Indian J.Sci.Res. 14 (1): 340-343, 2017 ISSN: 0976-2876 (Print)
ISSN: 2250-0138 (Online)

IMPACT OF PREREQUISITES IN ENGINEERING MATHEMATICS – A FUZZY APPROACH

K. RAJESWARI[a1] AND A. GEORGE[b]

[ab]Department of Mathematics, Periyar Maniammai University, Vallam, Thanjavur, Tamilnadu, India

ABSTRACT

The impact of prerequisites knowledge in basic mathematics for the student's performance in engineering mathematics is analyzed using Fuzzy inference rule.

KEYWORDS: Fuzzy Inference, Students Performance, Prerequisite Knowledge.

The quality of teaching and learning mathematics has been one of the major challenges and concern for the educators. Mathematics comprises of wide variety of skills and concepts. Mathematics education should enable engineering students to communicate their ideas in an unambiguous and understandable way and should equip themselves with the analytical skills as practicing engineers. Mathematical thinking and modelling give engineers the ability to approach new problems with confidence. More number of arrears is kept in this subject compared to other subjects by students who are backward in studies. Students fail to understand the seriousness of this subject. The aim of this paper is to analysis the attributes of student's arrears due to lack of prerequisites subject knowledge using Fuzzy Matrix.

PROCEDURE FOR COMBINED EFFECTIVE TIME DEPENDENT DATA MATRIX

1. In the first stage an initial raw data matrix representation is formed on basis of different department along the columns and the reason of student's arrear in mathematics along the rows.
2. Raw data transform into Average Time Dependent (ATD) matrix.
3. We find the average and standard deviation of every column in the ATD matrix.
4. Formulate Refined Time Dependent(RTD) matrix using the average and S.D and we choose the parameter α from the interval

[0, 1] and using the formula

$$if \quad a_{ij} \le \left(\mu_j - \alpha * \sigma_j\right) \quad then \; e_{ij} = -1$$

$$else$$

$$if \quad a_{ij} \in \left(\mu_j - \alpha * \sigma_j,\ \mu_j - \alpha * \sigma_j\right)$$

$$then \; e_{ij} = 0$$

$$else$$

$$if \quad a_{ij} \ge \left(\mu_j + \alpha * \sigma_j\right) \quad then \; e_{ij} = 1$$

Finally we combine each of RTD matrixes to get a Combined Effective Time Dependent Data (CETD) matrix whose row sum gives the combined effect of RTD matrix.

Estimation of the major attributes of student getting arrear in Mathematics using

5×5 matrix

The causes for failures in mathematics among students studying Engineering courses in colleges are categorized as five attributes by interviewing and collecting the data from engineering students, engineering faculties and counselors of the students in our Institution.

X_1 : Lack of sufficient knowledge in basics

X_2 : Lack of logical reasoning and Application skill

X_3: Lack of problem solving skill

X_4: Lack of English language skill to understand mathematical terminology

X_5: Higher secondary school fails to provide clear knowledge in basics of XI and XII standard maths syllabus

The data is taken from students mark and opinion of corresponding course teacher. Table 1.

[1]Corresponding author

Table 1: Initial Raw data matrix of order 5 × 5

	X_1	X_2	X_3	X_4	X_5
Mech	20	23	30	10	15
Civil	15	16	20	10	12
ECE	5	6	9	2	2
EEE	8	7	9	5	5
Aero	2	1	1	0	1

Divide each element by the sum of the corresponding column then we get the following ATD matrix. Table 2.

Table 2: Average Time Dependent matrix (ATD) for 5×5

	X_1	X_2	X_3	X_4	X_5
Mech	0.4	0.43	0.43	0.37	0.43
Civil	0.3	0.3	0.29	0.37	0.34
ECE	0.1	0.11	0.13	0.07	0.06
EEE	0.16	0.13	0.13	0.19	0.14
Aero	0.04	0.02	0.01	0	0.03

Using the formula $Average = \frac{\sum x}{n}$ and $SD = \frac{\sum \left(x - \bar{x}\right)^2}{n}$ we get the following table.

