[Vision Institute Of Technology Kanpur]

[B.Tech.1st Year] [AG] [ASSIGNEMENT UNIT-1)]

[Engineering Mathematics- II (KAG-201)] [2019-20]

1. Transform $\begin{bmatrix}1 & 3 & 3\\ 2 & 4 & 10\\ 3 & 8 & 4\end{bmatrix}$ into unit matrix by using elementary transformations: [GBTU 07,09, 11]
2. Find the inverse of the following matrices employing elementary transformations:

   A = $\begin{bmatrix}0 & 1 & 2\\ 1 & 2 & 3\\ 3 & 1 & 1\end{bmatrix}$ [G.B.T.U. 2008, (SUM) 2009]
3. Employing elementary transformations, find the inverse of the matrices $\begin{bmatrix}1 & 2 & 3\\ 2 & 4 & 5\\ 3 & 5 & 6\end{bmatrix}$ [GBTU 07]
4. Find the inverse of the matrices by using elementary row operations: $\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$ [GBTU 14]
5. Find the inverse of the matrices: $\begin{bmatrix}2 & 3 & 4\\ 4 & 3 & 1\\ 1 & 2 & 4\end{bmatrix}$ [GBTU 12]
6. Using elementary transformations to reduce the following matrices A to triangular form and

   hence find the rank of A. A= $\begin{bmatrix}2 & 3 & -1 & -1\\ 1 & -1 & -2 & -4\\ 3 & 1 & 3 & -2\\ 6 & 3 & 0 & -7\end{bmatrix}$ G.B.T.U. (C.O) 2006, G.B.T.U. 2011]
7. Find Rank of matrix .(a) A= $\begin{bmatrix}2 & 3 & -2 & 4\\ 3 & -2 & 1 & 2\\ 3 & 2 & 3 & 4\\ -2 & 4 & 0 & 5\end{bmatrix}$[GBTU 07] , (b) A= $\begin{bmatrix}1 & -1 & 2 & -3\\ 4 & 1 & 0 & 2\\ 0 & 3 & 0 & 4\\ 0 & 1 & 0 & 2\end{bmatrix}$ [GBTU 12]
8. Reduce the matrix A=$\begin{bmatrix}1 & 1 & -1 & 1\\ -1 & 1 & -3 & -3\\ 1 & 0 & 1 & 2\\ 1 & -1 & 3 & 3\end{bmatrix}$to column Echelon form hence find Rank.[GBTU 10]
9. Reduce A to Echelon form and then to its row canonical form where A=$\begin{bmatrix}1 & 3 & -1 & 2\\ 0 & 11 & -5 & 3\\ 2 & -5 & 3 & 1\\ 4 & 1 & 1 & 5\end{bmatrix}$

   Hence find the rank of matrix A. [GBTU 2015]
10. Reduce the matrix to Normal form and hence find Rank A=$\begin{bmatrix}1 & 2 & -1 & 4\\ 2 & 3 & 3 & 4\\ 1 & 2 & 3 & 4\\ -1 & -2 & 6 & -7\end{bmatrix}$ [GBTU 2010]
11. Find the Rank of the matrices using elementary transformations:

   (a) $\begin{bmatrix}1 & -3 & 1 & 2\\ 0 & 1 & 2 & 3\\ 3 & 4 & 1 & -2\end{bmatrix}$ [GBTU 2010] (b) $\begin{bmatrix}-2 & -1 & 3 & -1\\ 1 & 2 & -3 & -1\\ 1 & 0 & 1 & 1\\ 0 & 1 & 1 & -1\end{bmatrix}$ [GBTU 2013]
12. Reduce the matrix to Normal form and find Rank, (a) A= $\begin{bmatrix}5 & 3 & 14 & 4\\ 0 & 1 & 2 & 1\\ 1 & -1 & 2 & 0\end{bmatrix}$ [GBTU 2011]

(b) A= $\begin{bmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{bmatrix}$ [GBTU 2007] (c) $A = \begin{bmatrix} 3 & 2 & -1 \\ 4 & 2 & 6 \\ 7 & 4 & 5 \end{bmatrix}$ [AKTU 2016]

(d) A= $\begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix}$ [GBTU 2015] (e) $A = \begin{bmatrix} 0 & 1 & 2 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ [GBTU 2011]

(f) $A = \begin{bmatrix} -1 & -3 & 3 & -1 \\ 1 & 1 & -1 & 0 \\ 2 & -5 & 2 & -3 \end{bmatrix}$ [GBTU 2014]

15. Find all value of P for which the matrix $A = \begin{bmatrix} 3 & P & P \\ P & 3 & P \\ P & P & 3 \end{bmatrix}$ is of rank 1. [UPTU 2012]

(16) Using matrix method, Show that the equations: $3x + 3y + 2z = 1$, $x + 2y = 4$, $10y + 3z = -2$, $2x - 3y - z = 5$ are consistent and hence obtain the solution for x, y, z.

