MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
UG Model question paper
Mathematics-I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define Rank of a matrix? [2M]

b) Find the rank of the matrix A by reducing it to the normal form where

A= $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$ [4M]

c) Find the eigen values and eigen vectors of the following matrix $\begin{bmatrix} 5 & -2 & 0 \\ -2 & 6 & 2 \\ 0 & 2 & 7 \end{bmatrix}$ [8 M]

OR

2 a) Diagonalize the matrix A= $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ [7M]

b) Show that the only real number μ for which the system x+2y+3z= μy, 3x+y+2z= μy 2x+3y+z= μz has non zero solution is 6 and solve them, when μ = 6. [6 M]

c) Define Caley-Hamilton theorem? [1 M]

SECTION-II

3 a) Define Rolle's theorem and also write geometrical representation? [4M]

b) Find maximum and minimum of the function f (x,y)=sin x + sin y + sin (x+y)? [10 M]

OR

4 a) Use Lagranges mean value theorem to prove that if 0 < u<v $\frac{v-u}{1+v^2} < \tan^{-1} u - \tan^{-1} v < \frac{v+u}{1+v^2}$ And also deduce that $\frac{\pi}{4} + \frac{3}{5} < \tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$ [7M]

b) Find the dimensions of a rectangular box of maximum capacity whose surface area is gien when a) box is open at the top b)box is closed [7M]

SECTION-III

5 a) Solve $\frac{dy}{dx} + y cot x = 2x cosec x$ [7M]

b) Solve 2xyy'= $y^2 - 2x^3$, y(1) = 2 [7M]

OR

6 a) Water at temperature 100^0c cools in 10min to 80^0c in a room of temperature 25^0c. (a) Find the temperature of water after 20min (b) When is the temperature 40^0c replace by 26^0c [7M]

b) Solve y'+y+y^2(sinx-cosx) = 0 [7M]

SECTION-IV

7 a) Solve $(D^2-4D+1)y = \cos x\cos 4x + \sin^2 x$ [7M]

b) Solve the D.E. $(D^2-2D)y = e^{x}\sin x$ by using variation of parameters [7M]

OR

8 a) Solve $(D^2+2)y = x^2 e^{3x} + e^{x}\cos 2x$ [7 M]

b) Solve $(D^2-1)y = x\sin x + x^2 e^{x}$ [7 M]

SECTION-V

9 a) Verify Green's thorem in plane for $\oint (x^2 - 2xy)\,dx + x^2y+3)dy$ where c is the boundary of the region defined by $y^2=8x$ and $x= 2$ [10M]

b) Find the work done in moving a particle in the force field $\underset{f}{\rightarrow} = 3x^2i + (2xz-y)j + zk$ along straight line from A(0,0,0) to B(2,1,3) [4 M]

OR

10 a) If $\underset{A}{\rightarrow} = (x-y)\,i + (x+y)\,j$ evaluate $\oint A\,.\,dr$ around the curve c consisting of $y = x^2$ and $y^2 = x$ [4 M]

b) Verify Stoke's theorem for $\underset{A}{\rightarrow} = y^2i + xyi - xzk$ where S is the hemisphere $x^2+y^2+z^2 = a^2$, $z \geq 0$ [10M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
UG Model question paper
Mathematics-I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define rank of a matrix. [2M]

b) Show that the equations x+2y-z=3, 3x-y+2z=1, 2x-2y+3z=2, x-y+z=-1 are consistent and hence obtain the solution. [6M]

c) Determine the values of a, b, c when $\begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ is orthogonal [6M]

OR

2 a) Show that the Eigen values of a unitary matrix are of unit modulus [4M]

b) Find the Characteristic polynomial of the matrix $A = \begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ verify Cayley-Hamilton theorem and hence find A^{-1} and A^4 [10M]

