



TAKSHASHILA UNIVERSITY

(Tamil Nadu State Private University)

ONGUR, TINDIVANAM TK, VILLUPURAM DT

FACULTY OF ENGINEERING AND TECHNOLOGY

SCHOOL OF COMPUTATIONAL ENGINEERING

Department of Artificial Intelligence and Data Science
(IBM)

REGULATION – R25 NEP

CURRICULUM & SYLLABI

II Semester



Page 1 of 30

B.Tech. in Artificial Intelligence and Data Science with IBM

VISION AND MISSION OF UNIVERSITY

VISION:

To create change makers and world leaders similar to the ancient Takshashila University.

MISSION:

The brightest minds and the best resources are used to nurture and develop the leaders of tomorrow, where they are encouraged to be eternally curious and ethically sound.

DEPARTMENT VISION AND MISSION

VISION:

To be a center of excellence in Artificial Intelligence and Data Science by fostering transformative education, interdisciplinary research and innovation to develop intelligent, ethical, and sustainable solutions that address global challenges and contribute to societal progress.

MISSION:

M1: Academic Excellence	Deliver a contemporary, outcome-based curriculum that equips students with strong foundations in Artificial Intelligence, Data Science and computational thinking to solve complex real-world problems.
M2: Research and Innovation	Promote interdisciplinary research, innovation, and the adoption of emerging AI and data-driven technologies to develop impactful solutions for industrial and societal needs.
M3: Industry Readiness and Entrepreneurship	Strengthen employability and entrepreneurial capabilities through industry collaborations, experiential learning, internships, professional certifications and start-up incubation.
M4: Ethics and Lifelong Learning	In still ethical values, responsible AI practices, professional integrity, and a commitment to lifelong learning to develop socially responsible leaders capable of driving sustainable technological advancement.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis

Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: 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.

PO4: 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.

PO5: Modern tool usage

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: 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.

PO7: 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.

PO8: Ethics

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: Life-long learning

Recognize the need for, and have the preparation and ability to engage in continuous learning in the face of technological change.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Competitive Platform

To create a competitive platform for solving critical problems in a wide variety of fields.

PEO2: Exploration

To encourage enthusiastic participation in learning, understanding, designing and applying new innovative research ideas as the field evolves.

PEO3: Career

To Apply cutting-edge technology that improves knowledge and to commit students for life-long learning to reach the leading positions in the career.

PEO4: Professional Excellence

To develop competent professionals with strong analytical, computational and problem skills for multidisciplinary and global work environment.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: AI and Data Analytics Competency

Apply the principles of Artificial Intelligence and Data Science to develop intelligent, data-driven solutions for complex real-world problems.

PSO2: Research and Innovation

Design and implement AI-based and data-centric solutions using modern tools, emerging technologies and research methodologies to address industrial and societal challenges.

PSO3: Professional Competence

Demonstrate professional ethics, entrepreneurial mind-set and lifelong learning to excel in careers, higher education, research, and innovation in Artificial Intelligence and Data Science.



**TAKSHASHILA
UNIVERSITY**

(Established Under Tamil Nadu State Private Universities Act 2019 &
Recognized by UGC u/s 2(f) of the UGC Act, 1956)

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Tamil Nadu - 604 305, India.
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**FACULTY OF COMPUTATIONAL ENGINEERING
B.TECH. IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE WITH IBM
(REGULATION – R25 NEP)
SEMESTER – II**

S. No.	Course Code	Course Title	Category	Periods			Credits	Hrs.	Max. Marks								
				L	T	P			CAT Theory (Best of two)	ASS	MCQ	ATT	SEM	PRAC	CAM	ESM	Total
1	U25EN08T	Technical English	HS	3	0	0	3	45	20	5	5	5	5	-	40	60	100
2	U25MA08T	Multiple Integrals and Transforms	BS	3	1	0	4	60	20	5	5	5	5	-	40	60	100
3	U25GE03T	Biology for Engineers	BS	3	0	0	3	45	20	5	5	5	5	-	40	60	100
4	U25EC02B	Basic Electrical and Electronics Engineering	ES	2	0	2	3	60	20	5	5	5	5	10	50	50	100
5	U25AD82B	Java programming language	PC	3	0	2	4	75	20	5	5	5	5	10	50	50	100
6	U25CE03T	Computer Architecture	ES	3	0	0	3	45	20	5	5	5	5	-	40	60	100
Total							20	330							260	340	600
7	U25VA04T	Introduction to Indian Knowledge System	VAC	2	0	0	1	30	-	-	-	-	-	-	100	-	100
8	U25SE01P	Skill Enhancement Course I	SEC	0	0	2	1	30	-	-	-	-	-	-	100	-	100
Total:							2	60							200	-	200
Semester Total							22	390							460	340	800

Note:

L – Lecture

T – Tutorial

P – Practical

CAT – Continuous Assessment Test

ESM – End Semester Exam Marks

ASS – Assignment

ATT – Attendance

CAM – Continuous Assessment Marks

SEM – Seminar

PW – Project Work

BoS Chairman

U25EN08T	Technical English	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To develop proficiency in English grammar and vocabulary for effective communication
• To enhance speaking skills for academic, professional, and interpersonal interactions
• To build functional and technical writing skills for workplace communication
• To familiarize students with professional documentation and business communication practices
• To prepare students to communicate confidently in digital and professional environments

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Apply grammar rules and appropriate vocabulary in oral and written communication.
CO2:	Demonstrate effective speaking skills in academic, professional, and group communication contexts.
CO3:	Produce functional and technical documents using appropriate writing conventions.
CO4:	Prepare professional documents such as reports, emails, proposals, manuals, and meeting records.
CO5:	Utilize digital communication tools and professional networking platforms for effective workplace communication.

