2111E730   Candidate's Seat No :_____

M.Sc Sem-3 Examination
502
Physics

Time : 2-30 Hours]   November-2024   [Max. Marks : 70

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

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

OR

Q.1 (A) Write briefly about Runge-Kutta (RK) method for solving ordinary differential [07] equations. Using 4th order RK method to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$.

(B) How are Euler's method and its modified form found helpful for solving the [07] ordinary differential equation? explain with their limitations.

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

(B) Calculate the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0) = \sin \pi x, 0 \le$ [07] $x \le 1$; 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.

OR

Q.2 (A) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with [07] boundary values as shown.

0	300	600	300	0	0
500		u1 C	u2	u3	**500**
1000	A	u4	u5	u6 B	**1000**
500		u7	u8	u9	**500**
0					**0**
0	300	600	300	0	

(B) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ satisfying the initial condition: $u(x,y,0) =$ [07] $cos2\pi x \, cos2\pi y$, $0 \le x,y \le 1$ and conditions: $u(x,y,t) = 0$, $t > 0$ on the boundaries, using Alternating Direction Explicit (ADE) method with $h = \frac{1}{3}$ and $\alpha = \frac{1}{8}$. Calculate the results for one-time level.

Q.3 (A) Explain the working of 32-bit diode ROM organized as 8 words of 4 bit each, [07] drawing necessary circuit diagram. Write Boolean equations for Y_0, Y_1, Y_2 and Y_3.

(P.T.o)

(B) Draw the circuit diagram of Monostable multivibrator using IC-555 and explain the working of the circuit. [07]

OR

Q.3 (A) Draw the block diagram for serial-input, serial-output shift register using IC-74LS91 and explain its working. [07]

(B) Draw the circuit diagram of Switched tail Counter and its truth table to explain its working. [07]

Q.4 (A) Explain the working of D/A converter drawing necessary circuit diagram with Read input, Flip-Flops, level amplifiers and the D/A converter. [07]

(B) Discuss the working of 3-bit A/D converter using simultaneous conversion method, drawing necessary block diagram. [07]

OR

Q.4 (A) Explain the D/A conversion Accuracy and Resolution. [07]

(B) Discuss the working of A/D conversion using Section Counter, drawing necessary block diagram. [07]

Q.5 Answer in brief **Any Seven** questions from the following: [14]
(Each question is of **two** marks).

(i) State multi-step methods of solving the differential equation?

(ii) State limitations of Picard's method of solving the ordinary differential equation.

(iii) In Euler's method, if 'h' is small the method is too slow, if 'h' is large, it gives inaccurate value. (TRUE or FALSE)

(iv) Write an expression of standard 5-point formula of partial differential equations.

(v) What is the classification of the partial differential equation $f_{xx} + 2f_{xy} + f_{yy} = 0$?

(vi) Why is Crank-Nicholson's scheme calling an implicit scheme?

(vii) Assuming that the input reference voltage is $V = 10.0$ V dc, the digital output of the 8-bit simultaneous A/D converter for an input voltage of 6.40 V is _____.

(viii) A TTL clock circuit provides a 10-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?

(ix) The output voltage caused by 11100 in a 5-bit ladder is _____.
The input levels are 0 = 0 V and 1 = +10 V?

(x) The output voltage caused by 4th bit in a 5-bit ladder is _____.
The input levels are 0 = 0 V and 1 = +5 V?

(xi) The maximum clock frequency that can be used with a logic gate having a propagation delay of 200 *ns*, is _____.

(xii) Find the binary equivalent weight of each bit in a 4-bit system.

*** PAPER ENDS ***