SECTION-II

3 a) Explain Geometrical interpretation of Rolle's Mean Value Theorem [4M]

b) If a<b, prove that $\frac{b-a}{1+b^2} < Tan^{-1}b - Tan^{-1}a < \frac{b-a}{1+a^2}$ and deduce

$i.\ \frac{\pi}{4} + \frac{3}{25} < Tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$

$ii.\ \frac{5\pi+4}{20} < Tan^{-1}2 < \frac{\pi+2}{4}$ [10M]

OR

4 a) If $x = e^r \sec\theta, y = e^r \tan\theta$ prove that $\frac{\partial(x,y)}{\partial(r,\theta)} \cdot \frac{\partial(r,\theta)}{\partial(x,y)} = 1$ [7M]

b) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction. [7M]

SECTION-III

5 a) Solve $\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$. [7M]

b) Show that the system of confocal conics $\frac{x^2}{a^2+\lambda}+\frac{y^2}{b^2+\lambda}=1$ where λ is a parameter is self orthogonal. [7M]

OR

6 a) The number N of bacteria in a culture grew at a rate proportional to N. The value of N initially was 100 and increased to 332 in one hour. What was the value of N after $1\frac{1}{2}$ hours? [7M]

b) A body kept in air with temperature 25^0C cools from 140^0C to 80^0C in 2 minutes. Find when the body cools down to 35^0C. [7M]

SECTION-IV

7 a) Solve $(D^2-4D+4)y=e^{2x}+x^2+\sin 3x$ [7M]

b) A particle is executing S.H.M with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same side of it. [7M]

OR

8 a) Solve $(D^2+a^2)y=\tan ax$ by the method of variation of parameters. [7M]

b) Solve $(4D^2-4D+1)y=100$ [7M]

SECTION-V

9 a) Find the Directional Derivative of the function $f=x^2-y^2+2x^2$ at the point P = (1, 2, 3) in the direction of the line PQ, where Q = (5, 0, 4). [4M]

b) Verify Green's theorem in a plane for $\oint_C (3x^2-8y^2)dx+(4y-6xy)dy$ where 'C' is the region bounded by $y=\sqrt{x}$ and $y=x^2$. [10M]

OR

10 a) Find the constants a, b, c so that the vector $(x+2y+az)i+(bx-3y-z)j+(4x+cy+2z)k$ is irrotational. [4M]

b) Verify Stokes Theorem for $\bar{F}=(2x-y)\bar{\imath}-yz^2\bar{\jmath}-y^2z\bar{k}$ over the upper half surface of the sphere $x^2+y^2+z^2=1$ bounded by the projection of the xy – plane. [10M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Mathematics - I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Find the value of k if the rank of the matrix $\begin{bmatrix} 4 & 4 & -3 & 1 \\ 1 & 1 & -1 & 0 \\ k & 2 & 2 & -2 \\ 9 & 9 & k & 3 \end{bmatrix}$ is '3'. [4M]

b) For what values of λ and μ, the system of equations 2x+3y+5z=9, 7x+3y-2z=8, 2x+3y+ λ z= μ has i) unique solution, ii). No solution, iii). An infinite number of solutions. [10M]

OR

2 a) Define skew Hermitian matrix and give an example [2M]

b)Define eigen values and eigen vector [2M]

c)) Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ [10M]

SECTION-II

3 a) If a<b, prove that $\frac{b-a}{1+b^2} < Tan^{-1}b - Tan^{-1}a < \frac{b-a}{1+a^2}$ and hence deduce [10M]

$i.\ \frac{\pi}{4} + \frac{3}{25} < Tan^{-1}\,{}^{4}\!/_{3} < {}^{\pi}\!/_{4} + {}^{1}\!/_{6}$

$ii.\ \frac{5\pi+4}{20} < Tan^{-1}2 < \frac{\pi+2}{4}$

b) write geometrical interpretation of Lagranges mean value theorem [4M]