UNIT I: TECHNICAL WRITING SKILLS	9 Hrs.
Parts of Speech (Noun, Verb, Adjective, Adverb), Subject-predicate; Basic Question Formation: Yes/No questions, Wh-questions; Practical application in describing routines, ongoing actions, past events, and future plans; Common errors in writing and speaking.	

UNIT II: TECHNICAL WRITING SKILLS	9 Hrs.
Learning Vocabulary /Acquiring Vocabulary: Active & Passive Vocabulary, Reading & Speaking Vocabulary; Word Building (Affixation and Compounding); Content Words and Function Words; Types of Vocabulary: Jargons, Technical Vocabulary, Academic Vocabulary (AWC); Vocabulary for Daily Life.	

UNIT III: TECHNICAL ASPECTS OF SPEAKING SKILLS	9 Hrs.
Greetings, Self-introduction, making requests, asking for permission; Expressing opinions, Agreeing/disagreeing politely; Group Discussions (GD): Purpose and importance; Strategies for effective participation (initiating, expressing, interrupting, agreeing, disagreeing, concluding); Short Presentations/Show & Tell: Describing an object, a place or a simple process using visual aids.	

UNIT IV: FUNCTIONAL WRITING FOR PRACTICAL PURPOSES	9 Hrs.
Personal Notes and Messages: Writing short notes, leaving phone messages, informal emails/texts; Simple Descriptions: Describing people, places and objects, describing a simple event or experience; Vocabulary Building for Writing: Synonyms, antonyms, common collocations. Formal Reports & Proposals: Comprehensive reports (analytical, research, feasibility), executive summaries, abstract writing; Professional Correspondence Mastery: Emails (persuasive, informational, request-based), formal letters, memos, notices and press releases.	

UNIT V: ADVANCED BUSINESS WRITING AND DOCUMENTATION	9 Hrs.
Technical Writing Principles: Clarity, conciseness, precision, use of visuals, avoiding jargon, writing for specific technical audiences; Minutes of Meetings and Agendas: Recording discussions, decisions, and action items, Preparing effective meeting agendas; Manuals and Instructions: Designing instructions (MoU), standard operating procedures (SOPs), and user manuals. Building an Online Professional Brand: Crafting compelling LinkedIn profiles, professional use of social media, online networking; Virtual Communication: Video conferences, virtual presentations, and online collaboration tools, advantages and disadvantages.	

Total Hours: 45

TEXT BOOKS:	
1.	Syal, Pushpinder and D.V Jindal. An Introduction to Linguistics:Language, Grammar and Semantics. 2nd Ed. Delhi: PHI learning private Limited, 2016.
2.	Lightbown, Patsy and Nina Spada. How Languages are Learned. 4th Ed. Oxford: Oxford University Press, 2000.
3.	Robinson, Sarah. "A Context Driven Approach To Teaching Accademic Vocabulary." North Dakota: University of North Dakota, 2012. 1-46.
4.	Carnegie, Dale. <i>The Art of Public Speaking</i> . Random House, 2010.

REFERENCE BOOKS:

1.	Fisher, D., & Frey, N. (2010). Unpacking the Language Purpose: Vocabulary, Structure, and Function. TESOL Journal, 315-337.
2.	Spada, N. (2007). Communicative Language Teaching. In J. Cummins & C. Davison (Eds.), International Handbook of English Language Teaching (pp. 271–288). Springer US. https://doi.org/10.1007/978-0-387-46301-8_20
3.	Oliveira, L. C. D. (2015). A systemic-functional analysis of English language learners' writing. DELTA: Documentação de Estudos em Lingüística Teórica e Aplicada, 31(1), 207-237.

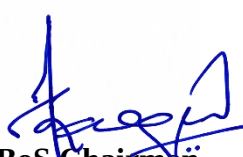
WEB REFERENCES:

1.	https://www.scribd.com/document/522901749/English-Notes-Form-1-to-4
2.	Vocabulary - Wikipedia
3.	https://www.slideshare.net/slideshow/asking-and-giving-opinion-agreeing-and-disagreeingpptx/265509737
4.	https://l1nk.dev/9y4g0vq
5.	https://blog.bit.ai/technical-writing/

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	–	–	–	–	–	–	1	3	–	1	1	–	3
2	2	3	–	–	–	–	–	–	2	3	–	2	1	–	3
3	1	2	–	–	–	–	–	1	3	3	–	2	–	–	3
4	1	2	–	–	–	–	–	–	2	3	–	2	–	1	3
5	1	2	–	–	1	–	–	–	2	3	1	2	–	1	3

Correlation Level: 1-Low, 2-Medium, 3- High, '–' - no correlation


BoS Chairman

U25MA08T	Multiple Integrals and Transforms	L	T	P	C	Total
		3	1	0	4	60

COURSE OBJECTIVES:

• To develop logical thinking and analytic skills in evaluating multiple integrals
• To equip them familiar with Laplace, transform and solve the differential equations using Laplace transform techniques
• To enable the students to expand functions into Fourier series using change of intervals
• To gain good knowledge in application of Fourier transforms
• To inculcate the computational knowledge in Z-transforms.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Understand the concept of double and triple integrals.
CO2:	Find Laplace transform and inverse transform of simple functions.
CO3:	Convert a periodic function into series form.
CO4:	Compute Fourier transforms of various functions.
CO5:	Solve difference equations using Z- transforms.

