6\. a) Solve (i) $p(1+q)=qz$ (ii) $py^2 = x(y^2+q^2)$ — 6 L1

b) Solve by the method of separation of variables $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x,0) = 6e^{-3x}$. — 7 L2

c) Derive one dimensional wave equation in the form $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ — 7 L2

Unit – IV

7\. a) Evaluate $\int_2^3\int_1^2\int_0^1 5x^2y^3z\, dxdydz$. — 6 L1

b) Change the order of integration and hence evaluate $\int_0^\infty\int_0^x x^2(e^{-x^3/y})dydx$. — 7 L2

c) Prove that $\beta(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. — 7 L2

8\. a) Evaluate $\int_0^2 x(8-x^3)^{1/3}dx$ in terms of Gamma function. — 6 L1

b) Find the area of the cardioid $r = a(1+\cos\theta)$. Using double integration. — 7 L2

c) Find the volume common to the cylinders $x^2+y^2=a^2$ and $x^2+z^2=a^2$. — 7 L2

Unit – V

9\. a) Find (i) $L\{\cos 2t\cos 3t\}$, (ii) $L\{e^{-4t}\int_0^t \frac{\sin 3u}{u}du\}$. — 6 L2

b) Rewrite $f(t) = \begin{cases} \cos t, & 0<t<\pi \\ \cos 2t, & \pi<t<2\pi \\ \cos 3t, & t>2\pi \end{cases}$ using unit step functions and find its Laplace transform. — 7 L2

c) Find the Laplace transform of
$f(t) = t;\ 0<t<c$
$= 2c-t;\ c<t<2c$, $f(t+2c)=f(t)$. — 7 L2

10\. a) Find (i) $L^{-1}\{\frac{5s+1}{(s^2+2s+15)}\}$, (ii) $L^{-1}\{\log\frac{s+4}{s+5}\}$ — 6 L2

b) Using convolution theorem find $L^{-1}\{\frac{2}{(s^2+1)(s+1)}\}$ — 7 L2

c) Solve $y''(t)+2y'(t)+5y(t) = e^{-t}\sin t;\ y(0)=0,\ y'(0)=1$ by Laplace transform method. — 7 L2

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)

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

Supplementary Examinations - September 2022

20MA201– ENGINEERING MATHEMATICS - II

Ion: 3 Hours — Max. Marks: 100

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

	Marks	BT*	CO*	PO*
Unit – I				
Solve $\left[3x^2y + 6xy + x\right]dx + \left[x^3 + 3x^2 + y\right]dy = 0$.	6	L*1	1	1
If a body originally is at $85^\circ C$ cools down to $60^\circ C$ in 20 minutes, the temperature of air being $40^0 C$, find the temperature of the body after 40 minutes from the original.	7	L2	1	2
Solve $\cos^2 x \dfrac{dy}{dx} + y = \tan x$.	7	L1	1	1
Solve $\sin(px - y) = p$.	6	L1	1	1
Find the member of the orthogonal trajectories of the family $y = ke^{-2x} + 5x$ passing through the point (0, 5).	7	L2	1	2
Solve $p(p+x) = y(y+x)$.	7	L1	1	1
Unit – II				
Solve $(D^2 + 5D + 6)y = xe^{3x} + e^{2x}$.	6	L1	2	1
Solve $(D^2 - 2D + 2)y = e^x \tan x$ using the method of variation of parameters.	7	L2	2	1
Solve $x\dfrac{d^3y}{dx^3} + \dfrac{d^2y}{dx^2} - \dfrac{2y}{x^2} = x + \dfrac{1}{x^3}$	7	L2	2	1
Solve $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = \cos 4x + 5x^2$.	6	L1	2	1
Solve $(D^2 + 2D + 3)y = 5 + 7x + 3x^2$	7	L2	2	1
Solve $(D^2 + 2D + 1)\, y = 2e^x + e^{2x} + 7$	7	L2	2	2
Unit – III				
Solve by direct integration $\dfrac{\partial^3 u}{\partial x \partial y^2} = \sin(5x + 2y) + 2xy$	6	L1	3	
Solve by Lagrange's method $(mz - ny)\dfrac{\partial z}{\partial x} + (nx - lz)\dfrac{\partial z}{\partial y} + mx - ly = 0$	7	L2	3	
Derive one dimensional heat flow equation in the form $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$	7	L2	3	

