Total No. of Questions : 8]

SEAT No. :

P617

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[5869]-239

S.E. (Electrical Engineering)

NUMERICAL METHODS AND COMPUTER PROGRAMMING

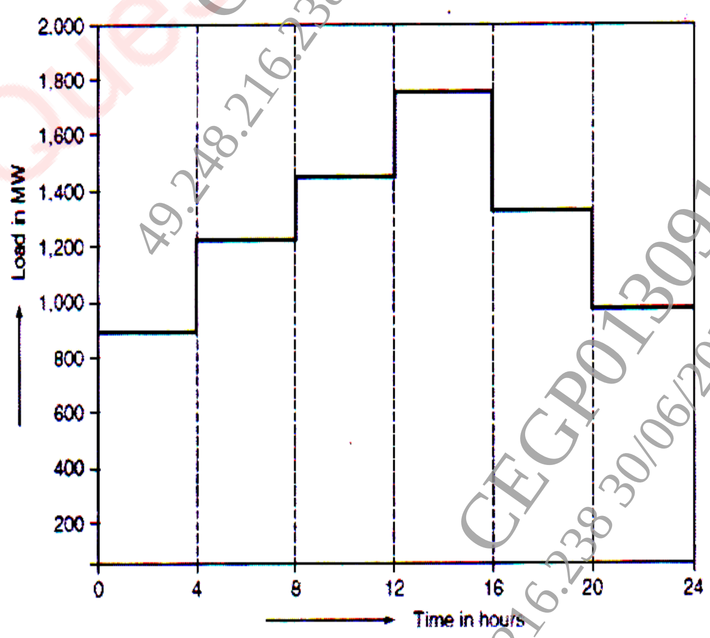
(2019 Pattern) (Semester - IV) (203148)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.*
2) *Neat diagrams must be drawn whenever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) The total load of the power system is not constant but varies thoughout the day and reaches a different peak value from one day to another. It follows a particular hourly load cycle over a day. There will be different discreate load levels at each period as shown in the following figure. From the same diagram, the time in hours versus active power consumption by load (MW) data is tabulated. What will be the power consumed by the load when the time in hours will be 3 hrs? Use Newton's forward interpolation method. **[6]**



P.T.O.

Time in hours	0	4	8	12	16	20
active power consumption by load (MW)	900	1200	1450	1700	1300	1000

b) Construct a divided difference table from the following data. **[6]**

x	0.2	0.3	0.7	0.9	1.0
$f(x)$	1.32	2.43	–1.5	6.15	–0.06

Hence find the value of $f(x)$ when $x = 0.4$.

c) Derive Lagrange's interpolation formula for unequally data spacing. **[6]**

OR

Q2) a) In the Electrical Machines laboratory, while performing the experiment of speed control of a DC shunt motor utilizing the armature control method, the armature voltage V_a and accompanying speed N in RPM were measured. The data is as shown in the observation table below. **[6]**

Armature voltage V_a	60	100	150	200
Speed N in RPM	379	655	936	1356

Find the value of the speed N in RPM corresponding to the armature voltage $V_a = 120V$. Use Lagrange's interpolation method.

b) The day-wise total solar radiation (in MJ/m^2-day) is collected in the month of May which is required for experimentation. Use the Sterling interpolation method to find solar radiation corresponding to 6th day. **[6]**

Day	1	3	5	7	9
total solar radiation (in MJ/m^2-day)	14.59	18.82	26.00	29.35	26.88

c) Construct the backward difference table for the following data. **[6]**

x	2	4	6	8	10
$f(x)$	101	97	111	120	125

Hence find the value of $f(x)$ when $x = 9$ by using Newton's backward interpolation method.

Q3) a) Evaluate the integral using the trapezoidal rule. Take $h = 0.5$, $k = 0.5$ **[6]**

$$z = \int_0^1 \int_0^1 e^{(x+y)} dx dy$$

b) Find the first and second-order derivatives of the function $f(x)$ at $x = 2$ from the given data : **[6]**

x	2	4	6	8	10
$f(x)$	3.375	7.00	13.525	25	38.889

c) Derive the formula for dy/dx and d^2y/dx^2 at $x = x_n$ using Newton's backward difference interpolation formula. **[5]**

OR

Q4) a) Evaluate the integral using Simpson's one-third rule. Take step size as 0.2. **[6]**

$$z = \int_0^1 x e^{(x)} dx$$

b) Find the first and second-order derivatives of the function $f(x)$ at $x = 20$ from the given data : **[6]**

x	12	14	16	18	20
$f(x)$	5.789	10.478	14.663	17.143	22.745

c) Derive the formula for dy/dx and d^2y/dx^2 at $x = x_0$ using Newton's forward difference interpolation formula. **[5]**

Q5) a) Find the A^{-1} by using Gauss Jordan method. **[6]**

$$A = \begin{bmatrix} 3 & 2 & 4 \\ 2 & 1 & 1 \\ 1 & 3 & 5 \end{bmatrix}$$

b) Solve the following set of linear simultaneous equation using the Gauss Jacobi method. Solve up to six interations. **[6]**

$$x_1 + 2x_2 - x_3 = 3$$

$$x_1 - x_2 + 3x_3 = 1$$

$$2x_1 - x_2 + 2x_3 = 2$$

c) Explain the Gauss Elimination method used for the solution of the linear simultaneous equation. (Problem is not expected. Just write in detail steps). **[6]**

OR

Q6) a) The following system of equations was generated by applying mesh current law to the circuit. Use the Gauss Elimination method to find the current in the circuit. **[6]**

$$-2I_1 + I_2 - I_3 = 8$$

$$I_1 - 3I_2 + I_3 = 8$$

$$3I_1 + I_2 - 2I_3 = 0$$

b) Solve the following set of the linear simultaneous equation using the Gauss Seidel method. Solve up to six interations. **[6]**

$$5x_1 + 2x_2 + x_3 = 12$$

$$x_1 - 4x_2 + 2x_3 = 15$$

$$2x_1 + 2x_2 + 5x_3 = 20$$

c) Explain the Gauss Jordan method used for the solution of the linear simultaneous equation. (Problem is not expected. Just write in detail steps). **[6]**

Q7) a) For the differential eq., $\frac{dy}{dx} = -x^2 y$ with the value $y(0) = 1$, calculate $y(0.2)$ by Taylor's series method. Take h = 0.1. Consider the terms up to fourth derivative. **[6]**

b) Solve the following ODE using Runge-Kutta fourth order method at $x = 0.2, 0.4$.

$$\frac{dy}{dx} = \frac{y - x^2}{y^2 + x}$$

With the value $y(0) = 2$. **[6]**

c) Derive the expression for the solution of ODE using Euler's method. **[5]**

OR

Q8) a) Use Euler's method to find the value of $y(1)$ from the following ordinary differential equation. **[6]**

$$\frac{dy}{dx} = -x^2 + y$$

With the value $y(0) = 2$. Take the step size as 0.2.

b) Use the Runge-Kutta method to solve the following second-order ODE with $x = 0.4$. Correct to four decimal places. **[6]**

$$y'' = xy'^3 - y^2$$

The initial conditions given are $x = 0$, $y = 1.5$, $y' = 0$

c) Derive the expression for the solution of ODE using Taylor's series method. **[5]**

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