Curriculum for B.Tech

Computer Science and Engineering with Major in Artificial Intelligence

From The Academic Year 2025

(Approved in Senate 60)

Indian Institute of Information Technology Design and Manufacturing, Kancheepuram

Chennai-600 127

Semester 1					
Category	Course Name	L	T	P	C
BSC	Calculus	3	1	0	4
BSC	Physics for Engineers	3	0	2	4
BEC	Basic Electrical Engineering	3	1	0	4
ITC	Problem Solving and Programming	3	0	2	4
DSC	Concepts in Engineering Design	2	0	2	3
BEC	Engineering Skills Practice	0	0	2	1
HMC	Effective Language and Communication Skills	1	0	2	2
HMC	NSO/NCC/SSG/NSS/YOGA	0	0	2	P/F
					22.0
Semester 2					
Category	Course Name	L	T	P	C
BSC	Differential Equations	3	1	0	4
SEC	Dept. Specific Science Elective I	3	0	0	3
BEC	Engineering Graphics and Modeling	2	0	2	3
ITC	Data Structures and Algorithms	3	0	2	4
DSC	Design Realization	2	0	2	3
PCC	Discrete Structures for Computer Science	3	1	0	4
HMC	Earth, Environment and Design	1	0	0	P/F
					21.0
Semester 3					
Category	Course Name	L	T	P	C
SEC	Dept. Specific Science Elective II [Linear Algebra]	3	0	0	3
ITC	Introduction to AI with Python	2	0	2	3
PCC	Object Oriented Programming	2	0	4	4
PDC	Digital Systems Design	3	0	2	4
PCC	Design & Analysis of Algorithms	3	0	2	4
PDC	Database Systems Design	3	0	2	4
PCC	Computing Paradigms	2	0	0	2
HMC	Indian Constitution and Essence of Indian Traditional Knowledge	1	0	0	P/F
					24.0
Semester 4					
Category	Course Name	L	T	P	C
SEC	Dept. Specific Science Elective III [Probability and Statistics]	3	0	0	3
ITC	Applied Data Science	2	0	2	3
PDC	Computer Organization	3	0	2	4
PCC	Machine Learning Algorithms	3	0	2	4
PCC	Operating Systems	3	0	2	4
PCC	Data - Driven Optimization	2	0	0	2
PCC	Theory of Computation	3	1	0	4
HMC	Human Values and Stress Management	1	0	0	P / F
					24.0

Semester 5				
Category	Course Name	L	T	P	C
HMC	Entrepreneurship and Management Functions	1	0	2	2
PCC	Computer Networks	3	0	2	4
PCC	Prompt Engineering	1	0	2	2
PDC	Human Computer Interaction	2	0	2	3
PCC	Reinforcement Learning	3	0	2	4
PCC	Natural Language Processing	2	0	2	3
PEC	Program Elective 1	3	1	0	4
HMC	Professional Ethics and Organizational Behaviour	1	0	0	P/F
					22.0

Semester 6				
Category	Course Name	L	T	P	C
PCD	Product Design and Prototyping	0	0	2	1
PDC	Full Stack Development	2	0	2	3
PCC	Introduction to Generative AI	2	0	2	3
PCC	Cyber Security	3	0	2	4
PEC	Program Elective 2	3	1	0	4
ELC	Open Elective 1	3	0	0	3
HMC	Professional Communication	1	0	2	2
HMC	Intellectual Property Rights	1	0	0	P/F
					20.0
	Summer				
PCD	Summer Internship MID MAY to MID JULY				P/F

Semester 7				
Category	Course Name	L	T	P	C
PEC	Program Elective 3	3	0	0	3
ELC	Open Elective 2	3	0	0	3
ELC	Open Elective 3	3	0	0	3
ELC	Open Elective 4	3	0	0	3
ELC	Open Elective 5	3	0	0	3
PCD	Comprehensive Exam				P/F
HMC	Invited Expert Lectures*	0	0	0	P/F
	* 6 Expert lectures to be attended from Sem 1 to Sem 7				15.0

Semester 8				
Category	Course Name	L	T	P	C
PCD	B.Tech. Project (BTP)	0	0	18	9
					9.0

9 Credits for the BTP can be earned by any of the following:

1. Fully In-house BTP at the institute.

2. BTP IITs/IISc/IISERs/TIFR/ISI/DRDO/ISRO, etc if 148 credits are completed by the end of 7th semester.

3. Three Program Elective courses, each with a minimum of three credit, in lieu of BTP.

4. Industry Internship/Training in lieu of BTP at the company selected through the Institute Placement Cell and if 148 credits are completed by the end of 7th semester.

Semester wise Credit Distribution	Credits									
Category	S1	S2	S3	S4	S5	S6	S7	S8	Total	%
Basic Science Course (BSC)	8	4	0	0	0	0	0	0	12	7.6
Science Elective Course (SEC)	0	3	3	3	0	0	0	0	9	5.7
Basic Engineering Course (BEC)	5	3	0	0	0	0	0	0	8	5.1
Design Course (DSC)	3	3	0	0	0	0	0	0	6	3.8
IT Skill Course (ITC)	4	4	3	3	0	0	0	0	14	8.9
Program Core Course (PCC)	0	4	10	14	13	7	0	0	48	30.6
Program Design Course(PDC)	0	0	8	4	3	3	0	0	18	11.5
Program Elective Course (PEC)	0	0	0	0	4	4	3	0	11	7.0
Elective Course (ELC)	0	0	0	0	0	3	12	0	15	9.6
Humanities and Management Course (HMC)	2	0	0	0	2	2	0	0	6	3.8
Professional Career Development (PCD)	0	0	0	0	0	1	0	9	10	6.4
Total	22	21	24	24	22	20	15	9	157	100
	22	43	67	91	113	133	148	157	157	

**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM**

<u>COURSE FORMAT</u>

Course Code		Course Name	Calculus			
Offered by the Department	SH-Mathematics	Structure (LTPC)	3	1	0	4
To be offered for	B Tech	Course type	Core			
Pre-requisite	NIL	Approved In	**Senate 61**			
Learning Objectives	The course will introduce the students to basic concepts in Calculus, such as convergence, differentiation & integration, and their applications.					
Contents of the Course	➢ Limit and Continuity of functions defined on intervals, Intermediate Value Theorem, Differentiability, Rolle's Theorem, Mean Value Theorem, and Taylor's Formula (5L+2P) ➢ Sequences and series (7L+2P) ➢ Definite integral as the limit of sum, Mean value theorem, Fundamental theorem of integral calculus, and its applications (9L+3P) ➢ Functions of several variables, Limit and Continuity, Geometric representation of partial and total derivatives, Derivatives of composite functions (8L+3P) ➢ Directional derivatives, Gradient, Lagrange multipliers, Optimization problems (7L+2P) ➢ Multiple integrals: Evaluation of line and surface integrals (6L+2P)					
Essential Reading	1. Thomas G B. and Finney R. L., Calculus, Pearson Education, 2007					
Supplementary Reading	1. Piskunov N., Differential and Integral Calculus, Vol. I & II, Mir Publishers, 1981 2. Kreyszig E., Advanced Engineering Mathematics, Wiley Eastern, 2007. 3. Hass J., Weir M. D., Giordano F. R., Thomas Calculus, 11th Edition, Pearson.					

Course Code		Course Title	Physics for Engineers				
Dept./ Specialization	SH -Physics	Structure (LTPC)	3	0	2	4	
To be offered for	B. Tech. and DD	Status	Core ■		Elective ☐		
Faculty Proposing the course	SH - Physics	Type	New ■		Modification ☐		
Pre-requisite	None	Submitted for approval		Senate 61			
Learning Objectives	To learn about • Transformation of three dimensional coordinate systems for scalar and vector fields • Concepts of gradient, divergence and curl in the context of scalar and vector fields. • Theories of electrostatics, magnetostatics, magnetism with hands on experience experiments.						
Learning Outcomes	At the end of the course, the student should be able to • Visualize the three dimensional coordinates transformation of vectors and curved surfaces • Describe physical meaning of gradient, divergence and curl for practical purposes • Explain knowledge of electrostatics, magnetostatics and magnetism						
Contents of the course *(With approximate break-up of hours for L/T/P)*	• Vectors-an introduction; Unit vectors in Cartesian, spherical, and cylindrical polar co-ordinates; Transformation of coordinate systems, line, surface, and volume integrals, Concept of scalar and vector fields; Gradient of a scalar field; Directional derivative, Equipotential surfaces, Conservative vector fields and their potential functions-gravitational and electrostatic examples. (9L) • Flux, divergence of a vector, Gauss's theorem, Continuity equation; Curl–rotational and irrational vector fields, Stoke's theorem. Conservation principles for matter, energy, and electrical charge, physical applications in gravitation and electrostatics. Irrotational versus rotational vector fields. (8L) • Electrostatics: Electrostatic potential and field due to discrete and continuous charge distributions, boundary condition, Energy for a charge distribution, Conductors and capacitors, Laplace's equation Image problem, Dielectric polarization, Electric displacement vector, Dielectric susceptibility, Energy in dielectric systems. (12L) • Magneto statics: Lorentz force law, Bio-Savart's law and Ampere's law in magneto statics, Divergence and curl of B, Magnetic induction due to configurations of current-carrying conductors, Magnetization and bound currents, Energy density in a magnetic field, Magnetic permeability and susceptibility, Boundary conditions. (13 L) Practice components will cover the experiments on electrostatics and magneto statics viz. Electrostatic field, dielectric polarization, Electric Permittivity, capacitance, electric conductivity, Biot Savart law, Magnetic field, Magnetic permeability, Helmholtz Coil, Magnetization, Hysteresis, Faraday's law etc. (28 P)						
Text Book	1. David J. Griffiths, Introduction to Electrodynamics, 4th Edition, Pearson, 2015, ISBN – 13: 978-9332550445 2. Bhag Singh Guru, Huseyin R. Hiziroglu, Electromagnetic field Theory, 2nd Edition, Cambridge University Press, 2009; ISBN-13 : 978-0521116022						
Reference Books	1. W. H. Hayt, J. A. Buck and M. Jaleel Akhtar, Engineering Electromagnetics, McGraw Hill (India) Education Pvt. Ltd, Special Indian Edition 2020. 2. G. B. Arfken, H. J. Weber and F. E. Harris, Mathematical Methods for Physicists, Academic Press, 7th Edition, 2013, ISBN-13: 978-9381269558						

Course Code		Course Title	Basic Electrical Engineering			
Dept./Faculty proposing the course	ECE	Structure (LTPC)	L	T	P	C
			3	1	0	4
To be offered for	B.Tech & DD (All Branches)	Type	Core ■		Elective	
		Status	New ▱		Modification ◨	
Pre-requisite		Submitted for approval	Senate 61			

