Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Electronics and Computer Science

Second Year Scheme & Syllabus (R-2024)

(As per NEP 2020, with effect from the Academic Year 2025-26)

Preamble

The National Education Policy (NEP) framework aims to break the mold from teacher centric to student centric educational practices. It empowers the students with flexibility in terms of choosing courses across different faculties and modes of learning.

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with, and this enables lifelong learning. It also enhances the scope for holistic personality development.

This premise is truly reflected in preamble of the NEP document, "The future of nation is decided in the classrooms of the schools and colleges today".

Details of implementation:

NEP curriculum framework enables us to accelerate change, redesign systems with equity in mind, respond to feedback, encourage collaboration, catch and pollinate ideas and create a culture of research and development. It will allow us to offer the required academic flexibility which will focus on improving competency level of students with diverse strengths.

The curriculum planned by VIT has vertical **Program Courses** consisting of Programme core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Programme elective courses (PEC) which offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability.

The vertical **Multidisciplinary Courses** consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of **Skill courses** vertical that make student capable to work in industrial environment.

The student is expected to demonstrate their ability through courses in **Experiential Learning Courses** vertical like internships/On Job Training, Community Engagement Project, Real Industry Project/ research problem. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking. This will lead to the creation of products and/ or patents through this program.

For holistic development of students, apart from technical courses, Ability Enhancement Courses, Entrepreneurship/Economics/Management Courses, Indian Knowledge System and Value Education courses from vertical **Humanities and Social Science and Management** develop the required soft-skills and attitude amongst learners.

In **Liberal Learning** vertical courses like Various Dance Forms, Global citizenship Education, Facets of Astronomy etc. aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

In addition to core courses, professional and open electives; our framework offers honor degree in each programme of engineering. It includes specialized courses along with field/ domain study that make students capable of working on industry relevant problems.

Chairperson, Board of Studies
Department of Electronics and Computer Science
Vidyalankar Institute of Technology

Chairperson, Academic Council
Vidyalankar Institute of Technology

Second Year B. Tech. Electronics and Computer Science **Preferred Semester: III**

Course Structure and Assessment Guidelines

Course			Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP-Vertical	Code	Name			ISA	MSE	ESE	
HSSM	AEC02	Technical and Business Writing	Theory + Practical	2	75	-	-	075
BSC	BSC06	Engineering Mathematics-III	Theory	3	20	30	50	100
PC-PCC	PCEC01T	Electronic Devices and Circuits	Theory	2	15	20	40	075
	PCEC01P	Electronic Devices and Circuits Lab	Practical	1	25	-	25	050
PC-PCC	PCEC02T	Electrical Circuit Analysis	Theory	2	15	20	40	075
	PCEC02P	Electrical Circuit Analysis Lab	Practical	1	25	-	25	050
PC-PCC	PCEC03T	Data Structures	Theory	2	15	20	40	075
	PCEC03P	Data Structures Lab	Practical	1	25	-	25	050
SC	VSEC04T	Python Programming	Theory	2	15	20	40	075
	VSEC04P	Python Programming Lab	Practical	1	25	-	25	050
ELC	CEP01	Social Service Internship	As per course	2	25	-	50	075
MC-MDM	MDMXX	Multidisciplinary Minor Course-1	Theory	4	45	30	50	125
Total Credits				**23**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

[#]**For CEP01- Social Service Internship:** 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 30 hours needs to be completed during the semester (besides the regular timetable) or after the semester (during inter-semester break).

NOTE: As per Institute guidelines, the results of courses completed in inter-semester break will appear in the marksheet of the next semester.

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a

panel constituted at Institute level and published to the learners before the commencement of the semester.

Guidelines for Multidisciplinary Elective Courses and Minor Degree – Refer Appendix-B (Programme Structure R 2024)

Learners are required to go through the Appendix-B carefully before selecting the Multidisciplinary Elective courses. Detailed guidelines regarding Multidisciplinary Elective courses, Minor Degree Titles and courses relevant to each MDM Title are given in Appendix-B of Programme Structure.

