

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT. / CENTRE: **Mathematics Department**

1. Subject Code: **IMA-301** Course Title: **Advanced Engineering Mathematics**

2. Contact Hours: **L: 3 T: 0 P: 0**

3. Examination Duration (Hrs.): **Theory** **Practical**

4. Relative Weightage: **CWS** **PRS** **MTE** **ETE** **PRE**

5. Credits: 6. Semester: **Both** 7. Subject Area: **OEC**

8. Pre-requisite: **None**

9. Objective: To impart knowledge of essential mathematical tools of complex variables, partial differential equations and calculus of variations to engineering students.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Functions of a Complex Variable: Analytic functions, conjugate harmonic functions, applications to the problems of potential flow.	6
2.	Conformal Mapping: Bilinear transformations, Schwartz-Christoffel transformations and their applications to engineering problems.	6
3.	Complex Integration: Line integrals, Cauchy integral theorem, Taylor's and Laurent's expansions, zeros and singularities, Cauchy residue theorem, contour integration and its applications.	10
4.	Partial Differential Equations: Solution of first order quasi linear equations, four standard forms of PDE, solution of first order non-linear PDE using Charpit's method, solution of linear equations with constant coefficients, classification of second order PDE, solution of one dimensional wave and diffusion equations, Laplace equation in 2 and 3 dimensions.	12
5.	Calculus of Variations: Functionals, Euler's equations for one and several variables, isoperimetric problems, sufficient conditions for weak and strong maxima and minima, applications.	8
	Total	42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Brown, J. A. and Churchill, R. V., Complex Variables and Applications , 6 th Edition, Mc Graw Hill.	1996
2.	Prasad, C., Advanced Mathematics For Engineers , Prasad Mudralaya.	1991
3.	Grewal, B. S., Higher Engineering Mathematics , Khanna Publishers.	2005
4.	Kreyszig, Erwin, Au., Advanced Engineering Mathematics , 8 th Edition, John Wiley.	1999

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPTT./CENTRE: **Mathematics Department**

1. Subject Code: **IMA-302** Course Title: **Fuzzy Set Theory and Fuzzy Systems**

2. Contact Hours: **L: 3** **T: 0** **P: 0**

3. Examination Duration (Hrs.): **Theory** 3 **Practical** 0

4. Relative Weightage: **CWS** 25 **PRS** 00 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 3 6. Semester: **Both** 7. Subject Area: **OEC**

8. Pre,quisite: **Nil**

9. Objective: To introduce concepts of fuzzy set theory and its applications in some areas.

S. No.	Contents	Contact Hours
1.	Fuzzy Sets: Concepts of crispness and fuzziness, crisp sets and fuzzy sets, α -cuts, convex fuzzy sets, operations on fuzzy sets, type-2 fuzzy sets, fuzzy numbers and extended operations on them, LR- representations of fuzzy sets and extended operations on them, t-norm and t-conorms, increasing and decreasing generators, interval equations, fuzzy equations.	17
2.	Fuzzy Relations and Fuzzy Graphs: Fuzzy relations on fuzzy sets, composition of fuzzy relations, fuzzy graphs.	5
3.	Fuzzy Analysis: Fuzzy fuctions and their extrema, integration of fuzzy functions, fuzzy differentiation.	5
4.	Fuzzy Logic and Approximate Reasoning: Fuzzy measures and measures of fuzziness, linguistic variables, fuzzy logic, truth tables, approximate reasoning in support logic programming.	5
5.	Expert Systems and Fuzzy Control: Expert systems, uncertainty modeling in expert systems, fuzzy control, pocess of fuzzy control.	5
6.	Decision Making in Fuzzy Environments: Fuzzy decisions, fuzzy linear programming problems, fuzzy transpotation problems, fuzzy dynamic programming, fuzzy multi-criteria analysis.	5
Total		42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Zimmermann, H. J., Fuzzy Set theory and its Applications , Allied Publishers Limited.	1996
2.	Klir, George J. and Folger, Tina A., Fuzzy Sets, Uncertainty and Information , Prentice Hall of India, Pvt. Ltd.	2003
3.	Klir, Geogrg J. and Bo Yuan, Fuzzy sets and Fuzzy Logic: Theory and Applications , Prentice Hall of India, Pvt. Ltd.	2003
4.	Ross, T.J., Fuzzy Logic with Engineering Aplications , 2 nd Edition, John Wiley & Sons Ltd.	2005
5.	Lai, Y and Hwang, C., Fuzzy Mathematical Programming , Springer - Verlag.	1992

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NAME OF DEPTT. / CENTRE: **Mathematics Department**

1. Subject Code: **IMA-303** Course Title: **Robotics & Control**

2. Contact Hours: **L: 3 T: 0 P: 0**

3. Examination Duration (Hrs.): **Theory** **Practical**

4. Relative Weightage: **CWS** **PRS** **MTE** **ETE** **PRE**

5. Credits: 6. Semester: **Both** 7. Subject Area: **OEC**

8. Pre-requisite: **Nil**

9. Objective: To impart the knowledge of basic principles of robot manipulators and their control.

10. Details of Course:

S. No.	Contents	Contact Hours
1.	Introduction: Robotics, Robot manipulators, simple two/three degrees of freedom model.	4
2.	Homogeneous Transformation: Co-ordinate frames, translation and rotation, change of frames, homogeneous transformation, composite homogeneous transformations, general axis of rotation.	6
3.	Kinematics: Link co-ordinate frames, kinematics parameters, the D-H representation, Arm equation.	10
4.	Inverse Kinematics: The inverse kinematics problem, tool configuration, Solution of inverse kinematics problem with examples, trajectory planning and work space analysis.	10
5.	Differential Relationships: Derivative of homogeneous transformation, velocity and acceleration of end-effector, manipulator, Jacobian, dynamical equations control of manipulator dynamics, robotic vision and control.	12
Total		42

11. Suggested Books:

S. No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Yoshikawa, Tsuneo, Au., Foundations of Robotics Analysis and Control , Prentice Hall.	1990
2.	Schilling, Robert J., Fundamentals of Robotics: Analysis and Control , Prentice Hall of India.	2005
3.	Ghosal, Ashitava, Robotics: Fundamental Concepts and Analysis , Oxford University Press.	2006
4.	Craig, John J., Introduction to Robotics Mechanics and Control , Pearson Education.	2004