OR

4 a) S.T the functions u = x + y + z , v = $x^2 + y^2 + z^2$ -2xy – 2yz -2xz and w = $x^3 + y^3 + z^3$ – 3xyz are functionally related. [7M]

b) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction. [7M]

SECTION-III

5 a) Define Newtons law of cooling. [2M]

b) A body is originally at 80^0 C and cools down to 60^0C in 20 min . If the temperature of the air is 40^0 C find the temperature of body after 40 min. [6M]

c) solve $x + 2y^3)\frac{dy}{dx} = y$ [6M]

OR

6 a) Prove that the family of curves $\frac{x^2}{a^2+\lambda} + \frac{y^2}{b^2+\lambda} = 1$,where λ is a parameter is self – orthogonal. [7M]

b) solve $x\frac{dy}{dx} + y = x^2y^6$ [7M]

SECTION-IV

7 a) A particle is executing S.H.M, with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the Centre of force and are on the same side of it. [10M]

b) $(D^2 + 1)y = sin2x$ [4M]

OR

8 a) Use the method of variation of parameters to solve the differential equation $\frac{d^2y}{dx^2} + 4y = tan2x.$ [7M]

b) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x sinx$ [7M]

SECTION-V

9 a).State stokes thoeroem [2M]

b) Verify Stokes Theorem for $\bar{F} = (2x - y)\bar{\imath} - yz^2\bar{\jmath} - y^2z\bar{k}$ over the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ bounded by the projection of the xy – plane. [12M]

OR

10 a) State Green's theorem. [2M]

b).Find the Directional Derivative of $x^2 + 2xyz$ in the direction of $2i + 3j + 4k$ at the point (1,-1,2) [4M]

c) calculate the work done by a force vector $F = 3xyi - y^2j$ in moving a particle in xy-plane from (0,1) to (1,2) along the parabola $y = x^2$ [8M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Mathematics - I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) P.T $\frac{1}{2}\begin{bmatrix} 1+i & -1+i \\ 1+i & 1-i \end{bmatrix}$ is a unitary matrix . [2M]

b) Find the Characterstic polynomial of the matrix $A=\begin{bmatrix} 3 & 1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ verify Cayley-Hamilton theorem and hence find A^{-1} [12M]

OR

2 a) Define Rank of a matrix [1M]

b) Prove that the eigen values of A^{-1} are the reciprocals of the eigen values of A [3M]

c) Diagonalize the matrix $A=\begin{bmatrix} 2 & 2 & -7 \\ 2 & 1 & 2 \\ 0 & 1 & -3 \end{bmatrix}$ and hence find A^4. [10M]

SECTION-II

3 a)Discuss the applicability of Rolle's theorem to the function $f(x)=|x| in [-1,1]$ [2M]

b) Explain graphical interpretation of Rolle's theorem [2M]

c) Prove using mean value theorem $|\sin u - \sin v| \leq |u - v|$ [2M]

OR

4 a) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction. [7M]

b)Determine whether the function $u = x\sqrt{(1-y^2)} + y\sqrt{(1-x^2)}$, $v = \sin^{-1}x + \sin^{-1}y$ is functionally dependent if so find the relation. [7M]

SECTION-III

5 a) Solve $\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$ [7M]

b) Show that the system of confocal conics $\frac{x^2}{a^2+\lambda}+\frac{y^2}{b^2+\lambda}=1$ where λ is a parameter and is self orthogonal [7M]

OR

6 a) A body kept in air with temperature $25^0 C$ cools from $140^0 C$ to $80^0 C$ in 20 minutes. Find when the body cools down to $35^0 C$. [7M]

b) Solve $xdx + ydy = \frac{xdy - ydx}{x^2 + y^2}$ [7M]

SECTION-IV

7 a) Solve $(4D^2 - 4D + 1)y = 100$ [2M]

b) Solve $(D^2 - 2D + 1)y = x^2 e^{3x} - \sin 2x + 3$ [12M]

