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

Question Paper Code : 27326

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Second Semester

Marine Engineering

MA 6252 — MATHEMATICS FOR MARINE ENGINEERING — II

(Regulations 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Form the differential equation of simple harmonic motion given by $y = 2\cos(nt+4)$.

2. Solve : $\frac{dy}{dx} = \frac{y}{x}$.

3. Solve the equation : $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$.

4. Find the particular integral of the equation $(D^2 - 9)y = e^{-3x}$.

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

6. Prove that $curl(\vec{r}) = 0$, where $\bar{r} = x\hat{i} + u\hat{j} + z\hat{k}$.

7. State the sufficient conditions for the function $f(z) = u + iv$ to be analytic.

8. Find the invariant points of $f(z) = \frac{1}{z}$.

9. Find : $L[t\sin t]$.

10. Evaluate $L^{-1}\left[\frac{1}{s^2+6s+13}\right]$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve : $\frac{y}{x}\frac{dy}{dx}+\frac{(x^2+y^2)-1}{2(x^2+y^2)+1}=0$. (8)

(ii) Solve : $(2x^2+3y^2-7)xdx-(3x^2+2y^2-8)\,ydy=0$. (8)

Or

(b) (i) Solve : $(x^2-y^2)\,dx-xy\,dy=0$. (8)

(ii) Solve : $(x+1)\frac{dy}{dx}-y=e^{3x}(x+1)^2$. (8)

12. (a) (i) Solve : $(D^2-4D+3)\,y=\cos 2x+2x^2$. (8)

(ii) Solve : $\frac{d^2y}{dx^2}+a^2y=\tan ax$ using variation of parameters. (8)

Or

(b) (i) Solve : $(x^2D^2-xD+1)y=\log x$. (8)

(ii) Solve the simultaneous equations : $\frac{dx}{dt}+2y=\sin t$ and $\frac{dy}{dt}-2x=\cos t$. (8)

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

Or

(b) (i) Find the value of n such that the vector $r^n\vec{r}$ is both solenoidal and irrotational. (8)

(ii) Verify Stokes theorem for $\vec{F}=(x^2-y^2)\vec{i}+2xy\vec{j}$ in the rectangular region of $z=0$ plane bounded by the lines $x=0, y=0, x=a$ and $y=b$. (8)

14. (a) (i) Prove that the real and imaginary parts of an analytic function are harmonic. (8)

(ii) Find the bilinear transformation that maps 1, i and -1 of the z-plane onto 0,1 and ∞ of the w-plane. (8)

Or

(b) (i) Construct the analytic function $f(z)=u+iv$, where $u(x,y)=e^{-x}\,(x\cos y-y\sin y)$. (8)

(ii) Find the image of $|z+1|=1$ under the map $w=\frac{1}{z}$. (8)

15. (a) (i) Find the Laplace transform of $f(t)$, where $f(t) = \begin{cases} \sin wt, & \text{for } 0 < t < \frac{\pi}{w} \\ 0, & \text{for } \frac{\pi}{w} < t < \frac{2\pi}{w} \end{cases}$ and $f\left(t + \frac{2\pi}{w}\right) = f(t)$. (8)

(ii) Using convolution find the inverse Laplace transform of $\frac{s^2}{\left(s^2 + a^2\right)\left(s^2 + b^2\right)}$. (8)

Or

(b) (i) Find Laplace transform of $f(t) = \frac{\cos 2t - \cos 3t}{t}$. (8)

(ii) Using Laplace transform, solve $\frac{d^2y}{dt^2} + 4y = \sin 2t$, given $y(0) = 3$ and $y'(0) = 4$. (8)

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Question Paper Code : 72067

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Second Semester

Marine Engineering

MA 6252 — MATHEMATICS FOR MARINE ENGINEERING — II

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the order and degree of $\left[1+\left(\frac{dy}{dx}\right)^2\right]^3 = c^2\left[\frac{d^2y}{dx^2}\right]^2$

2. Obtain the differential equation of simple harmonic motion given by $x = A\cos(nt+a)$.

3. Transform the equation $x^2y'' + xy' = x$ into a linear differential equation with constant coefficients.

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

5. Find the directional derivative of $f(x,y,z) = xy^2 + yz^3$ at the point (2-1,1) in the direction of vector $\hat{i} + 2\hat{j} + 2\hat{k}$.

