c) Obtain the reduction formula for $\int \cos^n x dx$. Hence evaluate $\int_0^{\frac{\pi}{2}} \cos^n x dx$.	7	L2	5	1
a) i) Evaluate $\int_0^{\infty} x^6 e^{-3x} dx$ using Gamma function ii) Evaluate $\int_0^1 x^3 (1-x)^2 dx$ using Beta and Gamma functions.	6	L1	5	1
b) Find the volume of the solid generated by revolving the cardioid $r = a\ (1 + \cos\theta)$ about the initial line	7	L2	5	2
c) Find the surface area of the solid generated by revolving the astroid $x = a \sin^3 t$, $y = a \cos^3 t$ about the x-axis	7	L2	5	1

Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

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c) Obtain the Maclaurin's expansion of $\log(1+x)$ upto three non-vanishing terms. 7 L1 2

Unit – III

5\. a) Find the extreme values of $u = x^2 + y^2 + 12x - 6$ 6 L1 3

b) i) If u is a homogeneous function of degree n in x and y, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nu$

ii) If U=log$\left(\frac{x^4+y^4}{x+y}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$ 7 L2 3

c) If U=$e^x \sin(yz)$, where $x=t^2$, $y=t-1$, $z=1/t$ find $\frac{du}{dt}$ at t=2. 7 L2 3

6\. a) Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1,-2,-1) in the direction of vector $2i - j - 2k$ 6 L1 3

b) Find the angle between the surfaces $x^2+y^2+z^2=5$ and $z = x^2 + y^2 + 1$ at (0,1,2) 7 L2 3

c) Establish the following identities:

(i) $\nabla \bullet \nabla\phi = \nabla^2\phi$ ii) $\nabla \bullet \left(\nabla \times \vec{F}\right) = 0$ 7 L2 3

Unit – IV

7\. a) Evaluate $\int_0^1\int_0^2\int_1^2 x^2yz\, dx\, dy\, dz$ 6 L1 4

b) Change the order of integration and hence evaluate $\int_0^1\int_0^{\sqrt{1-x^2}} y^2\, dy\, dx$ 7 L2 4

c) Find the area of the Cardioid $r = a(1+\cos\theta)$. 7 L2 4

8\. a) Evaluate $\int_0^1\int_0^{x^2} e^{\frac{y}{x}}\, dy\, dx$ 6 L1 4

b) Show that the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is $\frac{16}{3}a^2$ 7 L2 4

c) By changing to polar co-ordinates evaluate $\int_0^a\int_0^{\sqrt{a^2-y^2}} (x^2+y^2)\, dx\, dy$ 7 L2 4

Unit – V

9\. a) Evaluate $\int_0^\infty \frac{1}{(1+x^2)^4}\, dx$ 6 L1 5

b) Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ with usual notations. 7 L2 5

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

Supplementary Examinations – July 2019

18MA101 – ENGINEERING MATHEMATICS - I

ration: 3 Hours | Max. Marks: 100

Note: Answer ***Five full*** *questions choosing* ***One full*** *question from* ***each Unit***

		Marks	BT*	CO*	PO*
	Unit – I				
a)	Find the rank of the following matrix using elementary row transformation $\begin{bmatrix} 1 & 2 & 2 & 1 \\ 2 & 1 & 1 & 2 \\ 3 & 2 & 2 & 3 \\ 0 & 1 & 1 & 0 \end{bmatrix}$	6	L*2	1	1
b)	Test for consistency and solve the following system of equations by Gauss elimination method $x+y+z=3$; $x+2y+3z=4$; $x+4y+9z=6$	7	L2	1	2
c)	Find the eigen values and eigen vectors of the following matrix $\begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$	7	L1	1	1
a)	Reduce the quadratic form $8x^2+7y^2+3z^2$ into canonical form.	6	L2	1	1
b)	Show that the transformation $y_1 = x_1+x_2+3x_3;\ y_2 = x_1+3x_2-3x_3;\ y_3 = -2x_1-4x_2-4x_3$ represent a regular linear transformation. Find the inverse of this transformation.	7	L1	1	2
c)	Diagonalize the matrix $\begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$	7	L2	1	1
	Unit – II				
a)	i)State Comparison test . ii) Test the convergence of the following series $\frac{1}{1+\sqrt{2}}+\frac{2}{1+2\sqrt{3}}+\frac{3}{1+3\sqrt{4}}+\ldots\ldots\ldots.\infty$	6	L1	2	2
b)	State Cauchy's root test and test the convergence of the series $\sum\left(\frac{nx}{n+2}\right)^n,\ x>0$	7	L2	2	1
c)	Obtain Taylor's series expansion of $\log x$ about $x=1$ upto fourth degree terms	7	L2	2	1
a)	State Rolle's theorem , & verify the theorem for $f(x)=\frac{\sin x}{e^x}$ in $[0,\pi]$.	6	L2	2	2
b)	State and prove Cauchy' s mean value theorem .	7	L2	2	1

