

**B.TECH SEM - V (2007 COURSE) (CHEMICAL ENGG.) : WINTER
- 2017**

SUBJECT : CHEMICAL ENGINEERING MATHEMATICS

Day : **Saturday**
Date : **13/01/2018**

W-2017-2444

Time : **02.30 PM TO 05.30 PM**
Max. Marks : **80**

N.B.

- 1) Q.1 and Q.5 are **COMPULSORY**. Out of the remaining attempt any **TWO** questions from each Section.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be written in **SEPARATE** answer book.
- 4) Use of non programmable calculator is allowed.
- 5) Assume suitable data if necessary.

SECTION – I

Q.1 a) Use Gauss-Jordan method, find the inverse of the matrix. **(05)**

$$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$$

b) A firm manufactures two products A and B on which the profits earned per unit are 3 Rs and 4 Rs. respectively. Each product is processed on two machines M_1 and M_2 . Product A requires one minute of processing time on M_1 and 2 minutes on M_2 while B requires one minute on M_1 and one minute on M_2 machine M_1 is available for not more than 7 hours and 30 minutes while M_2 is available for 10 hours during any working day. Formulate LPP to maximize profit. (Only write down the equations to maximize the profit) **(05)**

c) Find y at $x = 0.1$ when $y(0) = 1$. Take $h = 0.1$. $\frac{dy}{dx} = xy + y^2$. **(04)**

Q.2 a) Solve the following equation matrix inversion method **(07)**

$$\begin{aligned} 3x + y + 2z &= 3 \\ 2x - 3y - z &= -3 \\ x + 2y + z &= 4 \end{aligned}$$

b) Solve the following equations using Jacobin method. **(06)**

$$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$$

Q.3 A farmer has 1000 acres of land on which he can grow corn, wheat or soyabeans. Each acre of corn costs Rs. 100 for preparation requires 7 man-days of work and yields a profit of Rs. 30. An acre of wheat costs Rs. 120 to prepare, requires 10 man-days of work and yields a profit of Rs. 40. An acre of soyabeans costs Rs. 70 to prepare, requires 8 man-days of work and yields a profit of Rs. 20. If the farmer has Rs. 1,00,000 for preparation and can count on 8,000 man-days of work. Formulate the LPP to maximize profits. Solve using Simplex method. **(13)**

P.T.O.

Q.4 a) Find y at $x=1$ using modified Euler method when $y(0) = 1$. Take $h = 0.5$. (07)

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

b) Solve using Picard method $\frac{dy}{dx} = x + y^2$ (06)
 subject to the condition $y(0) = 1$.

SECTION – II

Q.5 a) Write a short note on Crank-Nicolson method. (05)

b) Evaluate using Cauchy’s integral formula (05)

$$\int_C \frac{e^{z^2} dz}{(z-1)(z-2)} \text{ where } C \text{ is circle } |z|=3.$$

c) An aeroplane flies along the four sides of a square at speeds of 100, 200, 300 and 400 km/hr respectively. What is the average speed of the plane in its flight around the square? (04)

Q.6 a) Use Romberg’s method to compute (07)

$$I = \int_0^1 \frac{1}{1+x} dx \text{ Correct to three decimal places.}$$

$$I(0.5) = 0.7084$$

$$I(0.25) = 0.6970$$

$$I(0.125) = 0.6941$$

b) Employ Stirling’s formula to compute $y_{h_{12.2}}$ from the following table: (06)

x	10	11	12	13	14
f(x)	0.23967	0.28060	0.31788	0.35209	0.38368

Q.7 a) Calculate the mean and standard deviation for the following : (06)

Size of item	6	7	8	9	10	11	12
Frequency	3	6	9	13	8	5	4

b) The following is the frequency distribution of a random sample of the weekly earnings of 509 employees. (07)

Weekly earnings	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
No. of employees	3	6	10	15	24	42	75	90	79	55	36	26	19	13	9	7

Calculate average weekly earnings using direct method and step deviation method.

Q.8 a) Prove that the function $f(z)$ defined by $f(z) = \frac{x^3(1-i) - y^3(1+i)}{x^2 + y^2} (z \neq 0)$ (08)

is continuous and the Cauchy-Riemann equations are satisfied at the origin ye $f'(0)$ does not exist.

b) Write a short note on Monto-Carlo simulation. (05)

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