Sub.Code : 926

NEB-GRADE XII

General Mathematics

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs. **Full Marks: 100**

Pass Marks:35 (For partial students only)

Attempt **all** the questions.

1. a) Define function. What do you mean by the domain and range of function ? Write the equation of vertical shift, horizontal shift by 2 units for the function $y = x^2$. 5

   b) Define rational function. Graph the function $f(x) = x^3 - x$. 5

   c) Under ideal conditions, a population of rabbits has as exponential growth rate of 11.7% per day. Consider an initial population of 100 rabbits.
   i) Find the exponential growth function.
   ii) What will the population be after 7 days, after 2 weeks ?
   iii) Find the doubling time. 2+2+2

2 What is the monthly payment necessary to amortize a loan of Rs. 30,00,000 at 8.5% annual interest in 25 years ? What is the payment per year ? What is the total payment for 25 years ? How much of this total payment is interest on the loan ? What do you mean by present value of annuity due, write its formula. 2+1+2+1

3. a) Solve by **Row-equivalent matrix method:** 5
   $3x + 2y = 8, \quad 4x + y = 9,$

   b) Show that $A^3 - 4A^2 + A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ where $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$. 5

   c) A bus has 3 seats for passengers those willing to pay first class fares can take 60 kg of baggage each, but tourists class passengers are restricted to 30 kg each only. 120 kg baggage can be carried altogether. Make the matrix form of equation representing the conditions. 4

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4. a) Find the coordinates of inequalities for any vertices and show it in the graph.
   $3x - y \leq 6, y - 3 \leq 0,$ and $x + y \geq 0$ 5

   b) Define slack, basic, non-basic variables and simplex-tableau with suitable example. 4

   c) From the dual problem, given below for minimization, make it the initial simplex-tableau. 5
   minimize, $z = 4x + 7y$ subject to $x + y \geq 3$, $3x + y \geq 21$, $x, y \geq 0$

5. a) Find the value of n, if $16 \times P(n, 3) = 13 \times P(n+1, 3)$ 4

   b) There are 18 boys and 15 girls in a class. In how many ways 2 boys and 1 girl can be selected ? 3

6. a) Show that $\lim_{x \to 2} \frac{|x - 2|}{x - 2}$ does not exit. 5

   b) Find the derivative of $y = \sqrt{x-1}$ using first principle. 5

   c) Find $\frac{dy}{dx}$ if $x = \frac{3at}{1+t^2}$ and $y = \frac{3at^2}{1+t^2}$ 6

7. a) A firm produces 'x' tons output at the total cost, $c(x) = \frac{x^3}{10} - 5x^2 + 10x$.
   At what level of output will the marginal cost and the average cost attain their respective minima. 5

   b) Discuss the concavity for $f(x) = x^3 - 6x^2 + 9x + 30$ 5

8. a) Evaluate : $\int \left((2x + 3)\sqrt{3x + 1} \right) dx$ 6

   b) State fundamental theorem of integration.
   Evaluate : $\int_0^4 x^2 \sqrt{1 + 2x^3}\ dx$ 6

   c) Find the area bounded by the y-axis, the curve $x^2 = 4by$ and the line $y = b$ 5

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