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B.Tech. (CE) (2018 Batch) (Sem.–3)

MATHEMATICS-III (TRANSFORM & DISCRETE MATHEMATICS)

Subject Code : BTAM-301-18

M.Code : 76373

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO 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

Write briefly :

1. Prove that $\int \vec{r}\,.dr = 0,$ where r has its usual meaning.

2. If $\vec{A} = 2z\hat{i} + y\hat{j} - x^2\hat{k},\ \vec{B} = x^2yz\hat{i} - 2xz^3\hat{j} - xz^2\hat{k}$ then find $\frac{\partial^2}{\partial x \partial y}(\vec{A} \times \vec{B})$ at (1, 1, 1).

3. Show that $curl\ curl\ \vec{v} = grad\ div\ \vec{v} - \nabla^2 \vec{v}$ where $\vec{v}$ is any vector.

4. If $\vec{f}$ is solenoid vector then show that $curl\ curl\ curl\ curl\ \vec{f} = \nabla^4 f.$

5. Define Gradiant and state its physical significance.

6. State and prove Second shifting property of Laplace transform.

7. Evaluate L $(\cos^2 \alpha t\ \sin \beta t)$.

8. Find finite Fourier sine transform of $f(t) = 1$.

9. Define Euler formulae.

10. State and prove change of scale property of laplace transform.

SECTION-B

11. Find directional derivative of $\varnothing = 3y^2 + yz^3$ at a point (2, –1, 1) in the direction normal to the surface $x \log z - y^2 + 4 = 0$ at a point (–1, 2, 1).

12. $\vec{f} = (2x^2 + y^2)\hat{i} + (3y - 4x)\hat{j}$, evaluate $\int_C \vec{f}\, d\vec{r}$ around the triangle ABC whose vertices are A (0, 0), B (2, 0) and C (2, 1).

13. Using Laplace evaluate $\int_0^\infty t^3 e^{-t} \sin t\, dt$.

14. Find inverse laplace of $\dfrac{s^2}{(s^2 + \alpha^2)^2}$.

15. Use convolution theorem to find $F^{-1}\left(\dfrac{1}{12 - s^2 + 7is}\right)$.

SECTION-C

16. Verify Green's theorem in the XY-plane for $\oint_C (xy^2 - 2xy)\, dx = (x^2 y + 3)\, dy$ around boundary C of the region enclosed $y^2 = 8x$ and $x = 2$.

17. The string is stretched between the points (0, 0) and (l, 0). If it is displaced along the curve $y = K\sin\left(\dfrac{\pi x}{l}\right)$ and released from rest in that position at time $t = 0$. Find the displacement $y\,(x, t)$ at any time $t > 0$ and at any point, x, $0 < x < l$.

18. If $f(x) = \begin{cases} x, \text{ when } 0 < x < \dfrac{\pi}{2} \\ \pi - 2, \text{ when } \dfrac{\pi}{2} < x < \pi \end{cases}$ show that $f(x) = \dfrac{4}{\pi}\left[\sin x - \dfrac{\sin 3x}{3^2} + \dfrac{\sin 5x}{5^2} + \ldots..\right.$

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.