


SUBJECT NAME	: Engineering Mathematics – II	
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MATERIAL NAME	: Part – A questions	
REGULATION	: R2008	
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TEXTBOOK FOR REFERENCE	: Sri Hariganesh Publications (Author: C. Ganesan)	

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Name of the Student:

Branch:

Unit – I (Ordinary Differential Equations)

1. Solve the equation $(D^2 - 6D + 13)y = 0$. (Text Book Page No.:2.8)
2. Solve $(D^2 - 4)y = 1$. (Text Book Page No.:2.55)
3. Find a particular integral of the differential equation $(D^2 + 6D + 5)y = e^{-5x}$.
4. Find the particular integral of $(D^2 - 4)y = \cosh 2x$. (Text Book Page No.:2.55)
5. Find the particular integral of $(D^2 - 2D + 1)y = \cosh x$.
6. Find the particular integral of $(D^2 + 4)y = \sin 2x$.
7. Find the particular integral of $(D^2 + 1)y = \sin x$. (Text Book Page No.:2.56)
8. Find the particular integral of $(D^2 + 2D + 1)y = e^{-x} \cos x$.
9. Find the particular integral of $(D + 1)^2 y = e^{-x} \cos x$. (Text Book Page No.:2.40)
10. Find the particular integral of $(D^2 - 2D + 2)y = e^x \cos x$.
11. Find the particular integral of $(D - 1)^2 y = e^x \sin x$.

12. Find the particular integral of $(D^2 - 4D + 4)y = x^2 e^{2x}$.
13. Solve the equation $x^2 y'' - xy' + y = 0$.
14. Solve $x^2 \frac{d^2 y}{dx^2} + 4x \frac{dy}{dx} + 2y = 0$. (Text Book Page No.:2.59)
15. Reduce the equation $(x^2 D^2 + xD + 1)y = \log x$ into an ordinary differential equation with constant coefficients.
16. Transform the differential equation $x^2 y'' - xy' + 2y = 0$ with constant coefficients.
17. Transform the equation $x^2 y'' + xy' = x$ into a linear differential equation with constant coefficients.
18. Convert $(3x^2 D^2 + 5xD + 7)y = 2/x \log x$ into an equation with constant coefficients.
19. Transform the differential equation $(x^2 D^2 + 4xD + 2)y = x + \frac{1}{x}$ to a differential equation with constant coefficients.
20. Transform the equation $(2x + 3)^2 \frac{d^2 y}{dx^2} - 2(2x + 3) \frac{dy}{dx} - 12y = 6x$ into a differential equation with constant coefficients.

Unit – II (Vector Calculus)

1. Find $\Delta \left((x^2 - yz)\vec{i} + (y^2 - xz)\vec{j} + (z^2 - xy)\vec{k} \right)$ at the points $(1, -1, 2)$.
2. Define solenoidal vector function. If $\vec{V} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + 2\lambda z)\vec{k}$ is solenoidal, find the value of λ . (Text Book Page No.: 1.49)
3. Find the value of m so that the vector $\vec{F} = (x + 3y)\vec{i} + (y - 2z)\vec{j} + (x + mz)\vec{k}$ is solenoidal. (Text Book Page No.: 1.49)
4. Find λ such that $\vec{F} = (3x - 2y + z)\vec{i} + (4x + \lambda y - z)\vec{j} + (x - y + 2z)\vec{k}$ is solenoidal.

