RAGHU ENGINEERING COLLEGE

AUTONOMOUS

(Approved by AICTE, New Delhi, & Permanently Affiliated to JNTU-GV, Vizianagaram)

NBA & NAAC A+ grade Accredited institute

Dakamarri, Bheemili Mandal, Visakhapatnam Dist. – 531 162 (A.P.)

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INSTITUTE VISION

Envisioning to be a world class technical institution by synergizing quality education with ethical values.

INSTITUTE MISSION

- ➢ To encourage training and research in cutting-edge technologies.
- ➢ To develop and strengthen strategic links with the industry.
- ➢ To kindle the zeal among the students and promote their quest for academic excellence.
- ➢ To encourage extra-curricular activities along with good communication skills.

QUALITY POLICY

- ➢ Contributing to the academic standing and overall knowledge development of the students.
- ➢ Inculcating moral and ethical values among the students and staff.
- ➢ Ensuring continual improvement of Quality Management System

Department of Mathematics

VISION

The Department of Mathematics has a vision of developing an intellectually vigorous community of students and faculty, together with engaging in research, teaching, and learning that advance knowledge in diverse areas of mathematics and support current progress in science and technology and become a center of excellence in mathematics and computing.

MISSION

- M1: To discover, mentor, and nurture mathematically inclined students and provide them with a supportive environment that fosters intellectual growth and a strong foundation in engineering sciences.
- M2: To create among students the curiosity, the desire, and the ability to keep learning activities throughout their life.
- M3: To impart science-based engineering education to develop professional skills that will prepare the students for immediate employment in the relevant branch of engineering in industry, as against the model that prepares them for post-graduate education.

PROGRAMME EDUCTIONAL OBJECTIVES(PEOs)

- PEO 1: Graduates will be able to use mathematical techniques, such as optimization methods and numerical analysis, to solve complex civil engineering problems.

- PEO 2: Graduates will be able to effectively use computational tools, such as MATLAB, Python, and Excel, to analyze and solve mathematical problems in civil engineering.

- PEO 3: Probability and Risk Assessment: Graduates will be able to apply probability concepts and statistical methods to assess and manage risks in civil engineering projects.

MAPPING OF MISSION STATEMENTS WITH PEOs

MS/PEO	PEO 1	PEO 2	PEO 3
MS 1	1	2	2
MS 2	1	3	2
MS 3	1	2	3

1-Slight ,**2**- Moderate, **3**- Substatial

PROGRAM OUTCOMES

Graduates of Civil Engineering will:

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

	PROGRAM SPECIFIC OUTCOMES (PSOs)

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PSO 1: Analyze, design and execute the civil engineering structures with good knowledge in engineering, mathematics & basic sciences.

PSO 2: Follow the economic, environmental and safety factors involved in the construction industry.

Mapping of PEOs with POs and PSOs

PEO/PO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2
PEO 1	3	3	3	2	3	2	2	2	3	3	3	3	3	3
PEO 2	3	3	3	2	3	2	2	1	3	3	3	3	3	2
PEO 3	3	3	3	3	3	1	1	1	2	3	2	3	3	2

1-Slight **, 2-** Moderate**, 3-** Substatial

23BS106 – Numerical and Statistical Methods							
Numerical and Statistical Methods							
Programme &Branch	**B.Tech.& Civil**	**Sem**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**23BS101- LA & C** **23BS102 - DE & VC**	**3**	**HSS**	**3**	**0**	**0**	**3**

Course Objectives :

1. To elucidate the different numerical methods to solve nonlinear algebraic equations
2. To disseminate the use of different numerical techniques for carrying out numerical integration.

3. To familiarize the students with the foundations of probability and statistical methods.
4. To equip the students to solve application problems in their disciplines.

Preamble :	Basic algebraic Equations, Probability, random variables (discrete and continuous) and probability distributions.

Course Contents:

Unit-1	Solution of Algebraic & Transcendental Equations	Contact Hours: 9

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method System of Algebraic equations: Gauss Elimination, Jacoby and Gauss Seidal method.

Unit-2	Interpolation	Contact Hours: 9

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

Unit-3	Solution of Initial value problems to Ordinary differential equations.	Contact Hours: 9

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

Unit-4	Estimation and Testing of hypothesis, large sample tests	Contact Hours: 9

Review concepts-Normal Distribution – t & F- distribution (not for examination)

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.

Unit-5	**Small sample tests**	Contact Hours: 9

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

	Total Hours: 45

Text Books:

1	S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2	B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
3	Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.India.

Reference Books:

1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.
2	R.K.Jain and S.R.K.Iyengar,Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5th Edition(9th reprint).
3	Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, PNIE

Web References :

1	https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2	https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3	http://nptel.ac.in/courses/111105090

COURSE OUTCOMES:	**BT Mapped**
Upon completion of the course, students shall have ability to	(Highest Level)

CO 1	Apply numerical methods to solve algebraic and transcendental equations	L2, L3
CO 2	Derive interpolating polynomials using interpolation formulae	L3, L5
CO 3	Solve differential and integral equations numerically	L3
CO 4	To identify real life problems into Mathematical Models.	L2, L3
CO 5	To apply the probability theory and testing of hypothesis in the field of civil engineering Applications.	L3, L5

Mapping of Cos with POs and PSOs

COs/POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO 1	2	2	1	-	-	-	-	1	1	-	-	1	-	-
CO 2	2	2	1	-	-	-	-	1	1	-	-	1	-	-
CO 3	3	2	1	-	-	-	-	1	1	-	-	1	-	-
CO 4	2	2	1	-	-	-	-	1	1	-	-	1	-	-
CO 5	2	2	1	-	-	-	-	1	1	-	-	1	-	-

1 – Slight,   2 – Moderate,   3 – Substantial,   BT- Bloom's Taxonomy

ASSESSMENT PATERN - THEORY							
TEST	Remembering (K1)%	Understanding (K2)%	Applying (K3)%	Analyzing (K4)%	Evaluating (K5)%	Creating (K6)%	Total%
MID-1	6	9	85				100
MID-2	6	9	85				100
SEE	10	10	80				100
*± 3% may be varied							