Multidisciplinary Minor Courses (MDM)

Specialization Track Name#	Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40 % of total marks)
	Code	Name			ISA	MSE	ESE	
Bioinformatics	MDMBI01	Introduction to Bioinformatics	Theory	4	45	30	50	125
Innovation, Entrepreneurship and Venture Development	MDMIE01	Foundations of Innovation and Entrepreneurship	Theory	4	45	30	50	125
Business Development, Marketing and Finance	MDMBD01	Introduction to Business Development and Marketing Principles	Theory	4	45	30	50	125
Robotics	MDMRB01	Fundamentals of Robotics and Control	Theory	4	45	30	50	125

Second Year B. Tech. Electronics and Computer Science **Preferred Semester: IV**

Course Structure and Assessment Guidelines

Course			Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
NEP-Vertical	Code	Name			ISA	MSE	ESE	
HSSM	EEMC01	Design Thinking	Theory	3	50	-	50	100
MC-OE	OEC10	Engineering Mathematics-IV	Theory	3	20	30	50	100
ESC	ESC09T	Computer Organization & Architecture	Theory	2	15	20	40	075
	ESC09P	Computer Organization & Architecture Lab	Practical	1	25	-	25	050
PC-PCC	PCEC04T	Control Systems Engineering	Theory	2	15	20	40	075
	PCEC04P	Control Systems Engineering Lab	Practical	1	25	-	25	050
PC-PCC	PCEC06T	Web Technology	Theory	2	15	20	40	075
	PCEC06P	Web Technology Lab	Practical	1	25	-	25	050
PC-PCC	PCEC07T	Database Management System	Theory	2	15	20	40	075
	PCEC07P	Database Management System Lab	Practical	1	25	-	25	050
MC-MDM	MDMXX	Multidisciplinary Minor Course-2	Theory	4	45	30	50	125
MC_OE	OEC14	Professional Competency Development 1	Practical	1	50	-	-	050
Total Credits				**23**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Multidisciplinary Minor Courses (MDM)

Specialization Track Name[#]	Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40 % of total marks)
	Code	Name			ISA	MSE	ESE	
Bioinformatics	MDMBI02	Algorithms and Data Structures in Bioinformatics	Theory	4	45	30	50	125
Innovation, Entrepreneurship and Venture Development	MDMIE02	Startup Planning and Development	Theory	4	45	30	50	125
Business Development, Marketing and Finance	MDMBD02	Financial Basics for Engineers and Technopreneurs	Theory	4	45	30	50	125
Robotics	MDMRB02	Machine Vision and Robotic Perception	Theory	4	45	30	50	125

Second Year B. Tech. Electronics and Computer Science - Summer Break

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
OEC01[$]	Collaborative Inter-Institute Studies	As per course	4	125	-	-	125

[$] For Collaborative Inter-Institute Studies: Collaboration with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break (i.e. summer break between semester 4 and semester 5).
NOTE: As per Institute guidelines, the result of courses completed in inter-semester break will appear in the marksheet of the next semester.

Detailed Syllabus of Second Year Semester - III

Course Name: Technical and Business Writing

Course Code: AEC02

NEP Vertical_Basket:: Humanities Social Sciences and Management (HSSM)

Preamble:

The course, Technical and Business Writing, introduces students to the basics of effective writing. Writing, being one of the core pillars of Communication Skills, is a significant aspect of the engineering curriculum. Engineers will encounter a plethora of technical writing tasks in their careers, and their writing needs to be professional. Technical and Business Writing will enable students to draft effective emails and letters, technical proposals and reports, maintain meeting documentation, while actively using contemporary digital writing tools.

Pre-requisites:

Effective Communication (Sem I)
Professional Skills (Sem II)

Course Objectives:

- To enable learners to gain understanding of writing effective letters, proposals and reports.
- To facilitate learners in developing the skills of participating in meetings.
- To create awareness of strengthening research orientation by reading and paraphrasing technical papers.
- To introduce strategies for drafting documentation required for higher studies.

Course Outcomes:

Learner will be able to:
CO1 Draft effective letters and emails for various professional and business requirements.

CO2 Collect and compile data in the form of a technical report, and present findings in front of an audience.

CO3 Write technical reviews and instructions and differentiate between various hazard notations.

