

Total No. of Questions :8]

[Total No. of Printed Pages :2

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**MMTP/MMCM/MMMD/MMPD/MMIE-101****M.E./M.Tech. I Semester**

Examination, June 2016

**Advanced Mathematics****Time : Three Hours****Maximum Marks: 70****Note :** Attempt any five questions. All questions carry equal marks.

1. a) Prove that the function  $e^{3x}, e^{4x}$  on  $(-\infty, \infty)$  are solutions of the differential equation

$$\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 12y = 0$$

Determine whether they are linearly independent and whether they form a basis for the solution space. 7

- b) What are error function (give Mathematical definition) and why they are called error function. Also define Hash function. 7
2. a) Discuss the orthogonality of Hermite polynomial. 7
- b) A string is stretched between the fixed points (0, 0) and (1, 0) and released from rest from the position  $u(x, 0) = A \sin 2\pi x$ . Find the displacement  $u(x, t)$ . 7
3. a) Write the properties of DFT, WFT and Haar transform. 7
- b) Find the Fourier sine transform of  $e^{-|x|}$ . Hence evaluate  $\int_0^\infty \frac{x \sin mx}{1+x^2} dx$ . 7
4. a) A speaks the truth in 60% and B in 75% of the cases. In what percentage of cases are they likely to contradict each other in stating the same fact. 7

- b) Define normal distribution and state its properties. Why this distribution is important? 7

5. a) Write short notes on the following: 7
- i) Concept of estimation theory
- ii) Theory of Hypothesis
- b) Solve  $a_r - 7a_{r-2} - 6a_{r-3} = 0$  with initial conditions  $a_0 = 9, a_1 = 10, a_2 = 32$ . 7
6. a) What do you mean by significance level. Explain the types of errors in test. 7
- b) Obtain the steady state difference equation for the queueing model (M/M/S) :  $(\infty/\text{FCFS})$ . 7
7. a) Define stochastic process and Markov process with example. 7
- b) In a bank cheques are cashed at a single 'teller' counter. Customer arrive at the counter in a poisson manner at an average rate of 30 customer per hour. The teller takes, on an average a minute and a half to cash cheque. The service time has been shown to be exponentially distributed.
- i) Calculate the percentage of time the teller is busy.
- ii) Calculate the average of time the teller is busy. 7
8. a) Prove that the necessary condition for  $I = \int_{x_1}^{x_2} f(x, y, y') dx$  to be an extremum is that  $\frac{\partial f}{\partial y} - \frac{d}{dx} \left( \frac{\partial f}{\partial y'} \right) = 0$ . 7
- b) Solve the differential equation  $y'' - y + x = 0$  ( $0 \leq x \leq 1$ ) with the condition  $y(0) = y(1) = 0$  by Rayleigh-Ritz method. 7

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