Learning Objectives	● To impart foundational knowledge on the construction, operation, and analysis of basic electrical and electronic circuits. ● To develop the ability to systematically analyze DC and AC circuits for practical engineering applications. ● To introduce students to fundamental electrical machines and their relevance in industrial and consumer contexts.
Learning Outcomes	At the end of the course, the students will be able to ● Represent and interpret basic electrical systems using standard technical conventions. ● Analyze and solve linear electric circuits (both DC and AC) with single or multiple power sources in the time domain. ● Understand the fundamentals of electronic components and circuits. ● Understand the construction, operation, and applications of electrical machines commonly used in industry.
Contents of the course *(With approximate break-up of hours for L/T/P)*	Basics of Electricity: Systems of units - charge and current, voltage, power and energy, electricity tariff, circuit elements - sources and passive elements (R,L,C), Overview of power system (4L+1T) DC Circuits: Basic laws and circuit analysis - Ohm's law, Kirchhoff's laws, voltage and current division, Wye-Delta transformations, Nodal and Mesh analysis with independent sources (6L+3T). Circuit theorems (with independent sources) - Linearity property, Superposition, source transformation, Thevenin's theorem, Norton's theorem, maximum power transfer theorem (5L+3T) AC Circuits: Sinusoids and phasors – phasor relationships, Impedance and Admittance; sinusoidal steady-state analysis – Nodal and mess analysis, theorems; AC power analysis- Instantaneous and average power, RMS, apparent and PF, complex power (10L+4T) Electrical Machines: Transformers – principle of operation, types, EMF equation, equivalent circuit, Losses and efficiency calculation, Dot convention (4L+1T) DC Machines - principle of operation, emf and torque equation, types, characteristics and speed control of DC motors (4L+1T). AC Induction Machines- operating principles, equivalent circuits, torque-speed characteristics, speed control, efficiency (4L+1T) Electronic Circuits: Operational Amplifiers - Ideal op-amp, inverting and noninverting amplifier, Applications of Op-Amp (2L+1T)

	Diodes - V-I characteristics and their applications (2L)
Text Books	1. Alexander C. and Sadiku M. N. O., Fundamentals of Electric Circuits, 7th Edition, Tata McGraw-Hill, New Delhi, ISBN: 9781260226409, 2013. 2. A.E. Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw-Hill Education Publications, 6th Edition, 2002.
Reference Books	1. Hughes, 'Electrical and Electronic Technology', Pearson Education India, 10th Edition, 2010. 2. W. H. Hayt and T. E. Kimmerley, Engineering Circuit Analysis, 9th Edition, TMH, ISBN: 9780073545516, 2019. 3. Joseph. A. Edminister, 'Electric Circuits - Schaum's Outline Series', McGraw-Hill Publications, 6th Edition, 2003.

Course Code		Course Title	**Problem Solving and Programming**			
Dept./Faculty proposing the course	CSE	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech, DD	Type	Core ▬		Elective ☐	
		Status	New ☐		Modification ▬	
Pre-requisite	--	Submitted for approval		Senate 61		
Learning Objectives	The course focuses on problem solving skills / techniques Students shall be exposed to data representations, base conversions, arithmetic in fixed and floating point representations. Sequence, selection, iterative statements and various other programming constructs in C,Python shall be discussed with case studies. The practice component of this course shall equip the students to test drive the theory concepts using appropriate case studies.					
Learning Outcomes	• The teaching and assessment shall ensure that given a computational problem, students can use computers as a tool to solve the problem. • Developing pseudo codes and programs using various programming constructs are expected out of the students. • Students will be able to develop simple applications using the various programming constructs.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Evolution of Computing Machines - Number Representation - Fixed & Floating Point - Base Conversions: Binary, Decimal, Octal, Hexa-decimal number systems and conversions. Introduction to algorithms and flow chart, Data types in C – Input and output statements – Formatted input/output – Phases of program development –Applications involving sequence statements (8L) Operators - Arithmetic, logical, relational, shift, unary operators – Precedence and Associativity - Selection Statements: IF-ELSE, SWITCH-CASE - Programs involving sequence & selection - GOTO statements - break statement - Nested IF (6 L) Repetition Statements - FOR, WHILE, DO WHILE - Programs involving sequence, selection & repetition - continue statement - Nested loops - Introduction to Arrays and Strings - Array manipulation - string manipulation -string operations - multi-dimensional arrays (10 L) Functions in C – Function declaration, definition – scope -storage class-Built-in and user defined functions –Recursive functions (5 L) Introduction to Pointers, Pointer Arithmetic, Dynamic Memory Allocation – Basic data structures using pointers, Structures and File processing, Command Line Arguments (6 L) Introduction to Python programming: basic programming constructs, selection (IF), Looping Statements, Functions and Recursion - Examples. (7 L) **Practice Component:** Introduction to text editors - basic text processing - case studies involving office software - doc and ppt creation, Introduction to Linux commands - file/directory creation - copy, move, pdf creation, zip commands -Applications using sequence statements - input/output statements - arithmetic with precedence and associativity. Case studies involving selection and repetition statements – arrays, functions, strings, recursion. Case studies involving pointers, dynamic memory allocation, structures, file processing (28P) Note: 30% of the practice component to be done using Python					
Text Books	1. Deitel P J and Deitel H M, C How to Program, Prentice Hall, 9th Edition, 2022, 978-0137398355 2. Deitel P J and Deitel H M, Python for Programmers, Pearson Education, 2019, 978-0135224335.					
Reference Books	1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2nd Edition, 2015, 978-9332549449 2. Byron S. Gottfried, Programming with C, TMH Publishers, 4th Edition, 2018, 978-9353160272 3. Donald E. Knuth, The Art of Computer Programming, 3rd Edition, 2022, 978-0137935109. 4. Yashavant Kanetkar, Understanding Pointers in C& C++, BPB Publications, 5th Edition, 2019, 978-9388176378.					

Course Code		Course Title	Concepts in Engineering Design			
Dept./Faculty proposing the course	SIDI	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B Tech/DD	Type	Core ▄		Elective ☐	
		Status	New ▄		Modification ☐	
Pre-requisite	None	Submitted for approval	Senate 61			

Learning Objectives	- To understand the engineering design process, product development cycles, and market influences on design decisions. - To transform customer needs into technical specifications using QFD and competitive benchmarking. - To assess design alternatives using structured decision frameworks.
Learning Outcomes	Students will formulate engineering problems by translating customer requirements into technical specifications, generate and evaluate innovative design concepts using creative thinking methodologies.
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction** - Importance of engineering design- types of design- the design process- total life cycle- regulatory and social issues-product design- types of products- phases of product development process- product and process cycles-organization for product development-markets and marketing-technological innovation (5L+5P) **Problem definition & need identification** - Identifying customer needs- gathering information- classifying customer requirements- establishing engineering characteristics- competitive benchmarking- quality function deployment- product design specification (6L+6P) **Conceptual design** - Creativity in design- creativity and problem solving- creative thinking methods- conceptual decomposition- morphological methods-TRIZ (Theory of Inventive Problem Solving)- Decision making and concept selection-decision theories-concept screening and concept scoring (6L+6P) **Embodiment design** - Product architecture- steps in developing product architecture-configuration design-industrial design- human factors design- prototyping and testing (6L+6P) **Product Economics and related issues** - Risk, reliability and safety- failure mode & effects analysis- concept of total quality- robust design- economic decision making-time value of money-profitability of investment- cost estimation-design to cost (5L+5P)
Text Books	1. George E.Dieter & Linda C.Schmidt, Engineering Design, McGraw-Hill International Edition 5, 2013, ISBN-10 : 9355322259, ISBN-13 : 978-9355322258 2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, Product Design and Development , Tata McGraw-Hill Education, 4th Edition, 2009, ISBN-10: 0070146799, ISBN-13: 978-0070146792
Reference Books	1. Kevin Otto, Kristin Wood, Product Design, Pearson Education, Indian Reprint, 2004, ISBN-10: 0130212717, ISBN-13: 978-0130212719 2. Yousef Haik, T.M.M. Shahin, Engineering Design Process, Cengage Learning, 2nd Edition Reprint, 2010, ISBN-10: 0495668141, ISBN-13: 978-0495668145 3. Clive L. Dym, Patrick Little, Engineering Design: A Project-based Introduction, John Wiley & Sons, 3rd Edition, 2009, ISBN-10: 0470225963, ISBN-13: 978-0470225967

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COURSE FORMAT

Course Code		Course Title	Engineering Skill Practice			
Dept./Faculty proposing the course	Mechanical Engineering	Structure (LTPC)	L	T	P	C
			0	0	2	1
To be offered for	All UG & DD	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	NIL	Submitted for approval		Senate 61		
Learning Objectives	The objective of this course is to give an exposure on the basic practices followed in the domain of mechanical, electrical, electronics and communication engineering. The exercises will train the students to acquire skills which are very essential for the engineers through hands-on sessions.					
Learning Outcomes	At the end of the course, the students will be able to choose suitable process/method among the mechanical, electrical, electronics, and communication engineering concepts that can full fill the functional outcomes of the parts/prototypes/products.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Experiments will be framed to train the students in following common engineering practices: Basic manufacturing processes: **Fitting, Drilling & tapping**, Material joining processes, **Carpentry, Sheet-metal work, Arc Welding, 3D Printing.** (10P) Familiarization of electronic components by Nomenclature, meters, power supplies, function generators and Oscilloscope – **Bread board assembling of simple circuits: IR transmitter and receiver – LED emergency lamp** – Communication study: amplitude modulation and demodulation. (6P) Domestic wiring practice: Fluorescent lamp connection, Staircase wiring – Estimation and costing of domestic and industrial wiring – power consumption by Incandescent, CFL and LED lamps. (2P) Dismantle and assembly of PC. Installing OS and disk management. (4P).					
Text Books	1. Uppal S. L., "Electrical Wiring & Estimating", 5Edn, Khanna Publishers, 2003. 2. Chapman. W. A. J., Workshop Technology, Part 1 & 2, Taylor & Francis.					
Reference Books	1. Clyde F. Coombs, "Printed circuits hand book", 6Edn, McGraw Hill, 2007 2. John H. Watt, Terrell Croft, "American Electricians' Handbook: A Reference Book for the Practical Electrical Man", Tata McGraw Hill, 2002.					

Course Code				Effective Language & Communication skills		
Offered by Department	SH-English		Structure(LTPC)	1	0	2	2
To be offered for	B.Tech		Course Type	Core		
Prerequisite	NIL		Approved In	Senate 61		
Learning Objectives	- Hone LSRW and practice critical thinking - Enable students to speak and write grammatically acceptable sentences - Train students in technical communication - Cultivate interest to learn language and to build the confidence to communicate in English - Develop an interest in updating their language skills through continuous learning - Connecting personal growth with improvement in their proficiency in English					
Learning Outcomes	- Able to communicate effectively with grammatically acceptable constructions and appropriate words in formal and informal situations - Can extract information effectively and able to think critically - Able to present technical content confidently					
Course Contents(with approximatebreakup of hours forlecture/ tutorial/ be donepractice)	- Introduction: Language, effective communication, ethics and aesthetics of communication (L1) - Phonetics – sounds, pronunciation of words, stress, intonation, listening, Varieties of English (L3, P4) - Sentence structure, concord, punctuation, stylistic errors, common errors (L3, P4) - Reading and comprehension (L2, P5) - Different types of reading, analyzing the organization of the text - Critical thinking- thesis statement, argument, hypothesis, order, reason, evidence, consistency,tautology, conclusion - Exercises for vocabulary enrichment (for daily practice) - Speaking (L2, P5) - Barriers to effective communication, technical presentation and presentation skills, self-introduction, - Requests, enquiry, suggestion in formal and informal situations, reporting an event, grouppresentation – debate - Writing (L3, P8) - Writing formal letters, email, résumé, - Data interpretation, reports, product description/requirements/ technical instructions, recordingobservations - The language of content strategy - voice and tone strategy - the language of localization textanalysis tools - Plagiarism – the importance of documentation, different methods of note-taking - Essays/story/ book & movie reviews/writing for social media/blogging/ journaling - Life lessons through stories and activities (P2)					
Essential & Supplementary Reading	1. Tebeaux, Elizabeth, and Sam Dragga. *The Essentials of Technical Communication*. OUP, 2018. 2. Rizvi, M Ashraf. *Effective Technical Communication*. McGraw-Hill, 2017 3. Hancock, Mark. *English Pronunciation in Use: Intermediate Self-study and Classroom Use*.CUP,2012. 4. Cottrell, Stella. *Critical Thinking Skills: Developing Effective Argument and Analysis*. Palgrave,2005. 5. Gower, Roger. *Grammar in Practice*. CUP, 2005. 6. Paterson, Ken. *Oxford Living Grammar*. OUP, 2014. 7. Sabin, William A. *The Gregg Reference Manual:A Manual of Style, Grammar, Usage, andFormatting*. McGraw-Hill, 2011. 8. Fitikides, T. J. *Common Mistakes in English*. London: Orient Longman, 1984.					

Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Routledge, 2013.

9. Astley, Peter and Lewis Lansford. *Oxford English for Careers: Engineering*. OUP, 2013.
10. Savage, Alice and Patricia Mayer. *Effective Academic Writing*. OUP, 2013
11. Harari, Yuval Noah. *Sapiens: A Brief History of Humankind*. Vintage, 2014.
12. https://www.ted.com/
13. https://www.bbc.co.uk/learningenglish/features/pronunciation/tims-pronunciation-workshop-ep-13
14. https://learnenglish.britishcouncil.org/skills/listening
15. https://www.nationalgeographic.com/podcasts/overheard
16. https://www.youtube.com/user/NatureVideoChannel
17. https://www.youtube.com/watch?v=Aj-EnsvU5Q0&list=PLcetZ6gSk969oGvAI0e4_PgVnlGbm64bp
18. https://www.merriam-webster.com/word-of-the-day
19. https://www.newyorker.com/tag/book-reviews

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DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

COURSE FORMAT

Course Name		Course Name	Differential Equations			
Offered by the Department	SH-Mathematics	Structure (LTPC)	3	1	0	4
To be offered for	B. Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	**Senate 61**			
Learning Objectives	To provide an exposure to the theory of ODEs & PDEs and the solution techniques.					
Contents of the course	➢ Linear ordinary differential equations with constant coefficients, method of variation of parameters, Linear systems of ordinary differential equations (10L +3P) ➢ Power series solution of ordinary differential equations, Singular Points, Frobenius series solutions, Bessel and Legendre differential equations, Properties of Bessel functions and Legendre Polynomials (12L+4P) ➢ Fourier series (6L+2P) ➢ Laplace transforms: Elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem, and its applications to ordinary differential equations (6L+2P) ➢ Introduction to partial differential equations, wave equation, heat equation, and diffusion equation (8L+3P)					
Essential Readings	1. Simmons G. F., Differential Equations, Tata McGraw-Hill, 2003. 2. Kreyszig E., Advanced Engineering Mathematics, Wiley, 2007.					
Supplementary Reading	1. William E. Boyce and R. C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 8th Edition, 2004. 2. Sneddon I., Elements of Partial Differential Equations, Tata McGraw-Hill, 1972 3. Ross L. S., Differential Equations, Wiley, 2007 4. Trench W., Elementary Differential Equations, http://digitalcommons.trinity.edu/mono					

Course Code		Course Title	Engineering Graphics and Modeling			
Dept./Faculty proposing the course	Mechanical Engineering Department	Structure (LTPC)	L	T	P	C
			1	1	2	3
To be offered for	B Tech. programs of CSE, ECE and Physics	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	Nil	Submitted for approval			Senate 61	
Learning Objectives	• To introduce the basic concepts and techniques of technical drawing • To learn 2D and 3D representation of various shapes/objects and its engineering applications					
Learning Outcomes	Students will acquire visualization skills and will be able to prepare technical drawings and 3D models using computer aided tools					
Contents of the course *(With approximate break-up of hours for L/T/P)*	• Role of technical drawing in product development process, Basics of technical drawing, Standards, Dimensioning principles (L2+P2) • Computer aided drafting (L2 + P2) • Principles of orthographic projection. 3D drawings of objects to orthographic projection (L4+P4) • Principles of isometric projections. 2D orthographic to isometric drawings (L4+P4) • Introduction to 3D modelling of shapes and objects (L2+P2) • Solid Modelling – part modelling & assembly modelling; Surface modelling; NURBS modelling (L6+P6) • 3D modelling from physical objects (L2+P2) • Modelling of engineering applications including electrical CAD (L2+P2)					
Text Books	1. Venugopal K and Prabhu Raja V, Engineering Drawing + AutoCAD, New Age International (P) Limited. 7th Edition, 2024 (ISBN: 9360749222) 2 Narayana. K.L, and Kannaiah. P, Engineering Drawing, Scitech Publications (India) Pvt. Ltd, 3rd Edition, 2021 (ISBN: 9789385983177)					
Reference Books	1. Bertoline G.R, Wiebe E.N, Hartman N, Ross W, Technical Graphics Communication, Mcgraw-Hill College, 2008, IRWIN Graphic Series, 2008 (9780077221300) 2 Varghese P.I, Engineering Graphics, McGraw Hill Education, 2017 (ISBN: 1259081001) 3. Bhatt. N.D, Engineering Drawing – Plane and Solid Geometry, Charotar Publishing House Pvt. Ltd., 54th Edition, 2023 (ISBN: 9789385039706)					

Course Code		Course Title	**Data Structures and Algorithms**			
Dept./Faculty proposing the course	CSE	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech, DD	Type	Core ▣		Elective ☐	
		Status	New ☐		Modification ▣	
Pre-requisite	--	Submitted for approval		Senate 61		
Learning Objectives	Given a computational problem, the focus is on design and implementation of algorithms using suitable data structures. The notion of time and space complexity, design of efficient algorithms and data structures shall also be explored. The course also focuses on exploring role of data structure for solving problems efficiently.					
Learning Outcomes	Students are expected to design efficient algorithms and data structures for computational problems					
Contents of the course *(With approximate break-up of hours for L/T/P)*	ADT- Review of elementary data structures – List, Stack, Queue– time and space complexity – step count method based computation – asymptotic analysis and bounds – big oh, little oh,omega,theta notation (5L) Analysis using recurrence relations – solving recurrence relations through guess method, recurrence tree method, Master theorem (5L) Analysis of sorting/searching algorithms - Incremental Design - insertion sort, decremental Design - Celebrity problem - Divide and Conquer- quicksort ,merge sort– comparison/ non-comparison based sorting algorithms on restricted inputs –counting, radix sorting - discussion on inputs with best/worst case complexities (7L) Binary Trees - Tree representation, traversal, Introduction to expression trees: traversal vs post/pre/infix notation. Recursive traversal and other tree parameters (depth, height, number of nodes etc.) (5L) Dictionary ADT: Binary search trees, balanced binary search trees - AVL Trees. (5L) Hashing - collisions, open and closed hashing, properties of good hash functions. Priority queue ADT: Binary heaps with application (5L) Data Structures in Python – Strings, Lists, Tuples, Dictionary – Examples (5L) Graphs: Representations (Matrix and Adjacency List),basic traversal such as BFS, DFS with complexity, spanning tree (5L) **Practice Component**: Elementary Data Structures, Implementation of case studies involving algorithms and data structures using C, Binary Trees–Traversal –Computation of Structural parameters, Hashing– implementation of hash functions–computing collisions– Open vs closed hashing, Sorting and Searching Algorithms, Priority Queues and Heaps and its applications, Graph Traversals–BFS, DFS and its applications (28P) Note: 30% of the practice component to be done using Python					
Text Books	1. M.A. Weiss,Data Structures and Algorithm Analysis in C,Pearson,2nd edition,2002, 978-8131714744. 2. Deitel P J and Deitel H M, Python for Programmers, Pearson Education, 2019, 978-0135224335					
Reference Books	1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Introduction to Algorithms, Prentice Hall of India, 4th Edition, 2022, 978-0262046305. 2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd edition, 2017, 978-9332585485. 3. Horowitz, Sahni and Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2nd Edition, 2008, 978-8173716058 4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, 1st edition, 2013, 978-1118290279.					

Course Code		Course Title	Design Realisation			
Dept./Faculty proposing the course	SIDI	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech/ DD	Type	Core ▬		Elective	
		Status	New ▬		Modification ☐	
Pre-requisite	Concepts in Engineering Design	Submitted for approval		Senate 61		
Learning Objectives	• To understand the user-centric design principles to identify and prioritize customer needs accurately. • To generate creative design solutions using Morphological tools, SCAMPER, and TRIZ methodologies. • To assess product concepts systematically through Pugh charts and concept scoring techniques. • To learn visualization skills by producing freehand sketches and models for product development.					
Learning Outcomes	• Analyze customer needs through structured methods like interviews and Quality Function Deployment (QFD). • Create innovative design concepts using tools like Morphological tool, SCAMPER, and TRIZ. • Evaluate design concepts using Pugh charts for effective concept screening and scoring • Design product architecture by applying configuration and industrial design principles.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Practical case studies using** • Customer need analysis, Indoor Customer interviews, Quality Function Deployment – House of quality (5L+5P) • Tools for conceptual design - creative thinking methods - Morphological tool, SCAMPER, TRIZ (6L+6P) • Embodiment design - Product architecture - steps in developing product architecture-configuration design-industrial design (6L+6P) • Concept screening - concept scoring – Pugh chart (5L+5P) • Realisation using free hand sketched and models (6L+6P)					
Text Books	1. George E.Dieter & Linda C.Schmidt, Engineering Design, McGraw-Hill International Edition 5, 2013, ISBN-10 : 9355322259, ISBN-13 : 978-9355322258					
Reference Books	1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, Product Design and Development , Tata McGraw-Hill Education, 4th Edition, 2009, ISBN-10: 0070146799, ISBN-13 : 978-0070146792 2. Kevin Otto, Kristin Wood, Product Design, Pearson Education, Indian Reprint, 2004, ISBN-10: 0130212717, ISBN-13: 978-0130212719					

Course Code		Course Title	Discrete Structures for Computer Science			
Dept./Faculty proposing the course	CSE	Structure (LTPC)	L	T	P	C
			3	1	0	4
To be offered for	B.Tech, DD	Type	Core ▣		Elective ☐	
		Status	New ☐		Modification ▣	
Pre-requisite	--	Submitted for approval		Senate 61		
Learning Objectives	To introduce students to logical reasoning, inferences, relations, functions, counting principles, proof techniques and graph theory.					
Learning Outcomes	Students will learn to write concepts formally and various proof techniques. They shall also be able to prove the correctness of algorithms and learn counting techniques.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Logic:** Logical puzzles, propositions, laws of inferences, predicates, First Order Logic, quantifiers, negation of quantifiers, nested quantifiers, predicates with multiple variables. (9L+3T) **Relations:** Set theory, operations on sets, relations, digraphs, properties of relations, equivalence classes, partial ordering, full ordering, well ordering, lexicographic ordering, standard ordering, Hasse diagram, lattice, composition of relations, counting special relations.(9L+3T) **Functions and counting techniques:** Types of functions, counting functions, cardinal numbers, finite and infinite sets, countable and uncountable sets.(7L+2T) **Proof techniques:** Vacuous proof, trivial proof, direct proof, proof by contraposition, proof by contradiction, weak induction, strong induction, pigeonhole principle,principle of inclusion-exclusion, derangement, fallacies, famous theorems and conjectures.(8L+3T) **Graph theory:** Motivation for graphs, Graphs, subgraphs and induced subgraphs, degree sequence, handshaking theorem, special graphs, Hall's marriage theorem, representation of graphs, graph isomorphism, vertex/edge cut, Euler's path, Euler's circuit, Hamiltonian path, Hamiltonian circuit, planar graphs.(9L+3T)					
Text Books	K. H. Rosen, Discrete Mathematics and its Applications, McGraw Hill, 8th Edition, 2021, 978-9390727353.					
Reference Books	1. D. F. Stanat and D. F. McAllister, Discrete Mathematics in Computer Science, Prentice Hall, 1977, 978-0132161503. 2. C. L. Liu, Elements of Discrete Mathematics, Fourth Edition, Tata Mcgraw Hill, 3rd Edition, 2017, 978-1259006395. 3. Busby, Kolman and Ross, Discrete Mathematical Structures, Pearson Education, 6th Edition, 2015, 978-9332549593. 4. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Edition, Addison Wesley, 1994, 978-0201558029.					

