M.Tech Odd Semester (CBCS) Exam., December—2016

AGRICULTURAL ENGINEERING

(1st Semester)

Course No. : MAEEL01

(Computational Methods)

Full Marks : 50
Pass Marks : 15

Time : 2 hours

Note : 1. Attempt *any* **five** questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

1. *(a)* Compute the limit for

$$\lim_{x \to 1} \frac{\frac{1}{x} - \frac{1}{\sqrt{x}}}{\sqrt[3]{x} - 1} \qquad 5$$

(b) The volume of a cube is increasing at a rate of $9\ cm^3/sec$. How fast is the surface area increasing when the length of an edge is 10 centimetres? 5

2. Find the integral of

$$\int_0^3 \frac{dx}{(x-1)^{\frac{2}{3}}} \text{ and } \frac{dx}{3x^2 - 10x - 10} \qquad 10$$

3. *(a)* Evaluate : 5

$$\int_0^{\frac{\pi}{2}} \frac{\sin^4 x}{\sin^4 x - \cos^4 x}$$

(b) Find the area between the x-axis and the curve $y = \cos x$ from $x = 0$ to $x = 3/2$. 5

4. *(a)* Solve : 3

$$\frac{y}{x}\frac{dy}{dx} = \frac{x^2 - y^2 - 1}{2(x^2 - y^2)} = 0$$

(b) Given $\frac{dy}{dx} = \frac{y - x}{y - x}$ with initial condition $y = 1$ at $x = 0$. Find y for $x = 0.1$ by Euler's method. 3

(c) Find the differential equation of all planes which are at a constant distance from the origin. 4

5. The following gives the frequency distribution of daily wage earnings, in rupees, of 450 workers :

Daily wages (in ₹)	*No. of persons*
70–80	44
80–90	120
90–100	80
100–110	76
110–120	50
120–130	45
130–140	25
140–150	10
Total	450

(a) Draw a frequency histogram and then superimpose a frequency polygon and a frequency curve.

(b) Obtain the cumulative frequencies and the 'median' daily wage. 10

6. *(a)* The mean life of a sample of 60 bulbs was 650 hours and the standard deviation was 8 hours. A second sample of 80 bulbs has a mean life of 660 hours and standard deviation 7 hours. Find the overall standard deviation. 4

(b) Find the probability of the event getting at least 1 tail, if four coins are tossed once. 6

7. *(a)* In a single-throw of two dice, what is the probability that the sum is 9? 5

(b) Four persons are chosen at random from a group of 3 men, 2 women and 4 children. Find the chance that exactly two of them will be children. 5

8. Newton's law of cooling says that the temperature of a body changes at a rate proportional to the difference between its temperature and that of the surrounding medium (the ambient temperature)

$$\frac{dT}{dt} \quad k(T \quad T_a)$$

where T the temperature of the body (°C), t time (min), k the proportionality constant (per minute), and T_a the ambient temperature (°C). Suppose that a cup of coffee originally has a temperature of 68 °C. Use Euler's method to compute the temperature from t 0 to 10 min using a step size of 1 min if T_a 21 C and k 0 1/min. 10

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