6. Find the divergence and curl of the vector $\overline{V} = (xyz)\hat{i} + (3x^2y)\hat{j} + (xz^2 - y^2z)\hat{k}$ at the point (2,-1,1).

7. Find the fixed points of the transformation $\omega = \frac{6z-9}{z}$.

8. Define bilinear transformation, under what condition this is conformal.

9. Write down the formula to find the Laplace transform of f(t) which is periodic with period 'p'.

10. Find $L^{-1}\left[\frac{1}{(s-3)^2}\right]$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve $\frac{y}{x}\frac{dy}{dx}+\frac{x^2+y^2-1}{2(x^2+y^2)+1}=0$. (8)

(ii) Solve $(x^2-y^2)dx-x\ y\ dy=0$. (8)

Or

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

(ii) Find the orthogonal trajectory of the family of the cardioids $r=a(1-\cos\theta)$. (8)

12. (a) (i) Solve $(D^2-4D+4)y=e^{2x}x^4+\cos 2x$. (8)

(ii) Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=e^x\sin x$ using variation of parameters. (8)

Or

(b) (i) Solve $x^2y''+xy'+y=\log x.\sin(\log x)$. (8)

(ii) An uncharged condenser of capacity C is charged by applying an e.m.f $E\sin\frac{t}{\sqrt{LC}}$, through leads of self-inductance L and negligible resistance. Prove that at time t, the charge on one of the plates is $\frac{EC}{2}\left[\sin\frac{t}{\sqrt{LC}}-\frac{t}{\sqrt{LC}}\cos\frac{t}{\sqrt{LC}}\right]$. (8)

13. (a) (i) Find the work done in moving a particle in the force field $\vec{F}=3x^2i+(2xz-y)\hat{j}+z\hat{k}$, along a straight line from (0,0,0) to (2, 1, 3). (6)

(ii) Evaluate $\int_s \vec{F},d\bar{s}$ where $\mathbf{\vec{F}}=4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ and **S** is the surface boundingthe region $x^2+y^2=4, z=0$ nad $z=3$. (10)

Or

(b) Verify Stoke's theorem for $\vec{F} = x^2\hat{i} + xy\hat{j}$ integrated round the square whose sides are $x = 0, y = 0, x = a, y = a$ in the plane $z = 0$. (16)

14. (a) (i) Show that $u(x, y) = \frac{1}{2}\log(x^2 + y^2)$ is harmonic and find its conjugate harmonic function. (8)

(ii) Show that an analytic function with (1) constant real part is constant and (2) constant modulus is constant. (8)

Or

(b) (i) Show that the transformation $\omega = \frac{1}{z}$ maps a circle in z- plane to a circle in the ω- plane. Plane or to a straight line if the circle in the z-plane passes through the origin. (8)

(ii) Find the bilinear transformation that maps the points $z = 1, -i, -1$ to the points $\omega = i, 0, -i$. (8)

15. (a) (i) Find the Laplace transform of $\frac{\cos 2t - \cos 3t}{t}$. (8)

(ii) Find the Laplace transform of the rectangular wave of period 2π defined by $f(t) = \begin{cases} t, & 0 \le t \le \pi \\ 2\pi - t, & \pi \le t \le 2\pi \end{cases}$ (8)

Or

(b) (i) Find $L^{-1}\left[\frac{s+2}{(s^2 + 4s + 5)^2}\right]$. (8)

(ii) Solve $\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 9y = 2e^{-3t}$, $y(0) = 1$, $y'(0) = -2$ using Laplace transform. (8)

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Question Paper Code : 77190

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Second Semester

Marine Engineering

MA 6252 — MATHEMATICS FOR MARINE ENGINEERING – II

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the order and degree of the differential equation $\left(\frac{dy}{dx}\right)^3 - (x+1)\frac{dy}{dx} + y = 0$.

