PSN COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)
Melathediyoor, Tirunelveli – 627152

DEPARTMENT OF SCIENCE AND HUMANITIES

COURSE PLAN

(Regulation 2022)

Version: 1 **(ODD SEM)** **Academic year: 2024-2025**

Subject Name & Code	**NUMERICAL METHODS AND STATISTICS & IC630017**
Course Type	Institutional Core
Programme	B.E (MAE)
Year/Semester/Section	II/III
Nature of Course/Credit	Theory / 3
Course Coordinator	**Mr. A. Santhana Mahalingam**

Institute Vision & Mission

Institution Vision	Emerge as a pioneer institute inculcating engineering education and skills, research, values and ethics.	
Institution Mission	**IM-1**	To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices.
	IM-2	To develop the infrastructure to meet the demands of technological revolution.
	IM-3	To improve and foster research in all dimensions for betterment of society.
	IM-4	To develop individual competencies to enhance employability and entrepreneurship in students.
	IM-5	To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace.

Department Vision & Mission

Department Vision	To originate the department into a centralized learning, teaching and research domain to produce proficient Mechanical and Automation Engineers encapsulated with entrepreneurship skill to compete the modernized automation Industries with their technical knowledge.	
Department Mission	**DM-1**	To develop the student's technical skill to the excel level of Mechanical and Automation engineers by offering standard engineering education by means of excellent teaching methodologies and creating professionalism with their learning's
	DM-2	To strengthen the student capability of extracting knowledge and prepare them to compete the current scenario in Automated Industries and Research.
	DM-3	To amalgamate the technically enriched student to the stream line of Human values, ethics, communication skills, lifelong learning throughout the life and to work as a teamwork as well as individual.

1. **Pre-requisite (if any):**
2. **Course Description: (not exceeding 100 words)**

- Applied in the fields like heat conduction, communication system etc.
- The course will also serve as a prerequisite for post graduate and specialized studies and research.

3. **Career Opportunities: (one or two)**
4. **Syllabus**

NUMERICAL METHODS AND STATISTICS	L T P C
	4 0 0 4

AIM: Expose the students to understand the basic concepts of numerical methods for solving problems, mastering of methodological approaches of numerical calculation development.

OBJECTIVES:
With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems that occur in engineering numerically.

OUTCOMES:
On successful completion on this course the student will be able to

S.No.	COs	Blooms level
1	Find the values of the variables using iterative methods.	K2
2	Know the method of finding numerical solution for differential equation by initial value problems.	K1
3	Know the method of finding numerical solution for differential equation by final value problems.	K1
4	Solve the physical problems by small and large sampling theory.	K3
5	Understand the method of analysis of variance to solve real world problem	K2

UNIT I: SOLUTION OF EQUATION AND EIGNVALUE PROBLEM Solution of linear system of equation – Bijection method – fixed point Iteration method – Newton Raphson Method – Ragula Falsi method – Decomposition Method – Gauss Elimination Method – Gauss Jordan Method – Gauss Jacobi Method –Finding largest eigen value- Inverse of matrix by Jordan Method.	**9**
UNIT II: INTERPOLATION AND APPROXIMATING POLYNOMIALS Lagrangian polynomials – Divided difference formulae for equal intervals and unequal intervals – Interpolating with a cubic spline – Newton's forward and backward difference formulas – Stirlings formula.	**9**

UNIT III: NUMERICAL DIFFERENTIATION AND INTEGRATION Differentiation using interpolation formulae – Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rule – Romberg's Method – Double integrals using trapezoidal and Simpson's rules.	**9**
UNIT IV: THEORY OF ESTIMATION Estimation: Point and Interval estimates for population parameters of large sample and small samples, determining the sample size.	**9**
UNIT V: TESTING OF HYPOTHESIS Sampling distributions – Testing of hypothesis for mean – variance –proportions and differences using Normal–'t'–Chi-square and F-distributions–Tests for independence of distributions of attributes and goodness of fit.	**9**
Total: 45 Periods	

TEXT BOOKS:

1. M.K. JAIN, S.R.K. IYENGAR and R.K. JAIN "Numerical methods: for scientific and engineering computation" 2013. 6th ed.,

2. DEVORE, J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning , New Delhi, 8th Edition, 2014.

3. S.C. GUPTA AND V.K. KAPOOR "*Fundamentals of mathematical statistics*" Elevanth thoroughly revised ed., Sultan Chand & Sons educational publishers, New Delhi (June 2003)

4. T. VEERARAJAN, "*Probability, Statistics and Random Processes"* Tata McGraw-Hill Publishing Company Limited, New Delhi(2006)

REFERENCES:

1. SANKARARAO.K " Numerical Methods for Scientists and Engineers" -3rd edition Printice Hall of India Private Ltd. New Delhi-(2007).