UNIT I: MULTIPLE INTEGRALS	12 Hrs.
Change of order of integration and change of variables in double integrals (Cartesian only). Applications: Areas by double integration and volumes by triple integration (Cartesian only).	

UNIT II: LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS	12 Hrs.
Definition - Transforms of elementary functions – properties - Transform of derivatives and Integrals - Transform of periodic Function - Initial and final value theorems - Inverse Laplace Transforms - Convolution theorem.	

UNIT III: FOURIER SERIES	12 Hrs.
Dirichlet's conditions – General Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series.	

UNIT IV: FOURIER TRANSFORMS	12 Hrs.
Fourier Integral theorem (Statement only). Fourier transform and its inverse, properties - Fourier sine and cosine transform their properties.	

UNIT V: Z - TRANSFORMS	12 Hrs.
Z-transforms - definition, Standard z-Transforms - Initial value and final value theorems and problems, Inverse z-transform - Applications of z-transforms to solve difference equations.	

Total Hours: 60

TEXT BOOKS:	
1.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 45th edition, 2024.
2.	N. P. Bali and Manish Goyal, A Textbook of Engineering Mathematics, 11th Edition, Laxmi Publications, New Delhi, 2022.

REFERENCE BOOKS:	
1.	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House, New Delhi, 2021.
2.	H. K. Dass and Rajnish Verma, Higher Engineering Mathematics, 1st Edition, S. Chand Publishing, New Delhi, 2023.
3.	B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education India, 2022.
4.	T. Veerarajan, Engineering Mathematics – Volume II, Revised Edition, McGraw Hill Education, 2021.
5.	Dr. V. Sundarapandian, Engineering Mathematics – Volume II, 1st Edition, PHI Learning Pvt. Ltd., New Delhi, 2021.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/111105121/
2.	https://nptel.ac.in/courses/111105035/
3.	https://nptel.ac.in/courses/111107119/
4.	https://swayam.gov.in/nd1_noc20_ma17/preview
5.	https://nptel.ac.in/courses/111/103/111103021/

COs/POs/PSOs Mapping:															
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	–	–	–	–	–	–	1	2	2	2	3
2	3	3	2	2	1	–	–	–	–	–	1	3	2	2	3
3	3	2	1	1	–	–	–	–	–	–	1	-	3	2	3
4	3	3	2	2	1	–	–	–	–	–	1	2	3	3	3
5	3	3	2	2	2	–	–	–	–	1	1	1	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25GE03T	Biology for Engineers	L	T	P	C	Total
		3	0	0	3	45

COURSE OBJECTIVES:

• To introduce the fundamental concepts of biology relevant for engineers
• To explain cellular structures, functions, and energy mechanisms
• To examine the principles of organismal physiology, immunity, infectious diseases, and pathogen biology
• To analyse the applications of biology in medicine, environmental science, and bio-inspired engineering
• To evaluate recent advances in structural biology, biochemistry, biophysics, and emerging biological technologies.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Explain basic concepts of cell structure, function, and energy processes.
CO2:	Understand DNA, RNA, protein synthesis, and genetic control.
CO3:	Relate biological processes like immunity, infection, and diseases with human health.
CO4:	Identify applications of biology in medicine, environment, and engineering (drug design, biomimicry, biosafety).
CO5:	Appreciate major discoveries (e.g., Nobel Prizes) and current advances in biology that inspire engineering solutions.

UNIT I: FOUNDATIONS OF BIOLOGY	9 Hrs.
Origin of life and evolution (Darwinian perspective) - Classification of living organisms - Cell as the basic unit of life: structure and function of prokaryotic and eukaryotic cells - Energy and metabolism in cells.	

UNIT II: GENETIC INFORMATION & PROTEIN SYNTHESIS	9 Hrs.
DNA - RNA structure and function - Central dogma: replication – Transcription - Translation, Gene regulation – Mutations and applications of stem cells - Developmental biology basics.	

UNIT III: PHYSIOLOGY AND IMMUNOLOGY	9 Hrs.
Organismal physiology: Energy and constraints – Human immune system: self vs non-self – Antigens – Antibodies - Vaccines and Infectious Diseases - Pathogen biology basics	

UNIT IV: APPLIED BIOLOGY IN MEDICINE AND ENGINEERING	9 Hrs.
Cancer biology – Aging – Apoptosis – Stem cell therapy – Drug design basics –Environmental biosafety – Biodiversity and bioremediation – Bio mimicry: Engineering inspired by biology.	

UNIT V: ADVANCES IN BIOLOGY	9 Hrs.
Structural biology: proteins and large molecules - Techniques in biochemistry and biophysics (basic overview only) - Recent advances in biology and their impact on technology.	