OR

8 a) Solve $(D^2 + a^2)y = \tan ax$ by the method of variation of parameters [7M]

b) A particle is executing S.H.M with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same side of it. [7M]

SECTION-V

9 a) State Green's theorem [2M]

b) Find the directional derivative of xyz^2+xz at (1, 1 ,1) in a direction of the normal to the surface$3xy^2+y= z$ at (0,1,1). [4M]

c) Find the work done by the force $\bar{F} = (2y+3)\bar{i} + (zx)\bar{j} + (yz - x)\bar{k}$ when it moves a particle from the point (0,0,0) to (2,1,1) along the curve $x = 2t^2$, $y = t$, $z=t^3$ [8M]

OR

10 a) Verify the Stoke's theorem for $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$ and surface is the part of the sphere $x^2 + y^2 + z^2 = 1$ *above the xy plane.* [14M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Mathematics-I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define Rank of a Matrix? Write some important properties of rank . [4+10M]

b) Reduce the matrix $A=\begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}$ to normal form & hence find its Rank.

OR

2 a) Find whether the following system of equations are consistent, If so solve the $x+2y+2z=2, 3x-2y-z=5, 2x-5y+3z=-4, x+4y+6z=0$ [4+10M]

b) Verify cayley-Hamilton theorem and find the inverse of $\begin{bmatrix} 1 & 0 & 3 \\ 2 & -1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$

SECTION-II

3 a) (i) If a<b prove that $\dfrac{b-a}{1+b^2} < \tan^{-1} b - \tan^{-1} a < \dfrac{b-a}{1+a^2}$ using Lagrange's mean value theorem. Deduce the following

$(i)\ \dfrac{\pi}{4}+\dfrac{3}{25} < \tan^{-1}\dfrac{4}{3} < \dfrac{\pi}{4}+\dfrac{1}{6} \qquad (ii)\ \dfrac{5\pi+4}{20} < \tan^{-1} 2 < \dfrac{\pi+2}{4}$

[10+4M]

b) Verify cauchy's Mean Value theorem for $f(x)=\sin x, g(x)=\cos x\ on\left[0,\frac{\pi}{2}\right]$

OR

4 a) If $x+y+z=u, y+z=uv, z=uvw$ then evaluate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. [4+5+5M]

b) Verify Rolles theorem for $f(x)=e^x(\sin x-\cos x) in \left[\frac{\pi}{4},\frac{5\pi}{4}\right]$

c) Find the maximum values of $xy+\frac{a^3}{x}+\frac{a3}{y}$

SECTION-III

5 a) Solve : 2xy dy – (x^2 +y^2 +1)dx =0 . [4+10M]

b) prove that system of parabolas y^2= 4a(x+a) is self orthogonal .

OR

6 a) write order and degree of DE $y = x\frac{dy}{dx} + \sqrt{1+(\frac{dy}{dx})^2}$. [4+10M]

b) Solve : $x\frac{dy}{dx} + y = x^3y^6$.

SECTION-IV

7 a) Solve $(D^2+5D+6)y=e^x$ [3+6+6M]

b) Solve the D.E $(D^2-2D+4)y=e^{2x}$ cosx

c) Solve: $\frac{d^2y}{dx^2}+y=\cos ecx$ by the method of variation of parameters.

OR

8 a) Solve $\frac{d^2y}{dx^2}-a^2y=0, a\neq 0$ [4+5+5M]

b) Solve: $(D^2-4)y=2\cos^2 x$

c) Solve : $(D^2-4D+4)y=8x^2+e^{2x}$

SECTION-V

9. Verify Green's theorem in the plane for $\int_c (x^2-xy^3)dx+(y^2-2xy)dy)$ where C is a square with verfices (0,0), (2,0), (2,2),(0,2) . [14M]