Course Code		Course Title	**Introduction to AI with Python**			
Dept./Faculty proposing the course	Computer Science and Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	Common to All B.Tech, DD	Type	Core ▬		Elective ☐	
		Status	New ▬		Modification ☐	
Pre-requisite	--	Submitted for approval	Senate 62			
Learning Objectives	- The course focuses on imparting knowledge about the principles of search and logic with practical examples. - To develop a basic understanding of problem solving, knowledge representation, reasoning and learning methods of AI.					
Learning Outcomes	- The student will gain knowledge about space search and search algorithms, logic based knowledge representation, and the shortcomings in in reasoning methods. - Ability to decide on the suitable representation for a domain model. - Ability to choose appropriate algorithms for AI reasoning in that domain					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Overview of Python and AI:** Data types, Control Structures in Python, Philosophy of AI,Need, Use of Agents, Intelligent Agents – Rationality, Structure and Environments. (L5) **Search Strategies:** Uniformed Search-BFS, DFS, Iterative Deepening DFS,Informed Search – Best First, A* Search, Iterative Deepening A*, Depth First Branch Bound, Heuristic Functions, Local Search- Hill Climbing and Simulated Annealing, Limitations, Random walk/Restart (L10) **Adversarial Search and Constraint Satisfaction Problem :**Min Max Algorithm, Alpha Beta pruning, Backtracking for CSP, Arc Consistency (L5) **Logic in AI**: Knowledge Based Agents, Propositional logic, agent for wumpus world, Knowledge base, First order logic, Syntax& Semantics, Propositional vs. First-Order Inference, Forward Chaining, Backward Chaining, Resolution Refutation Systems (L8) **Practice Sessions:** All assignments would be implemented using Python packages for AI such as Tensorflow, Pytorch, Scikit learn, Tokenizers,Pytholog, etc. Solving Problems By Search: BFS,DFS, Iterative Deepening DFS, N-Queens problem, TSP, Local Search- N Puzzle problem using Hill Climbing, Game Playing Strategies: Alpha Beta Pruning,Tic tac toe game, CSP-Map Coloring Problem, Uncertainity in AI**:** Conditional Independence, Bayesian Networks, Applications of AI in respective engineering domain. [P28]					
Essential Reading	1. S Russell & P Norvig, Artificial Intelligence – A Modern Approach, Pearson, 3rd Edition, 2010, ISBN 9789332543515. 2. Nils J Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann Publications, 2000.					
Supplementary Reading	1. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill, 2013, ISBN 9783827370891 2. P Norvig, Paradigms of AI Programming, Morgan Kauffmann, 1991, ISBN 9781558601918 3. Dean, Allen & Aloimonos, AI Theory & Practice, Addison Wesley, 1995, ISBN 9780805325478					

Course Code		Course Title	**Object Oriented Programming**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	4	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	--	Submitted for approval	Senate 62			
Learning Objectives	The course introduces students to the object oriented programming paradigm and its benefits in application development. Students would be exposed to major benefits of the OO Paradgim, in terms of data security, reusability etc. Both C++ and Java would be used as implementation platforms for the various object oriented features.					
Learning Outcomes	• To understand Object Oriented Concepts for Software Design • To analyse various aspects of Software Design in a reusable and secure fashion • To create applications supporting a command line & graphical user interface in Object Oriented fashion.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Object oriented programming - Encapsulation – Constructors – Destructors - Composition – Friend functions/classes – this pointer – Dynamic memory management (L6) Operator overloading Reusability – Inheritance – Base & derived classes – Protected members – Constructors –Destructors in derived classes – public/private/protected inheritance – Polymorphism (L8) Virtual functions - Templates – Function & Class templates – Streams – Stream input Output Stream format states – Manipulators – Exception handling – Re–throwing exceptions –specifications–and exception handling – Inheritance – STL (L7) Event Handling, Applets, – Frames, Buttons, Menu – Visual design layout, Multithreading, Networking, Database connectivity support (L7) Practice Component: Exercises on Data Encapsulation / Data Abstraction based on the concept of Interface v/s Implementation Separation using constructors, destructors etc features. Package Creation using Operator Overloading feature eg. Rational number arithmetic package, etc., Input and Output operator overloading, Unary Operator overloading etc shall be built. Power of Inheritance in OOPs and packages using inheritance such as Shape Class, Employee class etc. shall be test driven including polymorphic / run time binding behavior will be tested. Class Templates and STL support to create applications utilizing built in data structures etc shall also be test driven. Support for exception handling – try throw catch for user defined / built in class support. Application development using Java Platform – applets, basic interface design and package support shall be test driven [P56]					
Text Books	1, Deitel P J and Deitel H M, C++: How To Program, Prentice Hall, 10th Edn, 2017, ISBN 9789332585737 2. Deitel P J and Deitel H M, Java: How To Program, Prentice Hall, 9th Edn, 2016, ISBN 9332563292					
Reference Books	1. David Flanagan, Java in a Nutshell, 5th Edition, O'Rielly, 2005, ISBN 9780596007737 2. Herbert Schildt, Java: A Beginners Guide, 13th Edition, McGraw Hill, 2024, ISBN 9355326475 3. HerbetSchildt, Teach Yourself C++, 4th Edition, Tata McGraw Hill, 2017, ISBN 978-0070532465					

Course Code		Course Title	**Digital Systems Design**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite		Submitted for approval		Senate 62		
Learning Objectives	To introduce the basic understanding of digital representation, Boolean algebra and the operation of the logic components, combinational and sequential circuits.					
Learning Outcomes	Students will be able to understand Digital Number systems, fixed and floating point representation and arithmetic operations. They shall also be able: • To use Boolean Algebra and Switching theory for Logic minimization. • To implement Combinational Circuits using Primitive gates and logic functions • To implement sequential circuit elements and finite state machines.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Digital Circuits: Number Representation- Fixed point and floating point, 1's and 2's complement. Switching Theory - Boolean algebra, switching functions, Truth Tables and Algebraic forms, Simplification of Boolean expressions – Algebraic methods, canonical forms and Minimization of functions using K-Maps (L8) Binary Codes: BCD, Gary, Excess 3, Alpha Numeric codes and conversion circuits. (L4) Arithmetic circuits: Half Adder, Full Adder/subtractor, 4-bit adders and subtractors, look-ahead carry adder (L4) Synthesis of combinational logic functions using MSIs: Mux/Demux, decoders/encoders, Priority encoders, Comparators, seven segment display (L6) Sequential Circuits: Clock - Latches and Flip-Flops - SR, JK, D, T - Excitation tables. (L6) Sequential circuits Design: Shift Registers, Counters, Random Access Memory. Finite State Machines- Mealy & Moore types Basic design steps- Design of counters, sequence generators, and sequence detectors - Design of simple synchronous machines – state minimization. (L10) Introduction to HDL- Introduction to Hardware Description Languages (HDL) - Basic syntax and structure of HDL (Verilog) -Simple design examples (L4) **Practice:** Design and implementation of logic functions, combinational circuits (code converters, half & full adders, comparator, ripple carry adder, priority encoder, Decoders, Seven segment display, multiplexer), Design of sequential Circuits using hardware kit, Design of 4-bit ALU (Adder, subtract or, logic and shift operations), Basic Design project in Verilog. [P28]					
Text Books	Mano, M. M., Kime, C. R., & Martin, T, Logic and computer design fundamentals 5th Edition, Pearson, 2015, ISBN-13: 978-0-13-376063-7.					
Reference Books	1. Samir Palnitkar, Verilog HDL, 2nd Edition, Pearson, 2003, ISBN**:** 978-8177589184. 2. S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits," McGraw-Hill Series in Electrical and Computer Engineering, 4th Edition, 2015, ISBN-13 : 978-0072320848. 3. R. J. Tocci, N. S. Widmer, and G. L. Moss, "Digital Systems Principles and applications," Pearson Prentice Hall,10th Edition, 2010, ISBN-13 : 978-0135103821. 4. Morris Mano M, Digital Logic and Computer Design, Pearson, 2nd Edition, 2017. ISBN: 9789332586048.					

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Code		Course Title	**Design and Analysis of Algorithms**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	● To design time or space efficient algorithms using well known paradigms. ● To understand the limitations of computing machines. ● To explore tractable vs intractable problems.					
Learning Outcomes	Students will be able to design efficient algorithms using paradigms such as divide and conquer, dynamic programming, greedy methods etc. Students will be able to differentiate easy vs hard problems. Students will get sufficient skills to design polynomial-time algorithms along with a proof of correctness.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	● Detailed discussion on asymptotic analysis – recurrence relations – recurrence tree method – Master theorem (L6) ● Incremental and Decremental strategies – divide and conquer – case studies – merge sort, quick sort with detailed analysis – lower bounds for sorting (L6) ● Greedy Method – Container loading – knapsack – scheduling – coin change – proof of correctness (L8) ● Dynamic programming – matrix chain, optimal binary search tree, travelling salesman, LCS, knapsack, greedy vs dynamic programming – Principle of optimality, overlapping subproblems – Dynamic programming vs Divide and Conquer (L8) ● Graph algorithms – Applications of DFS and BFS – Topological sort – Shortest path algorithms – Dijkstra's Algorithm, – Bellman-Ford's Algorithm – minimum spanning tree – Principle of optimality (L8) ● Tractability - Introduction to NP-completeness – NP, NP-hardness, polynomial-time reductions (L6) The practice component will require the student to write computer programs using a careful choice of data structures and algorithmic paradigms (in C++/Java/Python language) from scratch, based on the concepts learnt in the theory course. Case studies in respect of different paradigms discussed above shall be implemented. [P28]					
Text Books	1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and Clifford Stein, "Introduction to Algorithms", Prentice Hall India, 4 th Edition, 2022. ISBN 978-0-262-04630-5 2. E. Horowitz, S. Sahni, and S. Rajasekaran, "Computer Algorithms", 2 nd Edition, Galgotia Publications, 2007. ISBN 0-7167-8316-9					
Reference Books	1. Aho, Hopcroft, and Ullmann, "Data Structures & Algorithms", Addison Wesley, 1983. ISBN-13: 978-0201000238 2. Eva Tardos and Kleinberg, "Algorithm Design", Pearson, 2006, ISBN-13 : 978-0321295354 3. SanjoyDasgupta, Christos Papadimitriou, UmeshVazirani, "Algorithms", McGraw-Hill, 2006, 978-0073523408					

