JAIPUR ENGINEERING COLLEGE & RESEARCH CENTRE

ASSIGNMENT

Year: B. Tech. I Year

Semester: II

Subject: Engineering Mathematics -II

Session: 2020-21

CO1. To understand the concept of rank of matrix, inverse, Eigen values & vectors along with solution of linear simultaneous equation determine inverse of a matrix using Cayley Hamilton Theorem.

Q.1Find the Eigen value and Eigen vectors of the following matrix

$$\begin{bmatrix} -2 & 1 & 1 \\ -11 & 4 & 5 \\ -1 & 1 & 0 \end{bmatrix}$$

Q.2 Examine for Consistency the following equation and solve them if they are consistent

$$x + y + z = 6, \quad 2x + y + 3z = 13, \quad 5x + 2y + z = 12, \quad 2x - 3y - 2z = -10.$$

Q.3 Verify Cayley Hamilton Theorem for the following matrix $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$

Q.4 Verify Cayley Hamilton Theorem for the following matrix $\begin{bmatrix} -2 & 1 & 1 \\ 2 & 1 & 3 \\ 1 & -3 & 2 \end{bmatrix}$. Hence find A^{-1}.

Q.5 Find the Inverse of the following matrix by using elementary transformation method

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 1 & -1 & 1 \end{bmatrix}$$

Q.6Examine consistency of the system of equation and if consistent solve the equation. $2x + y + z = 4, -2x + y + 3z = 12, 3x + 2y + z = 12$ and $2x - 3y - 2z = -10$.

Q.7 Q 6 Investigate for what values of λ and μ the system of linear equations

$x + 2y + z = 7, x + y + \lambda z = \mu, x + 3y - 5z = 5$ has

(i) no solution (ii) a unique solution (iii) an infinite number of solutions.

Q.8 Q.5 Find the condition on a, b and c so that the following system of linear equations has one parameter family of solutions:

$x + y + z = a, x + 2y + 3z = b, 3x + 5y + 7z = c.$

Q.9 Determine the ranks of the following matrices and reduce in normal form:-

(i) $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ *(ii)* $\begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{bmatrix}$ *(iii)* $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$

Q.10 Define Rank-nullity theorem.

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Co2: To solve Ordinary D.E of first order, first degree and first order higher degree using various methods.

Solve:

Q. 1 $y = -px + x^4p^2$

Q. 2 $ydx - xdy + \log x\, dx = 0$

Q.3 $(x^4e^x - 2mxy^2)dx + 2mx^2ydy = 0$

Q 4 Solve x log x $\frac{dy}{dx}$+y = 2 log x.

Q 5 Solve $p^2 + 2py\cot x - y^2 = 0$

Q.6 Solve (y+px) (2p-1) = -p

Q. 7 Solve $(\sec x \tan x \tan y - e^x)dx + \sec x\, sec^2 ydy = 0$

Q.8 $\frac{dy}{dx} = \frac{x^3+y^3}{xy^2}$

Q.9 $(1 + xy)xdy + (1 - xy)ydx = 0$

Q.10 $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$

Q.11 $x^2\left(\frac{dy}{dx}\right)^2 + xy\left(\frac{dy}{dx}\right) - 6y^2 = 0$

Q.12 $9(y + xp\log p) = (2 + 3\log p)p^3$

Q.13 $x^3y^3(2ydx + xdy) - (5ydx + 7xdy) = 0$

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Co3: To find the complete solution of D.E of higher order with constant coefficient & variable coefficients & their methods of solution.

Q.1 Solve $(D^2 + a^2)y = \tan ax$

Q.2 $y'' + 3y' + 2y = e^{e^x}$

Q.3 $y'' - 4y' + 4y = 8x^2 e^{2x} sin2x$

Q.4 Solve $(D^2 - 3D + 2)y = e^x$

Q.5 $(x+2)\frac{d^2y}{dx^2} - (2x+5)\frac{dy}{dx} + 2y = (x+1)e^x$

Q .6 Solve $\frac{d^2y}{dx^2} + (\tan x - 3\cos x)\frac{dy}{dx} + 2y\cos^2 x = \cos^4 x$

Q.7 Solve $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 20y = (x+1)^2$

$Q.8$ $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = x^2 \sin(logx)$

$Q.9$ $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 4y = 2x^2$

$Q.10$ $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + y = \frac{logx.\sin(logx+1)}{x}$

Q.11 $\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + (4x^2 - 3)y = e^{x^2}$

Q.12 $x^2\frac{d^2y}{dx^2} - 2(x^2 + x)\frac{dy}{dx} + (x^2 + 2x + 2)y = 0$

Solve by the method of variation of parameter

Q.13 $y'' + 4y = 4tan2x$

Q. 14 Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10(x + \frac{1}{x})$

Q.15 $(D^2 - 2D + 1)y = e^x\ logx$

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Co4: To solve partial differential equations with its applications in Laplace equation, Heat & Wave equation

Q.1 Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ for the conditions

$(i)\ u(0,y)=0=u(l,y)=0$

$(ii)\ u(x,0)=0$ and $u(x,a)=sin\frac{\pi x}{l}$

Q.2 Using the method of separation of variables Solve $\frac{\partial \mathrm{u}}{\partial \mathrm{x}}=2\frac{\partial \mathrm{u}}{\partial \mathrm{t}}+\mathrm{u}$ where $u(x,0)=6e^{-3x}$

Q.3 Using the method of separation of variables, solve $\frac{\partial^2 u}{\partial x^2}=\frac{\partial u}{\partial t}$ given that u=0 when $t\ \rightarrow\ \infty$, as well as u(0,t)=0=u(l,t).

Q.4 Find the solution of one dimensional heat equation if the bar is 10cm long.

Q.5 If both the ends of a bar of length l are at temperature zero and the initial temperature is to be prescribed as a function $f(x)$ in the bar then find the temperature at a subsequent time t.

Q.6 Solve by the method of separation of variables: $3\frac{\partial \mathrm{u}}{\partial \mathrm{x}}+2\frac{\partial \mathrm{u}}{\partial \mathrm{y}}=0,\ u(x,0)=4e^{-x}$

Q.7 Using the method of separation of variables Solve $\frac{\partial \mathrm{u}}{\partial \mathrm{x}}=2\frac{\partial \mathrm{u}}{\partial \mathrm{t}}+\mathrm{u}$ where $u(x,0)=6e^{-3x}$