OR

10 a) Find curl $\bar{f}$ where $\bar{f}$ = grad(x^3+y^3+z^3-3xyz) [4+5+5M]

b) Find the angle between the surfaces $x^2+y^2+z^2=9$ & $z^2=x^2+y^2-3$ at the point (2,-1,2).

c) If a=x+y+z, b= x 2 +y 2 +z 2 , c = xy+yz+zx, then prove that [grad a, grad b, grad c] = 0.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Mathematics - I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define Rank of a matrix. [1M]

b) Find rank of the matrix $\begin{bmatrix} 2 & 1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}$ by reducing it to normal form [7M]

c)Find the values of p & q so that the equations 2x+3y+5z=9,7x+3y+2z=8,2x+3y+pz=q has i)No solution ii)Unique solution iii)An infinite number of solutions. [6M]

OR

2 a) Using Cayley – Hamilton theorem find inverse of $\begin{bmatrix} 1 & 0 & 3 \\ 2 & -1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ [6M]

b) Find Eigen values and eigen vectors of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [6M]

c) If is λ an eigen value of an orthogonal matrix then prove that $\frac{1}{\lambda}$ is also its eigen value. [2M]

SECTION-II

3 a) Find maximum and minimum values of $x^2 + 3xy - 15x^2 - 15y^2 + 72$ [8M]

b) Verify if u=2x-y+3z, v=2x-y-z,w=2x-y+z are functionally dependent, and if so , find the relation between them. [6M]

OR

4 a)Obtain Maclaurin's series expansion of f(x) = cosx. [4M]

b) If a<b, prove that $\frac{b-a}{1+b^2} < tan^{-1}b - tan^{-1}a < \frac{b-a}{1+a^2}$using Lagranges mean value theorem and deduce the following

i)$\frac{\pi}{4} + \frac{3}{25} < tan^{-1}\frac{4}{3} < \frac{\pi}{4} + \frac{1}{6}$

ii) $\frac{\mathbf{5\pi+4}}{\mathbf{20}} < tan^{-1}2 < \frac{\boldsymbol{\pi}\mathbf{+2}}{\mathbf{4}}$) [10M]

SECTION-III

5 a)Solve $(x^2 - y^2)$dx=2xydy [4M]

b) Solve (x+1)$\frac{dy}{dx}$ -y = $e^{3x}(x+1)^2$ [6M]

c) Solve $\frac{dy}{dx}(x^2y^3 + xy) = 1$ [4M]

OR

6 a)State Law of Natural growth. Bacteria in a culture grows exponentially so that the initial number has doubled in 3hrs. How many times, the initial number will be present after 9hrs. [7M]

b) Shoe that the system of confocal conics $\frac{X^2}{a^2+\lambda} + \frac{y^2}{b^2+\lambda} = 1$is self orthogonal.(where λ is a parameter) [7M]

SECTION-IV

7 a) Solve $(D^2 - 2D + 2)y = e^x tanx$ by the method of variation of parameters. [7M]

b) Solve $(D^2 + 2D + 1)y = xcosx$ [7M]

OR

8 a)Solve $(D^2 - 2D + 1)y = x^2e^{3x} - sin2x + 3$ [8M]

b) Solve $(D^2 + 4)y = e^x + sin2x$ [6M]

SECTION-V

9 a) Find the directional derivative of $\nabla.\nabla\phi$ at the point (1,-2,1) in the direction of the normal to the surface x$y^2z = 3x + z^2$ where ϕ=2$x^3y^2z^4$. [7M]

b) Find the workdone by a force $\bar{F}$ =$(x^2 - y^2 + x)\bar{\imath} - (2xy + y)\bar{\jmath}$ which moves a particle in xy-plane from (0,0) to (1,1) along the parabola $y^2 = x$ [7M]