Course Code			Course Title	**Database Systems Design**			
Dept./Faculty Proposing the course	Computer Science & Engineering		Structure (LTPC)	L	T	P	C
				3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE		Status	Core		Elective	
			Type	New		Modification	
Pre-requisite	Nil		Submitted for approval			Senate 62	
Learning Objectives	Students will be exposed to understand database design principles, architecture, and relational models. They shall learn the fundamentals of SQL programming, design databases using ER diagrams, schema mapping, and normalization.						
Learning Outcomes	Students will be able to design and implement databases with formal analysis and design thinking. They shall also be able students would be equipped with skills required for basic application development involving database connectivity.						
Contents of the course*(With approximate break-up of hours for L/T/P)*	**Introduction to Database systems:** Overview of databases, Data models, Schemas, Instances, Three schema architecture, Database Architecture (L3) **Conceptual Data Modelling**: Entity – Relationship (ER) Model, Database Design Process, ER Diagrams -Entities, Attributes, Relationships, Constraints, keys (L6) **Relational Data Model:** Relational Model concepts, Constraints, Keys, Relational Schemas, Conversion of ER to Relational model. Relational Algebra: Expressive power of relational databases. (L6) **SQL:** Basics of SQL, DDL, DML, Constraints - CHECK, Three-Valued Logic, Retrieval Queries: Nested queries, Set operations, Aggregate functions, Grouping, Assertions, View in SQL. (L6) **Normalization:** Functional Dependencies: Inference Rules, Equivalence, Minimal Cover. Database Decomposition: Lossless joins, Normal Forms (First to Third, BCNF) (L9) **Transactions:** Introduction to Transactions, Desirable properties, Schedules: Recoverability, Serializability, Two Phase locking techniques for Concurrency (L6). **Physical Database Design:** Internal Schema Design, Single Level and Multi Level indexing, B-Trees, B+Trees.(L4) **Advanced Concepts:** Introduction to Non-Relational Databases, NOSQL systems, CAP Theorem. (L2) **Practice Sessions:**Higher level modelling using ER diagram, Introduction to SQL, DDL, DML - Implementation of Set Theoretic operations, Aggregate functions, Views using SQ - Indexing using B-Trees and B+Trees- Introduction to MongoDB – Document model – Find, Replace, Aggregation, etc. Assignment/Mini project-based application design and development involving database [P28]						
Text Books	R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2016, ISBN 9789332582705						
Reference Books	1. J Ullman, J Widom, A First Course in Database Systems, Pearson, 3rd Edition, 2007, ISBN:9780136006374 2. A. Silberschatz, H.F. Korth and S. Sudharshan, Database System Concepts, Tata McGraw Hill, 7th Edition, 2021, ISBN: 9390727502 3. C.J. Date, A. Kannan , and S. Swamynathan, "An Introduction to Database Systems", Pearson, 8th Edition, 2006, ISBN: 978-0321197849						

Course Code		Course Title	**Computing Paradigms**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	0	2
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ▬		Elective ☐	
		Status	New ▬		Modification ☐	
Pre-requisite		Submitted for approval		Senate 62		
Learning Objectives	The course focuses on exposing students to the evolution of various computing paradigms on a breadth perspective. The course shall focus on the following: • Facilitate comparison between legacy and emerging approaches like cloud, edge, fog, and serverless computing. • Architectural and functional differences across paradigms.					
Learning Outcomes	By the end of the course students will develop a clear understanding of how computing paradigms have evolved, from traditional systems to emerging technologies and gain the ability to distinguish and compare various computing approaches such as centralized, distributed, parallel, cloud, edge, fog, and serverless computing.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction to Computing Paradigms:** Introduction and motivation for computing paradigm evolution, Centralized, decentralized, distributed and parallel computing, Limitations of traditional models (monolithic systems, scalability issues), Concepts of resource sharing, fault tolerance, and elasticity (L4) **Cluster and Grid Computing:** Introduction to clusters; types – load-balancing, HA, HPC; architecture and components. Grid computing – evolution, motivation, architecture layers (fabric to application), resource discovery and allocation. (L7) **Cloud, Edge, and Fog Computing**: Cloud, Edge, and Fog Computing fundamentals: Essential characteristics, Architectural Influences, Technological Influences, and Operational Influences. Cloud Service Models, Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Expected benefits (L6) **Serverless and Pervasive Computing:**Introduction to serverless; evolution from traditional models; FaaS, BaaS; use cases in IoT, microservices, real-time data; introduction to pervasive computing; context-awareness; serverless orchestration via Step Functions. (L6) **Quantum, Natural, and Emerging Computing Paradigms:**Qubits, superposition, entanglement, quantum gates; basics of natural computing; compare paradigms; how to choose a paradigm; latest trends in new computing models. (L5)					
Text Books	Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier, 2012ISBN: 9780123858801.					
Reference Books	1. Mahmood, Zaigham, ed. *Fog computing: concepts, frameworks and technologies*. Springer, 2018.ISBN: 978-3030069322 2. Rajalakshmi Krishnamurthi, Adarsh Kumar, Sukhpal Singh Gill, Rajkumar Buyya, eds. *Serverless Computing: Principles and Paradigms*. Springer International Publishing, 2023.ISBN: 978-3031266324. 3. Bernhardt, Chris. *Quantum computing for everyone*. MIT Press, 2019.ISBN: 9780262539531.					

Course Code		Course Title	**Applied Data Science**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	This course covers the basic concepts of Data Science to help the student to learn, understand and practice data analytics encompassing concepts from descriptive, inferential statistics and predictive techniques and big data concepts.					
Learning Outcomes	- Ability to identify the characteristics of datasets; Ability to select and implement machine learning techniques suitable for the respective application; - Ability to solve problems associated with big data characteristics such as high dimensionality; - Ability to integrate machine learning libraries and mathematical and statistical tools					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Introduction to relevant industry applications and analytics – Descriptive Statistics – Data Visualization & Interpretation -Measures of Central Tendency & Dispersion - Basic and advanced plots such as Stem-Leaf Plots, Histograms, Pie charts, Box Plots, Violin Plots etc. – Merits of Demerits & Interpretation (L7) Inferential Statistics – Hypothesis Testing - Tests of Significance – Analysis of Variance - Regression – Linear and Logistic (L7) Predictive Analytics – Supervised and Unsupervised – Association Rules, Classification, Clustering, Outlier Analysis, Time Series Modelling (L8) Big Data Characteristics – Map Reduce –Distributed Storage, Implementation using Hadoop / Pyspark platforms (L6) Practice Component**:** Concepts from Descriptive Statistics, Inferential and Predictive Analytics would be test driven using platforms such as Python, R etc. ML support in these platforms for rule mining and application, classification & clustering algorithms etc. would also be test driven as part of the practice exercises. Modern technologies for big data handling such as Pyspark – support for Map reduce would also be test driven. Applications relevant to the student's stream of Offered by Department would be explored for exercises / course project as case studies. [P28]					
Text Books	J Han, M Kamber, Data Mining Concepts & Techniques, Elsevier, 4th Edition, 2022, ISBN 9780128117606					
Reference Books	1. Joel Grus, Data Science from Scratch, Orielly, 2nd Edn, 2019, ISBN 9781492041139 2. Leskovec, Anand Rajaraman, Ullmann, Mining of Massive Data Sets, Cambridge University Press, Open Source free version , ISBN 9781107015357 3. P Bruce, A Bruce and P Gedeck, Practical Statistics for Data Scientists, O'Reilly, 2020, ISBN 978-1492072942					

Course Code		Course Title	**Computer Organization**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech (CSE,AI),DD CSE	Type	Core ■		Elective	
		Status	New ☐		Modification ■	
Pre-requisite	None	Submitted for approval		Senate 62		
Learning Objectives	The course aims to explore various aspects of computer design, including common design trade-offs and optimizations used to build high-performance and cost-effective systems, as seen in modern computers.					
Learning Outcomes	The students will learn paradigms of computer systems design and implement a subset of them in practice.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction to a computing system:** Functions and structure of a computer, components of a a computer, performance of a computer - Speed, Throughput, **Instruction Set Architecture:** CISC and RISC Instruction Set. Load-Store Architecture. Advantages of Load-Store Architecture. Types of instructions in a RISC processor. Addressing modes (L6) **Processor Organization** **Register File:** IR, PC, MAR, MBR, Register File, **Decode Unit:** Decoding RISC instructions. Micro-instructions. Converting an instruction into micro-instructions, **ALU Design:** High performance integer and floating point adders and multipliers (L12) **Pipelining:** Introduction to pipelining. Performance analysis of pipelining. Building a single stage processor that supports ADD/BE/LW/SW instructions. Converting the single stage processor into a single issue, in-order five-stage pipelined processor. Pipelining Hazards. Dual Issue pipelined processor. (L12) **Memory Organization** **Semi-conductor RAM memories:** Static memories, Asynchronous DRAMs. Synchronous DRAMs. **Cache Memories:** Introduction to Cache Memory. Cache Mapping functions, Cache Replacement Algorithms, Multi-level Cache Memories. Performance analysis of cache memories: Hit Rate, Miss Penalty. (L6) **Virtual Memories:** Need for virtual memory. Address space mapping of virtual memory to physical memory, Page-walk, Translation look aside buffer. (L3) **I/O Organization :** Multiple bus Organization. Access mechanisms of I/O devices, I/O ports, I/O control mechanisms – Program Controlled I/O. Interrupt controlled I/O and DMA controlled I/O; I/O interfaces – Serial port, parallel port; I/O processor. (L3) **Practice Sessions:** Implementation of register file. Implementation of multi-bit integer adder. Implementation of multi-bit integer multiplier. Implementation of floating point adder. Implementation of floating point multipliers. Implementation of decoder for a RISC ISA. Implementation of instruction fetch unit. Implementation of ALU design. Implementation of Virtual address translation to physical address. Implementation of cache controller. Implementation and simulation of a simple non-pipelined processor. [P28]					
Text Books	David A. Patterson and John L. Hennessy, Computer Organization and Design RISC-V Edition: The Hardware Software Interface, 1st ed, Morgan Kaufmann Publishers Inc., San Francisco, CA, USA. 2017ISBN:978-0-12-812275-4					
Reference Books	C. Carl Hamacher, Zvonko G. Vranesic, and Safwat G. Zaky, Computer Organization, 5th. Ed, McGraw-Hill, Inc., USA. 2017, ISBN: 9781259005275					