2. WALPOLE, R.E., MYERS, R.H., MYERS, S.L. and YE. K., "Probability and Statistics For Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010

3. Dr. Singaravelu, " Numerical Methods" 19th Edition, Meenakshi Agency, Chennai (Dec 2012)

5. **Course Outcome (COs): CO1…..CO5 (should follow Bloom's taxonomy)**
   After successful completion of the course, the students should be able to

CO's	CO - STATEMENTS	Blooms level	PO's
CO 1	Compute the solutions of the variables using iterative methods.	K2	1,2,3,4,5,11
CO 2	Understand and apply methods to find interpolating and approximating polynomials.	K1	1,2,3,4,5,6
CO 3	Solve complicated differentiation and integration by numerical methods.	K1	1,2,3,4,5,11

CO 4	Identify the type of estimations for small samples and large samples	K3	1,2,3,4,5,6
CO 5	Solve the physical problems by small and large sampling theory	K2	1,2,3,4,5

6. **Instructional Learning outcomes (unit wise/assignments/tutorials)**

Unit	Assessment Procedure
I	The outcome will be assess through Assignment – 1, Class Test – 1 and CAT-I.
II	The outcome will be assess through Assignment – 2, Class Test – 2, CAT-I and CAT –II.
III	The outcome will be assess through Assignment-3, Class test -3, CAT-II
IV	The outcome will be assess through Assignment-4, Class test -4, CAT-III
V	The outcome will be assess through Assignment-5, Class test -5, CAT-III

7. **Program Educational Objectives (PEOs) (max. 4)**

S. No	Topic	PEOs
PEO1	**Fundamental Knowledge**	To impart Knowledge on the fundamental principles of mathematics, science, and sub-disciplines in the field of Engineering
PEO2	**Career Development**	To make them undergo industrial training, and Professional development courses inculcating the habit of perceptual learning for career development.
PEO3	**Social Identity**	To develop effective communication skills and make them socially responsible to work cooperatively in all environments.

8. **Program Outcomes (POs) (12 attributes)**

PO's No	KNOWLEDGE	STATEMENTS
1	Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem Analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
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.
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.

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.
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.
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.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

9. **Program Specific Outcomes (PSOs) (max.3)**

PSO1	Ability to apply the knowledge of Mathematics, Sciences and Engineering Fundamentals to formulate, analyze and provide solutions to the problems related to Engineering and Communicating them effectively.
PSO2	Development of skill to deal with complex problems in the field of Engineering to achieve design solutions with modern technological approach and application software.

10. **CO ,PO and PSO mapping (3 point scale)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2						1	
CO2	2	2	1	1	1	2						
CO3	2	1	2	2	2							
CO4	1	1	1	1							1	
CO5	2	2	2	1	2						1	

1- Low 2- Medium 3- High

11. **Text Book s & Reference Books**

S.No.	Name of the Book	Author/Publisher/Year/Edition	Text Book/Reference Book
1	Numerical Methods for Scientific & Engineering Computation	M.K. JAIN, S.R.K. IYENGAR and R.K. JAIN. New age international publish., sixth edition 2013.	Text Book
2	Probability and Statistics for Engineering and the Sciences	DEVORE, J.L,Cengage Learning, 8th Edition, 2014	Text Book
3	Fundamentals of mathematical statistics	S.C. GUPTA AND V.K. KAPOOR Elevanth thoroughly revised ed., Sultan Chand & Sons educational publishers, New Delhi (June 2003)	Text Book
4	Probability, Statistics and Random Processes	T. VEERARAJAN,Tata McGraw-Hill Publishing Company Limited, New Delhi(2006)	Text Book
5	Numerical Methods for Scientists and Engineers	SANKARARAO.K -3rd edition Printice Hall of India Private Ltd. New Delhi-(2007).	Reference Book
6	Probability and Statistics For Engineers and Scientists	WALPOLE, R.E., MYERS, R.H., MYERS, S.L. and YE. K., 9th Edition, Pearson Education, Asia, 2010	Reference Book
7	Numerical Methods	Dr. A. Singaravelu, 19th Edition, meenakshi agency, Chennai (Dec 2012)	Reference Book

12. **Web Resources**:

Sl. No	Topic	Web link
1.	Boundary Value Problems for Functional Differential Equations	https://www.worldscientific.com/worldscibooks/10.1142/2884

13. **E – learning videos/NPTEL/ SWAYAM and other universities related to syllabus:**

Video	https://www.youtube.com/watch?v=_VFLX7xJuqk
Lecture Notes	https://lecturenotes.in/subject/24/numerical-methods-nm

14. **Magazines & Journals (one or two)**

Magazine	https://digfir-published.macmillanusa.com/psbe4e/psbe4e_ch14_2.html
Journals	https://www.ahajournals.org/doi/full/10.1161/circulationaha.105.586461