OR

10 a) Use Divergence theorem to evaluate $\iint (y^2z\bar{\imath} + z^2x^2\bar{\jmath} + z^2y^2\bar{k}).\bar{n}ds$ where S is the part of the unit sphere above the xy-plane. [7M]

b) Use Stoke's theorem to evaluate $\int \bar{v}\,.\,\overline{dr}$where $\bar{v} = y^2\bar{\imath} + xy\bar{\jmath} + xz\bar{k}$ and c is the bounding curve of the hemisphere $x^2 + y^2 + z^2 = 9, z > 0$ oriented in the positive direction. [7M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
UG Model question paper
Mathematics- I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define the rank of the matrix [2M]

b) Find the rank of the following Matrix by reducing it to the canonical form $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$

[6M]

c) P.T the following set of equations are consistent and solve them
$3x+3y+2z=1; x+2y=4; 10y+3z=-2; 2x-3y-z=5$ [6M]

OR

2 a) State Cayley-Hamilton Theorem and Find A^8, If $A=\begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ [3M]

b) P.T. The eigen values of a hermitian matrix are all real. [3M]

b) Find the eigen values and eigen vectors of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [8M]

SECTION-II

3 a) State Rolle's Theorem & Verify Rolle's Theorem can be applied for f(x) = tanx in [0,π] [3M]

b) If f(x) = logx and g(x) = x^2 in [a, b] with b>a>1 using Cauchy's Theorem Prove that
$\dfrac{\log b-\log a}{b-a}=\dfrac{a+b}{2c^2}$ [5M]

c) P.T $\frac{\pi}{3}-\frac{4}{5\sqrt{3}} > \cos^{-1}\frac{3}{5} > \frac{\pi}{3}-\frac{1}{8}$ using Lagrange's Mean value theorem [6M]

OR

4 a) $If\ u=x^2-2y; v=x+y+z, w=x-2y+3z\ find\ \dfrac{\partial(u,v,w)}{\partial(x,y,z)}$ [3M]

b) S.T the functions u=x+y+z, v=xy+yz+zx and w=$x^2+y^2+z^2$ are functionally dependent and find the relation between them . [5M]

c) Find the volume of the largest rectangular parallelepiped that can inscribed in the ellipsoid $\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$ [6M]

SECTION-III

5 a) Form the D.E. by eliminating arbitrary constant log(y/x) = cx [2M]

b) Solve $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$ [6M]

c) Solve $(1 + y^2)dx = (\tan^{-1}y - x)dy$ [6M]

OR

6 a) Solve $(e^y + 1)\cos x\, dx + e^y sinx\, dy = 0$ [2M]

b) Find the Orthogonal Trajectories of the family of curves $r^n \sin n\theta = a^n$ [6M]

c) A body kept in air with temperature 25^0C cools from 140^0C to 80^0C in 20 mins. Find when the body cools down to 35^0C. [6M]

SECTION-IV

7 a) Sole $(D^4 - 1)y = 0$ [2M]

b) Solve $\frac{d^3y}{dx^3}+4\frac{dy}{dx}=\sin 2x$ [4M]

c) Solve $(D^2 + 4D + 3)y = e^x\cos 2x - \cos 3x - 3x^3$ [8M]

OR

8 a) Sole $(4D^2 - 4D + 1)y = 100$ [2M]

b) Apply the Method of variation of parameters to solve $\frac{d^2y}{dx^2}+y=\cos ecx$ [6M]

c) A particle is executing S.H.M., with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing b/w points which are at distances 4 and 2 meters from the centre of force and are on the same side of it. [6M]

SECTION-V

9 a) Find the constants a, b, c so that the vector $(x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is Irrotational. [4M]

b) Verify Green's theorem in the plane for $\oint_c (x^2 - xy^2)dx + (y^2 - 2xy)dy$ where 'C' is a square with vertices (0, 0) (2, 0) (2, 2) (0, 2) [10M]

OR

10 a) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ [4M]

b) Verify Stokes Theorem for $\bar{F} = (2x - y)\bar{\imath} - yz^2\bar{\jmath} - y^2z\bar{k}$ over the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ bounded by the projection of the xy – plane [10M]

