Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80208

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Second Semester

Marine Engineering

MA 8201 — MATHEMATICS FOR MARINE ENGINEERING – II

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Find the order and degree of the differential equation $\frac{d^3y}{dx^3} - 7\frac{d^2y}{dx^2} + 8\frac{dy}{dx} + 7 = 0$.

2. Find the differential equation of the family of $y^2 = 4ax$.

3. Solve : $(D^4 - 4D^2 + 4)y = 0$.

4. Find the particular integral of $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = (1-e^x)^2$.

5. Find the unit vector normal to the surface $x^2 + y^2 - z = 10$ at (1, 1, 1).

6. State Stoke's theorem.

7. Prove that the function $e^{-2x}\cos 2y$ is harmonic.

8. Find the fixed points of $\frac{z-1}{z+1}$.

9. Find $[t\sin at]$.

10. Give the Laplace transform of the unit step function.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) Solve the following differential equation $(2xy + x^2)\frac{dy}{dx} = 3y^2 + 2xy$ using homogenous method. (8)

(ii) Solve $[y^2 e^{xy^2} + 4x^3]dx + [2xye^{xy^2} - 3y^2]dy = 0$. (8)

Or

(b) (i) Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ using linear first order equation. (8)

(ii) Solve $(x+1)\frac{dy}{dx} + 1 = 2e^{-y}$ using Bernoulli equation. (8)

12. (a) (i) Solve the equation $x^2y'' + 4xy' + 2y = e^{x^x}$. (8)

(ii) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$. (8)

Or

(b) (i) Solve the following simultaneous equations $\frac{dy}{dx} + 5x - 2y = 0$ and $\frac{dy}{dx} + 2x + y = 0$, given $x = y = 0$ when $t = 0$. (8)

(ii) Solve the equation $(D^4 + \alpha^2)y = \tan \alpha x$ by the method of variation of parameters. (8)

13. (a) Verify that Gauss divergence theorem. $\vec{F} = xz\vec{i} - y^2\vec{j} + yz\vec{k}$ taken over the cube bounded by $x = 0,\ x = 1,\ y = 0,\ y = 1,\ z = 0,\ z = 1$. (16)

Or

(b) (i) Prove that $\vec{F} = (2x + yz)\vec{i} + (4y + zx)\vec{j} - (6z - xy)\vec{k}$ is solenoidal as well as irrotational. Also find the scalar potential of $\vec{F}$. (8)

(ii) Find the angle between the surface $x \log z = y^2 - 1$ and $x^2y = 2 - z$ at the point (1, 1, 1). (8)

14. (a) (i) Prove that $\nabla^2 |f(z)|^2 = 4|f'(z)|^2$. (8)

(ii) Determine the analytic function whose real part $\dfrac{\sin 2x}{\cosh 2y - \cos 2x}$. (8)

Or

(b) (i) Find the bilinear transformation that maps the points $\infty, i, 0$ onto $0, i, \infty$ respectively. (8)

(ii) Find the image of $|z - 2i| = 2$ under the transformation $w = \dfrac{1}{z}$. (8)

15. (a) (i) Evaluate $L^{-1}\left[\dfrac{1}{(s+1)\,(s-2)^2}\right]$. (8)

(ii) Find $L^{-1}\left[\dfrac{s^2}{(s^2+a^2)\,(s^2+b^2)}\right]$ using convolution theorem. (8)

Or

(b) (i) Using Laplace transform solve $y'' - 3y' + 2y = e^{-t}$, given $y(0) = 1,\ y'(0) = 0$. (8)

(ii) Find the Laplace transform of $f(t) = \begin{cases} 1 & 0 < t < b \\ -1 & b < t < 2b. \end{cases}$ (8)

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