Table 3: Average and Standard deviation of ATD matrix

Average	0.2	0.148	0.198	0.2	0.2
SD	0.15	0.16	0.16	0.17	0.18

Using the following formula and taking α = 0.25, 0.5, 0.75 and 0.9 we get the different RTD matrices (graph 1, 2, 3, 4, 5 & 6)

$$if \quad a_{ij} \le \left(\mu_j - \alpha * \sigma_j\right) \quad then \; e_{ij} = -1$$

$$else$$

$$if \quad a_{ij} \in \left(\mu_j - \alpha * \sigma_j,\ \mu_j - \alpha * \sigma_j\right)$$

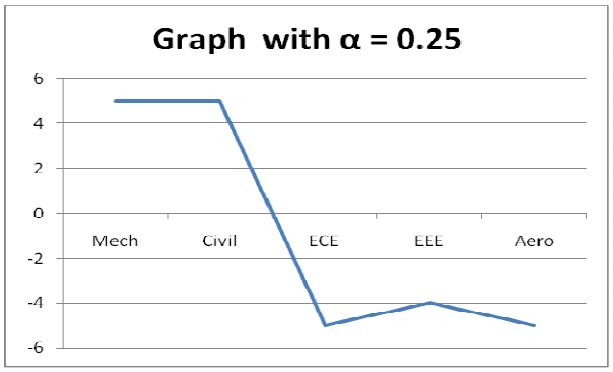
$$then \; e_{ij} = 0$$

$$else$$

$$if \quad a_{ij} \ge \left(\mu_j + \alpha * \sigma_j\right) \quad then \; e_{ij} = 1$$

RTD for α = 0.25

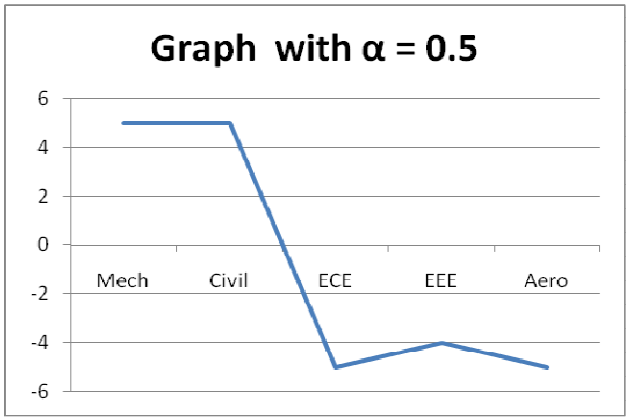
$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 & -1 \\ -1 & -1 & -1 & 0 & -1 \\ -1 & -1 & -1 & -1 & -1 \end{bmatrix} \qquad Row\,sum \begin{bmatrix} 5 \\ 5 \\ -5 \\ -4 \\ -5 \end{bmatrix}$$



Graph 1: Depicting the impact of prerequisite subject knowledge α = 0.25

RTD for α = 0.5

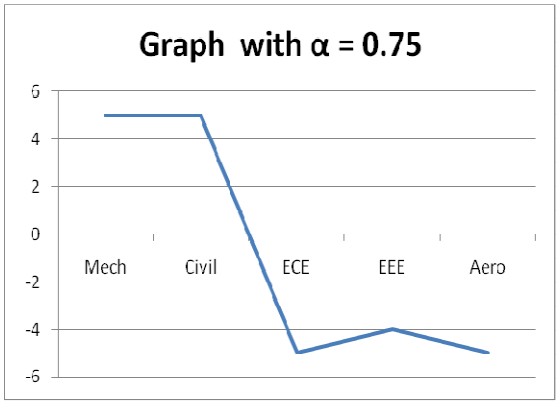
$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ -1 & -1 & 0 & -1 & -1 \\ 0 & 0 & 0 & 0 & 0 \\ -1 & -1 & -1 & -1 & -1 \end{bmatrix} \qquad Row\,sum \begin{bmatrix} 5 \\ 5 \\ -4 \\ 0 \\ -5 \end{bmatrix}$$



Graph 2: Depicting the impact of prerequisite subject knowledge α = 0.5

RTD for α = 0.75

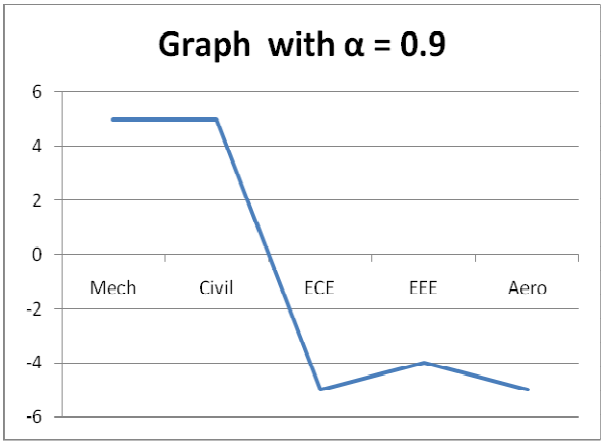
$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & -1 & -1 \\ 0 & 0 & 0 & 0 & 0 \\ -1 & -1 & -1 & -1 & -1 \end{bmatrix} \quad \begin{matrix} \textit{Row sum} \\ \begin{bmatrix} 5 \\ 2 \\ -2 \\ 0 \\ -5 \end{bmatrix} \end{matrix}$$