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

1 a) Define Rank of a Matrix.

b) Reduce the matrix A to normal form where $A=\begin{bmatrix}0 & 1 & 2 & -2\\ 4 & 0 & 2 & 6\\ 2 & 1 & 3 & 1\end{bmatrix}$,hence find the rank.

c) Solve x+2y-z=3, 3x-y+2z=1, 2x-2y+3z=2, x-y+z=-1 . **[2+6+6M]**

OR

2 a) Find the Characterstic polynomial of the matrix $A=\begin{bmatrix}3 & 1 & 1\\ -1 & 5 & -1\\ 1 & -1 & 3\end{bmatrix}$ verify Cayley-Hamilton theorem and hence find A^{-1} and A^4

b)Prove that the eigen values of A^{-1} are the reciprocals of the eigen values of A. **[10+4M]**

SECTION-II

3 a)Give Geometrical Interpretation of Rolle's Theorem.

b) Verify Rolle's theorem for the function $f(x)=(x-a)^m(x-b)^n$ where m,n are positive integers in [a,b].

c) If x+y+z=u, y+z= uv, z=uvw then evaluate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. **[2+6+6M]**

OR

4 a) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction.

b) Find C of Cauchy's mean value theorem for $f(x)=\sqrt{x}\ and\ g(x)=1/\sqrt{x}$ in [a,b] where 0<a<b. **[7+7M]**

SECTION-III

5 a) Solve $\sec^2 y\dfrac{dy}{dx}+2x\tan y=x^3$

b) Find orthogonal trajectories of the family of curves $x^{2/3}+y^{2/3}=a^{2/3}$ where 'a' is the parameter. **[7+7M]**

OR

6 a) Solve the differential equation $y(xy+e^x)dx-e^y dy=0$.

b) A body kept in airwith temperature 25^0C cools from 140^0C to 80^0C in 2 minutes. Find when the body cools down to 35^0C. **[7+7M]**

SECTION-IV

7 a) Solve $(D^2-2D+1)y=x^2e^{3x}-\sin 2x+3$

b) Solve $(D^2+a^2)y=\tan ax$ by the method of variation of parameters. **[7+7M]**

OR

8 a) Solve $(D^2-4D+4)y=e^{2x}+x^2+\sin 3x$

b) A particle is executing S.H.M with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same side of it. **[7+7M]**

SECTION-V

9 a) Verify Green's theorem in plane for $\int_c (2xy-x^2)dx+(x^2+y^2)dy$, where 'c' is the closed curve of the region bounded by $y=x^2$ and $x=y^2$ **[7+7M]**

b) Find the unit normal vector to the surface $x^2+y^2+2z^2=26$ $at\ the\ point$ (2,2,3).

OR

10 a) State Gauss Divergence Theorem. **[7+7M]**

b) Evaluate $\int\int_s \bar{F}.\bar{n}ds$ where $\bar{F}=2x^2y\bar{i}-y^2\bar{j}+4xz^2\bar{k}$ and 's'is closed the surface of the region in the first octant bounded by the cylinder $y^2+z^2=9$ and planes x=0, x=2, y=0, z=0

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

Mathematics - I

Time: 3 hours **Max Marks: 70**

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks. Each question may

SECTION-I

1 a) Define Rank of a Matrix. Find the rank of the matrix A = $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & -4 \\ 2 & 3 & 5 & -5 \\ 3 & -4 & -5 & 8 \end{bmatrix}$ by reducing into canonical form or normal form. [5M]

b) Show that x+2y-z=3; 3x-y+2z=1; 2x-2y+3z=2; x-y+z=-1are consistent and solve them. [4M]

c) Discuss for what values of λ, μ the simultaneous equations x + y + z = 6, x+2y+3z =10, x+2y+λz = μ have (i). No solution (ii). A unique solution (iii). An infinite number of solutions. [5M]