2. Solve : $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$.

3. Obtain the particular integral of the differential equation $(3D^2 + D - 14)y = 13e^{2x}$.

4. Convert the equation $x^2 y'' + 4xy' + 2y = e^x$ as a linear equation with constant co-efficients.

5. Show that $\overline{F} = (x+2y)\overline{i} + (y+3z)\overline{j} + (x-2z)\overline{k}$ is solenoidal.

6. State Green's theorem in a plane.

7. Define analytic function with an example.

8. Write orthogonal property of an analytic function.

9. Find $L(t^2 \sin t)$.

10. State initial and final value theorems on Laplace transform.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve $(2x-4y)+\frac{dy}{dx}(x-2y+1)=0$. (8)

(ii) Solve $y'+y\cos x=\sin x\cos x$. (8)

Or

(b) (i) Solve $\cos(x+y)\,dx+\left(3y^2+2y+\cos(x+y)\right)dy=0$. (8)

(ii) Find the orthogonal trajectories of the family of coaxial circles $x^2+y^2+2\lambda x+c=0$ where λ is a parameter. (8)

12. (a) (i) Solve $y''-4y'+3y=\sin 3x+x^2$. (8)

(ii) Solve the equation $y''+y=x\cos x$ by the method of variation of parameters. (8)

Or

(b) (i) Solve $x^2y''-2xy'-4y=32(\log x)^2$. (8)

(ii) A cantilever beam of length l, with uniform lead w per unit length has a concentrated load W at the free end. If the differential equation of the elastic curve is given by $EIY''=W(l-x)+\frac{w}{2}(l-x)^2$. Find the maximum deflection of the beam. (8)

13. (a) Verify Stoke's theorem for $\overline{F}=xy\,\overline{i}-2yz\,\overline{j}-zx\,\overline{k}$, where S is the open surface of the rectangular parallelepiped formed by the planes $x=0$, $x=1$, $y=0$, $y=2$ and $z=3$ above the xoy plane. (16)

Or

(b) Verify Gauss divergence theorem for $\overline{F}=x^2\,\overline{i}+y^2\,\overline{j}+z^2\,\overline{k}$, where S is the surface of the cuboid formed by the planes $x=0$, $x=a$, $y=0$ $y=b$, $z=0$ and $z=c$. (16)

14. (a) (i) State and prove the necessary condition for $f(z)$ to be analytic. (8)

(ii) Find the bilinear transformation which maps the points 0, 1, ∞ into the points i, 1, $-i$ respectively. (8)

Or

(b) (i) Prove that the function $v = xy\left(x^2 - y^2\right)$ is harmonic. Also find the conjugate harmonic function u and the corresponding analytic function $f(z) = u + iv$. (8)

(ii) Discuss the transformation $w = \frac{1}{z}$. (8)

15. (a) (i) Find the Laplace transform of triangular wave function $f(t) = \begin{cases} t, & \text{in } 0 \le t \le a \\ 2a - t, & \text{in } a \le t \le 2a \end{cases}$ and $f(t + 2a) = f(t) \; \forall t$. (8)

(ii) Using convolution theorem, find the inverse Laplace transform of $\frac{s}{\left(s^2 + a^2\right)^2}$. (8)

Or

(b) (i) Solve the equation $y'' + y' - 2y = 3\cos 3t - 11\sin 3t$, $y(0) = 0$ and $y'(0) = 6$, using Laplace transform technique. (8)

(ii) Find the inverse Laplace transform of the function $F(s) = \frac{(s+1)e^{-\pi s}}{s^2 + 2s + 5}$. (8)

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Question Paper Code : 80607

B.E/B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Second Semester

Marine Engineering

MA 6252 — MATHEMATICS FOR MARINE ENGINEERING — II

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Form the differential equation by eliminating the arbitrary function from $y = \cos(2x)$.