Graph 3: Depicting the impact of prerequisite subject knowledge α = 0.75

RTD for α = 0.9

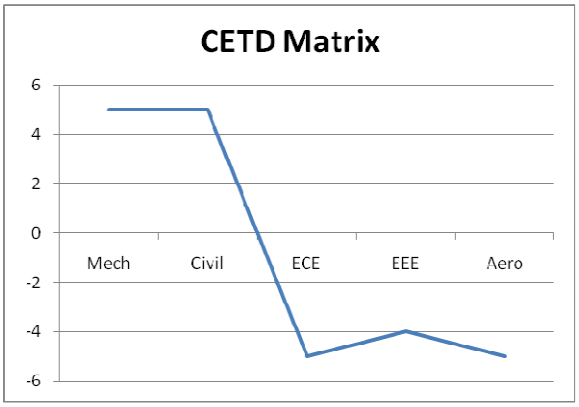
$$\begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ -1 & -1 & -1 & -1 & -1 \end{bmatrix} \quad \begin{matrix} \textit{Row sum} \\ \begin{bmatrix} 5 \\ 1 \\ 0 \\ 0 \\ -5 \end{bmatrix} \end{matrix}$$



Graph 4: Depicting the impact of prerequisite subject knowledge α = 0.9

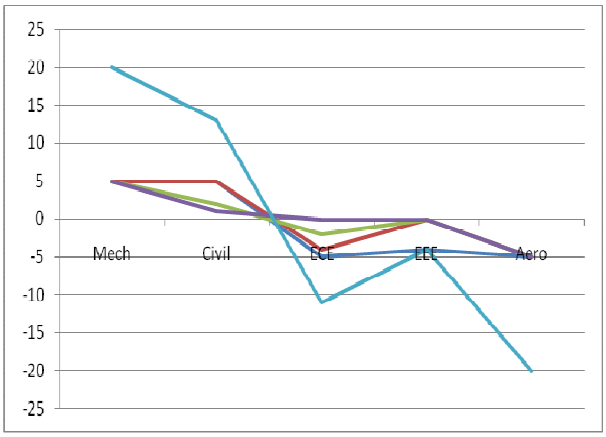
Combined Effective Time Dependent Data matrix (CETD)

$$\begin{bmatrix} 4 & 4 & 4 & 4 & 4 \\ 2 & 2 & 2 & 4 & 3 \\ -2 & -2 & -1 & -3 & -3 \\ -1 & -1 & -1 & 0 & -1 \\ -4 & -4 & -4 & -4 & -4 \end{bmatrix} \quad \begin{matrix} \textit{Row sum} \\ \begin{bmatrix} 20 \\ 13 \\ -11 \\ -4 \\ -20 \end{bmatrix} \end{matrix}$$



Graph 5: CETD Matrix

Combined RTD and CETD Matrix



Graph 6: Combined RTD and CETD

I. CONCLUSION

From the above graph it is observed that the current batch mechanical and civil Engineering students are affected by lack of prerequisite subject knowledge compared to other department students.

REFERENCES

Klir G.J. and Folger N.J. 1998. T.A. Fuzzy SetsUncertainty and Information, Prentice Hall Englewood, Cliffs.

Vasantha Kandasamy W.B., Florentin S. and Ilanthenral K., 2007. Elementary Fuzzy Matrix Theory and Fuzzy Models for Social Scientistis. Published by Automaton. Los Angeles. USA.

Vasantha Kandasamy W.B. and Florentin S., 2004. Analysis of Social Aspects of Migrant Labourers Living with HIV /AIDS using Fuzzy theory and Neutrosophic Cognitive Maps with Special Reference to Rural Tamilnadu in India.Published by Xiquan, Phoenix, USA.

Wickens C.D. and Hollands J., 1999. Engineering and Psychology and human performance, Colombus, Tornoto London, Sydney; Longman 573.