z}{z^2-1} dz$, where 'C' is the circle $|z-1| = \frac{1}{2}$, by Cauchy's-Integral formula. **[5]**

c) Show that the map $w = \frac{2z+3}{z-4}$ transforms the circle $x^2 + y^2 - 4x = 0$ in to the straight line $4u+3=0$. **[5]**

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