Text Book Page No.: 1.26

5. Find the values of a, b, c so that the vector $\vec{F} = (x + y + az)\vec{i} + (bx + 2y - z)\vec{j} + (-x + cy + 2z)\vec{k}$ may be irrotational.
6. State the physical interpretation of the line integral $\int_A^B \vec{F} \cdot d\vec{r}$.
7. Find the directional derivative of $\phi(x, y, z) = xy^2 + yz^2$ at the point $(2, -1, 1)$ in the direction of the vector $i + 2j + 3k$. (Text Book Page No.: 1.18)
8. Find the directional derivative of $\phi = xyz$ at $(1, 1, 1)$ in the direction of $\vec{i} + \vec{j} + \vec{k}$.
Text Book Page No.: 1.16
9. Is the position vector $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ irrotational? Justify. (Text Book Page No.: 1.49)
10. Prove that $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$ is irrotational. (Text Book Page No.: 1.25)
11. Find grad (r^n) where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = |\vec{r}|$. (Text Book Page No.: 1.3)
12. Find the unit normal to the surface $x^2 + xy + z^2 = 4$ at $(1, -1, 2)$.
(Text Book Page No.: 1.4)
13. Prove that $\text{div } \vec{r} = 3$ and $\text{curl } \vec{r} = \mathbf{0}$. (Text Book Page No.: 1.24)
14. If \vec{A} and \vec{B} are irrotational, prove that $\vec{A} \times \vec{B}$ is solenoidal.
15. State Stoke's theorem. (Text Book Page No.: 1.20)
16. State Green's theorem. (Text Book Page No.: 1.72)
17. State Gauss divergence theorem. (Text Book Page No.: 1.93)
18. Prove by Green's theorem that the area bounded by a simple closed C curve is $\frac{1}{2} \int_C (x dy - y dx)$. (Text Book Page No.: 1.90)
19. Evaluate $\iiint_V \nabla \cdot \vec{F} dV$ where $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ and V is the volume enclosed by the cube $0 \leq x, y, z \leq 1$.

Unit – III (Analytic Functions)

1. Show that $u = 2x - x^3 + 3xy^2$ is harmonic. (Text Book Page No.:4.35)

2. Verify whether the function $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$ is harmonic.

Text Book Page No.:4.37

3. If $u(x, y) = 3x^2y + 2x^2 - y^3 - 2y^2$, verify whether u is harmonic.

4. Given an example of a complex-valued function which is differentiable at a point but not analytic at that point.

5. Find the map of the circle $|z| = 3$ under the transformation $w = 2z$.

(Text Book Page No.:4.59)

6. Find the image of the line $x = k$ under the transformation $w = \frac{1}{z}$.

(Text Book Page No.:4.61)

7. State the Cauchy-Riemann equation in polar coordinates satisfied by an analytic function. (Text Book Page No.:4.7)

8. Prove that a bilinear transformation has at most two fixed points.

Text Book Page No.:4.82

9. Find the fixed points of mapping $w = \frac{6z - 9}{z}$. (Text Book Page No.:4.83)

10. Find the invariant points of the transformation $w = \frac{2z + 6}{z + 7}$. (Text Book Page No.:4.83)

11. Find the critical points of the transformation $w = 1 + \frac{2}{z}$. (Text Book Page No.:4.78)

12. Find the constants a, b, c if $f(z) = x + ay + i(bx + cy)$ is analytic.

Text Book Page No.:4.19

13. Find the constants a, b if $f(z) = x + 2ay + i(3x + by)$ is analytic.
Text Book Page No.:4.18
14. State the basic difference between the limit of a function of a real variable and that of a complex variable.
15. Verify whether $f(z) = \bar{z}$ is analytic function or not. (Text Book Page No.:4.8)
16. Show that the function $f(z) = \bar{z}$ is nowhere differentiable.
17. Are $|z|, \text{Re}(z), \text{Im}(z)$ analytic? Give reason. (Text Book Page No.:4.8)
18. Define Conformal. (Text Book Page No.:4.59)
19. Show that an analytic function with constant imaginary part is constant.

Unit – IV (Complex Integration)

1. Define Singular point.
2. Expand $f(z) = \sin z$ in a Taylor series about origin. (Text Book Page No.:5.63)
3. Evaluate $\int_C \tan z \, dz$ where C is $|z| = 2$. (Text Book Page No.:5.34)
4. Find the Taylor series for $f(z) = \sin z$ about $z = \frac{\pi}{4}$. (Text Book Page No.:5.38)
5. State Cauchy's integral formula. (Text Book Page No.:5.5)
6. Evaluate $\int_C \left(\frac{3z^2 + 7z + 1}{z + 1} \right) dz$, where C is $|z| = \frac{1}{2}$. (Text Book Page No.:5.8)
7. Using Cauchy's integral formula, evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z + 1)(z + 2)} dz$, where C is $|z| = \frac{1}{2}$.
8. Evaluate $\int_C \frac{z \, dz}{(z - 1)(z - 2)}$, where C is the circle $|z| = 1/2$.

