


SUBJECT NAME	: Engineering Mathematics – II	
SUBJECT CODE	: MA8251	
MATERIAL NAME	: Part – A questions	
REGULATION	: R2017	
UPDATED ON	: Nov-Dec 2017	
TEXTBOOK FOR REFERENCE	: Sri Hariganesh Publications (Author: C. Ganesan)	

To buy the book visit [www.hariganesh.com/textbook](http://www.hariganesh.com/textbook)

(Scan the above Q.R code for the direct download of this material)

### Unit – I (Matrices)

1. Find the sum and product of the eigenvalues of a  $3 \times 3$  matrix  $A$  whose characteristic equation is  $\lambda^3 - 7\lambda^2 + 36 = 0$ .

2. Find the sum and product of all the eigenvalues of  $\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$ .

Text Book Page No.: 1.8

3. Given:  $A = \begin{pmatrix} -1 & 0 & 0 \\ 2 & -3 & 0 \\ 1 & 4 & 2 \end{pmatrix}$ . Find the eigenvalues of  $A^2$ . (Text Book Page No.: 1.7)

4. Find the eigenvalues of  $A^{-1}$  where  $A = \begin{pmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{pmatrix}$ . (Text Book Page No.: 1.8)

5. Find the eigenvalues of the inverse of the matrix  $A = \begin{pmatrix} 2 & 1 & 0 \\ 0 & 3 & 4 \\ 0 & 0 & 4 \end{pmatrix}$ .

6. If 3 and 6 are two eigenvalues of  $A = \begin{pmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{pmatrix}$ , write down all the eigenvalues of  $A^{-1}$ . (Text Book Page No.: 1.9)
7. Two eigenvalues of the matrix  $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$  are 3 and 0. What is the third eigenvalue? What is the product of the eigenvalues of  $A$ ?
8. If 1 and 2 are the eigenvalues of a 2 X 2 matrix  $A$ , what are the eigenvalues of  $A^2$  and  $A^{-1}$ ?
9. The product of two eigenvalues of the matrix  $A = \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$  is 16. Find the third eigenvalue of  $A$ . (Text Book Page No.: 1.10)
10. If 2, 3 are the eigenvalues of  $\begin{pmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ b & 0 & 2 \end{pmatrix}$ , then find the value of  $b$ .
11. If  $2, -1, -3$  are the eigenvalues of the matrix  $A$ , then find the eigenvalues of the matrix  $A^2 - 2I$ .
12. If the sum of two eigenvalues and trace of a 3 X 3 matrix  $A$  are equal, find the value of  $|A|$ . (Text Book Page No.: 1.10)
13. If the eigenvalues of the matrix  $A$  of order 3 X 3 are 2, 3 and 1, then find the eigenvalues of adjoint of  $A$ .
14. If  $\lambda$  is the eigenvalue of the matrix  $A$ , then prove that  $\lambda^2$  is the eigenvalue of  $A^2$ .
15. If  $\lambda (\neq 0)$  is an eigenvalue of a square matrix  $A$ , then show that  $\lambda^{-1}$  is an eigenvalue of  $A^{-1}$ .
16. State Cayley- Hamilton theorem. (Text Book Page No.: 1.41)
17. Find the constants  $a$  and  $b$  such that the matrix  $\begin{bmatrix} a & 4 \\ 1 & b \end{bmatrix}$  has 3 and -2 as its eigenvalues.

18. Use Cayley- Hamilton theorem to find  $(A^4 - 4A^3 - 5A^2 + A + 2I)$  when  $A = \begin{pmatrix} 1 & 2 \\ 4 & 3 \end{pmatrix}$ .

Text Book Page No.: 1.54

19. Write down the quadratic form corresponding to the matrix  $A = \begin{bmatrix} 0 & 5 & -1 \\ 5 & 1 & 6 \\ -1 & 6 & 2 \end{bmatrix}$ .

Text Book Page No.: 1.93

20. Check whether the matrix  $B$  is orthogonal? Justify.  $B = \begin{pmatrix} \cos \theta & \sin \theta & 0 \\ -\sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$ .