[G. B. T. U. (A. G.)SUM 2010, U. K. T. U. 2010]

(17) Test the consistency of the following system of linear equations and hence find the solution: If exists: (i) $4x_1 - x_2 = 2$, $-x_1 + 5x_2 - 2x_3 = 0$, $-2x_2 + 4x_3 = -8$ [G.B.T.U. 2006] (ii) $7x_1 + 2x_2 + 3x_3 = 16$, $2x_1 + 11x_2 + 5x_3 = 25$, $x_1 + 3x_2 + 4x_3 = 13$ [U.B.T.U. 2008]

(18) Investigate for what values of λ and μ do the system of equations $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ (i) no solution (ii) unique solution (iii) Infinite Solution. [G. B. T. U. SUM 2007

(19) Solve the system of equation $2x_1+3x_2+x_3=9$, $x_1+2x_2+3x_3=6$, $3x_1+x_2+2x_3=8$ by Gaussian elimination method: [GBTU 2007]

(20) Show that the of equations $2x + 6y + 11 = 0$, $6x + 20y - 6z + 3 = 0$ *and* $6y - 18z + 1 = 0$ are not Consistent. [U.K.T.U. 2011]

(21) Test the consistency of the following system of linear equation and hence find the solution: $4x_1-x_2=12$, $-x_1+5x_2-2x_3=0$, $-2x_2+4x_3=-8$.

(22) Determine 'b' such that system of homogeneous equation $2x + y + 2z = 0, x + y + 3z = 0$, $4x + 3y + bz = 0$ has (i) trivial solution (ii) Non-trivial solution & find Non-trivial Solution using matrix method? : [G.B.T.U. 2009]

(23) Find the value of k so that the equations: $x + y + 3z = 0$, $4x + 3y + kz = 0$, $2x + y + 2z = 0$ have a non- trivial solution. [G.B.T.U. (SUM) 2008]

(24) Show that system of equation $3x + 4y + 5z = a$, $4x + 5y + 6z = b$, $5x + 6y + 7z = c$ does not have a solution unless a+c=2b . [G.B.T.U. (SUM) 2008]

(25) For what values of λ , the equations $x + y + z = 1$, $x + 2y + 4z = \lambda$, $x + 4y + 10z = \lambda^2$ Have a solution and solve them completely In each case. [G.B.T.U. (C.O.) 2011] (SUM) 2007]

(26) Show that the matrix $\begin{bmatrix} \alpha + i\gamma & -\beta + i\delta \\ \beta + i\delta & \alpha - i\gamma \end{bmatrix}$ is Unitary if $\alpha^2 + \beta^2 + \gamma^2 + \delta^2 = 1$

[G.B.T.U 2011, 2006]

(27) If $N = \begin{bmatrix} 0 & 1+2i \\ -1+2i & 0 \end{bmatrix}$, Obtain the matrix $(I-N)(I+N)^{-1}$,show that it is Unitary.
[GBTU.CO11]

(28) Express the matrix $A = \begin{bmatrix} i & 2-3i & 4+5i \\ 6+i & 0 & 4-5i \\ -i & 2-i & 2+i \end{bmatrix}$, as a sum of Hermition and Skew-Hermition Matrix. [G.B.T.U. 2010]

(29) Find Eigen values of matrix $A = \begin{bmatrix} 1 & 0 & 4 \\ 0 & 2 & 0 \\ 3 & 1 & -3 \end{bmatrix}$ [G.B.T.U. 2008]

(30) Find Eigen values of matrix $A = \begin{bmatrix} 2 & 5 & 7 \\ 5 & 3 & 1 \\ 7 & 0 & 2 \end{bmatrix}$ [G.B.T.U. (SUM) 2008]

(31) Find Eigen values and Eigen vectors of the matrix:$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ [GBTU(SUM) 2010]

(32) Find Eigen values and Eigen vectors of the matrix:$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [G. B. T. U. 2011]