Total Hours: 45

TEXT BOOKS:	
1.	Lodish, H., Berk, A., Kaiser, C. A., et al. Molecular Cell Biology. 10th Edition, W. H. Freeman, 2025.
2.	Reece, J. B., Urry, L. A., Cain, M. L., et al. Campbell Biology. 13th Edition, Pearson, 2024.
3.	Alberts, B., Johnson, A., Lewis, J., et al. Essential Cell Biology. 6th Edition, W. Norton & Company, 2024.

REFERENCE BOOKS:	
1.	Alberts, B., Hopkin, K., Johnson, A., et al. Essential Cell Biology: Student Companion. 6th Edition, W. W. Norton, 2024.
2.	Madigan, M. T., Bender, K. S., Buckley, D. H., et al. Brock Biology of Microorganisms. 17th Edition, Pearson, 2024.

3.	Cooper, G. M., & Hausman, R. E. The Cell: A Molecular Approach. 10th Edition, Oxford University Press, 2024.
4.	Berg, J. M., Tymoczko, J. L., Gatto, G. J., & Stryer, L. Biochemistry. 10th Edition, W. H. Freeman, 2023.
5.	Raven, P. H., Johnson, G. B., Mason, K. A., et al. Biology. 13th Edition, McGraw-Hill Education, 2023.

WEB REFERENCE:

1.	https://openstax.org/details/books/biology-2e
2.	https://www.ncbi.nlm.nih.gov/books
3.	https://www.nih.gov
4.	https://www.nature.com/scitable
5.	https://www.biointeractive.org

COs/POs/PSOs Mapping:

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-	-	1	-	-	-	-	2	-	1	-
2	3	3	1	1	1	-	-	-	-	-	-	2	1	2	-
3	3	2	1	1	-	2	1	1	-	1	-	2	-	1	2
4	3	2	3	2	2	2	3	1	-	1	-	2	2	3	2
5	2	2	2	1	1	1	2	1	-	1	-	3	1	2	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25EC02B	Basic Electrical and Electronics Engineering	L	T	P	C	Total
		2	0	2	3	60

COURSE OBJECTIVES:

• To introduce the basics of electric circuits and analysis
• To learn the basic concepts and behavior of AC circuits
• To learn the basic concepts of semiconductor theory
• To introduce basic concepts of diodes and its applications
• To educate on the fundamental concepts of Transistors.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Compute the electric circuit parameters for simple problems.
CO2:	Explain the working principle and applications of AC Circuits.
CO3:	Analyze and execute the characteristics of semiconductor devices.
CO4:	Explain and implement the basic concepts of diodes and its applications.
CO5:	Explain and demonstrate the operating principles of Transistors.

UNIT I: DC CIRCUITS	6 Hrs.
Circuit components: Resistor, Inductor, Capacitor – E.M.F, potential difference, power, energy Ohm's Law, series parallel connections of resistance, voltage and current division rules - Kirchhoff's Laws - Nodal and Mesh analysis.	

UNIT II: AC CIRCUITS	6 Hrs.
Alternating current, Alternating E.M.Fs, Waveforms - Cycle, period, frequency, instantaneous, peak, average, RMS values, peak factor, form factor, phase difference, leading, lagging and in phase quantities. Instantaneous power - real power - reactive power - apparent power - power factor, RC, RL and RLC circuits.	

UNIT III: SEMICONDUCTOR THEORY	6 Hrs.
Introduction to Electronics - Study of Semiconductor Physics – semiconductor materials, structure of atom, metals, insulators and semiconductors, Intrinsic Semiconductors, Extrinsic Semiconductors – Theory of Bandgap.	

UNIT IV: SEMICONDUCTOR DIODES AND ITS APPLICATIONS	6 Hrs.
Theory of PN Junction diode, Volt - Ampere Characteristic, Diode Equation. Zener Diode, LED, Rectifiers: Half wave and Full Wave Rectifiers.	

UNIT V: TRANSISTORS	6 Hrs.
Bipolar Junction Transistor - Operation of PNP and NPN transistors – configurations, V-I characteristics, BJT as a switch and amplifier, Operation of JFET, MOSFET – Types, I-V Characteristics.	

Total Hours: 30

List of Experiments
1. Verification of KCL and KVL.
2. Verification of Superposition theorem
3. Study of DSO
4. Verification of ohms and Kirchhoff's laws
5. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits
6. Characteristics of PN Junction Diode
7. Characteristics of Zener Diode
8. Half wave Rectifier
9. Full Wave Rectifier
10. Characteristics of BJT under CE configuration
11. Characteristics of JFET
12. Characteristics of MOSFET

Total Hours: 30

TEXT BOOKS:

1.	A. T. Johnson, Biology for Engineers. Boca Raton, FL, USA: CRC Press, 2011.
2.	Kothari D.P. and I.J. Nagrath- “Basic Electrical and Electronics Engineering-” 2nd Edition- McGraw Hill Education- 2020.
3.	S.K. Bhattacharya- “Basic Electrical and Electronics Engineering-” 2nd Edition- Pearson Education- 2017.
4.	Sedha R.S.- “A Textbook of Applied Electronics-” S. Chand & Co.- 2008.
5.	James A. Svoboda and Richard C. Dorf- “Dorf’s Introduction to Electric Circuits-” Wiley- 2018.

