



**Engineering Mathematics - III**  
**(173101 / 223101)**

**P. Pages : 4**

**Time : Three Hours**

**Max. Marks : 80**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** subquestions from each question.
5. Figures to the right indicate full marks.
6. Assume suitable data if any.

**1. Solve any two.**

- a) i) Obtain the Laplace transform of  $\cosh at \sin at + \frac{\sin 2t}{t}$  4
- ii) Evaluate  $\int_0^{\infty} e^{-2t} \left( \frac{\cos 8t - \cos 4t}{t} \right) dt.$  4
- b) i) Evaluate  $L \left( t \int_0^t e^{-3t} \sin 2t dt \right).$  4
- ii) Obtain the inverse Laplace transform of  $\frac{S+2}{S^2(S-1)^2}.$  4
- c) Solve  $\frac{d^2y}{dt^2} + 9y = 18t, y(0) = 0, y'(0) = 3\pi + 2$  by Laplace Transform method. 8

**2. Solve any two.**

- a) i) Find the Fourier sine transform of the function 4
- $f(x) = \frac{\pi}{2} e^{-x} \cos x, x > 0$

- ii) Find the Fourier cosine transform of 4
- $$f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2-x, & 1 \leq x \leq 2 \\ 0, & x > 2 \end{cases}$$

- b) i) Find the z-transform of  $\frac{a^k}{k!} e^{-a}, k \geq 0$ . 4

- ii) Find  $Z^{-1} \left\{ \frac{1}{(z-4)^3} \right\}, |z| > 4$ . 4

- c) Using inverse sine transform, find  $f(x)$  of  $F_S(\lambda) = \frac{1}{\lambda} e^{-a\lambda}$ . 8

**3. Solve any two.**

- a) Calculate the first four moments of a distribution about mean. 8

CI	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100
f	6	8	21	10	5

- b) Calculate the coefficient of correlation between the age of husbands (x) and wives (y). 8

x	23	27	28	28	29	30	31	33	35	36
y	18	20	22	27	21	29	27	29	28	29

- c) i) Fit a binomion distribution to the following data. 4

x	0	1	2	3	4
f	30	62	46	10	2

- ii) Using poisson distribution find the probability that the ace of spade will be drawn from a pack of well shuffled cards at least once in 104 consecutive trials. 4

**4. Attempt any two.**

- a) i) Define the terms hypothesis critical region, test statistic, level of significance. 4

- ii) The mean life time of 100 picture tubes produced by a manufacturing company is estimated to be 5795 hrs with a standard deviation of 150 hrs. Test the hypothesis that the mean life time of all the picture tubes produced by company is 6000 hrs. 4

- b) i) Out of a sample of 100 residents in a certain area 73 found to own their homes. Test the hypothesis that proportion of house owners is 80% against the alternative that it is less than 80% (1% l.o.s.) 4
- ii) Random samples of 200 bolts manufactured by a machine A and 100 bolts manufactured by machine B showed 19 and 5 defective bolts respectively. Is there any significant difference between the performance of the machines. 4
- c) Fit a poisson distribution to the following data and test for its goodness of fit at 5% l.o.s. 8

x	0	1	2	3	4	5
f (x)	158	160	60	25	10	2

Given  $\chi^2_{4,0.05} = 9.49$

5. Attempt **any two**.

- a) i) Define fuzzy sets with examples. Discuss intersection, union and complements in fuzzy sets with example. 4
- ii) Given below two fuzzy sets 4
- $$\tilde{A}(x) = \begin{cases} x & 0 \leq x \leq 1 \\ 2-x & 1 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$
- $$\tilde{B}(x) = \begin{cases} x/3 & 0 \leq x \leq 3 \\ 4-x & 3 \leq x \leq 4 \\ 0 & \text{otherwise} \end{cases}$$

Draw their graphs and evaluate  $\tilde{A} \cap \tilde{B}$ .

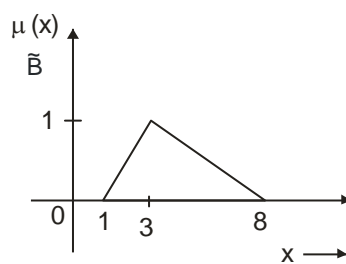
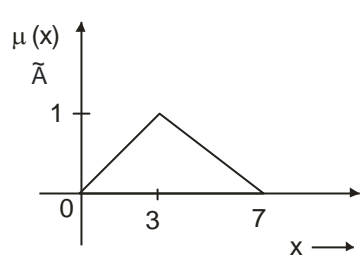
- b) By extension principle fuzzy addition is defined by 8
- $$\mu_{\tilde{A}+\tilde{B}}(z) = \max_{x+y=z} \left\{ \min \left( \mu_{\tilde{A}}(x), \mu_{\tilde{B}}(y) \right) \right\}$$

For the following fuzzy subsets  $\tilde{A}, \tilde{B}$  find  $\tilde{A} + \tilde{B}$  and  $\tilde{A}^c, \tilde{B}^c$ .

$$\mu_{\tilde{A}}(1) = 0.3, \mu_{\tilde{A}}(2) = 0.4, \mu_{\tilde{A}}(3) = 0.5, \mu_{\tilde{A}}(4) = 0.6$$

$$\mu_{\tilde{B}}(1) = 0.3, \mu_{\tilde{B}}(2) = 0.6, \mu_{\tilde{B}}(3) = 0.9, \mu_{\tilde{B}}(4) = 0.2$$

c) Given below two fuzzy numbers



Calculate  $\tilde{A} + \tilde{B}$ ,  $\tilde{A} - \tilde{B}$ .

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