OR

2 a) Find the Eigen values and Eigen vectors of the matrix is $\begin{bmatrix} 3 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [6M]

b) If λ is an eigen value of a non – singular matrix A, then $\frac{|A|}{\lambda}$ is an eigen value of matrix Adj A. [2M]

c) Using Cayley - Hamilton Theorem find the inverse and A^4 of the matrix A = $\begin{bmatrix} 7 & 2 & -2 \\ -6 & -1 & 2 \\ 6 & 2 & -1 \end{bmatrix}$ [6M]

SECTION-II

3 a) Geometrical Interpretation of Rolle's Theorem. [4M]

b) Calculate approximately $\sqrt[5]{245}$ by using L.M.V.T and Statement of CMVT [5M]

c) Expand cosx. [5M]

OR

4 a) If x + y + z = u, y + z = uv, z = uvw then evaluate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. [4M]

b) The Find the stationary points of u(x, y) = sin x siny.sin(x+y) where $0 < x < \pi; 0 < y < \pi$ and find the maximum. [5M]

c) Find the volume of the largest rectangular parallelepiped that can be inscribed in the ellipsoid $x^2/a^2 + y^2/b^2 + z^2/c^2 = 1$. [5M]

SECTION-III

5 a) Find the order of $x\frac{d^2y}{dx^2}-(2x-1)\frac{dy}{dx}+(x-1)y=e^x$. [1M]

b) Solve $x\frac{dy}{dx}+y=x^3y^6$ [6M]

c) A pot of boiling water 100^0C is removed from the fire and allowed to cool at 30^0 room temperature. Two minutes later, the temperature of the water in the pot is 90^0C. What will be the temperature of water after 5 minutes? [7M]

OR

6 a) Find orthogonal trajectories of the family of curves $x^{2/3}+y^{2/3}=a^{2/3}$. [7M]

b) The number N of bacteria in a culture grew at a rate proportional to N. The value of N initially was 100 and increased to 332 in one hour. What was the value of N after $1\frac{1}{2}$ hours? [7M]

SECTION-IV

7 a) Solve $(4D^2-4D+1)y=100$. [4M]

b) Solve $(D^2-2D+1)y=x^2e^{3x}-\sin 2x+3$. [10M]

OR

8 a) Solve $(D^2+a)y=\tan ax$, by the method of variation of parameters. [7M]

b) A particle is executing S.H.M with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of force and are on the same idea of it. [7M]

SECTION-V

9 a) If $\bar{f}$ = $x^2y\bar{i}-2zx\,\bar{j}+2yz\,\bar{k}$ find (i) curl curl $\bar{f}$. [3M]

b) Evaluate $\int \bar{F}.ndS$ where $\bar{F}$ = $z\vec{i}+x\vec{j}-3y^2\vec{z}k$ and S is the surface $x^2+y^2=16$ included in the first octant between z = 0 and z = 5. (i) Find the work done by the force. [5M]

c) Using Stroke's theorem evaluate the integral $\int_c \bar{F}.d\bar{r}$ where $\bar{F}=2y^2\,\bar{i}+3x^2\,\bar{j}-(2x+z)\bar{k}$ and C is the boundary of the triangle whose vertices are (0,0,0),(2,0,0),(2,2,0). [7M]

OR

10 a) If $\bar{f}$ = $(x+3y)\bar{i}+(y-2z)\bar{j}+(x+pz)\bar{k}$ is solenoidal , find P [3M]

b) (i) If $\phi=x^2yz^3, evaluate\int_c \phi d\bar{r}$ along the curve x= t, y =2t, z=3t from t = 0 to t=1 [5M]

c) Verify Green's theorem for $\int_c[(3x^2-8y^2)dx+(4y-6xy)dy]$ where c is the region bounded by x=0, y=0 and x+y=1. [7M]