REFERENCE BOOKS:

1.	Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, 3rd Edition, 2010.
2.	S. Salivahanan, N. Suresh Kumar, " Basic Electrical, Electronics and Measurement Engineering", Tata McGraw-Hill Education, 5th Edition, 2018.
3.	Albert Malvino, David Bates, ‘Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4.	Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGrawHill, 2002.

WEB REFERENCES:

1.	https://nptel.ac.in/courses/108106075
2.	https://ocw.mit.edu/courses/6-002-circuits-and-electronics-spring-2007/
3.	https://www.allaboutcircuits.com/textbook/
4.	https://www.electronics-tutorials.ws/

COs/POs/PSOs Mapping:															
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
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1	3	3	2	2	3	1	–	1	1	–	2	2	3	2	2
2	3	3	2	3	3	1	–	1	1	–	2	3	3	3	2
3	2	2	2	2	2	1	–	1	–	–	3	1	2	3	2
4	3	3	3	2	3	2	1	1	1	–	2	2	3	3	3
5	3	3	3	3	3	2	1	2	2	2	3	1	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High, '–' - no correlation

S. Menugayath
BoS Chairman

U25AD82B	Java Programming Language	L	T	P	C	Total
		3	0	2	4	75

COURSE OBJECTIVES:

To understand the fundamentals of Java programming, object-oriented programming concepts, Java architecture (JVM, JRE, JDK), and the Java development environment
To apply Java data types, variables, operators, control statements, arrays, methods, and object-oriented programming principles to develop basic Java applications
To design Java programs using classes, objects, constructors, packages, wrapper classes, type casting, and inheritance while following standard coding conventions and secure programming practices
To develop modular and reusable Java applications by implementing object-oriented features such as polymorphism, abstraction, encapsulation, interfaces, and exception handling
To analyze, design, implement, test, and debug Java programs to solve real-world problems using object-oriented programming techniques and best programming practices.

COURSE OUTCOMES:

After successful completion of the course, learners will be able to:

CO1:	Understand Java Programming Language.
CO2:	Design, implement, test, debug, and document GUI, event-driven programs.
CO3:	Design, implement, test, debug, and document in object-oriented programming language.
CO4:	Understand JSP and Servlet Technology.
CO5:	Web development and deployment.

UNIT I: INTRODUCTION TO JAVA AND OBJECT ORIENTED PROGRAMMING	9 Hrs.
The Introduction to Java - IBM Rational Application Developer, Object Oriented Programming, Object Oriented Programming Concepts, Class, Objects, Inheritance, Polymorphism, Encapsulation, Abstraction, Message Passing, Overview of Object Oriented Programming Language, Procedural Approach Versus Object Approach, Difference Between C++ and Java, Overview of Java - The	

Structure of Java - Three Main Steps in Java Programming Language, Types of Application in Programming Language, Java, Platform, Java Is Important, Java Is Used in, Types of Application in Java Programming Language, Standalone Application, Web Application, Enterprise Application, Mobile Application, 4 Java Editions or 4 Java Platforms, J2SE, J2ME, J2EE, JavaFX - The Basics of Java - History of Java, Features of Java, Platform Independent, Types of Platforms, Characteristics of Java, Java Environment, JSL, API, Java Architecture Diagram, WORA, Sample Program in Java, Program in Public Static Void Main and Private Static Void Main, Basic Programs in Java Using Scanner Class, Console Application, Types of Integrated Development Environment.

UNIT II: JAVA ARCHITECTURE, DATA TYPES AND CONTROL STATEMENT	9 Hrs.
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The Architecture of JVM, JRE, JDK - Compile Time, Runtime, Flow Diagram of Runtime, Compiler, Interpreter, Class Loader, JVM – JRE – JDK Is the Platform Dependent, Performance of JVM, Java Runtime Environment, Java Development Kit - Variables / Data Types - Variables, Types of Variables, Local Variable, Instance Variable, Static Variable, Java Programs On Variables, Data Types, Primitive Data Types, Non-Primitive Data Types, Method Signature, Accessing The Methods, Method Returns Data, Strings, Arrays. Operators / Control Statements - Operands, Operators, Expressions, Types of Operators, Arithmetic Operators, Unary Operators, Ternary Operators, Shift Operators, Relational Operators, Bitwise Operators, Logical Operators, Assignment Operators, Special Operators or Comma Operators, Java Programs Using Operators.

UNIT III: OBJECT-ORIENTED CONCEPT AND INTRODUCTION TO SECURE APPLICATIONS	9 Hrs.
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Java Comments / Naming Conventions - Java Comments, Types of Comments, Single Line Comment, Multi Line Comments, Documentation Comments, Javac Tool Compilation, Javadoc Tool Compilation, Advantages of Object-Oriented Programming Versus Procedure – Object Oriented Programming Language. Classes & Objects / Constructors - Class in Java, Objects in Java, Instance Variable, Method, Keyword, Three Ways to Initialize an Objects, Different Ways to Create an Object in Java, Anonymous Class, Java Programs on Classes and Objects, Objects and Classes. The Fundamentals of Java - Arrays, Basic One-Dimensional Array Using Advanced for Loop, Integer Versus Float, Widening Data Types, Lower Type Data Types. Introduction To Programming Language / Web Application Security – Introduction to Programming Language, High Level Languages, The Top Programming Languages, Security, Web Application Security.