(33) Find Eigen values and Eigen vectors of the matrix: $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$ [G.B.T.U. 2009]

(34) Verify Cayley -Hamilton theorem for the matrix: $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & 1 \\ 1 & -1 & 2 \end{bmatrix}$, Find A^{-1}. [GBTU 2006]

(35) Verify Cayley -Hamilton theorem for the matrices (i) $A = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ [G. B. T. U. 2009]
(ii) $A = \begin{bmatrix} 2 & 2 & 1 \\ 0 & 1 & -1 \\ 3 & -1 & 1 \end{bmatrix}$ [G.B.T.U. 2007], (iii) $A = \begin{bmatrix} 1 & 0 & -4 \\ 0 & 5 & 4 \\ -4 & 4 & 3 \end{bmatrix}$ [G.B.T.U.] (C.O.) 2010]

(36) Reduce the Matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & 1 & 0 \end{bmatrix}$ to the Diagonalizes ($P^{-1}AP$) form. [G.B.T.U. 2006]

(37) Find a Matrix P which diagonalizes the Matrix = $\begin{bmatrix} 4 & 1 \\ 2 & 3 \end{bmatrix}$. Verify $P^{-1}AP = D$, Where D Is the Diagonal Matrix. [G.B.T.U. 2009]

(38) Show that the matrix $A = \begin{bmatrix} 3 & 1 & -1 \\ -2 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$ is diagonalizable. Hence, find P such that $P^{-1}AP$ Is a diagonal matrix. . [G.B.T.U. C.O.) 2009]

(39) Diagonalize the Matrix (i) $\begin{bmatrix} 3 & 5 \\ 7 & 31 \end{bmatrix}$ [G.B.T.U. (SUM)2009] (ii) $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ [G.B.T.U. 2007]

(40) Find Eigen values and corresponding Eigen vectors of the matrix and hence diagonalize it.

a. $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 3 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ [G.B.T.U. C.O.) 2011]

[B.Tech.1st Year] [AG] [ASSIGNEMENT UNIT-2)]

[Engineering Mathematics- II (KAG-201)] [2019-20]

1. Define velocity and Acceleration in vector calculus. [G.B.T.U. (SUM 2010)]
2. Define Gradient of a scalar field. [G.B.T.U.20006,2007 (SUM 2008)]
3. Find $grad\emptyset$ when $\emptyset$ is given by $\emptyset = 3x^2y - y^3z^2$ at the point $(1, -2, -1)$. [G.B.T.U. 2007]
4. Show that $\nabla r^n = nr^{n-2}\,\vec{r}$ and hence evaluate $\nabla\frac{1}{r}$ where $\vec{r} = xi + yj + zk$.
5. Show that $\nabla(\vec{a}.\vec{r}) = \vec{a}$ where $\vec{r} = xi + yj + zk$ and $\vec{a}$ is a constant vector. [G.B.T.U. 2008]
6. Find a unit Normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(1, 2, -1)$. [G.B.T.U. 2014]
7. Find a unit vector Normal to the surface $x^2y + 2xyz = 4$ at the point $(2, -2, 3)$. [G.B.T.U. 2014]
8. What is the greatest rate of increase of $u = xyz^2$ at the point $(1, 0, 3)$?
9. If $\nabla\emptyset = (y^2 - 2xyz^3)i + (3 + 2xy - x^3y^3)j + (6z^3 - 3x^2yz^2)k$, find k. [G.B.T.U. 2015]
10. Find the Angle between the surfaces $x^2+y^2 + z^2 = 9$ and $z = x^2+y^2 - 3$ at the point $(2, -1, 2)$.
11. If $u = x + y + z$, $v = x^2 + y^2 + z^2$, $w = yz + zx + xy$, prove that $grad\ u, grad\ v, and\ grad\ w\ are$ Coplanar vectors. [G.B.T.U. 2010, 13, 2015]
12. Find the directional derivative of the function $f = x^2 - y^2 + 2z^2$ at the point $P(1,2,3)$ In the direction of the PQ where Q is the point $(5, 0, 4)$. [G.B.T.U. AG (SUM 2010)]
13. Find the directional derivative of $\emptyset = (x^2 + y^2 + z^2)^{\frac{-1}{2}}$ at the point $P(3,1,2)$ in the direction Of the vector $yzi + zxj + xyk$. [G.B.T.U. (SUM 2007, 2014)]
14. Find the directional derivative of $\emptyset = 5x^2y - 5y^2z + \frac{5}{2}z^2x$ at the point $P(1,1,1)$ In the direction of the line $\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}$. [G.B.T.U. (SUM 2010)]
15. Find a unit vector normal to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$. [G.B.T.U. (SUM 2008)]
16. Find a unit normal vector $\hat{n}$ of the cone of revolution $z^2 = 4(x^2 + y^2)$ at $P(1,0,2)$ [GBTU(CO)2010]
17. If $\emptyset = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the normal to the surface $x\ logz - y^2 + 4 = 0$ at $(2, -1, 1)$. [G.B.T.U. 2011]
18. If $f(x, y, z) = 2x^2 + 3y^2 + z^2$ at point P(2,1,3) in the direction of vector $\vec{a} = i - 2k$. [GBTU(CO)09]
19. If $\vec{r} = xi + yj + zk$ then show that (a) $grad\ r = \frac{\vec{r}}{r}$ [G.B.T.U. (CO)2011]