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Code		Course Title	**Machine Learning Algorithms**			
Dept./Faculty proposing the course	Computer Science and Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	The goal of this course is to master foundational ML concepts, including supervised, unsupervised, and reinforcement learning. The course also helps the students to understand and implement modern ML algorithms, to explore practical applications, and to develop skills in ML programming using Python and frameworks like PyTorch, TensorFlow, Scikit-learn.					
Learning Outcomes	In this course students will learn to formulate ML problems, select algorithms, evaluate performance, design/train deep learning for vision, NLP, generative tasks. The students will be also learn to apply unsupervised learning, dimensionality reduction, implement RL for sequential decision-making, and address interpretability, fairness, scalability with tools.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction to Machine Learning** Overview: Supervised, unsupervised, reinforcement, self-supervised learning; applications. ML pipeline: Data preprocessing, feature engineering, training, evaluation, deployment. [L8] **Supervised Learning and Model Evaluation** Linear models: Linear/logistic regression, perceptron, L1/L2 regularization. Generalized Linear Models (GLMs): Exponential family, link functions. Support Vector Machines: Hard/soft margins, kernels, dual formulation. Evaluation: Bias-variance, cross-validation, ROC curves, fairness metrics. Modern techniques: Gradient boosting, ensemble methods. Debugging: Learning curves, overfitting/underfitting, hyperparameters tuning. [L10] **Unsupervised Learning and Dimensionality Reduction** Clustering: K-means, hierarchical, DBSCAN, GMMs with EM. Dimensionality reduction: PCA, ICA. Applications: Anomaly detection, segmentation, visualization. Trends: Graph-based clustering, representation learning. [L8] **Reinforcement Learning** RL: MDPs, Bellman equations, value/policy iteration. Algorithms: Q-learning, DQN, PPO, SAC. Value function approximation: LQR, function approximation. [L6] **Deep Learning and Generative Models** Deep Learning: Neural networks, backpropagation, optimization. Architectures: CNNs, RNNs, LSTMs, Transformers. Introduction to generative models like Gaussian Discriminant Analysis, Naive Bayes, VAEs, GANs, diffusion models [L6] **Emerging Topics and Practical Applications** Transfer learning, Federated Learning, Graph Neural Networks, Applications: NLP, computer vision, healthcare. Trends: Neuromorphic computing, quantum ML, sustainable AI, Generative AI (LLMs, diffusion models), AutoML, MLOps. Explainable AI, Ethical AI [L4] **Practice Component** [P28] • Data Preprocessing and Feature Engineering (Standardizing Features and Handling Missing Data) • Logistic Regression with Cross-Validation and ROC Curve • K-Means Clustering with PCA for Visualization • MDP Application like grid world navigation, using RL framework like Gymnasium • Working with Pre-trained models (BERT, ResNet, LLaMA) • Working with frameworks: Scikit-learn, PyTorch, TensorFlow, Hugging Face, JAX, OpenCV for small project development.					
Text Books	1. Christopher Bishop. Pattern Recognition and Machine Learning. Springer, 2006, ISBN: 9780387310732. 2. Aurélien Géron, Hands-On Machine Learning with Scikit-learn, Keras, TensorFlow, O'Reilly, 2022, ISBN: 9789355421982.					
Reference Books/Articles	1. Trevor Hastie, Robert Tibshirani, and Jerome Friedman. The Elements of Statistical Learning, Springer, 2008, ISBN: 9780387848570. 2. Tom M. Mitchell. Machine Learning, Mc Grew Hill, 2017, ISBN: 9781259096952.					

INDIANINSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Code		Course Title	**Operating Systems**			
Dept./Faculty Proposing the course	Computer Science Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Status	Core ■		Elective ☐	
		Type	New ☐		Modification ■	
Pre-requisite		Submitted for approval		Senate 62		
Learning Objectives	The course focusses on the structure and functions of an operating system. Students will be exposed to operating systems abstraction, mechanisms and their implementation support for concurrency (threads) and synchronization, resource management, scheduling strategies.					
Learning Outcomes	Students will gain a sound understanding of basic concepts relating to the design and implementation of an operating system. They will be equipped with skills relating to: ● Scheduling, multithreading, synchronization, deadlock management and the structure of the operating system (Linux), at the concept and the source code level. ● Kernel API support to implement various features to be supported by an OS					
Contents of the course*(With approximate break-up of hours for L/T/P)*	**Introduction to Operating Systems**: Functionalities & Services of an Operating System, System Calls & Types, **ProcessConcept**:Process Control Block, Linux System calls for Process creation, Inter Process Communication using Shared memory, Message passing, Pipes. (L10) **Concurrency**: Multithreaded programming – benefits, challenges, models, Amdahls Law, Pthreads library in Linux for thread creation, cancellation, thread specific data, Thread pools, Signal handling. (L5) **Scheduling**: Pre-emptive, Non pre-emptive algorithms -FCFS, SJF, SRT, RR, Thread scheduling – contention scope, pthread support for scheduling, Basics of multiprocessor scheduling– Asymmetric and Symmetric. (L7) **Synchronization**: Race condition, Critical Section Problem, Solution, Mutex Locks and Semaphores, Priority Inversion, Pthreads synchronization for Producer Consumer problem, Reader Writers Problem. (L6) **Deadlock:** Characteristics, Resource graph, Avoidance & Prevention, Safe state, Bankers algorithm, Recovery schemes. (L4) **Memory management**: Logical v/s Physical address space, Paging, Page table structures, Segmentation, Virtual memory, Page replacement strategies. (L6) **File and Disk Management**: File Systems – file operations, types, file allocation and access methods, Directory structure, Mounting file systems, Disk Scheduling. (L4) **Practice Sessions:** Linux System Calls for process creation, management – Applications such as command prompt simulator using fork - Interprocess Communication (IPC) Using Shared Memory, Message Passing, and Pipes with Producer-Consumer Applications - Multithreading - Pthreads with applications like merge sort and min-max-average, including thread scheduling using pthread_setschedparam and pthread_getschedparam - Synchronization - classical problems like Dining Philosophers and Readers-Writers with mutex locks and semaphores - Deadlock detection / avoidance algorithms – case studies related to mobile operating systems [P28]					
Text Book	1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, John Wiley, 10th Edition, 2021, ISBN 9781119800361 2. William Stallings, Operating Systems: Internals and Design Principles, Pearson,9th Edition, 2017, ISBN: 978-0134670959					
Reference Books	1. Robert Love, Linux Systems Programming, O Reilly Media, 2 nd Edition, 2013, ISBN 9781449339531. 2. D Butlar, J Farrell, B Nichols, Pthreads Programming, O Reilly Media, 1996, ISBN 9781565921153					

Course Code		Course Title	**Data Driven Optimization**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	0	2
To be offered for	B.Tech CSE(AI)	Type	Core ▤		Elective ☐	
		Status	New ▤		Modification ☐	
Pre-requisite	--	Submitted for approval	Senate 62			

Learning Objectives	- Understand and apply mathematical optimization algorithms to real-life problems - Identify efficient optimization algorithms and implement them for data-driven applications - Critically assess recent research papers in data-driven optimization - Formulate novel research questions in the domain of data-driven optimization
Learning Outcomes	- Model real-world problems as mathematical optimization tasks - Apply gradient-based and stochastic optimization techniques - Solve constrained and unconstrained optimization problem - Analyze convergence and evaluate optimization strategies in data-driven applications
Contents of the course *(With approximate break-up of hours for L/T/P)*	Data-Driven Modelling Concepts: Review of linear algebra, calculus, probability. Unconstrained Optimization Techniques: Golden section, Random, Pattern and Gradient search methods – Interpolation methods, Gradient Descent Method - Recognizing a Local Minimum, Taylor's Theorem, [8] Constrained Optimization Techniques: Linear Programming Problems, Optimization with equality and inequality constraints - Continuous Optimization, Discrete Optimization, Characteristics of optimization problems. [10] Meta heuristic Optimization: Genetic Algorithm, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Tabu Search. Least squares, Loss functions in ML (non-convexity, saddle points, plateaus), optimization of classification models; optimization in neural networks [10]
Text Books	1. D.E.Goldberg, Genetic Algorithms in Search, Optimization and Machine, Barnen, Addison Wesley, New York, 1989, 978-0201157673 2. Kalyanmoy Deb, Multi-Objective Optimization using Evolutionary Algorithms, Wiley,2020, 978-8126528042
Reference Books	1. J Nocedal and S Wright , Numerical Optimization, Springer Series in Operations Research and Financial Engineering, 2nd Edition, 2006, 978-0387303031 2. C. Shah, A Hands-on Introduction to Data Science, Cambridge University Press, 2020, 978-1108472449 3. C. Balaji, Essentials of Thermal System Design and Optimization, Ane Book Pvt. Ltd, 2011, 978-9381162187 4. Suvrit Sra , Sebastian Nowozin,et.al, Optimization for Machine Learning. MIT press, 2019, 978-0262537766

Course Code		Course Title	**Theory of Computation**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	1	0	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ▬		Elective ☐	
		Status	New ☐		Modification ▬	
Pre-requisite	--	Submitted for approval	Senate 62			
Learning Objectives	This course aims to provide fundamentals of computing models such as finite state automata, pushdown automata, linear bounded automata and Turing machine. Powers and limitations of the models will also be discussed. Solvability and Tractability will be introduced through Turing machine					
Learning Outcomes	Students shall develop sufficient mathematical skills to design various computing models such as FSA, PDA, LBA and TM.Further, one will have the understanding of the relation among digital computer, algorithms and Turing Machines. Further students will also gain necessary skills to comment on the solvability/unsolvability aspect of computational problems.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Finite Automata &Regular Languages-Languages vs. Problems. Finite State Automata, Regular Languages, Closure properties. Non-determinism, Regular Grammar and Regular Expressions, Equivalence of NFA andDFA.NFA and NFA with ε-transitions. (L10, T3) Limitations of Finite Automata, Pumping Lemma, Myhill-Nerode relations, Quotient Construction, Minimization Algorithm.(L8,T3) Push Down Automata &Context-free Languages(CFLs)- Grammars and Chomsky Hierarchy, CFLs, Chomsky Normal Form, Pumping Lemma for CFLs, Inherent Ambiguity of Context-Free Languages, Pushdown Automata (PDA), PDA vs CFLs. Non-equivalence of Deterministic and non- deterministic versions of PDA.Deterministic CFLs.–Closure properties (L12,T4) Linear Bounded Automata, Turing Machines & Computability -Introduction to Linear Bounded Automata (LBA), Turing Machines – Accepting vs Computing TMs, TM for addition, subtraction, and multiplication, Primality test. (L6, T2) Recursive and Recursively enumerable languages – Theory of Undecidability, Diagonalization language, Universal Turing machine, Halting Problem. (L6,T2)					
Text Books	1. Hopcroft, Motwani, and Ullman, , Introduction to Automata Theory, Languages and Computation, Pearson Publishers, New International Edition (reprint of 3rd Edition), 2013, ISBN: 9781292039053. 2. Peter Linz and Susan H. Rodger,An Introduction to Formal Languages and Automata, Jones & Bartlett Learning, Seventh Edition, 2023, 9781284231601, 2023.					
Reference Books	1. H. R. Lewis and C. H. Papadimitriou , Elements of the Theory of Computation, , Prentice Hall Publishers, Second Edition, 1997, ISBN: 9780132624787 2. John C. Martin, Introduction to Languages and the Theory of Computation, McGraw Hill Higher Education, Fourth Edition, 2011, ISBN: 9780073191461,					

