University Institute of Engineering and Technology

(A constituent Autonomous Institute)
Kurukshetra University, Kurukshetra
B.Tech. 2nd (Common for ECE & Mech.)

Paper: Calculus and Ordinary Differential Equations — Subject Code: BS-136

Duration: 3 Hrs — Max Marks: 75

Note: All questions in Part-A and Part-B are compulsory. Attempt any four questions from Part-C.

PART-A

Q 1. Answer the following multiple choice questions: (15×1)

1(i) If the differential equation Mdx+Ndy=0 is exact and M=x+3y, then

(a). N=3
(b). N=x
(c). N=y
(d). N=x+$g(y)$, $g(y)$ being an arbitrary function of y.

1(ii) Integrating factor of $\frac{y}{y'} = -2x + 10y^3$ is...

1(iii) The particular integral of $y'' - 2y' + y = e^x \sin x$ is...

1(iv) The differential equation satisfying $y = Ae^{3x} + Be^{2x}$ is...

1(v) The relation between cartesian and spherical polar coordinates is given by...

1(vi) The value of the integral $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x\,dz\,dx\,dy$ is...

1(vii) Value of Jacobian for changing cartesian to cylinderical polar coordinates is...

1(viii) Draw the region enclosed by cylinder $x^2 + y^2 = 4$ and, the planes x=, y=0, z=0 and x+y+z=2.

1(ix) The line integral of a function F will be path dependent if

(a). grad F=0
(b). div F=0
(c). curl F=0
(d). None of these.

1(x) Given that F and G are vector fields and f is a scalar field, which of the following statement is not false?

(a). $\nabla.(\phi F) = \nabla\phi.F + \phi(\nabla.F)$

(b). $\nabla\times(\nabla\phi)=\vec{0}$

(c). $\nabla.(F\times G)=(\nabla\times F).G+F.(\nabla\times G)$

(d) $\nabla.(\nabla\times F)=0$

1(xi) The relation between the Line and Volume integrals can be established by

(a). Stokes theorem
(b). Gauss divergence theorem
(c). Green's theorem
(d). None of these

1(xii) The unit vector normal to the surface $z^2=4(x^2+y^2)$ at the point $P(1,1,2)$ is...

1(xiii) The relation between sinx and sinhx is given by...

1(xiv) The value of log(-i) is ...

1(xv) The real part of the function e^z is....

PART-B (4×5)

Q 2. Solve the differential equation, $x\frac{dy}{dx}+y=x^3y^7$.

Q 3. Evaluate $\int_0^1\int_0^{1-x}\int_0^{x+y} e^z\,dx\,dy\,dz$.

Q 4. *If* $\vec{F}=x^3\hat{i}+y\hat{j}+z\hat{k}$ is the force field , find the work done by $\vec{F}$ along the line from (1,2,3) to (3,5,7).

Q 5. Find all the roots of the equation $x^5-1=0$.

PART-C (4×10)

Unit-1

Q 6. Solve the differential equation $\left(D^2+4D+5\right)y=e^{-2x}(1+\sin 2x)$.

Q 7. By variation of parameter ,find the particular integral of equation

$$\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=e^x\tan x$$

Unit-2

Q 8. Change the order of integration in $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dy\,dx$ and then evaluate it.

Q 9. Evaluate the following by changing into polar co-ordinates: $\int_0^a \int_0^{\sqrt{a^2-y^2}} (x^2+y^2)\,dy\,dx.$

Unit-3

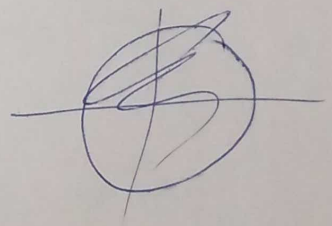
Q 10. Find the rate of change of $f(x,y,z) = xyz$ in the direction normal to the surface $x^2y + y^2x + yz^2 = 3$ at the point (1,2,1).

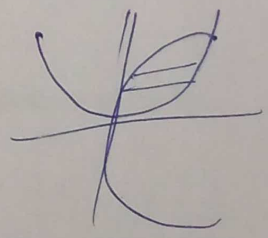
Q 11. Discuss the physical interpretation of vector operator Divergence.

Unit-4

Q 12. Find the regular function whose imaginary part is $e^x \sin y$.

Q 13. Evaluate $\oint_C \frac{3z^2+2}{(z-1)(z^2+9)}\,dz$, where C is $|z-2| = 2$.





$y = \frac{x^2}{4a}$

$x = \sqrt{4ay}$

$y^2 = 2\sqrt{ax}^2$

$y^2 = 4ax$