BANKURA UNIVERSITY

Curriculum and Credit Framework
for
COMPUTER SCIENCE
(Basic, Hons. and Hons. with Research)
w. e. f. Academic Year 2026 – 27

Semester – VII										
Sl No	**Course Code**	**Course Title**	**Credit**	**Marks**				**No of Hr**		
				IA	**ESE**		**Total**	**L**	**T**	**P**
1	CSC/701/MJC-17	Machine Learning	4	10	40	T: 40 L: 00	50	4	0	0
2	CSC/702/MJC-18	Compiler Design	4	10	40	T: 40 L: 00	50	4	0	0
3	CSC/703/MJC-19	Operations Research	4	10	40	T: 25 L: 15	50	3	0	2
4	CSC/704/MJC-20	8085 – Microprocessor	4	10	40	T: 25 L: 15	50	3	0	2
5	CSC/705/MN-07	Operations Research	4	10	40	T: 25 L: 15	50	3	0	2
Semester Total			Credit = 20		Marks = 250					

MJC – 17: Machine Learning
Credits: 4 (Theory = 04) L, T, P = 4, 0, 0

Learning Outcomes
After completion of the course a student will be successfully able to
- Explain core concepts of ML and data preprocessing.
- Apply regression and classification algorithms.
- Implement clustering and dimensionality reduction techniques.
- Evaluate models using statistical metrics.
- Develop small ML-based applications.

THEORY
Unit I: Introduction to ML
- Types of learning: Supervised, Unsupervised and Reinforcement Learning
- Applications,
- Data preprocessing,
- Cross-validation.

Unit II: Regression
- Linear regression,
- Gradient descent,
- Polynomial regression,
- Over-fitting and Under-fitting
- Regularization
- NOVA
- t-test
- Evaluation metrics.

Unit III: Classification
- Logistic regression,
- k-NN,
- Naive Bayes,
- Decision Tree,
- Random Forest,
- ROC curve.

Unit IV: Unsupervised Learning
- K-Means,
- Hierarchical clustering,
- PCA,
- Association rule mining.

Unit V: Neural Networks
- Perceptron,
- Activation functions,
- MLP, back propagation
- Bias-variance trade-off.
- Deep learning: Generative AI

Suggested Reference Books
1. Dr. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das – Machine Learning (Pearson India), 2018.
2. U. Dinesh Kumar & Manaranjan Pradhan – Machine Learning using Python (Wiley India), 2019.

Paper MJC – 18: Compiler Design
Credits: 4 (Theory = 04) L, T, P = 4, 0, 0

Learning Outcomes

After completion of the course a student will be successfully able to

- Understand compiler architecture and phases.
- Design lexical analyzers and parsers.
- Construct syntax trees and intermediate code.
- Apply semantic analysis and type checking.
- Implement basic compiler components.

THEORY

Unit I: Introduction

- Language processors,
- compiler phases,
- Bootstrapping.

Unit II: Lexical Analysis

- Tokens,
- Regular expressions,
- Finite automata,
- Lexical analyzer design.

Unit III: Syntax Analysis

- CFG,
- Parse trees,
- LL(1),
- Recursive descent,
- Shift-reduce,
- LR parsing (conceptual).

Unit IV: Semantic Analysis

- Symbol table,
- Type checking,
- Syntax-directed translation,
- Three address code.

Unit V: Code Optimization

- Basic blocks,
- Control flow graph,
- Peephole optimization,
- Loop optimization,
- Register allocation.

Suggested Reference Books

1. Aho, Lam, Sethi & Ullman – Compilers: Principles, Techniques and Tools (Pearson), 2023.
3. V. Raghavan – Principles of Compiler Design (Tata McGraw Hill India), 2017
4. Santanu Chattopadhyay – Compiler Design (PHI Learning India), 2005

Paper MJC – 19 & MN – 07: Operations Research

Credits: 4 (Theory = 03, Practical = 01) L, T, P = 3, 0, 2

Learning Outcomes

After completion of the course a student will be successfully able to

- Understand concepts and tools of Operations Research
- Understand mathematical models used in Operations Research
- Develop linear programming (LP) models for solving different real life problems
- Apply the techniques constructively to make effective business decisions

THEORY

Unit-I: Introduction to Operational Research (OR):

- Origin & Development,
- Different Phases of OR study,
- Methodology of OR,
- Scope and Limitations of OR,
- Applications of OR

Unit-II: Linear Programming:

- Linearly independent / dependent vectors,
- Basis,
- Convex sets,
- Extreme points.
- Graphical method.
- Simplex method,
- Artificial variable techniques - Two Phase Method; Charnes big – M Method,
- Special cases in LPP

Unit-III: Duality:

- Definition of the dual problem,
- Primal - dual relationships,
- Economic Interpretation of Duality,
- Dual simplex Method.

Unit-IV: Sensitivity analysis:

- Changes in cost and resource vector

Suggested Reference Books

1. G. Hadley: Linear Programming. Narosa, 2002 (reprint).
2. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research - Principles and Practice, John Wiley & Sons, 2005.
3. Hamdy A. Taha: Operations Research -An Introduction, Prentice Hall, 8th Edition,2008.
4. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research - Concepts and Cases, 9th Edition, Tata McGraw Hill. 2010.

LABORATORY

1. Solving Linear Programming Problem using Graphical Method
2. Solving LPP with simplex method.
3. Problem solving using Charnes big – M method.
4. Problem solving using Two Phase method.
5. Illustration of special cases in LPP using Simplex method
6. Unbounded solution, Infeasible solution, Alternative or multiple solution
7. Problems based on Dual simplex method.
8. Problems based on sensitivity analysis.

Paper MJC – 20: 8085 – Microprocessor
Credits: 4 (Theory = 03, Practical = 01) L, T, P = 3, 0, 2

Learning Outcomes
After successful completion of the Course a student will be able to:

- Understand and describe the functional blocks of Microprocessor.
- Demonstrate the internal architecture (Hardware model) as well as Programming model.
- Acquire insight of interfacing.
- Understand Assembly Language Programming.
- Perform different experimental works using Assembly Language.

THEORY

Unit-I: Microprocessor architecture:

- Internal architecture,
- System bus architecture,
- Memory and I/O interfaces
- Addressing Modes

Unit-II: Microprocessor programming:

- Register Organization,
- Instruction formats,
- Assembly language programming.

Unit-III: Interfacing:

- Memory address decoding,
- Cache memory and cache controllers,
- I/O interface,
- Keyboard,
- Display,
- Timer,
- Interrupt controller,
- DMA controller,
- Video controllers,
- Communication interfaces.

Unit-IV: Migration to 8086 - microprocessor

- Limitations of 8085 – microprocessor

Suggested Text Books:

1. Barry B. Brey: The Intel Microprocessors: Architecture, Programming and Interfacing (Pearson Education, Sixth Edition), 2009.
2. Ramesh Gaonkar: Microprocessor Architecture, Programming and Applications with the 8085 (Pernam), 2013.

LABORATORY
(Besides traditional Hardware Platform use of open source Simulators are also encouraged)

1. Write a program for 16-bit binary division and multiplication
2. Write a program for 16-bit BCD addition and subtraction
3. Write a program for linear search and binary search.
4. Write a program to add and subtract two arrays
5. Write a program for binary to ASCII conversion
6. Write a program for ASCII to binary conversion
7. Write a program for HCF and LCM of two given integers.
8. Write a program for Bubble sort of an array of numbers.
9. Write a program to add two numbers from an array and complement the result