Course Code		Course Title	**Computer Networks**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ▰		Elective ▰	
		Status	New ☐		Modification ☐	
Pre-requisite		Submitted for approval		Senate 62		
Learning Objectives	To introduce the basics of computer networking, error detection and correction techniques, and flow control techniques. Also an exposure to IP addressing and routing and its associated protocols would be given. A highlight of various application layer protocols and its relevance in modern networking world would be discussed.					
Learning Outcomes	To design a local area network and analyse the network using performance metrics. To appreciate the importance of subnetting, masking, and nuances involved in setting up a campus network					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Foundation of Networks:** Network architecture - protocol implementation issues - network design. Reference models- The OSI Reference Model- the TCP/IP Model - A Comparison of the OSI and TCP/IP, Implementing Network Software. (L5) **Physical Layer:** Different types of transmission media, Encoding-NRZ, Manchester, Differential Manchester, Transmission media, Performance evaluation of a network: propagation delay,transmission delay, RTT, effective bandwidth. (L5) **Data Link Layer:** Framing-Byte-Oriented Protocols, Bit-Oriented Protocols, Error Detection and correction, Reliable Transmission-Stop-and-Wait ARQ, Sliding Window-HDLC, Flow control and error control, switches, bridges, virtual circuit switching and addressing schemes. Ethernet, Token Ring, Performance evaluation of IEEE 802.3, 802.5, 802.11 networks, Medium Access Control-CSMA, CSMA/CD etc., (L11) **Network layer:**Global Internet Protocol, Fragmentation and IP addressing, IPV4, IPv6, ARP,DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing, subnetting, supernetting, Classless addressing, Network Address Translation, Multicast, Multiprotocol Label Switching, Routing. (L9) **Transport Layer:** UDP,TCP, Remote Procedure Call, Transport for Real-Time (RTP), Congestion Control: Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control, Advanced Congestion Control, Quality of Service, Presentation Formatting, Multimedia Data - Lossless Compression Techniques. (L4) **Application layer protocols:** DNS, SMTP, HTTP, FTP, Email, Multimedia Applications, Infrastructure Applications, Overlay Networks. Introduction to network security (L8) **Practice Sessions:** Connecting two nodes using Ethernet cable and study the performance evaluation parameters such as delay, effective bandwidth - Basic Networking commands – Ping, IP Config, Traceroute, NS lookup - Introduction to Socket Programming. File transfer using TCP. Echo, Chat between two or more clients using socket programming - Simulation of Stop and Wait Protocol -Simulation of Stop and Wait protocol with NACK, Modelling of ACK, NACK drops, etc., -Modelling and simulation of Sliding window protocol - Sliding window protocol with ACK/NACK drops, frame drops etc., Performance evaluation through simulation of IEEE 802.3/802.5 networks - Implementation of OSPF. Introduction to NS2/OPNET simulator, Course Project [P28]					
Text Books	Bruce S. Davie and Larry L. Peterson, Computer Networks: A Systems Approach, 6th Edition - January 2021, Morgan Kaufmann, ISBN: 9780128237151					
Reference Books	1. Andrew S. Tanenbaum, Nick Feamster and David J. Wetherall, Computer Networks, 7th Edition, July 2021,Pearson Education India, ISBN:9781292374062. 2. James F. Kurose and Keith W. Ross, "Computer Networking - A top-down approach", 8th Edition,June 2021,Pearson Education India, ISBN:9781292405469. 3. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suit , 6th edition, August 2022, Tata McGraw- Hill, ISBN: 9789355320940.					

Course Code		Course Title	Prompt Engineering			
Dept./Faculty proposing the course	Computer Science & Enginering	Structure (LTPC)	L	T	P	C
			1	0	2	2
To be offered for	B.Tech, DD	Type	Core ☐		Elective ☐	
		Status	New ▰		Modification ☐	
Pre-requisite		Submitted for approval	Senate 62			
Learning Objectives	1. Introduce core principles of effective prompting (clarity, specificity, context) in AI systems. 2. Teach zero-shot/few-shot prompting, chain-of-thought reasoning, and persona-based templates. 3. Explore applications of prompting in creative writing, code generation, and multimodal tasks.					
Learning Outcomes	1. Design prompts that improve AI response accuracy by 40-60% on platforms like ChatGPT/Claude. 2. Implement chain-of-thought prompts to debug code or interpret complex datasets. 3. Test prompts via A/B testing, achieving ≥85% task success in image-text analysis.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Introduction to Prompt Engineering: Definition, scope, and importance of prompt engineering in AI system, Fundamentals of Effective Prompting: Components of good prompts, clarity, specificity, and context. (L3) Core Techniques and Patterns: Zero-Shot and Few-Shot Prompting, Chain-of-Thought and Advanced Reasoning, Systematic approach to prompt patterns (persona, template, cognitive verifier), Contextual Prompting and Information Integration: Managing context windows, information retrieval, and knowledge integration. (L5 hours) Prompts for creative writing, marketing, and content creation, code generation, data analysis, and technical documentation prompts, Multimodal and Advanced Applications: Image analysis, vision-language models, and multimodal prompting (L4) Prompt Optimization and Performance Measurement: Metrics for prompt effectiveness, A/B testing, and optimization strategies. (L2) **Practice:** Setup AI environments and master prompt creation across platforms like ChatGPT, Claude, and Gemini. Use zero-shot, few-shot, chain-of-thought, and persona-based prompting for tasks from code review to creative content and image analysis. Test and refine prompts systematically to improve model outputs, consistency, and cross-modal generation. Develop skills for analyzing responses, synthesizing multi-source data, and measuring prompt performance. [P28]					
Text Books	1, John Berryman, Albert Ziegler. Prompt Engineering for LLMs: The Art and Science of Building Large Language Model–Based Applications, , 1st Edition, O'Reilly Media, 2024, ISBN: 9781098156152 2. Richard Davies. Prompt Engineering in Practice, , 1st Edition , Manning Publications, 2025, ISBN: 9781617299693					
Reference Books	1. Ian Khan. The Quick Guide to Prompt Engineering: Generative AI Tips and Tricks for ChatGPT, Bard, DALL-E, and Midjourney – An Indian Adaptation, ISBN: 978-9356666491, 1st Edition (2024), Wiley India. 2. DAIR.AI Community, Prompt Engineering Guide, 2025, GitHub Repository https://github.com/dair-ai/Prompt-Engineering-Guide)					

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Course Code		Course Title	**Human Computer Interaction**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI), DD CSE	Type	Core ◾		Elective ☐	
		Status	New ☐		Modification ◼	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	The course focuses on fundamental principles relating to the design, implementation and evaluation of interactive applications. User centric design approaches that contribute to the development of usable interface and interaction are focused.					
Learning Outcomes	Students gain a sound understanding of the interdisciplinary nature of HCI and are equipped with skill sets required for the creation of used,useful and usable applications.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	Introduction - user interface design - Concept of usability - Usability Principles - HCI and software engineering - GUI design and aesthetics - Psychological theories of human behavior – Design rules for enhanced usability [L8] HCI Framework , Introduction to different types of models -KLM, GOMS - Fitts' law and Hick Hyman's law - Shneiderman's eight golden rules - Norman's seven principles - Gestalt Laws of Design - Norman's model ofinteraction- Nielsen's ten heuristics with example of its use – User Data Gathering Techniques [L9] Usability Engineering – Life cycle model – Needs analysis - Systems analysis- User profiling - Rapid prototyping and interactive design - Formative evaluation techniques, including usability testing - Using standards and guideline [L9] Interaction Design Paradigms - CLI, WIMP -Form Fillins - Menus - DMI –Navigation Design - Dialog notations and design [L8] Evaluation Techniques – Universal Design – User Support Systems - Web Usability Guidelines, Recent trends in VR and AR Design guidelines [L8] **Practice Component:** Assignments covering various aspects of the course to test drive cognitive principles, various design laws such as 80-20, digit span etc would be test driven. Exercises would also involve form designs, interaction design paradigms, navigation design, usability and universal design guidelines & OO pseudocode for front end design. Course would encourage use of tools such as Figma, Protopie, Adobe XD etc. to design and develop various concepts of the course in addition to a course project. [P28]					
Text Books	Alan Dix, J Finlay, G D Abowd, R Beale Human Computer Interaction,Prentice Hall, 2003, 9780130461094					
Reference Books	1. Jakob Nielsen, Usability Engineering, Morgan Kauffman, 1994, 978-0125184069 2. Samit Bhattacharya, Human Computer Interaction, McGraw Hill, 2019, 9789353168049 3. Donald Norman, Design of Everyday Things, Basic Books, 2013, 9780465050659 4. Articles from Nielsen Norman Group relating to Usability and UserExperience					

Course Code		Course Title	**Reinforcement Learning**			
Dept./Faculty proposing the course	Computer Science and Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech CSE (AI)	Type	Core ■		Elective ☐	
		Status	New ☐		Modification ■	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	The goal of this course is to master foundational RL concepts, including MDPs, value functions, and policy optimization. The course also helps the students to understand and implement modern RL algorithms, to explore practical applications and to program using frameworks like PyTorch, TensorFlow, and Gymnasium.					
Learning Outcomes	In this course students will learn to formulate RL problems using MDPs and implement classical algorithms, design/train deep RL models for complex environments. Students will be able to apply RL to robotics, gaming, autonomous systems and would be able to address safety, scalability, multi-agent coordination, etc. Students will be exposed to industry-standard tools (Gymnasium, RLlib).					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction to RL:** RL problem: Evaluative feedback, non-associative vs. associative learning, rewards, returns, exploration-exploitation. MDPs: Definition, real-world applications. Value functions: State/action value functions, optimality, approximation. [L6] **Classical and Sampling-Based RL Methods:** Bellman equations,Dynamic Programming: Value iteration, policy iteration, asynchronous DP, generalized policy iteration. Monte Carlo Methods: Policy evaluation, rollouts, on-policy vs. off-policy. [L6] **Temporal Difference and Deep RL:** TD Learning, TD(0), SARSA, Q-learning, double Q-learning. Eligibility Traces: N-step TD, TD(λ), forward/backward views, Q(λ). Deep RL: Deep Q-Networks (DQN), experience replay, target networks, DQN variants. Modern algorithms: DDPG, TD3, SAC. **[L8]** **Function Approximation and Scalability:** Function approximation: Value prediction, gradient descent, linear approximation, neural networks. Advanced techniques: CNNs, transformers for state representation. Challenges: Instability, divergence, overfitting. Scalable RL: Distributed RLlib. [L**8**] **Policy Gradient and Multi-Agent RL:**Policy Gradient: REINFORCE, exact/approximate gradients, variance reduction. Actor-Critic: A2C, A3C, PPO. Multi-Agent RL: Cooperative/competitive settings, emergent behaviours. [L8] **Emerging Topics and Practical Applications:** Safe RL, Offline RL, Hierarchical RL, Real-world systems: Robotics, autonomous vehicles, healthcare. Ethical considerations: Bias, fairness, societal impact, explainable RL.RL in generative AI, autonomous systems, real-time strategy games. [L6] **Practice Component** [P28] • Grid World Navigation (MDP Application), using RL framework like Gymnasium • Monte Carlo Policy Evaluation, viz. Blackjack Game • Q-Learning in a Maze, viz. Mouse in a Maze • Neural Network for CartPole, viz. CartPole Balancing • Multi-agent systems in robotics, traffic management, gamesviz. Traffic Light Coordination • Usage of variousindustry-standard environments and tools in small projects viz.RLlib, MuJoCo, PyTorch/TensorFlow, Atari, Unity ML-Agents, ROS, AWS RoboMaker.					
Text Books	1. Richard S. Sutton and Andrew G. Barto, Introduction to Reinforcement Learning, 2nd Edition, MIT Press. 2018. ISBN: 9780262039246. 2. Csaba Szepesvari, Algorithms for Reinforcement Learning, Morgan & Claypool, 2010. ISBN: 9781608454921.					
Reference Books	1. Boris Belousov, Hany Abdulsamad, Jan Peters, Pascal Klink, and Simone Parisi, Reinforcement Learning Algorithms: Analysis and Applications, Springer, 2021, ISBN: 9783030411879. 2. Maxim Lapan., Deep Reinforcement Learning Hands-On, Packt, 2020, ISBN:9781838826994.					