Text Book Page No.: 1.57

21. Can  $A = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$  be diagonalized? Why?

22. Find the nature of the Quadratic Form  $x_1^2 + 2x_2^2 + x_3^2 - 2x_1x_2 + 2x_2x_3$ .

Text Book Page No.: 1.94

23. Write down the matrix of the quadratic form  $2x^2 + 8z^2 + 4xy + 10xz - 2yz$ .

Text Book Page No.: 1.94

24. Give the nature of a quadratic form whose matrix is  $\begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{pmatrix}$ .

25. Find the symmetric matrix  $A$ , whose eigenvalues are 1 and 3 with corresponding eigenvectors  $\begin{pmatrix} 1 \\ -1 \end{pmatrix}$  and  $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ . (Text Book Page No.: 1.88)

## Unit – II (Vector Calculus)

1. 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)

2. Find  $\lambda$  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
3. Find the values of  $a, b, c$  so that the vector (Text Book Page No.: 1.26)  
 $\vec{F} = (x + y + az)\vec{i} + (bx + 2y - z)\vec{j} + (-x + cy + 2z)\vec{k}$  may be irrotational.
4. 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  $\vec{i} + 2\vec{j} + 3\vec{k}$ . (Text Book Page No.: 1.18)
5. 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
6. Is the position vector  $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  irrotational? Justify. (Text Book Page No.: 1.49)
7. Find  $\text{curl}\vec{F}$  if  $\vec{F} = xy\vec{i} + yz\vec{j} + zx\vec{k}$ .
8. Prove that  $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$  is irrotational. (Text Book Page No.: 1.25)
9. Find  $\text{grad}(r^n)$  where  $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$  and  $r = |\vec{r}|$ . (Text Book Page No.: 1.3)
10. Evaluate  $\nabla^2 \log r$ .
11. Find the unit normal to the surface  $x^2 + xy + z^2 = 4$  at  $(1, -1, 2)$ . (Text Book Page No.: 1.4)
12. Find the unit normal vector to the surface  $x^2 + y^2 = z$  at  $(1, -2, 5)$ . (Text Book Page No.: 1.18)
13. Prove that  $\text{div}\vec{r} = 3$  and  $\text{curl}\vec{r} = \mathbf{0}$ . (Text Book Page No.: 1.24)
14. Prove that  $\text{curl}(\text{grad}\phi) = \mathbf{0}$ . (Text Book Page No.: 1.40)
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)

**Unit – III (Analytic Functions)**

1. Verify  $f(z) = z^3$  is analytic or not. (Text Book Page No.:4.10)
2. Show that  $|z|^2$  is not analytic at any point. (Text Book Page No.:4.11)
3. Define harmonic function. (Text Book Page No.:4.21)
4. Show that  $u = 2x - x^3 + 3xy^2$  is harmonic. (Text Book Page No.:4.35)
5. Verify whether the function  $u = x^3 - 3xy^2 + 3x^2 - 3y^2 + 1$  is harmonic.  
Text Book Page No.:4.37
6. Define Conformal mapping. (Text Book Page No.:4.59)
7. Find the map of the circle  $|z| = 3$  under the transformation  $w = 2z$ . (Text Book Page No.:4.59)
8. Find the image of the line  $x = k$  under the transformation  $w = \frac{1}{z}$ . (Text Book Page No.:4.61)
9. State the Cauchy-Riemann equation in polar coordinates satisfied by an analytic function.  
Text Book Page No.:4.7
10. Prove that a bilinear transformation has at most two fixed points. (Text Book Page No.:4.82)
11. Find the fixed points of mapping  $w = \frac{6z - 9}{z}$ . (Text Book Page No.:4.83)
12. Find the invariant points of the transformation  $w = \frac{2z + 6}{z + 7}$ . (Text Book Page No.:4.83)
13. Find the invariant points of the transformation  $w = \frac{z - 1}{z + 1}$ . (Text Book Page No.:4.84)
14. Find the invariant points of a function  $f(z) = \frac{z^3 + 7z}{7 - 6zi}$ .
15. Find the invariant points of  $f(z) = z^2$ . (Text Book Page No.:4.82)
16. Find the critical points of the transformation  $w = 1 + \frac{2}{z}$ . (Text Book Page No.:4.78)

