Total No. of Questions: 4

Enrollment No......................................

Knowledge is Power

Faculty of Engineering

Mid Sem – II Examination May– 2022

EN3BS12 Engineering Mathematics –II

Programme: B.Tech. | Branch/Specialisation: C Group

Duration: 2 Hrs. | **Maximum Marks: 40**

Q.1 i. Degree of the partial differential equation $p^4 + 5qx^2 + z^5 = 0$ is... **1**

(a) two (b) three (c) four (d) five

ii. General form of Lagrange's linear partial differential equation of order one, involving a dependent variable z and two independent variables x and y, where P, Q, R are functions of x, y, z is... **1**

(a) $Pp + Qq = R$ (b) $Pp - Qq = R$

(c) $Pp + Qq = Rr$ (d) $Pp - Qq = Rr$.

iii. Complete solution of $z = px + qy + 2\sqrt{pq}$ will be **1**

(a) $z = x + y + 2$ (b) $z = x + y + 2\sqrt{ab}$

(c) $z = ax + by$ (d) None of these.

iv. The complementary function of the differential equation $r + s - 6t = 0$ is **1**

(a) $f_1(y + 2x) + f_2(y + 3x)$

(b) $f_1(y - 3x) + f_2(y + 2x)$

(c) $f_1(y - 3x) + x f_2(y + 2x)$

(d) $f_1(y + 3x) + x f_2(y + 3x)$

v. In method of separation of variables for solution of partial differential equation, we assume that the dependent variable is the ______ of functions each of which contains only one of the variables. **1**

(a) sum (b) difference

(c) product (d) ratio

vi. The magnitude of the gradient of the function $f(x,y,z) = xyz^3$ at $(1,0,2)$ will be 1

(a) 3 (b) 5 (c) 8 (d) 14

vii. The directional derivative of a scalar field ϕ at a point $P(x,y,z)$ in the direction of unit vector $\hat{a}$ is given by 1

(a) $\hat{a}.grad\phi$ (b) $\hat{a} \times grad\phi$

(c) $\hat{a} + grad\phi$ (d) $\hat{a} - grad\phi$

viii. If $\vec{\nabla}.\vec{F} = 0$ then vector field $\vec{F}$ is called 1

(a) solenoidal (b) irrotational

(c) rotational (d) None of these

ix. The line integral $\int_C \vec{F}.d\vec{r}$ of the vector function $\vec{F} = 2x\hat{i} + x^2\hat{j}$ along the X-axis from $x = 1$ to $x = 2$ is 1

(a) 0 (b) 1

(c) 2 (d) 3

x. Gauss's divergence theorem relates certain 1

(a) line integral to surface integral

(b) line integral to volume integral

(c) surface integral to volume integral

(d) None of these.

Q.2 i. Solve by Charpit's method $px + qy = pq$. 4

ii. Solve $x^2p + y^2q = (x+y)z$. 6

OR iii. Use the method of separation of variables to solve the equation 6

$$\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0, \text{ with } u(0, y) = 5\,e^{2y}$$

Q.3 i. By using Green's theorem evaluate $\oint_C (xy + y^2)dx + x^2 dy$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.

ii. A particle moves along the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$, where t is the time. Find the component of its velocity and acceleration at $t = 1$ in the direction $\hat{i} - 2\hat{j} + 3\hat{k}$. 6

OR iii. Evaluate $\iint_S \vec{F}.\hat{n}\, ds$, where $\vec{F} = z\hat{i} + x\hat{j} - 3y^2 z\hat{k}$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$. 6

Q.4 i. Form the partial differential equation by $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$. 2

ii. Solve $r - 4s + 4t = e^{2x+y}$. 3

iii. Find a unit vector normal to the surface $x^2 y + 2xz = 4$ at the point $(2, -2, 3)$. 5

OR iv. Define irrotational vector point function. Is the fluid motion given by: $\vec{V} = (\sin y + z)\hat{i} + (x\cos y - z)\hat{j} + (x - y)\hat{k}$ irrotational or not? 5