P.T.O.

c) Find the inverse Laplace transform of $\log \frac{s^2+1}{s(s+1)}$. 6 L2 4

Unit – III

7. a) Form the partial differential equation by eliminating the arbitrary constants / functions from
   i) $z = ax + by + a^2 + b^2$;
   ii) $x + y + z = f(x^2 + y^2 + z^2)$. 7 L2 5

   b) Derive one dimensional wave equation in the form $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$. 7 L3 5

   c) Solve the following PDE by direct integration method:
   $$\frac{\partial^3 z}{\partial x \partial y^2} + 12x^2 y + \sin(x - 2y) = 0.$$
   6 L2 5

8. a) Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ by the method of separation of variables. 7 L2 5

   b) Solve $(x^2 - y^2 - z^2)p + 2xyq = 2xz$. 7 L2 5

   c) Solve $p^2 y(1 + x^2) = qx^2$. 6 L2 5

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

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

September - October 2022

21MA201 - ENGINEERING MATHEMATICS - II

tion: 3 Hours — Max. Marks: 100

*ote: Answer **Five full** questions choosing **Two full** questions from **Unit – I** & **Unit – II** each and **One full** question from **Unit – III**.*

Unit – I

	Question	Marks	BT*	CO*	PO*
a)	Solve $\frac{dy}{dx} + y\tan x = y^3 \sec x$.	7	L*2	1	2
b)	A body originally at $80^0 C$ cools down to $60^0 C$ in 20 minutes, the temperature of air being $40^0 C$. Find the temperature of the body after 40 minutes from the original.	7	L3	1	2
c)	Solve $(4D^2 - 1)y = e^{2x} + 1$.	6	L2	2	2
a)	Solve $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$.	7	L2	1	2
b)	Solve $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$.	7	L2	2	2
c)	Find the orthogonal trajectories of $\frac{x^2}{a^2} + \frac{y^2}{a^2+\lambda} = 1$ where λ is a parameter.	6	L3	1	2
a)	Solve $(D^2 + 2D + 2)y = 1 + 3x + x^2$.	7	L2	2	2
b)	Using the method of variation of parameters, solve $(D^2 + 1)y = \sec x \tan x$.	7	L3	2	2
c)	Find the general and singular solutions of $p = \sin(y - xp)$.	6	L2	1	2

Unit – II

	Question	Marks	BT*	CO*	PO*
a)	If $L\{f(t)\} = F(s)$ then prove that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n}(F(s))$.	7	L3	3	1
b)	Using partial fraction method find the inverse Laplace transform of $\frac{s^2+s-2}{s(s+3)(s-2)}$.	7	L2	4	2
c)	Find the Laplace transform of $e^{-3t}(2\cos 5t - 3\sin 5t)$.	6	L2	3	2
a)	If $f(t)$ is a periodic function with period T, then prove that $L\{f(t)\} = \frac{1}{1-e^{-sT}}\int_0^T e^{-st} f(t)\, dt$.	7	L3	3	1
b)	Find the Laplace transform of $\int_0^t \frac{\cos at - \cos bt}{t}\, dt$.	7	L2	3	2
c)	Using convolution theorem find the inverse Laplace transform of $\frac{1}{(s^2+a^2)^2}$.	6	L2	4	2
a)	Rewrite the following function using unit step function and find its Laplace transform: $f(t) = \begin{cases} t^2, & 0 \le t < 2 \\ 4, & 2 \le t < 4 \\ 0, & t \ge 4 \end{cases}$	7	L2	3	2
b)	Using Laplace transform method, solve the differential equation $x''(t) + 4x(t) = 2t - 8$, $x(0) = 1$ and $x'(0) = 0$.	7	L3	4	2

P.T.O.