17. Find the critical points of the transformation  $w^2 = (z - \alpha)(z - \beta)$ . (Text Book Page No.:4.79)
18. Find the constants  $a, b$  if  $f(z) = x + 2ay + i(3x + by)$  is analytic. (Text Book Page No.:4.18)
19. Verify whether  $f(z) = \bar{z}$  is analytic function or not. (Text Book Page No.:4.8)
20. Are  $|z|, \text{Re}(z), \text{Im}(z)$  analytic? Give reason. (Text Book Page No.:4.8)

## Unit – IV (Complex Integration)

- Define Singular point.
- Define and give an example of essential singular points. (Text Book Page No.:5.65)
- Expand  $f(z) = \frac{1}{z^2}$  as a Taylor series about the point  $z = 2$ .
- Expand  $f(z) = \sin z$  in a Taylor series about origin. (Text Book Page No.:5.63)
- Evaluate  $\int_C \tan z \, dz$  where  $C$  is  $|z| = 2$ . (Text Book Page No.:5.34)
- Find the Taylor series for  $f(z) = \sin z$  about  $z = \frac{\pi}{4}$ . (Text Book Page No.:5.38)
- State Cauchy's integral theorem. (Text Book Page No.:5.5)
- State Cauchy's residue theorem. (Text Book Page No.:5.83)
- 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)
- Evaluate  $\int_C \frac{z \, dz}{(z - 1)(z - 2)}$ , where  $C$  is the circle  $|z| = 1/2$ .
- 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  $|z| = \frac{1}{2}$ .
- 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)
- Evaluate  $\int_C \frac{z}{z - 2} dz$ , where  $C$  is (a)  $|z| = 1$  (b)  $|z| = 3$ . (Text Book Page No.:5.34)

14. 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

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

Text Book Page No.:5.71

16. Identify the type of singularity of function  $\sin\left(\frac{1}{1-z}\right)$ . (Text Book Page No.:5.72)

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

18. Find the residue of the function  $f(z) = \frac{4}{z^3(z-2)}$  at a simple pole. (Text Book Page No.:5.67)

19. Find the residue of  $f(z) = \frac{z^2}{(z-2)(z+1)^2}$  at  $z = 2$ . (Text Book Page No.:5.68)

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

## 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. Evaluate  $\int_0^{\infty} t e^{-2t} \sin t \, dt$  using Laplace transform.

5. Find  $L(e^{-3t} \sin t \cos t)$ . (Text Book Page No.:3.14)

6. Find the Laplace transform of  $e^{-t} \sin 2t$ . (Text Book Page No.:3.12)

7. Find the Laplace transform of  $\frac{t}{e^t}$ . (Text Book Page No.:3.13)

8. Find the Laplace transform of  $\frac{1 - \cos t}{t}$ . (Text Book Page No.:3.18)
9. Find  $L\left[\frac{\sin t}{t}\right]$ . (Text Book Page No.:3.19)
10. Find Laplace transform of  $t \sin 2t$ . (Text Book Page No.:3.15)
11. State initial and final value theorem. (Text Book Page No.:3.36)
12. State convolution theorem on Laplace transforms. (Text Book Page No.:3.99)
13. Verify the final value theorem for  $f(t) = 3e^{-t}$ . (Text Book Page No.:3.30)
14. Verify initial value theorem for the function  $f(t) = ae^{-bt}$ . (Text Book Page No.:3.38)
15. Find  $L^{-1}\left[\frac{1}{s^2 + 4s + 4}\right]$ . (Text Book Page No.:3.62)
16. Find  $L^{-1}\left[\frac{1}{s^2 + 6s + 13}\right]$ . (Text Book Page No.:3.63)
17. Find the inverse Laplace transform of  $\frac{1}{(s+1)(s+2)}$ . (Text Book Page No.:3.65)
18. Find  $f(t)$  if the Laplace transform of  $f(t)$  is  $\frac{s}{(s+1)^2}$ . (Text Book Page No.:3.63)
19. Find  $L^{-1}\{\cot^{-1}(s)\}$ . (Text Book Page No.:3.88)
20. Find  $L^{-1}\left(\log \frac{s}{s-a}\right)$ .

## Textbook for Reference:

“ENGINEERING MATHEMATICS - II”

Publication: Sri Hariganesh Publications

Author: C. Ganesan

Mobile: 9841168917, 8939331876

To buy the book visit [www.hariganesh.com/textbook](http://www.hariganesh.com/textbook)



---- *All the Best* ----