2103N1682

Candidate's Seat No : _____

M.Sc. Semester-3 Examination

502

Physics

March-2024

Time : 2-30 Hours] **[Max. Marks : 70**

Q.1 (A) If $\frac{dy}{dx} = 2e^x y$, y(0)=2, find y(4) using Adams predictor correction formula by calculating y(1), y(2) and y(3) using Euler's modified formula. State merits and demerits of Adams-Bashforth method. [07]

(B) Explain Picard's method of solving ordinary differential equation. Using this method, solve $\frac{dy}{dx} = -xy$ with $x_0 = 0, y_0 = 1$ upto third approximation. [07]

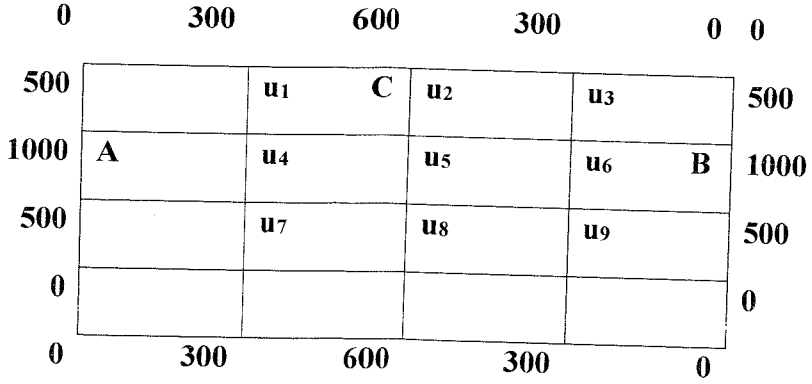
OR

Q.1 (A) Discuss Runge-Kutta method briefly of solving the ordinary differential equation. Using Runge-Kutta method of 4th order, solve for y at x=1.2, 1.4 from $\frac{dy}{dx} = \frac{2xy+e^x}{x^2+xe^x}$ given $x_0 = 1, y_0 = 0$. [07]

(B) Discuss Milne's method of solving the ODE. Using this method, find a solution of the differential equation $y' = x - y^2$ in the range $0 \leq x \leq 1$ for the boundary condition $y = 0$ at $x = 0$. [07]

Q.2 (A) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, 0<x<1, 0<y<1 given that u(0,y)=0, u(x,0)=0, u(1,y)=100, u(x,1)=100 and h=1/3. [07]

(B) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown. [07]



OR

Q.2 (A) Estimate the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$; u(0,t)=u(1,t)=0, using (a) Schmidt method, (b) Crank-Nicolson method and (c) Du Fort-Frankel method. Carryout computations for two levels, taking h=1/3 and k=1/36. [07]

(B) Define finite difference method to find approximate solution of 1D heat equation. [07]

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Q.3	(A)	Drawing the circuit diagram of Astable multivibrator using IC-555, explain the working of the circuit.	[07]
	(B)	Discuss the working of programmable array logic (PAL) structure drawing necessary circuit.	[07]
		OR	
Q.3	(A)	Draw the circuit diagram for (i) 8-bit parity checker and (ii) 9 bit odd-parity generator. Explain their working.	[07]
	(B)	Draw the circuit diagram, truth table and waveforms of Mod-10 counter using IC-7490 in 5x2 configuration and explain the working of the circuit.	[07]
Q.4	(A)	Explain the D/A conversion Accuracy and Resolution.	[07]
	(B)	Discuss the working of A/D converter using Successive Approximation, drawing necessary block diagram.	[07]
		OR	
Q.4	(A)	Explain the working of 3-bit resistive divider network drawing its circuit diagram. What are the drawbacks of the resistive divider network?	[07]
	(B)	Drawing a circuit diagram of 2-bit A/D converter, with simultaneous conversion and explain its working.	[07]
Q.5		Answer in brief **Any Seven** questions from the following: (Each question is of **two** mark).	[14]
	(i)	What is single-step methods? Write its examples.	
	(ii)	Write limitations of Taylor's series method of solving the ordinary differential equation.	
	(iii)	Outline initial and boundary conditions for ordinary differential equation.	
	(iv)	Gauss-Seidal method is faster than the Jacobi's method in computational way - Explain.	
	(v)	Classify the equation: $y^2u_{xx} - 2xyu_{xy} + x^2u_{yy} + 2u_x - 3u = 0$.	
	(vi)	How a general second order partial differential equation is classified?	
	(vii)	Draw the pulse generation circuit using Nand gates and its clock pulses.	
	(viii)	In PROM design each **x** represents ..... and each solid black bullet represents	
	(ix)	A TTL clock circuit provides a 12-MHz clock frequency with a stability better than 10 parts per million (ppm) over a 24-h time period. What are the frequency limits of the clock?	
	(x)	Draw the internal structure of IC 555.	
	(xi)	Find the output voltage from a 4-bit ladder that has a digital input of 1101. Assume that 0 = 0 V and 1 =+10 V.	
	(xii)	What is the resolution of an 8-bit *DI*A converter which uses a ladder network? If the full-scale output voltage of this converter is +5 V, what is the resolution in volts?	

***** PAPER ENDS *****