Q.No.		Question	Marks	BT*	CO*
6.	a)	If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, show that $x^2\frac{\partial u}{\partial x} + y^2\frac{\partial u}{\partial y} + z^2\frac{\partial u}{\partial z} = 0$	6	L1	3
	b)	Expand $x^2y + 3y - 2$ at the point $(1,-2)$ using Taylor's theorem upto terms of 2[nd] degree.	7	L2	3
	c)	The period of a simple pendulum is $T = 2\pi\sqrt{l/g}$. Find the maximum error in T due to the possible error upto 1% in l and 2.5% in g.	7	L1	3
		Unit – IV			
7.	a)	Evaluate $\int_0^1\int_x^{\sqrt{x}}(x^3 + y^2)dxdy$	6	L1	4
	b)	Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ using triple integral.	7	L2	4
	c)	Evaluate $\int_0^\infty\int_0^\infty e^{-(x^2+y^2)}dxdy$ by changing the polar coordinates.	7	L1	4
8.	a)	Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2 + y^2 + z^2)dxdydz$	6	L1	4
	b)	Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ in the 1[st] quadrant.	7	L2	4
	c)	Evaluate $\int_0^1\int_x^{\sqrt{x}} xydydx$ by changing the order of integration.	7	L1	4
		Unit – V			
9.	a)	Find the volume of the solid generated by revolving one arch of the cycloid $x = a(\theta + \sin\theta)$, $y = a(1 + \cos\theta)$ about the X -axis.	6	L1	5
	b)	Prove that $\beta(m,n) = \frac{\sqrt{m}\sqrt{n}}{\sqrt{m+n}}$ with usual notations.	7	L1	5
	c)	Obtain the reduction formula for $\int \sin^n x dx$ and hence evaluate $\int_0^{\pi/2} sin^n x dx$.	7	L1	5
10.	a)	Prove that $\int_0^{\pi/2}\frac{d\theta}{\sqrt{\sin\theta}} \quad \int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta = \pi$	6	L1	5
	b)	Evaluate $\int_0^a x^4\sqrt{a^2 - x^2}dx$ by using Beta & Gamma functions.	7	L1	5
	c)	Find the surface area of the solid generated by the revolution of the cardioid $r = a(1 - cos\theta)$ about the initial line.	7	L1	5

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

November - December 2019

19MA101 – ENGINEERING MATHEMATICS - I

Duration: 3 Hours | Max. Marks: 100

*Note: Answer **Five full** questions choosing **One full** question from each Unit.*

			Marks	BT*	CO*	PO*
		Unit – I				
1.	a)	Find the rank of the matrix using elementary row transformation. $\begin{bmatrix}1 & 1 & 1 & 6\\ 1 & -1 & 2 & 5\\ 3 & 1 & 1 & 8\\ 2 & -2 & 3 & 7\end{bmatrix}$	6	L*1	1	1
	b)	Test for consistency and solve the system of equations by Gauss elimination method. $2x + y + 4z = 12,\ \ 4x + 11y - z = 33,\ \ 8x - 3y + 2z = 20.$	7	L3	1	2
	c)	Diagonalize the matrix $\begin{matrix}-19 & 7\\ -42 & 16\end{matrix}$	7	L2	1	2
2.	a)	Find the eigen values and eigen vectors of the matrix $\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$	7	L3	1	2
	b)	Show that the transformation $y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$ is regular. Find the inverse transformation.	7	L1	1	1
	c)	Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form.	6	L1	1	1
		Unit – II				
3.	a)	i) State D'Alembert's ratio test. ii) Test the convergence of the series $1 + \frac{2!}{2^2} + \frac{3!}{3^2} + \cdots \infty$	6	L3	2	1
	b)	State and prove Lagrange's mean value theorem.	7	L1	2	1
	c)	Expand $\log_e(1+x)$ by using Maclaurin's series upto 4th degree terms.	7	L1	2	1
4.	a)	Verify Cauchy's mean value theorem for the functions $f(x) = e^x, g(x) = e^{-x}$ in $[a \quad b]$	6	L1	2	2
	b)	Expand $tan^{-1}x$ at $x = 1$ upto 3rd degree term.	7	L1	2	1
	c)	Discuss the convergence of the series $\frac{x}{1.3} + \frac{x^2}{3.5} + \frac{x^3}{5.7} + \cdots$	7	L3	2	
		Unit – III				
5.	a)	If $\tan u = \frac{x^3+y^3}{x-y}$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$	6	L1	3	1
	b)	If $u = x + 3y^2,\ v = 4x^2yz,\ w = 2z^2 - xy$. Then find $J = \partial(u,v,w)/\partial(x,y,z)$ at $(1,-1,0)$	7	L1	3	1
	c)	A rectangular box open at the top is to have a volume of 32 cubic units. What must be the dimensions of the box so that the total surface area of the box is a minimum?	7	L3	3	2

P.T.O.