

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 214201**

Roll No.

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## MCA.

### (SEM. II) THEORY EXAMINATION 2013-14 COMPUTER BASED NUMERICAL AND STATISTICAL TECHNIQUES

*Time : 3 Hours*

*Total Marks : 100*

**Note** :- Attempt questions from each Section as indicated :

#### SECTION-A

(10×2=20)

Attempt **all** parts :

1. Define 'Absolute error' and 'Relative error'. An approximate value of  $\pi$  is given as 3.1428571 and its true value is 3.1415926. Find absolute and relative errors.
2. In a normalized floating point mode, carry out the following mathematical operation :  $(0.4546 E3) + (0.5454 E8)$ .
3. Evaluate  $\sqrt{2}$  correct to four decimal places using Newton-Raphson method.
4. Write an algorithm for finding roots using iteration method.
5. What is an ill-conditioned system ?
6. What do you mean by interpolation and extrapolation ?
7. Find unique polynomial  $p(n)$  of degree 2 such that :  $P(1)=1$ ,  $P(3)=27$ , and  $P(4) = 64$ .

8. What is the principle of least squares for curve fitting.
9. Prove the formula for fitting a straight line.
10. Explain the terms :
  - (a) Null hypothesis
  - (b) Level of significance.

**SECTION-B**

**(3×10=30)**

Attempt any **three** :

1. (a) Write an algorithm for Regula-Falsi method. Also implement this algorithm in C language.  
 (b) Prove that order of convergence of Secant method is 1.62.
2. (a) Find the real root of the equation  $x^3 + x^2 - 1 = 0$  on the interval  $[0, 1]$  with the accuracy of  $10^{-4}$  by iteration method.  
 (b) Determine if the following system is ill-conditioned :

$$100x - 200y = 100$$

$$-200x + 400y = -100$$

3. Apply Gauss-Siedal iteration method to solve the equations :

$$20x + y - 2z = 17 ; 3x + 20y - z = -18 ; 2x - 3y + 20z = 25$$

4. Find the value of  $\log 58.75$ , if the given table is :

x	40	45	50	55	60	65
log x	1.60206	1.65321	1.69897	1.74036	1.77815	1.81291

5. Prove that :

(i)  $E = 1 + \Delta$

$$(ii) \Delta = \nabla(1 - \nabla)^{-1}$$

$$(iii) \delta = E^{1/2} + E^{-1/2}$$

$$(iv) e^{hD}$$

$$(v) \nabla = 1 - E^{-1}$$

### SECTION-C

(5×10=50)

Attempt any five :

1. (a) Apply Gauss forward formula to get  $f(3.75)$ , if given :  

$x$ :	2.5	3.0	3.5	4.0	4.5	5.0
$f$ :	24.145	22.043	20.225	18.644	17.262	16.047
- (b) Apply Bessel's formula to obtain  $y_{25}$  from the table below :  

$x$ :	20	24	28	32
$y$ :	2854	3162	3544	3992
2. (a) Prove that  $n^{\text{th}}$  differences of a polynomial of degree  $n$  is constant and all other higher differences are zero.  
(b) Explain Numerical differentiation and Numerical integration.
3. Find  $y(1)$ , if  $y(x)$  is the solution of  $\frac{dy}{dx} = x^2 + y^2$  by Range-Kutta method, in two steps taking  $h = 0.5$ . Given  $y(0) = 0$
4. Evaluate  $\int_0^6 dx / (1 + x^2)$  using
  - (i) Simpson's 1/3 rule
  - (ii) Simpson's 3/8 rule

5. A rod is rotating in a plane the following table gives the angle  $\theta$  (in radians) through which the rod has turned for various values of time  $t$  (in seconds). Calculate the angular velocity of the rod at  $t = 0.6$  seconds :

$t$ :	0	0.2	0.4	0.6	0.8	1.0
$\theta$ :	0	0.12	0.49	1.12	2.02	3.20

6. (a) For 10 observations on price 'x' and supply 'y'. The following data were obtained :  $\Sigma x = 130$ ,  $\Sigma y = 220$ ,  $\Sigma x^2 = 228$ ,  $\Sigma y^2 = 5506$ ,  $\Sigma xy = 3467$ . Obtain the line of regression of 'y on x' and estimate the supply when price is 16 units.

- (b) Prove that regression coefficients are independent of origin but not to scale.

7. (a) A die is thrown 90 times and the no. of faces shown are :

faces :	1	2	3	4	5	6
frequency :	18	14	13	15	14	16

Test whether the die is fair (Given  $\chi^2_5$  and  $.05 = 11.07$ )

- (b) Given the following information about two samples drawn from two normal population :

$$n_1 = 8, \Sigma (x - \bar{x})^2 = 94.5, n_2 = 10 \text{ and } \Sigma (y - \bar{y})^2 = 101.7$$

Test the equality of two popular variances.  
(Given :  $f_{7,9}(0.5) = 3.29$ )