Total No. of Questions :8] *[Total No. of Printed Pages :3*

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MCSE/MSE - 101

M.E./M.Tech., I Semester

Examination, July 2015

Advanced Computational Mathematics

Time : Three Hours

Maximum Marks : 70

Note : Solve any five questions. All questions carry equal marks.

1. a) Show that the vectors (2,1,4), (1,–1,2), (3,1,–2) form a basis for R^3.

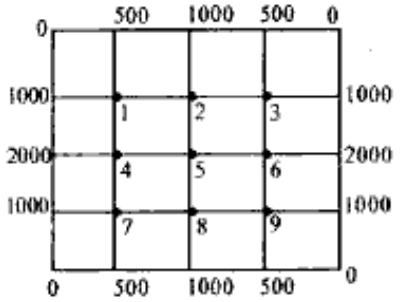
   b) Show that the mapping $T : V_3(R) \rightarrow V_3(R)$ defined by $T(x_1, x_2) = (x_1 - x_1 + x_2, -x_2)$, $\forall\ x_1, x_2 \in R$ is a linear transformation.

2. a) Prove the orthogonality property of Hermite polynomials.

   b) Prove that the set G = {1,5,7,11} constitutes a group under 'multiplication module12' as the composition in G.

3. a) 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 $u(x, t)$.

   b) Determine all mesh points if it satisfies Laplace equation in the grid with given boundary conditions :



iterate by Gauss-Seidel method.

a) Solve the Poisson's equation :
$u_{xx} + u_{yy} = -10(x_2 + y^2 + 10)$ over the square with sides $x = 0$, $y = 0$, $x = y = 3$ with $u = 0$ on the boundary and mesh length 1.

b) Write short notes on the following :
i) Wavelet transform
ii) Haar Transform

a) A continuous random variable X has the density function $f(x) = 3x^2$, $0 \le x < 1$. Find a and b when
i) $P(x \le a) = P(x > a)$
ii) $P(x > b) = 0.05$

b) A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the approximate probability that a box will fail to meet the guaranteed quality? [$e^{-5} = 0.006738$]

a) Explain the following :
i) Theory of estimators
ii) Theory of Hypothesis

b) Define Stochastic process and explain classification of Stochastic process.

a) In a rail way marshalling yard, goods trains arrive at rate 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes, then calculate :
i) The mean queue size
ii) The probability that the queue size exceeds
If the input of trains increases to an average 33 per day, what will be the change in (i) and (ii)?

b) Define Fuzzy relations. Discuss fuzzy if-then rules with some examples.

8. a) Write the MATLAB statements required to calculate $y(x)$ from the equation

$$y(x) = \begin{cases} -3x^2 + 5e^{6x}, & x \ge 0 \\ 6x + 9, & x < 0 \end{cases}$$

for the values of t between -4 to 4 in steps of 0.5.

b) Explain different functions which MATLAB provides in fuzzy tools box.

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