    (b) $grad\frac{1}{r} = -\frac{\vec{r}}{r^3}$ [G.B.T.U. (CO) 2011] (c) $gradr^n = nr^{n-2}\,\vec{r}$ [G.B.T.U. 2008 (CO)2011]

    (e) $curl(r^n\,\vec{r}) = 0$ [G.B.T.U (CO)2010]
20. Prove that $\nabla\, logr = \frac{\vec{r}}{r^2}$ [G.B.T.U. (CO) 2011] and $\nabla f(r) = f'(r)\,\nabla r$ [G.B.T.U. (CO)2011]
21. Find the directional derivative of $\frac{1}{r}$ in the direction $\vec{r}$ where $\vec{r} = xi + yj + zk$ [G.B.T.U. (CO)2012]
22. Find the directional derivative of $\frac{1}{r^2}$ in the direction $\vec{r}$ where $\vec{r} = xi + yj + zk$.
23. Define Divergence and curl of a vector point function. [G.B.T.U.2006, 2007 (SUM) 2008, 2012]
24. If $\vec{r} = xi + yj + zk.$, show that (i) $div\vec{r} = 3$ [G.B.T.U. 2014] (ii) $curl\vec{r} = 0$ [G.B.T.U. 2014]
25. If $\vec{F}(x, y, z) = xz^3i - 2x^2yzj + 2yz^4k$, Find divergence and curl of $\vec{F}(x, y, z)$. [G.B.T.U. 2007]
26. Find divergence and curl of the vector field $\vec{V} = x^2y^2i + 2xyj + (y^2 - xy)k$. [GBTU(SUM 2007)]
27. A vector field is given by $\vec{A} = (x^2 + xy^2)i + (y^2 + x^2y)j.$ $Show\ that\ the\ field\ is\ irrotational$ and Find the scalar potential.
28. A fluid motion is given by $\vec{V} = (y + z)i + (z + x)j + (x + y)k$
    (i) Is this motion irrotational? If so, find the velocity potential. [**A.K.T.U 2016**]
    (ii) Is the motion possible for an an incompressible fluid?

29. Find divergence and curl of the vector field (i) $\vec{V} = xyzi + 3x^2yj + (xz^2 - y^2z)k$

And $\vec{R} = (x^2 + yz)i + (y^2 + zx)j + (z^2 + xy)k$ [G.B.T.U. 2015]

30. Prove that $(y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational. [G.B.T.U. 2009]

31. A fluid motion is given by $\vec{v} = (y\,sinz - sinx)i + (x\,sinz + 2yz)j + (xy\,cox\,z + y^2)k. Is\ the\ motion$ Irrotational? If so find the velocity potential. [G.B.T.U. 2011]

32. If $\vec{F} = (x + y + z)i + j - (x + y)k,\ show\ that\ \vec{F}\,.curl\overrightarrow{F} = 0.$

33. If $\vec{A} = (3xyz^2)i - (yz)j + (x + 2z)k,\ \ find\ curl\ (curl\ \vec{A}).$

34. Show that the vector field $\vec{V} = (siny + z)i + (x\,cosy - z)j + (x - y)k\ \ is\ irrotational.$

35. Find the directional derivative of $\nabla.(\nabla\emptyset)$ at the point $(1, -2, 1)$ in the direction of the normal to the Surface $xy^2z = 3x + z^2$, where $\emptyset = 2x^3y^2z^4$. [G.B.T.U. 2009, 2014]

36. Show that $\vec{A} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is irrotational. Find the velocity potential $\emptyset$ Such that $\vec{A} = \nabla\emptyset$. [G.B.T.U. 2011, 2014]

37. Find the total work done by the force $\vec{F} = (x^2 + y^2)i - 2xyj$ in moving a point from $(0, 0)\ to\ (a, b)$ Along the rectangle bounded by lines $x = 0,\ x = a,\ ,y = 0, and\ y = b.$ [G.B.T.U.2014]

38. Evaluate $\int\int_S\ \vec{A}.n\,ds\ , where\ \vec{A} = (x + y^2)\,i - 2xj + 2yzk$ and S is the surface of the plane $2x + y + 2z = 6$ in the first octant.

