ECE - IV Sem 25th June

4E2137

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B. Tech. (Sem. IV) (Main/Back) Examination, June/July - 2011
Ceramic Engineering
4CRE5 Mathematics - IV (Common for AI, BM, EI & EC)

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

*Attempt any **five** questions.*
*Selecting **one** question from each unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably may be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Nil 2. Nil

UNIT - I

1 (a) Find f(4) from the following table :

x	0	1	2	5
$f(x)$	2	5	7	8

8

(b) From the following table, find the number of students who obtain less than 45 marks ?

Marks	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No.of Students	31	42	51	35	31

8

OR

1 (a) Use Stirling's formula to find y_{28} given y_{20}=49225, y_{25}=48316, y_{30}=47236, y_{35}=45926, y_{40}=44306.

8

(b) Show that :

(i) $(1+\Delta)(1-\nabla)=I$

4

(ii) $\mu^2=1+\delta^2/4$

4

UNIT - II

2 (a) Calculate the value of the integral $\int_2^{10} \frac{dx}{1+x}$ Using Simpson's 1/3rd rule by dividing the interval (2,10) into eight equal parts upto 4 decimal places. **8**

(b) Given $\frac{dy}{dx} = y - x$ with $y(0) = 2$, find $y(0.1)$ correct to 4 decimal places using Runge-Kutta 4th order method. **8**

OR

2 (a) Let $\frac{dy}{dx} = \frac{y-x}{y+x}$, with boundary conditions $y = 1$ when $x = 0$. Find approximately y for $x = 0.1$ by Euler's modified method (3 steps). **8**

(b) Find f'(1.5) and f''(1.5) from the following table : **8**

x	1.5	2.0	2.5	3.0	3.5	4.0
$f(x)$	3.375	7.00	13.625	24.00	38.875	59.00

UNIT - III

3 (a) If α and β are the roots of $J_n(x) = 0$ then prove that :

$$\int_0^1 x J_n(\alpha x) J_n(\beta x)\, dx = \begin{cases} 0, & \text{if } \alpha \neq \beta \\ \frac{1}{2} J_{n+1}^2(\alpha), & \text{if } \alpha = \beta \end{cases}$$

10

(b) Prove that :

(i) $\frac{d}{dx}\left[x^n J_n(x)\right] = x^n J_{n-1}(x)$ **3**

(ii) $\frac{d}{dx}\left[x^{-n} J_n(x)\right] = -x^{-n} J_{n+1}(x)$ **3**

OR

3 (a) Prove that :

(i) $(2n+1)xP_n(x) = (n+1)P_{n+1}(x) + nP_{n-1}(x)$

4

(ii) $nP_n(x) = xP_n'(x) - P'_{n-1}(x)$

4

(b) Prove that $P_n(x)$ is the coefficient of h^n in the expansion of $(1-2xh+h^2)^{-1/2}$ in ascending powers of h.

8

UNIT - IV

4 (a) Show that the angle θ, between the two lines of regression is given by

$$\tan\theta = \frac{1-r^2}{r}\,\frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}$$

Also interpret the cases when $r = 0, \pm 1$.

6

(b) Two random variables have the least square regression lines with equations $3x+2y-26=0$ and $6x+y-31=0$. Find coefficient of correlation between x and y.

4

(c) Obtain the rank correlation coefficient for the following data :

x	85	74	85	50	65	78	74	60	74	90
y	78	91	78	58	60	72	80	55	68	70

6

OR

4 (a) Write statement of Baye's theorem.

2

(b) Define normal probability distribution. If the mean of a normal distribution is μ and its variance σ^2, find its moment generating function.

8

(c) In a bolt manufacturer factory, machine A, B and C manufacture 25%, 35% and 40% of the total product respectively. Of their output 5%, 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine B ?

6

UNIT - V

5 (a) Find the curve through two points (x_1,y_1) and (x_2,y_2) which when rotated about the x-axis, given minimum surface area.

8

(b) Find the externals of the functional

$$I[y(x),z(x)]=\int_0^{\pi/2}\left[y'^2+z'^2+2yz\right]dx \text{ where}$$

$$y(0)=0,\ y\left(\frac{\pi}{2}\right)=1\ ;\ z(0)=0 \text{ and } z\left(\frac{\pi}{2}\right)=-1.$$

8

OR

5 (a) Find the path on which a particle, in the absence of friction, will slide down from one fixed point to another fixed point in the shortest time.

10

(b) Find the external of the functional $I[y(x)]=\int_0^1\left[1+y''^2\right]dx$ given $y(0)=0,\ y'(0)=1;y(1)=1$ and $y'(1)=1$.

6
