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MMIE/MMPD/MMIP/MMTP/MMMD-101

M.E./M.Tech., I Semester Examination, June 2020

Advanced Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Define linearly dependent and independent sets. Check whether the vectors are (2, 1, 1), (0, 5, –1), (–1, 2, –1) are linearly independent or linearly dependent.

   b) What is modular mathematics and solve

   $y = 2x + 3 \pmod 8$ if $x = 4$.

2. a) Give mathematical formula : for $He_n(x)$ and show that $He_3(x) = x^3 - 3x$.

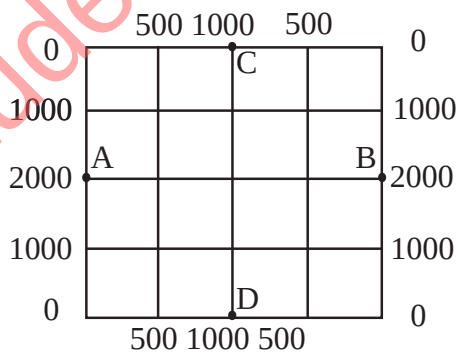
   Also write weight function for Hermite-Polynomial to be orthogonal.

   b) Define the following with example:

   i) Hash function

   ii) Heaviside's unit function and error function

3. a) Solve the Laplace equation $U_{xx} + U_{yy} = 0$ for the square mesh with boundary values shown in the following figure.



   b) Find the Fourier transform of :

$$f(x) = \begin{cases} 1 - x_2 \ , & |x| \le 1 \\ 0 \ , & |x| > 0 \end{cases}$$

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4. a) Solve by the method of separation of variables:

$$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u \text{, where } u(x, 0) = 6e^{-3x}.$$

b) Explain the following with one example in each case where it is applied;
   i) Haar transform
   ii) Wavelet transform

5. a) Fit a binomial distribution for the following data and compare the theoretical frequencies with actual ones:

x :	0	1	2	3	4	5
f :	2	14	20	34	22	8

b) Find the mean and standard deviation of Poisson's distribution.

6. a) Show that every stochastic process $\{x_t, t = 0, 1, 2,....\}$ with independent increment is a Markov process.

b) Obtain the steady state solution of (M/M/1:∞/FCFS) system and also find expected value of queue length n.

7. a) What do you understand by queue? Give some important applications of queueing theory.

b) Explain (M/M/1 : N/ FCFS) queueing system and solve it under steady state condition.

8. a) Use Rayleigh - Ritz method to solve the equation:

$$\frac{\partial^2 y}{\partial x^2} + y = x,\ y(0) = 0, y(1) = 1$$

b) What is the difference between FEM and DFT?

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