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Name:				• • • • • • • • • • • • • • • • • • • •		
Roll No. :					To the last 19' Exercising 2nd Experient	
Inv	igilato	or's S	ignature :			
		C	S/M.Tech(ECE)/	SEM-1/N	MM(EC)-901/2009-10	
			2	009		
	ADV	ANG	CED ENGINEE NUMERICAL		ATHEMATICS & IIQUES	
Time Allotted : 3 Hours					Full Marks : 70	
		Th	ne figures in the ma	rgin indica	ute full marks.	
Car	ıdida	tes a	•	heir answe s practicab	ers in their own words as ole.	
			· ·	UP – A		
			(Multiple Choic	e Type Qı	uestions)	
1.	Cho	Choose the correct alternatives of the following :				
					$10 \times 1 = 10$	
	i) The partial differential eq			l equation	$f_{xx} - 2f_{xy} = 0$ is	
		a)	elliptic	b)	parabolic	
		c)	hyperbolic	d)	none of these.	
	ii)	P_o (x) = 1.			
		a)	True	b)	False.	
iii) Milne's method is a predictor-co				orrector method.		
		a)	True	b)	False.	
iv) Crank-Nicolson method is kno				od is know	wn as an implicit scheme.	
		a)	True	b)	false.	
	v)	v) Euler's method is the Runge-Kutta method of			utta method of the first	
	order.					
		a)	True	h)	False	

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- Shooting method is used to find the solution of intitial value problems.
 - True a)

- b)
- $P_m(x) P_n(x) dx (m \neq n)$ is equal to vii)
 - a)

1 b)

c) - 1

- d) none of these.
- viii) Order of the differential equation

$$\frac{d^2y}{dx^2} = \phi \left(x, y, \frac{dy}{dx} \right)$$
 is

a)

- c) 3 d) none of these. $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 p^2) y = 0 \text{ is known as}$
 - Legendre's differential equation.
 - True

- $(1-x^2) \frac{d^2y}{dx^2} 2x \frac{dy}{dx} + n (n+1) y = 0$ is known as the Bessel's differential equation.
 - True a)

b) False.

GROUP - B

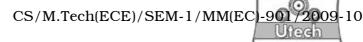
(Short Answer Type Questions)

Answer any three of the following.

- $3 \times 5 = 15$
- 2. Find the Laplace transform of t^n , n is positive but not necessarily an integer.
- Find the Fourier transform of the function $f\left(x\right)$, 3.

$$if f(x) = \begin{cases}
e^{i\omega x}, & a < x < b \\
0, & x < a, x > b
\end{cases}$$

Show that the shortest distance between two points in a plane is a straight line.





- Express x^5 in terms of Legendre polynomials.
- Prove that $\frac{d}{dx} \{ x^p J_p(x) \} = x^p J_{p-1}(x)$.
- Express \boldsymbol{J}_{4} (\boldsymbol{x}) in terms of \boldsymbol{J}_{0} (\boldsymbol{x}) and \boldsymbol{J}_{1} (\boldsymbol{x}) . 7.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

- Classify the equation 8. a) $U_{xx} + 4U_{xu} + (x^2 + 4y^2) U_{uu} = \sin xy$.
 - Write down the finite difference approximation for the b) partial derivatives $\frac{\delta^2 u}{\delta x^2}$, $\frac{\delta^2 u}{\delta u^2}$.
 - Derive Schmidt's formula to find the solution of onec) dimensional heat equation $U_{xx} - aU_t = 0$. 5 + 5 + 5
- 9. Find the Fourier series generated by the periodic function |x| of period 2π . Hence prove that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$.
 - Evaluate the inverse Laplace transform of b)

$$\frac{4}{s^2} + \frac{(\sqrt{s} - 1)^2}{s^2} - \frac{5}{3s + 4} .$$
 8 + 7

Use Laplace transform to solve 10. a)

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$$
, given that $y = 1$ and $\frac{dy}{dx} = 1$

when x = 0.

Use convolution theorem to find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$.

8 + 7

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- 11. a) If the Fourier transform of F(x) is f(s), then show that the Fourier transform of F'(x), the derivative of F(x) is (-is) f(s).
 - b) Find the Fourier sine and cosine transforms of the function $F(x) = x^{m-1}$.
- 12. a) Derive Euler's equation to determine a function f(x), for which the value of the definite integral

$$I = \int_{x_1}^{x_2} f\left(x, y, \frac{dy}{dx}\right) dx \text{ is a maximum or minimum}$$

under two end conditions $y_1 = f(x_1)$ and $y_2 = f(x_2)$.

b) If the integral $I = \int_{x_1}^{x_2} \frac{y^{1/2}}{y^{1/2}} dx$ is an extremum

show that y can be expressed in the form

$$y = ae^{bx}$$
, $a \& b$ are constants.

9 + 6

13. a) From the Rodrigue's formula $P_n(x) = \frac{1}{2^n n!}$

$$\frac{\mathrm{d}^n}{\mathrm{d}x^n}$$
 ($x^2 - 1$) n

prove that
$$P_n^l(x) = xP_{n-1}^l(x) + nP_{n-1}(x)$$
.

b) Using the Runge-Kutta method of fourth order find y (0.2) in steps of (0.1), given that

$$\frac{dy}{dx} = 1 + xy, y (0) = 2.$$