UNIT IV: JAVA PACKAGES, WRAPPER CLASSES AND INHERITANCE CONCEPTS	9 Hrs.
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Java Static Keyword / Java Packages - Types of Variables, Static Variables, Java Static Keyword, 4 Steps in Static Keyword That Can Be Applied, Static Variable, Program with Static Variable and Program Without Static Variable, Counter with Static Variable, Counter Without Static Variable, Static Method, Static Block, Static Nested Classes, Why Java Main Method Is Static, Execute A

Program Without main() Method. Java Wrapper Classes & Parsing / JAR File & Garbage Collection - Wrapper Class in Java, List of Primitive Data Types & Their Corresponding Wrapper Classes, Boxing, Unboxing, Two Constructors of Wrapper Classes in Java, Parsing, Parsing Methods of Wrapper Classes in Java. Java This Keyword / Type Casting / Java Inheritance / Java Aggregation - This Keyword, Usage of Java This Keyword, Programs on Without This Keyword & With This Keyword, Casting, Type Casting, Types of Casting, Primitive Casting, Types of Primitive Casting, Data Types with No Decimal Values, Data Types with Decimal Values, Auto Widening, Explicit Narrowing, Program On Auto Widening & Explicit Narrowing, Derived Casting.

UNIT V: JAVA PROGRAMMING CONSTRUCTS AND OBJECT-ORIENTED EXTENSIONS	9 Hrs.
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Java Polymorphism - Polymorphism, Types of Polymorphism, Examples of Polymorphism, Method Overloading in Java, Is It Possible to Overload main () method in Java, Advantage of Method Overloading, Different Ways to Overload the Method, Can We Overload Java Main () Method, Method Overriding in Java, Usage of Java Method Overriding, Rules of Java Method Overriding. Java Abstract Class / Java Interface / Java Enumerations - Abstraction, Abstract Class in Java, Ways to Achieve Abstraction, Abstract Method in Java, Abstract Class Having Constructor, Methods and Data Member, Programs on Abstraction, Interface in Java, Why We Use Java Interface, Internal Addition by Compiler, Difference Between Abstract Class and Interface, Java Enums. Java Encapsulation / Java Array - Encapsulation in Java, Advantage of Encapsulation, Object Class in Java, Programs on Java Encapsulation, Java Array, Advantage & Disadvantage of Java Array, Types of array in Java. Exception Handling in Java - Exception Handling, Advantages of Exception Handling, Hierarchy of Java Exception Class, Types of Exception, Checked Exception, Unchecked Exception, Java Exception Handling Keywords, Java Try Block, Java Catch Block, Internal Working of Java Try-Catch Block, Java Nested Try Block, Java Finally Block, Java Throw Exception, Java Throws Keyword, Difference Between Throw & Throws, Difference Between Final, Finally & Finalize, Programs On Exception Handling.

Total Hours: 45

LIST OF EXPERIMENTS:

- | |
|---|
| 1. Installation Process of Rational Application Developer (IBM RAD) |
| 2. Installation Process of IntelliJ IDEA |
| 3. To implement the fundamentals by using Java programming language |
| 4. To implement all the Arithmetic Operations by using Core Java |
| 5. To implement and to get user inputs by declaring scanner class using Java programming language |
| 6. To implement and work process the control loop statements in Java programming language |

7. To construct and implement the average of values and to process the basic one-dimensional array by using Java programming languages
8. To implement java widening of data type and lowering of data type by using Java programming languages
9. To implement, process and operate all the operators by Java programming language
10. To implement a Java program to access object and classes through various process by using Java programming languages
11. To implement the following Java objects and Classes; a) Initialization through Method b) Maintaining records of Employees c) Maintaining records of Rectangle Class by using Java programming language
12. To implement Java Objects and Class Example in Account Details by using Java programming languages
13. To implement constructor by using Java programming languages
14. To implement “static” keyword by using Java programming languages

Total Hours: 30

TEXT BOOKS:

1.	IBM Essentials of OOPS Using Java © Copyright International Business Machines Corporation 1993, 2009. US Government Users Restricted Rights – Use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
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REFERENCE BOOKS:

1.	Java Complete Reference Java by Herbet Shield-Ninth Edition
2.	Programming with Java by Balaguruswamy, – A primer, Tata McGraw Hill.-Seventh Edition

WEB REFERENCES:

1.	https://docs.oracle.com/en/java/
2.	https://onlinecourses.nptel.ac.in/noc25_cs56/preview
3.	https://www.javatpoint.com/java-tutorial
4.	https://www.tutorialspoint.com/java/index.htm

COs/POs/PSOs Mapping:															
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	2	3	1	–	1	1	–	2	1	3	2	2
2	3	3	2	3	3	1	–	1	1	–	2	-	3	3	2
3	2	2	2	2	2	1	–	1	–	–	3	-	2	3	2
4	3	3	3	2	3	2	1	1	1	–	2	2	3	3	3
5	3	3	3	3	3	2	1	2	2	2	3	1	3	3	3

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25CE03T	Computer Architecture	L	T	P	C	Hrs.
		3	0	0	3	45

COURSE OBJECTIVES:

• To understand the basic structure and operation of a digital computer
• To learn the fundamentals of organizational and architectural aspects of control unit
• To acquire knowledge about processor and memory design of a digital computer
• To have a broad understanding of various system interfaces and Input output devices
• To obtain knowledge on recent processors.

