Roll No: ----------

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme: B. Tech. [ME+ME(MD)+ME(MSNT)+ME(PROE)+ME(THE)] **Semester – V**

Course Name: Applied Numerical Techniques **Max. Marks:100**
Course Code: MATH 305 **Duration: 3 Hrs**
No. of page/s: 02

Instructions:
Attempt all questions from **Section A** (each carrying 4 marks); attempt all questions from **Section B** (each carrying 10 marks)**;** attempt **Section C** (each carrying 20 marks)**.**

Section A

1.	Show that the bisection method always converges for the equation $f(x) = 0$.	**[4]**	**CO2**
2.	Evaluate $\int_0^6 \frac{dx}{1+x^2}$, by using Simpson's 1/3 rule.	**[4]**	**CO1**
3.	Discuss the method of point collocation with an example.	**[4]**	**CO4**
4.	Classify the following equation $\frac{\partial^2 u}{\partial x^2}+4\frac{\partial^2 u}{\partial x \partial y}+4\frac{\partial^2 u}{\partial y^2}-\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$	**[4]**	**CO3**
5.	Find $f(3)$ and $f'(3)$ from x: 0, 1, 2, 5 $f(x)$: 2, 3, 12, 147	**[4]**	**CO1**

SECTION B

6.	Find an approximate solution of the differential equation by method of least squares $\frac{d^2y}{dx^2}-u=x, x\epsilon[0,1]$ with boundary conditions $u(0)= u(1)=0$. Use only two basis functions.	**[10]**	**CO4**
7.	Solve by Gauss-Seidel method (two approximations) $6x + y + z = 105$ $4x + 8y + 3z = 155$ $5x + 4y - 10z = 65$	**[10]**	**CO2**
8.	Find the value of y for x=0.1 by Picard's method , given that $y(0)$=1 and	**[10]**	**CO3**

	$\frac{dy}{dx}=\frac{y-x}{y+x}$		
9.	Derive the newton Cotes formula for integration. **OR** The velocity (v) of a car which starts from rest is given at fixed intervals of time (t) as follows. t: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 v: 10, 18, 25, 29, 32, 20, 11, 5, 2, 0 Estimate approximately the distance covered by car in 20 units of time.	**[10]**	**CO1**
	SECTION C		
9.A	Using Gauss Elimination Method Solve the following system of equations $2x + 4y + z = 3$ $3x + 2y - 2z = -2$ $x - y + z = 6$	**[10]**	**CO2**
9.B	Apply Runge-Kutta method (fourth order) to find an approximate value of $y(0.1)$, given that $\frac{dy}{dx}=x+y$ $y(0)=1$ with $h=0.1$	**[10]**	**CO3**
10. A	Derive the Lagrange's interpolation formula for interpolation. **OR** Derive Newton's forward difference formula for interpolation.	**[10]**	**CO1**
10.B	Solve the boundary value problem defined by $y''-x=0$ and $y(0)=1$, $y'(1)=-1/2$ **OR** Solve the equation $y''+y=-x$, $0<x<1$ and $y(0)=y(1)=0$	**[10]**	**CO4**

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Course Name: Applied Numerical Techniques **Max. Marks: 100**

Course Code: MATH 305 **Duration: 3 Hrs**

No. of page/s: 02

Instructions:
Attempt all questions from **Section A** (each carrying 4 marks); attempt all questions from **Section B** (each carrying 10 marks)**;** attempt **Section C** (each carrying 20 marks)**.**

Section A

1.	Show that the fixed point iteration method may not converge for some equations $f(x)=0$.with the help of an example	**[5]**	**CO2**
2.	Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Simpson's 3/8 rule.	**[5]**	**CO1**
3.	Discuss the method of point collocation with an example.	**[5]**	**CO4**
4.	Derive the Bessel's formula for the interpolation.	**[5]**	**CO3**
5.	Find $f(0.5)$ where x: 0, 1, 2, 3 $f(x)$: 1, 2, 1, 10	**[5]**	**CO1**

SECTION B

6.	Discuss the method of least squares with an example.	**[10]**	**CO4**
7.	Solve by Gauss-Jacobi method (two approximations) $6x + y + z = 105$ $4x + 8y + 3z = 155$ $5x + 4y - 10z = 65$	**[10]**	**CO2**
8.	Find the value of y for $x=0.1$ by Taylor Series method, given that $y(0)=1$ and $\frac{dy}{dx} = \frac{y-x}{y+x}$	**[10]**	**CO3**

9.	Derive the Trapezoidal rule by deriving Newton-Cotes formula for integration. **OR** The velocity (v) of a car which starts from rest is given at fixed intervals of time (t) as follows. 	t	2	4	6	8	10	12	14	16	18	20
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v	10	18	25	29	32	20	11	5	2	0 | Estimate approximately the distance covered by car in 20 units of time.	**[10]**	**CO1**
	SECTION C		
9.A	Using LU (Crout's) decomposition Method Solve the following system of equations $2x + 4y + z = 3$ $3x + 2y - 2z = -2$ $x - y + z = 6$	**[10]**	**CO2**
9.B	Apply Euler's method to find an approximate value of $y(0.1)$, given that $\frac{dy}{dx} = x + y$ $y(0)=1$	**[10]**	**CO3**
10.A	Derive the Newton's interpolation formula (divided difference) and hence find $f(3)$ 	x	0	1	2	5
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$f(x)$	2	3	12	147	 **OR** Derive Newton's backward difference formula for interpolation.	**[10]**	**CO1**
10.B	Solve the BVP $y'' - 64y + 10 = 0$ with $y(0)=y(1)=0$. **OR** Solve the equation $y'' + y = -x$, $0<x<1$ and $y(0)=y(1)=0$	**[10]**	**CO4**