Course Code		Course Title	**Natural Language Processing**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech CSE(AI), DD CSE	Type	Core ▬		Elective ☐	
		Status	New ▬		Modification ☐	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	• Identify core challenges in NLP such as syntactic ambiguity, semantic variation, and discourse understanding. • Appreciate the importance and applications of NLP in real-world domains (e.g., search engines, chatbots, translation). • List and describe classical problems in NLP: POS tagging, parsing, translation, sentiment analysis, etc.					
Learning Outcomes	• Understand the challenges and complexities of natural language processing from both linguistic and computational perspectives. • Apply foundational concepts in word, sentence, and discourse-level processing for various NLP tasks. • Design and implement basic and statistical models for key NLP tasks like parsing, tagging, translation, and information extraction. • Gain hands-on experience with lexical resources, grammars, and statistical models.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction**: Why NLP is hard/useful; overview of classical problemsMorphology & Spellchecking - Finite-state transducers (FSTs) Lexical Semantics - WordNet-based similarity, distributional semantics (LSA), word‑sense disambiguation (supervised, unsupervised, semi‑supervised) (L7) **Syntactic and Semantic Analysis**: Rule-based taggers (Brill's), statistical HMM taggers, Sentence Structure & Parsing - Compositional semantics. Classical parsing - bottom-up/top-down, CYK algorithm. Probabilistic parsing - PCFGs and EM for parameter estimation (L7) **Language Modeling and Machine Translation**: N-gram models with smoothing techniques.Rule-based approaches Statistical MT: IBM translation models learned via EM algorithm (L7) **Information Extraction and Natural Language Generation**: Named Entity Recognition, Relation Extraction, ML-based techniques for generating coherent text. (L7) **Practice:** Morphological generator / analyzer for an Indian language (e.g., Hindi, Tamil) using Finite-State Transducers. Context-aware spell checker using an N-gram language model. Topic modeling using Latent Dirichlet Allocation (LDA) - analyze the semantic structure of a large corpus. Constituency and dependency parser using a neural architecture (e.g., BiLSTM + MLP). Semantic role labeler using AllenNLP or custom PyTorch models. LSTMs / Transformers. Evaluate perplexity and compare it with N-gram models. Fine-tune a pre-trained T5 or mBART model for a translation task. Automatic story generator using a prompt and a fine-tuned GPT-2 model. Evaluate coherence and fluency. Generate structured-to-natural languages sentences using a Transformer or GPT model. [P28]					
Text Books	Speech and Language Processing: Daniel Jurafsky and James H. Martin, Prentice Hall, 3rd Edition, 2025, 978-0131873216					
Reference Books	1. Yoav Goldberg, Neural Network Methods in Natural Language Processing , Morgan & Claypool Publishers, 1st Edition, 2017, 978-1627052986 2. Philipp Koehn, Statistical Machine Translation, Cambridge University Press 2010. 978-0521874151 3. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing MIT Press, 1st Edition, 2019, 978-0521874151					

INDIANINSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Code		Course Title	**Full Stack Development**			
Dept./Faculty Proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech (CSE,AI), DD CSE	Status	Core ▬		Elective	
		Type	New ▬		Modification	
Pre-requisite		Submitted for approval		Senate 62		
Learning Objectives	The course is designed to provide students with a solid foundation in the front-end and back-end web development fundamentals.					
Learning Outcomes	By the end of the course, students will have a strong understanding of the core concepts and tools required to develop and deploy web applications. They shall be able to : ● Recognize and understand the components that make up a website. ● Gain an understanding of the current technologies used for building interactive websites. ● Learn to analyze logs to understand errors and their causes.					
Contents of the course*(With approximate break-up of hours for L/T/P)*	**HTML and styling:** Introduction to HTML, Basic structure of an HTML document, mark up tags, elements of HTML, headings, paragraphs, line breaks, formatting text, working with lists, tables, frames, hyperlinks, images, multimedia, forms and controls, CSS - inline, internal and external, selectors, syntax, Bootstrap - customization, layout, forms, components (L5) **JavaScript:** Introduction to JavaScript, control structures, functions, arrays, Document Object Model (DOM), event handling, form validation, regular expressions, jQuery (L5) **TypeScript:** Types, arrays, tuples, enums, aliases, functions, casting, classes, utility types, null and undefined handling (L4) **Node.js:** Node.js architecture, core modules, package management, HTTP requests and responses, routing, REST API (L4) **React:** React Components, JSX, props, state, lifecycle methods, conditional rendering, event handling, React hooks, form handling, lists and keys, state management, React router, styling in React, asynchronous programming, API integration, error handling (4) **Backend:**Introduction to Firebase, Firebase CLI, Cloud Firestore, data modeling, CRUD operations, data queries, offline persistence, user authentication, database triggers, HTTP endpoints, storage and hosting, Supabase. (L4) **Advanced topics:** Next.js, Tailwind CSS, Django, Angular. (L2) **Practice sessions:**Development static and dynamic web pages with HTML, CSS and JavaScript - Basic usage of Node.js using NPM / Yarn, and basic web concepts – routing /API - Building applications with React with Firebase / Supabase - Mini-project: application design and development using Next.js and Tailwind CSS [P28]					
Text Books	1. Deitel, Deitel and Nieto, Internet and Worldwide Web - How to Program, 5th Edition, PHI, 2018, 9789352868599 2. Bai and Ekedhi, The Web Warrior Guide to Web Programming, 3rd Edition, Thomson, 2008, 9780619064587.					
Reference Books	1. Brad Dayley, Brendan Dayley, and Caleb Dayley, Node.Js, Mongodb and Angular Web Development: The Definitive Guide to Using the Mean Stack to Build Web Applications, 2nd Edition, Pearson Education, 2018, 978 0134655536 2. Robert W. Sebesta, Programming World Wide Web, 8th Edition, Pearson Education, 2020, 9788813176583					

INDIANINSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

Course Code		Course Title	**Introduction to Generative Artificial Intelligence**			
Dept./Faculty proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			2	0	2	3
To be offered for	B.Tech CSE(AI)	Type	Core ▪		Elective ☐	
		Status	New ☐		Modification ▪	
Pre-requisite	--	Submitted for approval		Senate 62		
Learning Objectives	• Understand mathematical fundamentals required to build GenAI models • Comprehend GenAI models for generating different types of data, Develop and Deploy LLMs					
Learning Outcomes	• To be able to analyze the intuition behind working of GenAI models • To be able design and implement domain specific LLMs • To be able to finetune the open source LLMs for a specific task, and solve real world problems and design tools with LLMs					
Contents of the course *(With approximate break-up of hours for L/T/P)*	**Introduction to Deep Learning and NLP**: Overview of ANN - Motivation for ANN, Perceptron, MLP, Gradient Descent, Back Propagation and CNN. Text Representation -One-Hot Encoding, Bag of Words (BOW) and N-Grams. Text Embedding Techniques -Word2Vec (SkipGram, Continuous Bag of Words - CBOW) (L4) **Sequence to Sequence Models:** Generative vs Descriptive model, RNN, LSTM and their limitations, Text generation DNN models: Transformer, BERT, GPTs etc. (L6) **Image and Video Generation Models:** Auto regression models , GAN and its variants, Auto Encoders and its variants, Stable Diffusion, Knowledge Distillation models , Large Language models(LLMs), RAG models, Image GPT, Vision Transformer, CLIP, Vision Language Models (L8) **Domain Specific LLMs:** LLaMA, Moondeam2, LLaVA, Audio generation models, Code generation models, Explainability, Ethics and Fairness, APIs for GenAI models and Prompt Engineering (L6) **Applications of LLMs:** LLMs for Cyber Security, Legal Research etc. (L4) **Practice:** Time series forecasting using RNN and LSTM - Building a tool to perform Word-Auto-Completion using transformer - Building a chatbot using pre-trained models like those from Hugging Face - Developing a system that translates text from one language to another- Experiment with fine-tuning pre-trained language models on specific tasks or datasets- Crafting effective prompts to guide generative models in producing desired outputs- Building models that can generate captions for images- Explore techniques for generating images from text descriptions using models like DALL-E or Stable Diffusion - Using pre trained models, generating videos - Develop a model that can analyze the sentiment expressed in text [P28]					
Text Books	1. Jay Alammar, Maarten Grootendorst, Hands-On Large Language Models: Language Understanding and Generation, O'Reilly, 2024, 978-1098150969 2. Joseph Babcock and Raghav Bali,Generative AI with Python and PyTorch - Second Edition: Navigating the AI frontier with LLMs, Stable Diffusion, and next-gen AI applications, 2nd Ed. Packt Publishing, 2025, 978-1835884447					
Reference Books	1. Joseph Babcock and Raghav Bali,Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models, Packt Publishing, 2021(ISBN-13: 978-1800200883) 2. Research Articles from top Journals and Conferences relevant to Generative AI					

Course Code		Course Title	**Cyber Security**			
Dept./Faculty Proposing the course	Computer Science & Engineering	Structure (LTPC)	L	T	P	C
			3	0	2	4
To be offered for	B.Tech (CSE,AI) , DD CSE	Status	Core ■		Elective ☐	
		Type	New ☐		Modification ☐	
Pre-requisite		Submitted for approval		Senate 62		

Learning Objectives	The course focusses on cybersecurity principles and their relevance to identify cyber threats, attacks, and vulnerabilities. It shall expose students: ● To cryptographic methods for secure communication. ● To network security and secure system design. ● To Cyber forensics and incident response.
Learning Outcomes	Students will able to understand core concepts of cybersecurity, cryptography, and secure system design. They shall also be able to: ● Identify, analyze, and mitigate cyber threats and vulnerabilities ● Gain a holistic view of new and evolving security techniques ● Apply cyber forensic techniques to investigate security incidents. ● Manage cybersecurity incidents through effective incident response strategies.
Contents of the course*(With approximate break-up of hours for L/T/P)*	**Introduction to Cyber Security:** Overview of cybersecurity principles, understanding cyber threats, vulnerabilities, Risk, attack surface, attack vectors, attack trees, and basic threat modeling, Analysis of case studies related to cyber warfare and cyber terrorism (L11) **Core Security Mechanisms and Practices:** Authentication, Authorization, Cryptography, Firewalls, Scanning, Intrusion Detection and Prevention Systems (IDS/IPS), and Security Policies (L10) **Security Models, Frameworks, and Architectures:** Defense in depth, and fail-safe defaults, Bell-LaPadula Model, the Biba Model, and the Clark-Wilson Model (L6) **Evolving Security Techniques, Cyber Forensics & Incident Management:** IoT security, Cyber-physical system security, Adversarial ML, blockchain-based security models, basics of cyber forensics, evidence collection, chain of custody, incident detection, response, and recovery techniques (L10) **Emerging Trends and Future Directions in Cyber Security:** Zero Trust Architecture, SecureMulti-Party Computation, AI for Cyber Defense, Future Challenges and Research Directions (L5) **Practice Sessions:** Password Policy Testing, Linux Commands for Networking & Security - Network traffic analysis using Wireshark, Malware Analysis, Nmap and tcpdump- Basic Penetration Testing - Honeypot Tool: Cowrie and T-Pot - TCP Socket Programming – DdoS & Flood Attack Simulators and network-based attack generation - Adversarial attack generators (For ML Security) - Open-source IDS tools: Fail2Ban, Wazuh, Kismet,Zeek, Ntopng, Suricata, and Argus - Digital Forensics Basics: Autopsy and Sleuth Kit. Password Cracking Lab – Contiki Cooja simulator [P28]
Text Book	1. C J Brooks, C Grow, P Craig, D Short, Cybersecurity essentials John Wiley & Sons, 2018, ISBN 978 1119362395 2. Stallings, W. Cryptography ard Network Security: Principles and Practice (8th ed.). Pearson Education, 2023, 9357059717
Reference Books	1. Kaufman, C., Perlman, R., & Speciner, M., Network Security: Private Communication in a Public World, 2nd ed, Prentice Hall, 9357059717. 2. Anderson, R. J, Security Engineering: A Guide to Building Dependable Distributed Systems, 3rd ed, Wiley, 2020, 9781119642787