COURSE OUTCOMES:

After successful completion of the course, learners will be able to:

CO1:	Identify and explain the basic structure of a computer and instruction sets with addressing modes and discuss the design of ALU.
CO2:	Identify the mechanism in Hardwired control and micro programmed control unit.
CO3:	Using pipelining Concepts and applications in real world.
CO4:	Illustrate the memory mapping procedure to enhance the performance of the system.
CO5:	Discuss the standard I/O interfaces and peripheral devices.

UNIT I: BASIC STRUCTURE OF COMPUTERS	9 Hrs.
Functional units – Basic operational concepts – Bus structures – Performance and metrics – Instructions and instruction sequencing – Hardware – Software Interface – Instruction set architecture – Addressing modes – RISC – CISC. ALU design – Fixed point and floating-point operations.	

UNIT II: BASIC PROCESSING UNIT	9 Hrs.
Fundamental concepts – Execution of a complete instruction – Multiple bus organization– Hardwired control – Micro programmed control – Nano programming.	

UNIT III: PIPELINING	9 Hrs.
Basic concepts – Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations–Performance Considerations – Exception handling.	

UNIT IV: MEMORY SYSTEM	9 Hrs.
Basic concepts – Semiconductor RAM and ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices	

UNIT V: I/O SYSTEMS	9 Hrs.
Accessing I/O devices – Programmed Input/Output -Interrupts – Direct Memory Access – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.	

Total Hours: 45

TEXT BOOKS:	
1.	Computer Organization and Design: The Hardware/Software Interface –David A. Patterson & John L. Hennessy, 6th Edition, 2021
2.	Computer Organization and Architecture – William Stallings,11th Edition, 2023
3.	Computer Organization and Design – Patterson & Hennessy,6th Edition, 2021
4.	Computer Architecture: A Quantitative Approach – Patterson & Hennessy,6th Edition, 2019.

REFERENCE BOOKS:	
1.	Structured Computer Organization – Andrew S. Tanenbaum & Todd Austin, 6th Edition, 2013
2.	Digital Design and Computer Architecture – David Harris & Sarah Harris,2nd Edition, 2013.
3.	Computer System Architecture – M. Morris Mano,3rd Edition, 2017.
4.	Advanced Computer Architecture – Kai Hwang, 2018 Edition
5.	Modern Processor Design – John Paul Shen & Mikko H. Lipasti, 2013.
6.	Advanced Computer Architecture – Dezső Sima et al., 2018.

WEB REFERENCES:

1.	https://asq.org/
2.	https://www.iso.org/standard/70397.html
3.	https://www.isixsigma.com/
4.	https://www.quality.org/
5.	https://www.nist.gov/mep

COs/POs/PSOs Mapping:

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	2	–	–	–	1	–	2	1	3	2	2
2	3	3	2	2	2	–	–	–	1	–	2	-	3	2	2
3	3	3	3	2	2	–	–	–	1	–	2	-	3	3	2
4	3	3	3	3	2	1	–	–	1	–	2	2	3	3	3
5	3	2	2	2	3	1	–	–	1	–	2	1	3	3	2

Correlation Level: 1-Low, 2-Medium, 3- High, '-' - no correlation


BoS Chairman

U25VA04T	Introduction to Indian Knowledge System	L	T	P	C	Hrs
		2	0	0	1	30

COURSE OBJECTIVES:

• Provide an overview of India's intellectual, cultural, and scientific heritage
• Develop understanding of Indian philosophical systems and their relevance today
• Introduce India's contributions to mathematics, science, medicine, arts, and governance
• Promote appreciation for holistic knowledge traditions and sustainability practices
• Connect ancient Indian knowledge with contemporary challenges and modern disciplines.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1:	Explain the scope, sources, and foundational concepts of Indian Knowledge Systems.
CO2:	Compare major Indian philosophical traditions and epistemological frameworks.
CO3:	Discuss scientific and technological contributions of ancient India.
CO4:	Analyze Indian arts, literature, and aesthetic traditions.
CO5:	Evaluate socio-political systems, ecological wisdom, and contemporary applications of IKS.

UNIT I: FOUNDATIONS OF INDIAN KNOWLEDGE SYSTEMS	6 Hrs.
Definition, nature, and scope of IKS-Sources of IKS: Vedas, Upanishads, Puranas, Epics, Agamas-Guru-Shishya Parampara, oral & written traditions-Concepts of Rita, Dharma, Purusharthas, Samskaras-Indian worldview and holistic knowledge orientation.	

UNIT II: INDIAN PHILOSOPHICAL AND INTELLECTUAL TRADITIONS	6 Hrs.
Overview of Indian Darshanas: Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa, Vedanta-Heterodox traditions: Buddhism & Jainism-Theory of knowledge (Pramanas): perception, inference, verbal testimony, etc.-Concepts of self, consciousness, and mind - Ethical models from Upanishads, Gita, Buddhist and Jain texts.	