39. Evaluate the line integral $\int_C\ [(x^2 + xy)dx + (x^2 + y^2)dy]$, where C is the square formed by the lines $x = \pm 1\ and\ y = \pm 1.$

40. If $\vec{A} = 2xzi - xj + y^2k, evaluate\ \iiint_V\ \vec{A}\,dV, where\ V\ is\ the\ region\ bounded\ by\ the\ surface$ $x = 0, y = 0,\ x = 2, y = 6,\ z = x^2, z = 4.$

41. Evaluate $\oint_C\ \vec{F}.d\vec{r}$ where $\vec{F}(x, y, z) = e^{xyz}(yzi + zxj + xyk)$ and $\vec{r} = xi + yj + zk$ and c is the boundary of $0 \leq x \leq 1\,, 0 \leq y \leq 1,\ and\ z = 1$. Clockwise. [G.B.T.U. (SUM 2008)]

42. If $\vec{A} = (x - y)i + (x + y)j, evaluate\ \oint_C\ \vec{A}.d\vec{r}$ around curve C consisting of $y = x^2$ and $x^2 = y$. [14]

43. Show that the vector field $\vec{F} = (yz)i + (zx + 1)j + (xy)k$ is conservative. Find the scaler potential. Also find the work done by $\vec{F}$ in moving a particle from $(1, 0, 0)\ to\ (2, 1, 4)$. [GBTU 2013]

44. State Gauss Divergence Theorem. (OR)

Define relation between surface integral and volume integral. [GBTU 2006,2007,(CO)11,2012)]

45. Find $\int\int_S\ \vec{F}.n\,ds$, where $\vec{F} = (2x + 3z)i - (xz + y)j + (y^2 + 2z)k$ and S is the sphere having centre at (3,-1,2) and radius 3. [G.B.T.U. 2006]

46. Define STOKE's Theorem. (OR)
Define relation between line and surface integral. [G.B.T.U.2007, (SUM) 2008, 2009, 2012]

47. If $\vec{F} = 3yi - xzj + yz^2k$ and S is the surface of the paraboloid $2z = x^2 + y^2$ bounded by $z = 2$ Show by using Stoke's theorem that $\int\int_S\ (\nabla \times \vec{F}).\overline{dS} = -20\pi$ [G.B.T.U. (SUM 2007)]

48. State Green theorem in the plane. [G.B.T.U. 2008, 2012]

49. Apply Green theorem to evaluate $\oint_C\ [(2x^2 - y^2)dx + (x^2 + y^2)dy]$ where C is the boundary of the area enclosed by x- axis and the upper half of circle $x^2 + y^2 = a^2$.[GBTU (SUM) 2010,(CO)11]

50. Use Green's theorem to evaluate $\oint_C\ [(x^2 + xy)dx + (x^2 + y^2)dy]$ where C is the square formed by the lines $y = \pm 1,\ x \pm 1.$ [G.B.T.U. (CO) 2010]

[B.Tech.1st Year] [AG] [ASSIGNEMENT UNIT-3)]

[Engineering Mathematics- II (KAG-201)] [2019-20]

(1) Use the method of separation of variables to solve the equation,

$\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u$, Given that $u(x,0)=6e^{-3x}$ $[G.B.T.U.\ 2004,06,(SUM)10,11]$

(2) Use method of separation of variables to solve the equation, $\frac{\partial^2 u}{\partial x^2}-2\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=0[GBTU2005,09]$

(3) Solve by the method of separation of variables, $4\frac{\partial u}{\partial t}+\frac{\partial u}{\partial x}=3u,\ \ u=3e^{-x}-e^{-5x}$ when t=0

(4) Solve the following equation by the method of separation of variables,

$\frac{\partial^2 u}{\partial x\ \partial t}=e^{-t}\,Cosx$, Given that u=0 when t=0 and $\frac{\partial u}{\partial t}=0$ when x=0. $[G.B.T.U.\ 2008]$

