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Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐ **Total No. of Pages : 02**

Total No. of Questions : 09

B.Sc. Non Medical (2018 Batch) (Sem.–1)

MATHEMATICAL PHYSICS

Subject Code : BSNM-103-18

M.Code : 75744

Time : 3 Hrs. **Max. Marks : 50**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying ONE marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write briefly :

a) By eliminating the constants a & b obtain the differential equation for which $xy = ae^x + be^{-x} + x^2$.

b) Define wronskian and also evaluate it for the functions $y_1(x) = \sin x$ & $y_2(x) = \sin x - \cos x$.

c) Solve $y(2xy + e^x)\, dx = e^x dy$.

d) For $f(x, y) = \log(xy + 2y^2 - 2x)$. Find $f_x(2,3)$ & $f_y(2, 3)$.

e) Find grad ϕ, when $\phi = \log(x^2 + y^2 + z^2)$.

f) Show that V = $(x^2 - y^2 + x)\,\hat{i} - (2xy + y)\,\hat{j}$ is irrotational.

g) State Green's theorem for a plane.

h) Define Gradient and cure in case of spherical coordinates.

i) Calculate the area of the parallelogram spanned by vectors $a = (3, -3, 1)$ & $b = (4, 9, 2)$

j) State any two properties of Dirac Delta function. (5 × 4 = 20)

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SECTION-B

Q2. Solve $(D^2 - 1)\,y = 0$ where $D = \frac{d}{dx}$.

Q3. Solve $y\,(xy + 2x^2y^2)\,dx + x\,(xy - x^2y^2)\,dy = 0$.

Q4. Prove that $\text{curl}\;(\text{curl}\;\vec{V}) = \text{grad div}\,\vec{V} - \nabla^2\,\vec{V}$.

Q5. Evaluate $\int_c F.dr$ where $\vec{F} = (3x^2 + 6y)\hat{i} - 14yz\,\hat{j} + 20xz^2\,\hat{k}$ from (0, 0, 0) to (1, 1, 1) along the path $x = t$, $y = t^2$, $z = t^3$,

Q6. Represent the Dirac Delta function as a limit of Gaussian function.

SECTION-C

Q7. Using Lagrange's multiplier method divide 24 into three parts such that the continued product of the first, square of the second and cube of the third may be maximum.

Q8. Verify stoke's theorem for $\vec{F} = (x^2 - y^2)\hat{i} = 2xy\,\hat{j}$ over the region bounded by the planes $x = 0$, $x = a$, $y = 0$, $y = b$, $z = 0$, $z = c$.

Q9. Prove that $\nabla^2(r^n) = n\,(n + 1)\,r^{n-2}$, where $r = |\vec{r}\,|$ and $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.

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