UNIT III: INDIAN SCIENTIFIC KNOWLEDGE – MATHEMATICS, ASTRONOMY, HEALTH AND TECHNOLOGY	6 Hrs.
Mathematics and Astronomy:Zero, decimal system, algebra, geometry-Aryabhata, Brahmagupta, Bhaskaracharya, Kerala School of Mathematics-Timekeeping, Panchanga, cosmology.Ayurveda and Health Sciences:Tridosha theory, Panchamahabhutas-Contributions of Charaka and Sushruta-Yoga as a science of well-being Metallurgy, Chemistry and Technology:Iron pillar, metallurgy, Rasashastra-Architecture and engineering traditions.	

UNIT IV: INDIAN ARTS, LITERATURE, CULTURE AND AESTHETICS	6 Hrs.
Classical literature: Sanskrit and regional texts-Performing arts: music, dance, drama traditions-Natyashastra and Rasa theory-Temple architecture, iconography and symbolism-Aesthetic principles: Alankara Shastra, artistic consciousness.	

UNIT V: SOCIETY, GOVERNANCE, ENVIRONMENT AND CONTEMPORARY RELEVANCE	6 Hrs.
Society and Governance:Ancient education systems: Nalanda, Takshashila, Gurukula-Concepts of Varna, Jati, Ashrama-Leadership and ethics from Arthashastra, Tirukkural, Panchatantra-Role of women in IKS, Ecology, Sustainability & Indigenous Practices:Environmental ethics in Vedic and tribal traditions-Traditional agriculture, water systems, biodiversity conservation-Vriksha Ayurveda, holistic living, Contemporary Applications:NEP 2020 and IKS integration-Yoga and mindfulness in modern life-Traditional knowledge and modern innovation-Relevance of IKS for global challenges.	

Total Hours: 30

TEXT BOOKS:	
1.	Indian Knowledge Systems: Concepts and Applications – Kapil Kapoor (Ed.),1st Edition, 2023.
2.	Indian Philosophy – S. Radhakrishnan,2nd Edition (Reprint), 2020.
3.	Science and Technology in Ancient India – Debiprasad Chattopadhyaya,Reprint Edition, 2019.
4.	Indian Aesthetics – Coomaraswamy & others,Reprint Edition, 2019.
5.	Indian Knowledge Systems and Sustainable Development – N. Ganesan & M. Soundarapandian (Eds.), 1st Edition, 2023

6.	Arthashastra – Kautilya (Trans. R. Shamasastry), Reprint Edition, 2019.
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REFERENCE BOOKS:	
1.	Indian Philosophy: A Very Short Introduction – Sue Hamilton, 2nd Edition, 2020
2.	Classical Indian Philosophy – Peter Adamson & Jonardon Ganeri, 1st Edition, 2020.
3.	The Crest of the Peacock: Non-European Roots of Mathematics – George Gheverghese Joseph, 3rd Edition, 2020.
4.	An Introduction to Indian Art (Part I & II) – NCERT, Revised Edition, 2022.
5.	Tirukkural – Thiruvalluvar (Trans. G.U. Pope), Reprint Edition, 2018
6.	NEP 2020: Implementation and Indian Knowledge Systems – Ministry of Education, Govt. of India, 2021.

WEB REFERENCES:	
1.	https://iks.aicte-india.org/
2.	https://www.education.gov.in/en/indian-knowledge-systems
3.	https://onlinecourses.nptel.ac.in/noc25_ge58/preview
4.	https://sanskritdocuments.org/

COs/POs/PSOs Mapping:															
COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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3	3	2	1	1	–	1	1	–	1	–	2	2	2	2	2
4	2	2	1	–	–	2	2	1	2	–	2	1	1	2	2
5	2	3	1	1	–	3	3	2	2	–	3	2	2	3	3

Correlation Level: 1-Low, 2-Medium, 3- High, '–' - no correlation


BoS Chairman

U25SE01P	Skill Enhancement Course I	L	T	P	C	Hrs.
		0	0	2	1	30

The students must select international certification courses from reputed organizations like Google, Microsoft, AWS, Red Hat, Oracle, Palo Alto Networks, Unity, Raspberry Pi etc., with 40-50 hours duration specified in the curriculum, offered through Centers of Excellence.

Course Duration and Evaluation

- The duration is 40-50 hours as specified in the curriculum, which will be offered through Centre of Excellence.
- Pass/Fail will be determined on the basis of participation, attendance, performance, and completion of the course.
- If a student fails/he has to repeat the course in the subsequent years. Pass this course is mandatory for the award of degree

Provider	Sample Courses (40-50 hrs)	Platform/Link
Google	Introduction to Generative AI	grow. Google/certificates
Microsoft	AI & ML Engineering Professional Certificate	coursera.org/professional-certificates/microsoft-ai-and-ml-engineering
AWS	AWS Cloud Practitioner Essentials	aws.training
Red Hat	Red Hat OpenShift Fundamentals	redhat.com/learning
Oracle	Oracle Cloud Infrastructure Foundations	oracle.com/cloud/training
Palo Alto	Cybersecurity Essentials (PCNSA Intro)	paloaltonetworks.com/cyberacademy
Unity	Unity Certified Developer (AR/VR Basics)	learn.unity.com
Raspberry Pi	IoT and Embedded Systems	projects.raspberrypi.org


BoS Chairman