5. a)	Find (i) $(i) L^{-1}\{\frac{s^2-3s+4}{s^3}\}$ (ii) $L^{-1}\{\frac{s+2}{s^2-4s+13}\}$	6	L3	4
b)	If $L\{f(t)\}=\bar{f}(s)$, then prove that $L\{t^n f(t)\}=(-1)^n \frac{d^n}{ds^n}\bar{f}(s)$ for n=1,2,3,........	7	L2	3
c)	Find the inverse Laplace transform of $\frac{1}{(s^2+1)(s^2+9)}$ by using the convolution theorem.	7	L3	4
6. a)	Find the inverse Laplace transform of (i) $\log[\frac{s+1}{(s-1)}]$ (ii) $\frac{1-e^{-2s}}{s^2}$.	6	L2	4
b)	Express $f(t)=\begin{cases} t^2, 0<t\le 3 \\ 4t, t>3 \end{cases}$ in terms of unit step function and hence find its Laplace transform.	7	L3	3
c)	Find $L\{f(t)\}$ if $f(t)=\begin{cases} t, & 0<t<c \\ 2c-t, & c\le t<2c \end{cases}$ and $f(t+2c)=f(t)$.	7	L2	3

Unit – III

7. a)	Form the partial differential equation by eliminating the arbitrary functions / arbitrary constants from the equations i) $z=(x-a)^2+(y-b)^2+5$ ii) $z=f(x^2+y^2)$	6	L1	5
b)	Solve $\frac{\partial^3 z}{\partial x^2 \partial y}=\sin(5x+7y)$ by direct integration.	7	L2	5
c)	Derive one dimensional wave equation in the form $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$.	7	L3	5
8. a)	Solve the following non-linear partial differential equation $zpq=p+q$	6	L2	5
b)	Solve $(y+z)p-(x+z)q=(x-y)$ by Lagrange's method.	7	L2	5
c)	Solve $\frac{\partial^2 u}{\partial x^2}-2\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=0$ by the method of separation of variables.	7	L2	5

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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

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

Makeup Examination - November 2022

21MA201 - ENGINEERING MATHEMATICS - II

Duration: 3 Hours Max. Marks: 100

*Note: Answer **Five full** questions choosing **Two full** questions from **Unit – I** & **Unit – II each** and **One full** question from **Unit – III.***

	Unit – I	Marks	BT*	CO*	PO*
1. a)	Find the general and singular solutions of the equation $sin(px-y)=p$.	6	L*2	1	1
b)	Obtain the orthogonal trajectories for the curve $r=\frac{2a}{1+cos\theta}$.	7	L2	1	1
c)	Solve $y''-2y'+2y=e^x cosx$.	7	L1	2	1
2. a)	Solve $(D^2-4D+4)y=\frac{e^{2x}}{x}$ by using the method of variation of parameters.	6	L1	2	1
b)	Solve $y-2px=tan^{-1}(xp^2)$	7	L3	1	2
c)	Solve $x^2\frac{d^2y}{dx^2}+2x\frac{dy}{dx}-12y=x^2 logx$.	7	L2	2	2
3. a)	Solve $x^3\frac{dy}{dx}-x^2y=-y^4 cosx$.	6	L2	1	1
b)	A body is originally at 80°C cools down to 60°C in 20 min, the temperature of air being 40°C. Find the temperature of the body after 50 min from the original.	7	L2	1	1
c)	Solve $\frac{d^2y}{dx^2}+\frac{dy}{dx}=x^3+3x^2+5$.	7	L2	2	1
	Unit – II				
4. a)	Find (i) $L\{t^2 sin2t\}$ (ii) $L\{\frac{sin t}{t}\}$	6	L2	3	2
b)	If f(t) is a periodic function with period T so that f(t+ T)= f(t) for all values of t, then prove that L{f(t)} = $\frac{1}{1-e^{-sT}}\int_0^T e^{-st}f(t)dt$.	7	L1	3	1
c)	Solve $x''(t)+4x(t)=2t-8,\quad x(0)=1, x'(0)=0$ by the Laplace transform method.	7	L1	4	1

P.T.O.