(5) Find the solution of wave equation. $[G.B.T.U.\ 2005]$

(6) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y=A\,sin\frac{\pi x}{l}$ from which it is released at time t=0. Show that the displacement of any point at a distance x from one end at time t is given by-

$$y(x,t)=Asin\frac{\pi x}{l}\,Cos\frac{\pi ct}{l}$$ $[G.B.T.U.\ 2004,07,09,(SUM)09]$

(7) A tightly stretched string with fixed end points x=0, and $x=l$ is initially in a position given by $y=y_0\,Sin^3\frac{\pi x}{l}$. If it is released from rest from this position,

Find the displacement y(x,t). $[G.B.T.U.\ (CO)2011]$

(8) If a string of length l is initially at rest in equilibrium position and each of its point is given the

(9) Find the equation of one dimensional heat flow and its solution. $[\ G.B.T.U.\ (CO)2011]$

(10) A rod of length l with insulated sides is initially at a uniform temperature u_0 . Its ends are suddenly cooled to 0^0C and are kept at the temperature. Find the temperature $function$ u(x,t).

[G.B.T.U. (SUM) 2010, 2011]

(11) Solve the equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ with boundary condition, $u(x,0)=3\,sin\,\pi x, u(0,t)=0,$

$u(l,t)=0$ where $0<x<l$. $[\ G.B.T.U.\ 2002]$

(12) A bar with insulated sides is initially at a temperature 0^0C throughout. The end $x=0$, is kept

At 0^0C , and heat is suddenly applied at the end $x = l$, so that $\frac{\partial u}{\partial x} = A$ for $x = l$, where A is Constant. Find the temperature function $u(x,t)$. [$G.B.T.U.$ 2002]

(13) Use separation of variables method to solve the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the boundry conditions $u(0,y) = u(l,y) = u(x,0)$ and $u(x,a) = sin\frac{n\pi x}{l}$ [$G.B.T.U.$ 2003,04]

(14) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in a rectangular in the xy-plane with $(x,0) = 0$, $u(x,b) = 0$, $u(0,y) = 0$ and $u(a,y) = f(y)$ parallel to y- axis. [$G.B.T.U.$ (SUM)2008]

(15) Solve the equation *by the* method of separation of variables $u_{xx} + u_y + 2u$,

$u(0,y) = 0, \quad \frac{\partial}{\partial x} u(0,y) = 1 + e^{-3y}$ [$G.B.T.U.$ 2009, 2010]

(16) Solve by the method of separation of variables, $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$ $u(0,y) = 8e^{-3y}$ [$G.B.T.U.$ 2008]

(17) Solve by the method of separation of variables, $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial y} = 0$ [$G.B.T.U.(SUM)$ 2007]

(18) Solve by the method of separation of variables $y^3\frac{\partial u}{\partial x} + x^2\frac{\partial u}{\partial x} = 0$ [$G.B.T.U.$ 2011]

(19) Show how the wave equation $\frac{\partial^2 y}{\partial t^2} = c^2\frac{\partial^2 y}{\partial x^2}$ can be Solve by the method of separation of variables.

(20) Find the deflection $u(x,y,t)$ on the tightly stretched rectangular membrane with sides a and b having wave velocity $c = 1$, if the initial velocity is zero and its deflection is

$f(x,y) = sin\frac{2\pi x}{a}\ sin\frac{3\pi y}{a}$ [$G.B.T.U.$ 2011]

(21) Find the solution of heat equation. [$G.B.T.U.(CO)$ 2011], 2007]

(22) Find the temperature in a bar of length 2, whose ends are kept at zero and lateral surface insulated if the initial temperature $\frac{\pi x}{2} + 3sin\frac{5\pi x}{2}$. [$G.B.T.U.(CO)$2007, 2009]

(23) Find the solution of Laplace Equation in Two Dimension. [$G.B.TU$ 2011 (CO)10,]

(24) Solve by the method of separation of variables, $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to the boundary condition $u(0,y) = u(l,y) = u(x,0) = 0$, and $u(x,a) = sin\frac{n\pi x}{l}$. [$G.B.TU(CO)$2009,]

(25) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in a rectangular with $(0,y) = 0$, $u(a,y) = 0$, $u(x,b) = 0$ and $u(x,0) = f(x)$ parallel to x- axis. [$G.B.T.U.$ 2008]