4E 4135

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**4E 4135**

# B.Tech. IV Semester (Main/Back) Examination, May-2018
## Electronics & Comm.
## 4EC6A Advanced Engg. Mathematics - II
## AI, BM, EI, CRE, EC, PE, PC

**Time : 3 Hours** | **Maximum Marks : 80**
**Min. Passing Marks : 26**

*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.*

### UNIT - I

1. a) Show that $u_1x + u_2x^2 + u_3x^3 + \ldots = \frac{x}{1-x}u_1 + \left(\frac{x}{1-x}\right)^2 \Delta u_1 + \left(\frac{x}{1-x}\right)^3 \Delta^2 u_1 + \ldots$ **(8)**

   b) Using Lagrange's interpolation formula, find the polynomial which passes through the points (0,2), (1,3), (2,12) and (5, 147) **(8)**

**OR**

1. a) Prove the following relations, where symbols have their usual meaning:

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



   ii) $\Delta \log f(x) = \log\left[1 + \frac{\Delta f(x)}{f(x)}\right]$ **(8)**

   b) Using Newton-Gregory forward interpolation formula, find the sum $S_n = 1^3 + 2^3 + 3^3 + \ldots\ldots + n^3$ **(8)**

### UNIT - II

2. a) Find the approximate value of $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ by dividing the interval into nine ordinates. **(8)**

   b) Using Milne's method, find y(2), if y(x) is the solution of $\frac{dy}{dx} = \frac{1}{2}(x + y)$ assuming y(0) = 2, y(0.5) = 2.636, y(1.0) = 3.595 and y(1.5) = 4.968. **(8)**

**OR**

2. a) From the following table of values of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for $x=1.2$ **(8)**

| $x$ | $y$ | $x$ | $y$ |
|---|---|---|---|
| 1.0 | 2.7183 | 1.8 | 6.0496 |
| 1.2 | 3.3201 | 2.0 | 7.3891 |
| 1.4 | 4.0552 | 2.2 | 9.0250 |
| 1.6 | 4.9530 | | |

b) Given the differential equation $\frac{dy}{dx}=\frac{x^2}{y^2+1}$, with the initial condition y = 0 when x = 0, use Picard's method to obtain y for x = 0.25, 0.5 and 1.0 correct to three places of decimals. **(8)**

**UNIT - III**

3. a) State and prove Rodrigue's formula for Legendre polynomial. **(8)**

b) Prove that :

i) $xJ_n'(x)=nJ_n(x)-xJ_{n+1}(x)$

ii) $J_n(x)=\frac{2(x/2)^{n-m}}{\Gamma(n-m)}\int_0^1(1-t^2)^{n-m-1}t^{m+1}J_m(xt)\,dt, n>m>-1$ **(8)**

**OR**

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3. a) Show that : $\exp\left\{\frac{x}{2}\left(z-\frac{1}{z}\right)\right\}=\sum_{n=-\infty}^{\infty}z^nJ_n(x)$ **(8)**

b) Express $P(x)=x^4+2x^3+2x^2-x-3$ in terms of Legendre's polynomials. **(8)**

**UNIT - IV**

4. a) Suppose on an average 1 house in 1000 in a certain district has a fire during a year. If there are 2000 houses in that district, what is the probability that exactly 5 houses will have a fire during the year? **(4)**

b) A manufacturing firm produces steel pipes in three plants with daily production volume of 500, 1000 and 2000 units respectively. According to past experience it is known that the fractions of defective output produced by the three plants are respectively 0.005, 0.008 and 0.010. If a pipe is selected from a days total production and found to be defective. Find out what is the probability that it came from the first plant? **(6)**

c) Two random variables have the following regression lines : $3x+2y-26=0$ *and* $6x+y-31=0$. Find the mean values and coefficient of correlation between *x* and *y*. **(6)**

**OR**

4. a) A card is drawn from a well-shuffled pack of playing cards. What is the probability that it is either a spade or an ace? **(4)**

b) Find mean and variance of Binimial distribution. (6)

c) Calculate the coefficient of correlation between x and y using the following data :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | : | 1 | 3 | 5 | 7 | 8 | 10 |
| Y | : | 8 | 12 | 15 | 17 | 18 | 20 |

(6)

## UNIT - V

5. a) Prove that the shortest distance between two given points in a plane is always a straight line. (8)

b) Find the extremals of the functional $v[y(x), z(x)] = \int_0^{\pi/2} \left[(y')^2 + (z')^2 + 2yz\right] dx$

where $y(0) = 0, y(\pi/2) = 1, z(0) = 0$ *and* $z(\pi/2) = -1$. (8)

**OR**

5. a) Derive Euler - Lagrange's equation. (8)

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

$\int_0^1 y^2 dx = 2, y(0) = 0, y(1) = 0$. (8)

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