15. **Lesson Plan & Content Delivery Methodologies**

S.No	Unit	Topic to be covered	Hours Needed	Mode of Teaching (BB/PPT/Others)	Text/ Ref. Book	Page No
1.	**I**	Solution of equation- Bijection method –Fixed point iteration: x=g(x) method.	2	BB	R3	1.1
2.		Newton's method – Regular falsi method	2	VIDEO	R3	1.19
3.		Solution of linear system by Gaussian elimination and Gauss-Jordon method.	2	Worksheet	R3	1.62
4.		Iterative method -Gauss-Seidel method -	2	BB	R3	1.93
5.		Inverse of a matrix by Gauss Jordan method.	1	Open book test	R3	1.118
6	**II**	Lagrangian polynomials – Divided difference formulae for equal intervals	2	BB	R3	2.1
7		Lagrangian polynomials – Divided difference formulae for unequal intervals	2	BB	R3	2.16
8		Interpolating with a cubic spline	2	BB	R3	2.41
9		Newton's forward and backward difference formulas	2	Flipped Classroom	R3	2.74
10		Stirlings formula	1	BB	R3	2.90
11	**III**	Differentiation using interpolation formulae	2	Peer learning groups	R3	3.1
12		Numerical integration by trapezoidal	2	PPT	R3	3.32
13		Simpson's 1/3 and 3/8 rule	2	Guest Lecture	R3	3.37
14		Romberg's Method	1	BB	R3	3.52
15		Double integrals using trapezoidal	1	BB	R3	3.82
16		Double integrals using Simpson's rules	1	BB	R3	3.93
17	**IV**	Estimation:Point	2	Peer learning groups	T2	240
18		Estimation:Interval	2	PPT	T2	241
19		Point and Interval estimates for population parameters of large sample	2	Guest Lecture	T2	276
20		Point and Interval estimates for population parameters of small sample	2	BB	T2	285

21		Determining the sample size	1	BB	T2	294
22	**V**	Sampling distributions – Testing of hypothesis for mean	2	BB	T4	1.1
23		Sampling distributions – Testing of hypothesis for variance	2	MOOCs	T4	1.28
24		Proportions and differences using Normal–'t'–Chi-square	2	BB	T4	1.75
25		Tests for independence of distributions of attributes and goodness of fit	2	Google classroom	T4	1.137
26		Proportions and differences using F-distributions	1	BB	T4	1.106

Total Hours Needed = 45 Hours

16. **CLASS TIME TABLE**

(Enclosed separately)

17. COURSE TIME TABLE

(Enclosed separately)

18. Content Delivery Methodology:

Activity-based learning, BB, WorkSheets, Peer learning groups, VIDEO, PPT, Open Book Test, Guest Lecture, Flipped Classroom,MOOCs, Google Classroom

19. Assignments (Listed separately)

20. Assignment Rubrics:

Quality	Marks
Submission on Date	2
Understanding	3
Solving skill/ Presentation	3
End results with correct units conversions / Conclusion	2

21 **Mapping of CO to Assignment:**

CO's	CO – STATEMENTS	A1	A2	A3	A4	A5
CO1	Find the values of the variables using iterative methods.	2				
CO2	Know the method of finding numerical solution for differential equation by initial value problems.		2			
CO3	Know the method of finding numerical solution for differential equation by final value problems.			2		
CO4	Solve the physical problems by small and large sampling theory.				2	

CO5	Understand the method of analysis of variance to solve real world problem					2

22 **Assessment Methodologies**:

Assessment Tool		**Description**
CONTINIOUS ASSESSMENT	**40%**	CAT – I(8marks), CAT – II(8marks), CAT –III(4marks) will be considered for 20 marks, class test- 5marks, MCQ 10 marks, Assignments-5 marks,
End semester Examination	**60%**	End semester Examination for 100 marks Converted to 60marks
Course End Survey		At the end of the Course, will be evaluated

23. Distribution of portions for assessment tests

Assessments		**Portion**	**% of weight age**
CONTINUOUS ASSESSMENT	CAT – I	Unit-I & Unit-II	50
	CAT – II	Unit-III& Unit - IV	
	CAT-III	Unit-V	
	Class test(5)	Unit – I to Unit - V	12.5
	Assignments (5)	Unit – I to Unit - V	12.5
	MCQ	Unit – I to Unit - V	25
End Semester		Unit - 1 to 5	100

24. Mark Allotment for CO Assessment:

COs	**CAT - I**	**CAT - II**	**CAT-III**	**Assignment**	**Class test**	**MCQ**	**End Semester**
CO1	25			10	26	6	100
CO2	25			10	26	6	
CO3		25		10	26	6	
CO4		25		10	26	6	
CO5			50	10	26	6	
Marks Converted to	20(4*5)			5	5	10	60

25. Course Review & Closure Report

No. of hours prescribed for the course	45 hrs
No. of hours required or spent for the covering additional topics	0 hrs
No. of hours required to cover Assignments / Tests	0 hrs
No. of hours required for tutorials	15 hrs
No. of hours to revise the course content	5 hrs
No. of hours for any other activities related to the course	0
Total hours required for course	65 hrs

Course Coordinator **HOD** **Dean(academic)** **Principal**