9. Evaluate $\int_C \frac{z+4}{z^2+2z} dz$, where C is the circle $\left|z - \frac{1}{2}\right| = \frac{1}{3}$. (Text Book Page No.:5.8)

10. Evaluate $\oint_C \frac{e^z}{z-1} dz$, if C is $|z| = 2$.

11. If $f(z) = \frac{-1}{z-1} - 2[1 + (z-1) + (z-1)^2 + \dots]$, find the residue of $f(z)$ at $z = 1$.

Text Book Page No.:5.71

12. Identify the type of singularities of the following function: $f(z) = e^{\frac{1}{z-1}}$.

Text Book Page No.:5.71

13. Classify the singularity of $f(z) = e^{e^{\frac{1}{z^2}}}$.

14. Calculate the residue of $f(z) = \frac{e^{2z}}{(z+1)^2}$ at its pole. (Text Book Page No.:5.69)

15. Find the residue of the function $f(z) = \frac{4}{z^3(z-2)}$ at a simple pole.

Text Book Page No.:5.67

16. Find the residue of $f(z) = \frac{1-e^{-z}}{z^3}$ at $z = 0$.

17. Find the residue of $\frac{1-e^{2z}}{z^4}$ at $z = 0$. (Text Book Page No.:5.70)

18. Find the residue of $\left\{ \frac{\sin 3z}{z^6} \right\}$ at $z = 0$.

Unit – V (Laplace Transform)

1. State the conditions under which Laplace transform of $f(t)$ exists.

Text Book Page No.:3.1

2. Find the Laplace transform of unit step function. (Text Book Page No.:3.9)

3. State the first shifting theorem on Laplace transforms. (Text Book Page No.:3.9)
4. Find the Laplace transform of $f(t) = \begin{cases} 0, & t < \frac{2\pi}{3} \\ \cos\left(t - \frac{2\pi}{3}\right), & t > \frac{2\pi}{3} \end{cases}$.
5. Find $L(e^{-3t} \sin t \cos t)$. (Text Book Page No.:3.14)
6. Find the Laplace transform of $\frac{t}{e^t}$. (Text Book Page No.:3.13)
7. Find the Laplace transform of $\frac{1 - \cos t}{t}$. (Text Book Page No.:3.18)
8. Find the Laplace transform of $f(t) = \frac{1 - e^{-t}}{t}$. (Text Book Page No.:3.20)
9. Find the Laplace transform of $t \cos at$. (Text Book Page No.:3.16)
10. Find Laplace transform of $t \sin 2t$. (Text Book Page No.:3.15)
11. State initial and final value theorem in Laplace transform.
12. Verify the final value theorem for $f(t) = 3e^{-t}$. (Text Book Page No.:3.30)
13. Verify initial value theorem for the function $f(t) = ae^{-bt}$. (Text Book Page No.:3.38)
14. Find $L^{-1}\left[\frac{1}{s^2 + 4s + 4}\right]$. (Text Book Page No.:3.62)
15. Find the inverse Laplace transform of $\frac{1}{(s+1)(s+2)}$. (Text Book Page No.:3.65)
16. Find $L^{-1}\{\cot^{-1}(s)\}$. (Text Book Page No.:3.88)
17. Find the inverse Laplace transform of $\cot^{-1}\left(\frac{k}{s}\right)$. (Text Book Page No.:3.89)
18. Find inverse Laplace Transform of $\frac{e^{-as}}{s}$.

Textbook for Reference:

“ENGINEERING MATHEMATICS - II”

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