DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE – RAIGAD -402 103

Mid Semester Examination – October - 2017

Branch: F.Y.B.Tech (Group A/Group B) **Sem.:- I**

Subject with Subject Code:- Engineering Mathematics –I (MATH101)

Marks: 20

Date:-03/10/2017 **Time:- 1 Hr.**

Instructions: - 1. All questions are compulsory.
2. Use of nonprogrammable calculator is allowed.
3. Figures to the right indicate full marks.

(Marks)

Q.No.1 Attempt the following **(06)**

a. The maximum value of the rank of a non-zero matrix $(A)_{4\times5}$ is
i) 0 ii) 1 iii) 4 iv) 5

b. If the rank of matrix A is 2, then the rank of matrix A^T is
i) 2 ii) 0 iii) 4 iv) 1

c. The eigen values of a triangular matrix are
i) The elements of its principle diagonal ii) 0, 0, 0
iii) The elements of its non-principle diagonal iv) none

d. The two eigen vectors $X_1\, and\, X_2$ are said to be orthogonal iff
i) $X_1X_2 = I$ ii) $X_1X_2 = 0$ iii) $X_1X_2^T = 0$ iv) $X_1^TX_2 = I$

e. If $y = e^{a\sin^{-1}x}$, then the value of $(1-x^2)y_2 - xy_1 - a^2y$ is
i) 1 ii) a iii) 0 iv) none

f. The Maclaurin's series of $\tan^{-1}x$ is
i) $x + \frac{x^3}{3} + \frac{x^5}{5} + \cdots$ ....ii) $x - \frac{x^3}{3} + \frac{x^5}{5} - \cdots$ ....
iii) $1 - x + x^2 - \cdots$ ...iv) $1 + x + x^2 + \cdots$ ...

Q.No. 2 Attempt any one of the following: **(06)**

a. Find the eigen values and the corresponding eigenvectors for the Matrix

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$$

b. If $y = (\sin^{-1} x)^2$, then prove $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2 y_n = 0$, and hence prove that $(\sin^{-1} x)^2 = 2\frac{x^2}{2!} + 2.2^2\frac{x^4}{4!} + 2.2^2.4^2\frac{x^6}{6!} + \ldots\ldots$

Q.No 3. Attempt any two of the following **(08)**

a. Find for what value of k the set of equations
$2x - 3y + 6z - 5t = 3$, $y - 4z + t = 1$, $4x - 5y + 8z - 9t = k$
has (i) no solution (ii) Infinite number of solutions.

b. If $\cos^{-1}\left(\frac{y}{b}\right) = \log\left(\frac{x}{n}\right)^n$, then show that
$(x^2)y_{n+2} + (2n+1)xy_{n+1} + 2n^2 y_n = 0.$

c. Find the approximate value of $\tan^{-1}(1.003)$ correct upto four decimal places by using Taylor's theorem.
