

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
*(Formerly West Bengal University of Technology)*  
**Syllabus for M. Sc. In Human Computing & Artificial Intelligence**  
**(Effective for Academic Session 2019-2020)**

**Detailed Syllabus**  
**Semester I**

**Paper: ADVANCED ENGINEERING MATH**

**Code: AEM 101**

**Contacts Hours / Week: 4T**

**Credits: 4**

<b>Objectives</b>	
<p>Increase the student's appreciation of the basic role played by mathematics in modern technology. Incorporate the knowledge of advanced mathematics to support their concurrent and subsequent engineering studies</p>	
<b>Units</b>	<b>Course Content</b>
1	<p><b>LAPLACE TRANSFORM</b></p> <p>Definition, Properties, Laplace Transform of Derivatives and Integrals, Evaluation of integrals by Laplace Transform, Inverse Laplace Transform and its Properties, Convolution theorem(Statement only), Laplace Transform of Periodic Functions(Statement only) and Unit Step Function, Applications of Laplace Transform to solve Ordinary Differential Equations, Simultaneous Differential Equations, Integral Equations &amp; Integro-Differential Equations.</p>
2	<p><b>FOURIER SERIES &amp; FOURIER TRANSFORM</b></p> <p>Periodic Functions and their Fourier Expansions, Even and Odd functions, Change of interval, Half Range Expansions.</p> <p>Fourier Transform: Definition and Properties (excluding FFT), Fourier Integral Theorem, Relation with Laplace Transform, Applications of Fourier Transform to Solve Integral Equation.</p>
3	<p><b>Z-TRANSFORM</b></p> <p>Definition , Convergence of Z-transform and Properties, Inverse Z-transform by Partial Fraction Method, Residue Method (Inversion Integral Method) and Power Series Expansion, Convolution of two sequences. Solution of Difference Equation with Constant Coefficients by Z-transform method.</p> <p><b>FUNCTIONS OF COMPLEX VARIABLE</b></p> <p>Analytic Function, Cauchy- Riemann Conditions, Harmonic Functions (excluding orthogonal system), Milne-Thomson Method, Cauchy Integral Theorem &amp; Integral Formula (Statement only), Taylor's &amp; Laurent's series (Statement only), Zeros and Singularities of Analytic Function, Residue Theorem (Statement only), Contour Integration (Evaluation of real definite integral around unit circle and semi- circle).</p>

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4	<p>MATRICES</p> <p>Linear and Orthogonal Transformations, Linear dependence of vectors, Characteristics equation, Eigen values and Eigen vectors, Statement and Verification of Cayley-Hamilton Theorem [without proof], Reduction to Diagonal form, Reduction of Quadratic form to Canonical form by Orthogonal Transformation, Sylvester's theorem[without proof], Solution of Second Order Linear Differential Equations with Constant Coefficients by Matrix method. Largest Eigen value and Eigen vector by Iteration method.</p> <p>THEORY OF PROBABILITY</p> <p>Axioms of Probability, Conditional Probability, Baye's Rule, Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Mathematical Expectation, Variance, Standard Deviation, Moments, Moment generating function, Binomial, Poisson and Normal Distributions.</p>
<b>Reference Books</b>	
1. Advanced Engineering Mathematics, Chandrika Prasad, Khanna Publishing House	

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**Paper: ALGORITHM & LOGIC DESIGN**

**Code: ALD 102**

**Contacts Hours / Week: 4T**

**Credits: 4**

<b>Objectives</b>	
<p>Understand the theoretical backbone of computer science and are a must in the daily work of the successful programmer. The goal of this course is to provide a solid background in the design and analysis of the major classes of algorithms</p>	
<b>Units</b>	<b>Course Content</b>
1	<p>Arrays: single dimensional arrays, two dimensional arrays, multidimensional arrays, variable length arrays. Array operations. Strings, single dimensional array of string, two dimensional array of string, operations in “string.h”. Structures: array of structures, passing structure to function, structure within structures. Unions, bit-fields, enumerations, sizeof, typedef.</p> <p>Introduction File handling, :-File structure, File handling function, File types, Streams, Text, Binary, File system basics, The file pointer, Opening a file, Closing a file, Writing a character, Reading a character, Using fopen(), getc(), putc(), and fclose(), Using feof(). Using fread() and fwrite(), Direct access file, fseek() and random access I/O, fprintf() and fscanf(), getting file name as Command line arguments.</p>
2	<p>Pointers: pointers operators, pointer arithmetic, Pointers and function, Array of pointers, Pointer and Strings, Pointer to structure, Pointers within structure, Introduction of Static and Dynamic memory allocation, The process of Dynamic memory allocation, DMA functions Malloc() function, Sizeof() operator, Function free(), Function realloc()</p>
3	<p>Graphics: Graphics and Text mode, Video Adapter, Initialize Graphics Mode and resolution, header file graphics.h. Functions used In Graphics – Drawing a Point on Screen, Drawing – lines, rectangle, circles, arcs, polygon. Functions to fill colors. Display Text in Graphics mode, outtext(), outtextxy(), justifying text. Advanced Graphics : various functions used for moving of graphical objects viz moverel(), moveto(), putimage(), putpixel().</p>