2. Define exact differential equations.

3. Solve the equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$.

4. Find the particular integral of the equation $(D^2 + 5D + 6)\, y = e^x$.

5. Find the area of a circle with radius *a*, using Green's theorem.

6. Find the unit normal vector to the surface $xy^3 z^2 = 4$ at the point $(-1, -1, 2)$.

7. State the sufficient conditions for the function $f(z) = u + iv$ to be analytic.

8. Find the fixed points of $f(z) = \frac{1}{z}$.

9. Find $L[t \cos t]$.

10. Evaluate $L^{-1}\left[\frac{1}{s^2 - 4s + 5}\right]$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Obtain the differential equation of all circles of radius a and centre (h, k). (8)

(ii) Solve $y\left(2xy + e^x\right) dx = e^x\, dy$. (8)

Or

(b) (i) Solve $\frac{dy}{dx} = \sin\,(x+y) + \cos(x+y)$. (8)

(ii) Solve $(3y + 2x + 4)\; dx = (4x + 6y + 5)\, dy$. (8)

12. (a) (i) Solve $\left(D^2 - 2D + 2\right)y = e^x \cos x$. (8)

(ii) Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$, using variation of parameters. (8)

Or

(b) (i) Solve $\left[(1+x)^2\;\; D^2 + (1+x)\; D + 1\right]\, y = 2\sin\left[\log\;(1+x)\right]$. (8)

(ii) Solve $\left(D^2 + 2D + 4\right)y = 2x^2 + 3e^{-x}$, by using method of undetermined coefficients. (8)

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

Or

(b) (i) Find the value of n such that the vector $r^n\,\vec{r}$ is both solenoidal and irrotational. (8)

(ii) Verify Stokes theorem for $\vec{F} = \left(x^2 - y^2\right)\vec{i} + 2xy\vec{j}$ in the rectangular region of $z = 0$ plane bounded by the lines $x = 0,\; y = 0,\; x = a$ and $y = b$. (8)

14. (a) (i) Prove that the real and imaginary parts of an analytic function are harmonic. (8)

(ii) Find the bilinear transformation that map 1, i, and –1 of the z-plane onto 0, 1 and ∞ of the w-plane. (8)

Or

(b) (i) Construct the analytic function $f(z) = u + iv$, where $u(x,\; y) = e^{-x}\;\; (x\cos\; y - y\sin\; y)$. (8)

(ii) Find the image of $|z+1| = 1$ under the map $w = \frac{1}{z}$. (8)

15. (a) (i) Find the Laplace transform of $f(t)$, where $f(t)=\begin{cases} t, & \text{for } 0<t<a \\ 2a-t, & \text{for } a<t<2a \end{cases}$ and $f(t+2a)=f(t)$. (8)

(ii) Using convolution theorem, find the inverse Laplace transform of $\frac{s}{(s^2+a^2)(s^2+b^2)}$. (8)

Or

(b) (i) Find the Laplace transform of $f(t)=\frac{\cos at-\cos bt}{t}$. (8)

(ii) Using Laplace transform, solve $\frac{d^2y}{dx^2}+6\frac{dy}{dx}+8y=2$, given $y(0)=1$ and $y'(0)=1$. (8)

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

Question Paper Code : 97239

B.E./B.Tech. DEGREE EXAMINATION, DECEMBER 2015/JANUARY 2016.

Second Semester

Marine Engineering

MA 6252 — MATHEMATICS FOR MARINE ENGINEERING

(Regulation 2013)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Obtain the differential equation of the coaxial circles of the system $x^2 + y^2 + 2ax + c^2 = 0$ where c is a constant and 'a' is a variable.

