

16/7/2016

4E4135

Roll No. _____

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4E4135

B.Tech. IV-Sem (Main & Back) Exam; June-July 2016

Applied Electronics & Inst. Engineering

4AI1 Mathematics-IV

Common with AI, BM, EI, CRE, EC, PE, PC

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks (Main & Back): 26

Min. Passing Marks (Old Back): 24

Instructions to Candidates:-

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 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

Q.1 (a) Prove the following relations, where symbols have their usual meaning: [8]

(i) $E^{-1} = 1 - \frac{\delta^2}{2} + \delta \sqrt{1 + \frac{\delta^2}{4}}$

(ii) $\Delta = \frac{\delta^2}{2} + \delta \sqrt{1 + \frac{\delta^2}{4}}$

(b) Find interpolation polynomial, which passes through the points (1, -1), (2, -1), (3, 1) and (4, 5). [8]

- (b) Using Runge – Kutta method, solve the following initial value problem for $x = 1.2$ & 1.4 [8]

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}, y(1) = 1.$$

UNIT-III

- Q.3 (a) State and prove orthogonal property for Legendre polynomial. [8]

- (b) Prove that [8]

$$\frac{d}{dx} \left\{ \frac{J_{-n}(x)}{J_n(x)} \right\} = -\frac{2 \sin n\pi}{\pi x J_n^2}.$$

OR

- Q.3 (a) Show that [8]

(i) $xJ'_n(x) = nJ_n(x) - xJ_{n-1}(x)$

(ii) $J_{3/2}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{\sin x}{x} - \cos x \right)$

- (b) Show that [8]

$$(1 - 2xz + z^2)^{-1/2} = \sum_{n=0}^{\infty} z^n P_n(x), \quad |x| \leq 1, |z| < 1.$$

UNIT-IV

- Q.4 (a) There are three similar coins, one of which is ideal and other two are biased. The chances of head are respectively $1/3$ and $2/3$. A coin is selected at random and tossed twice. If head occurs both times, then find the probability that the ideal coin was selected. [8]

- (b) Derive moment generating function for Binomial distribution. Hence, find mean and variance for the same. [8]

OR

- Q.1 (a) By making use of the following table, find the value of x for which $f(x)$ is maximum or minimum [8]

x	1	2	7	8
$f(x)$	4	5	5	4

Also find the value of $f(x)$ at $x = 6$.

- (b) Use Sterling formula to find y_{25} , given that

$$y_{20} = 24, y_{24} = 32, y_{28} = 35, y_{32} = 40 \quad [8]$$

UNIT-II

- Q.2 (a) Find the value of $\log_e 2$ from $\int_0^1 \frac{x^2}{1+x^3} dx$, using Simpson's $\frac{1}{3}$ rule, by dividing into four equal parts. [8]

- (b) Using Euler's modified method, obtain a solution of $\frac{dy}{dx} = 2 + \sqrt{xy}$, $y(1) = 1$, for the range $1 \leq x \leq 1.6$ in three steps. [8]

OR

- Q.2 (a) Below given table shows the values of $l_{n,x}$ for various x . Find approximation to the derivatives of $l_{n,x}$ at $x = 2.4$ by using the central interpolation formula: [8]

x	2.0	2.2	2.4	2.6	2.8
$l_{n,x}$	0.69315	0.78846	0.87547	0.95551	1.02962

OR

- Q.4 (a) Prove that Poisson distribution is a limiting case of Binomial distribution. [8]
- (b) Calculate the rank correlation coefficient for the following data: [8]

X:	81	78	73	73	69	68	62	58
Y:	10	12	18	18	18	22	20	24

UNIT-V

- Q.5 (a) Find the curve joining the points (x_1, y_1) and (x_2, y_2) that yields a surface of revolution of minimum area when revolved about the axis. [8]

- (b) Find a function $y(x)$ for which $\int_0^1 [x^2 - (y')^2] dx$ is stationary, given that [8]

$$\int_0^1 y^2 dx = 2, y(0) = 0, y(1) = 0.$$

OR

- Q.5 (a) State and prove Euler's equation. [8]
- (b) Find the extremals of the functional [8]

$$v[y(x), z(x)] = \int_0^{\pi/2} [(y')^2 + (z')^2 + 2yz] dx$$

Where $y(0) = 0, y(\pi/2) = -1, z(0) = 0$ and $z(\pi/2) = 1$.