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4	<p>Introduction to problem solving and programming : Basic model of computation, Notion of Algorithms, Principle of Mathematical Induction, Basics of functional programming, notion of types, Iterative versus recursive style, Correctness and efficiency issues in programming, time and space measures</p> <p>Introduction to problem solving and programming: Basics of imperative style programming, Assertions and loop invariants, Top down design and examples of step-wise refinement, Programming using structures, introduction to encapsulation and object oriented programming.</p>
<b>Refer Reference Books</b>	
<ol style="list-style-type: none"><li>1. The C Programming Language : Dennis Ritchie &amp; Brain Kernighan [Pearson] 2. Practical “C” Programming: Steve Oualline, O’Reilly Publications</li><li>2. Programming with C :K.R.Venugopal &amp; S. R.Prasad [TMH]</li><li>3. Problem Solving &amp; Programming in C, R.S. Salaria, Khanna Publishing House</li><li>4. How to solve it by Computer by R. J. Dromey, Prentice-Hall India EEE Series. Reference Books 4. The Complete Reference C ( 4th Edition) : Herbert Schildt [ TMH]</li></ol>	

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**Paper: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

**Code: ALD 103**

**Contacts Hours / Week: 3T**

**Credits: 4**

**Objectives**

To enable the students to:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

<b>Units</b>	<b>Course Content</b>
1	<p><b>Advanced Algorithms and Analysis</b></p> <p><b>Machine Learning Techniques</b></p> <p><b>Artificial Intelligence and Neural Networks</b></p> <p><b>Statistical Modelling for Computer Sciences</b></p> <p><b>Artificial Intelligence and Neural Networks Lab</b></p> <p><b>Machine Learning Lab</b></p> <p><b>Computational Intelligence</b></p>

**References**

1. Stewart Russell and Peter Norvig. " Artificial Intelligence-A Modern Approach ", 2nd Edition, Pearson Education/ Prentice Hall of India, 2004 References
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000. 2.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
4. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, 2018.

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**Paper: SOFT COMPUTING**

**Code: OSC 104**

**Contacts Hours / Week: 3T**

**Credits: 4**

<b>Objectives</b>	
Develop the skills to gain a basic understanding of <b>neural network</b> theory and fuzzy logic theory	
<b>Units</b>	<b>Course Content</b>
1	Fuzzy Logic: Crisp set and Fuzzy set, Basic concepts of fuzzy sets, membership functions. Basic operations on fuzzy sets, Properties of fuzzy sets, Fuzzy relations. Propositional logic and Predicate logic, fuzzy If – Then rules, fuzzy mapping rules and fuzzy implication functions, Applications.
2	Neural Networks: Basic concepts of neural networks, Neural network architectures, Learning methods, Architecture of a back propagation network, Applications.
3	Genetic Algorithms: Basic concepts of genetic algorithms, encoding, genetic modeling.
4	Hybrid Systems: Integration of neural networks, fuzzy logic and genetic algorithms.
<b>Reference Books</b>	
<ol style="list-style-type: none"> <li>1. 1 S. Rajasekaran and G.A.Vijaylakshmi Pai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.</li> <li>2. 2 K.H.Lee.. First Course on Fuzzy Theory and Applications, Springer-Verlag.</li> <li>3. 3 J. Yen and R. Langari.. Fuzzy Logic, Intelligence, Control and Information, Pearson Education.</li> </ol>	

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**Paper: PROGRAMMING USING PYTHON**

**Code: ALD 105**

**Contacts Hours / Week: 3T**

**Credits: 4**

<b>Objectives</b>	
To enable the students to:	
<ul style="list-style-type: none"> <li>• Understand basics of binary computation</li> <li>• Understand the programming basics (operations, control structures, data types, etc.)</li> <li>• Readily use the Python programming language</li> <li>• Apply various data types and control structure</li> <li>• Understand class inheritance and polymorphism</li> <li>• Understand the object-oriented program design and development</li> <li>• Understand and begin to implement code</li> </ul>	
<b>Units</b>	<b>Course Content</b>
1	<b>Python Basics</b> Introduction, your first program, type, expressions and variables, string operations, packages
2	<b>Python Data Structure</b> Lists and Truples, Sets, Directories
3	<b>Programming Fundamentals</b> Conditions and Branching, Loops, Functions, Object and Classes, Strings
4	<b>Python Database</b> Working with database
5	<b>Working with Data</b> Open/Reading/Writing files, Loading data with Pandas, Saving data with Pandas
<b>References</b>	
<ol style="list-style-type: none"> <li>1. Introduction to Programming in Python: An Interdisciplinary Approach, By Sedgewick, Wayne and Dondero</li> <li>2. An Introduction to Python, By Guido Van Rossum.</li> <li>3. Introduction to Computing and Problem Solving in Python, Jeeva Jose (Khanna)</li> <li>4. Taming Python by Programming, Jeeva Jose (Khanna)</li> <li>5. Programming in Python 3: A Complete Introduction to Python Language, By Mark Summerfield</li> </ol>	

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6. Core Python Programming, By Dr R Nageshwar Rao

**Practical**

**Paper: PRACTICAL AI USING SAS**

**Code: ALP 191**

**Contacts Hours / Week: 2P**

**Credits:2**

Units	Course Content
1	Introduction, machine learning techniques, deep learning techniques, natural language processing, forecasting and optimization techniques.

**Paper: Python Lab**

**Code: ALP 192**

**Contacts Hours / Week: 2P**

**Credits:2**

Units	Course Content
1	Introduction, your first program, type, expressions and variables, string operations, packages, Lists and Tuples, Sets, Directories, Conditions and Branching, Loops, Functions, Object and Classes, Strings, Open/Reading/Writing files, Loading data with Pandas, Saving data with Pandas