2. Find an integrating factor of $2\sin(y^2)dx + xy\cos(y^2)dy = 0$.

3. Find the Wronskian of the independent solutions of $\frac{d^2y}{dx^2} + 4y = 0$.

4. State the four possible ways of the end fixation of a strut.

5. Give the greatest rate of increase of $u = xyz^2$ at $(1, 0, 3)$?

6. Show that the vector field $\overline{\mathbf{F}} = \frac{\overline{\mathbf{r}}}{r^3}$ is solenoidal.

7. Show that $y(x, y) = 3x^2y + 2x^2 - y^3 - 2y^2$ is harmonic.

8. Find the fixed points of $w = \frac{1}{z + 2i}$.

9. Find $L(t\cos t)$.

10. Give the Laplace transform of a periodic function with period 'p'.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Solve $\frac{y}{x}\frac{dy}{dx}+\frac{x^2+y^2-1}{2(x^2+y^2)+1}=0$. (8)

(ii) Show that the current 'i' in an electrical circuit containing an inductance 'L' and a resistance 'R' in series and acted on by an electromotive force $E\sin\omega t$ satisfies the differential equation $L\frac{di}{dt}+Ri=E\sin\omega t$. Also, find the value of the current at any time 't', if initially there is no current in the circuit. (8)

Or

(b) (i) Find the orthogonal trajectories of a system of confocal and coaxial parabolas. (8)

(ii) Solve $\left(xy^2-e^{1/x^3}\right)dx-x^2y\,dy=0$. (8)

12. (a) (i) Solve $\frac{d^2y}{dx^2}-4y=x\sinh x$. (8)

(ii) Solve the simultaneous equations : $\frac{dx}{dt}=2y$; $\frac{dy}{dt}=2z$; $\frac{dz}{dt}=2x$. (8)

Or

(b) (i) Solve by the method of undetermined coefficients: $\left(D^2-3D+2\right)y=x^2+e^x$. (8)

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

13. (a) (i) Prove that $\nabla^2 f(r)=f''(r)+\frac{2}{r}f'(r)$. (8)

(ii) If the vector field $\overline{\mathbf{F}}=x^2\hat{\mathbf{i}}+z\hat{\mathbf{j}}+yz\hat{\mathbf{k}}$ is defined over the volume of the cuboid given by $0\le x\le a,\ 0\le y\le b,\ 0\le z\le c$ enclosing the surface S, then evaluate the surface integral $\iint_S \overline{\mathbf{F}}\cdot\hat{\mathbf{n}}\,dS$. (8)

Or

(b) Verify Stokes theorem for the vector field $\overline{\mathbf{F}}=\left(x^2-y^2\right)\hat{\mathbf{i}}+2xy\hat{\mathbf{j}}$ integrated around the rectangle in the $z=0$ plane and bounded by the lines $x=0,\ x=a,\ y=0,\ y=b$. (16)

14. (a) (i) If $w = u + iv$ represents the complex potential for an electric field and $v = x^2 - y^2 + \dfrac{x}{x^2 + y^2}$, then find '$u$'. (8)

(ii) Find the image of the region bounded by the lines $x = 0,\ y = 0,\ x + y = 1$ in the z-plane by the mapping $w = \left(e^{i\pi/4}\right)Z$. (8)

Or

(b) (i) Show that under the transformation $w = \dfrac{1}{z}$, circles and straight lines are mapped into circles or straight lines. (8)

(ii) If $f(z) = u = iv$ is analytic, then prove that $\nabla^2 u^2 = \nabla^2 v^2 = 2|f'(z)|^2$. (8)

15. (a) (i) Verify the initial value theorem and the final value theorem under the Laplace transforms, for the function $f(t) = e^{-t}(t + 2)^2$. (8)

(ii) Using Laplace transform, solve the initial value problem $y'' - 6y' + 9y = te^{3t}$, $y(0) = 2$, $y'(0) = 6$. (8)

Or

(b) (i) Using convolution theorem, find $L^{-1}\left[\dfrac{s^2}{(s^2 + a^2)(s^2 + b^2)}\right]$. (10)

(ii) Find $L\{t \sin(2t + 3)\}$. (6)