WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Computer Science and Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus for
Honors Degree in
Data Science

S.Y. B. Tech. Computer Science and Engineering W.E.F. 2023-24

Computer Science and Engineering Department

Department Vision

To produce globally competent engineers in Computer Science & Engineering with ethical values and research aptitude,who will address the challenges of modernization in the IT industry and aim at overall sustainable development of the society.

Department Mission

- **M1** - To impart quality education in the field of Computer Science & Engineering in accordance with the needs of the Modernization & Globalization through technology-enabled education.
- **M2 -** To inculcate lifelong learning in students to face challenges posed by ever-changing IT career landscape as a disciplined professional with a sense of professional ethics.
- **M3** - To develop critical thinking and creativity for identifying various societal issues and to provide solutions.
- **M4** - To enhance career opportunities for students through academia-industry interaction and research.

Computer Science & Engineering Department
Under Graduate Programme
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in the field of Computer Science & Engineering to pursue a successful professional career, higher studies and research.
2. Graduates will exhibit capabilities to understand and resolve various societal issues through their problem solving skills.
3. Graduates will be sensitive to ethical, societal and environmental issues as a software engineering professional and be committed to life-long learning.

Program Outcomes (POs)

The program outcomes of B. Tech. Computer Science & Engineering Programme are summarized as follows:

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, review 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.

Program Specific Outcomes (PSOs)

Engineering graduate in Computer Science & Engineering Programme will be able to do-

1. Apply the principles of computational mathematics, computer systems and programming paradigms to solve computational problems.

2. Design and develop application software with functionalities applicable for desktop, web and mobile applications with due consideration of system software constraints.

3. Apply software engineering methods, cutting edge technologies, and ICT using appropriate tools and FOSS alternatives for designing, developing & testing application software.

Legends used–

L	Lecture Hours / week
T	Tutorial Hours / week
P	PracticalHours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format for Honors:

2	1	E	T	U/P	2	H	A	C	C	1	T/L
Year of Syllabus revision	Program Code			U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Honors Code	Course Code			Course Serial No. 1-9	T-Theory, L-Lab session

Program Code	
CS	Computer Science and Engineering
Honors Code	
HD	Honors in Data Science

Sample Course Code:

21CSU4HD1T	Mathematics for Data Science

Walchand Institute of Technology, Solapur
Computer Science and Engineering
Honors in Data Science

Structure of S. Y. B. Tech. Computer Science and Engineering
(W.E.F. 2023-2024)

Semester- IV

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA			
		L	T	P		ESE	ISE	ICA	Total
22CSU4HD1T	Mathematics for Data Science	3			3	60	40		100
22CSU4HD1A	Mathematics for Data Science		1		1			25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur

Honors Degree in Data Science

S.Y. B. Tech. (Computer Science and Engineering), Semester - IV

22CSU4HD1T: MATHEMATICS FOR DATA SCIENCE

Teaching Scheme	Examination Scheme
Lecture: 3 Hours /Week, 3 Credits	ESE – 60 Marks
Tutorial:1 Hours /Week, 1 Credits	ISE – 40 Marks
	ICA -25 Marks

Introduction:

Data science is a field of study and application that has been growing rapidly for the past several decades. As a growing field, it is gaining a lot of attention in both the media as well as in the jobmarket. This course introduces the fundamentals of mathematics which are used by data scientists to solve the real time problems.

Prerequisite: Basics of Linear algebra, Probability, Statistics

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COURSE OUTCOMES:

Students will be able to:

1. Use the properties of Linear Maps in solving problems on Linear Algebra.
2. Build a strong statistical foundation and learn how to 'infer' insights from a huge population using asmall sample.
3. Demonstrate various random variables, discrete and continuous distributions and their usage.
4. Use optimization techniques and formulate hypotheses for a population to solve real-life business problems.

SECTION-I

Unit 1–Basics of Data Science: **(04)**

Introduction to data science, Typology of problems; Importance of linear algebra, statistics and optimization from a data science perspective, Structured thinking for solving data science problems.

Unit 2–Linear Algebra   **(10)**

Vectors, Matrices and their properties (determinants, traces, rank, nullity, etc.); Eigen values and eigenvectors; Matrix factorizations; Inner products; Distance measures; Projections; Notion of hyper planes; half-planes.

Unit 3- Statistics   **(08)**

Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson's Paradox, Correlation &causation.

SECTION-II

Unit 4 – Probability   **(08)**

Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables Continuous Distributions, The Normal Distribution and the Central Limit Theorem.

Unit 5- Hypothesis and Inference (06)

Statistical Hypothesis Testing, Confidence Intervals, P- hacking, Bayesian Inference

Unit 6: Optimization (08)

Unconstraint optimization, necessary and sufficiency conditions for optima, gradient descent methods, constraint optimization, KKT condition, Introduction to non-gradient techniques, Introduction to least squares optimization,Optimization view of machine learning,

Internal Continuous Assessment (ICA):

ICA should consist of Solving 8- 10 assignments on the above units.

Text Books :

1. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly Media
2. David G. Luenberger (1969), Optimization by Vector Space
   Methods, John Wiley & Sons(NY).
3. G. Strang (2016). Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth
   edition, USA.

Reference Books:

1. Bendat, J. S. and A. G. Piersol (2010). Random Data: Analysis and Measurement Procedures, 4th Edition, John Wiley & Sons, Inc., NY, USA.
2. Montgomery, D. C. and G. C. Runger (2011). Applied Statistics and Probability for Engineers, 5th Edition, JohnWiley & Sons, Inc., NY,USA.
3. Cathy O'Neil and Rachel Schutt (2013). Doing Data Science, O'Reilly Media
4. Data Sciences, Jain V.K., Khanna Publishing House, Delhi