CO4 Draft persuasive proposals to achieve the desired outcomes.

CO5 Participate in meetings and draft meeting-related documentation like notice, agenda and minutes.

CO6 Write a Statement of Purpose and understand the requirements of a Letter of Recommendation.

Course Scheme:

Contact Hours			Credits Assigned	
Theory	Practical (Class-wise)	Practical (Batch-wise)	Theory	Practical
--	2*	2	-	2

*2 hours practical will be conducted for the entire class together (to discuss the necessary concepts so that students can participate in practical activities in the class and lab).

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	75	-	-	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Business Correspondence	Principles of Correspondence (7 Cs) Parts of a letter and Formats Request for information/permission Enquiry, Reply to Enquiry Letters Complaints, Claims, Adjustment Letters Email writing and etiquette	8
2	Report Writing	Significance, Objectives of Report Writing Types of Reports Language and Style of Reports Formats of Reports Synopsis writing	4
3	Technical Writing	Introduction to Technical Writing Writing Definitions, Instructions, Safety Notations, Descriptions Technical Reviews of gadgets, software and technologies Principles of Scientific Vocabulary Technical Reports Paraphrasing Technical Paper (IEEE Format)	6
4	Proposal Writing	Parts of a Proposal and Formats Drafting persuasive proposals	2
5	Meetings and Documentation	Strategies for conducting effective meetings (in person/virtual) Note Taking Notice, Agenda, and Minutes of Meeting	2

		Business Meeting Etiquettes	
6	Documentation for Higher Studies	Statement of Purpose Letter of Recommendation	2
Total			**24**

Suggested List of Practicals:

1. Ice Breakers/Elevator Pitch
2. Letter Writing & Email Writing
3. Synopsis Writing
4. Paraphrase a published IEEE Technical Paper
5. Technical Proposal – Discussion and drafting with relevant to domain (application-based)
6. Mock Meeting (Oral + Documentation)
7. Drafting Statement of Purpose
8. Mini Project Presentation

Suggested List of Assignments:

1. Draft an email and a reply to that on any one type of letter (Individual)
2. Draft a synopsis of the mini-project report (Group)
3. Paraphrase a published IEEE Technical Paper (Individual)
4. Draft a technical proposal (Group)
5. Participate in a mock meeting and prepare notice, agenda, and minutes (Group)
6. Draft a Statement of Purpose (for admission to Higher Studies) (Individual)

Suggested List of Value-Added Home Assignments:

1. https://www.ted.com/talks/eric_berridge_why_tech_needs_the_humanities
2. https://www.ted.com/talks/melissa_marshall_talk_nerdy_to_me

Suggested Online Courses:

1. Courses on Communication offered by Udemy, Coursera, EdX, NPTEL Swayam, TCS iON
2. Writing Skills for Engineering Leaders https://www.coursera.org/programs/vidyalankar-institute-of-technology-coursera-response-program-tysb7/browse?productId=6sk543Q6EeaRqAobOpNSMQ&productType=course&query=technical+and+business+writing&showMiniModal=true
3. Technical Writing https://www.coursera.org/programs/vidyalankar-institute-of-technology-coursera-response-program-tysb7/browse?productId=4ESRQQpFEea5dwol2CF9Kw&productType=course&query=technical+writing&showMiniModal=true

Reference Books:

1. Raman Meenakshi and Sangeeta Raman, "Communication Skills", OUP, 2016.
2. Murphy Herta, "Effective Business Communication", McGraw Hill, 2017.
3. Locker Kitty, "Business Communication-Building Critical Skills", McGraw Hill, 2013.
4. Lehman Dufrene, Sinha, "BCOM", Cengage Learning, 2020.
5. Stanton Nicky, "Mastering Communication", Palgrave Master Series, 2009.
6. A. Kaul, "Effective Business Communication", Prentice Hall of India, 2015.
7. Monippally, "Business Communication Strategies", Tata McGraw Hill, 2001.
8. Monipally, "The Craft of Business Letter Writing", Tata McGraw Hill, 1997.
9. Lesiker and Petit, "Report Writing for Business", Mc Graw Hill, 1997.
10. R.C. Sharma and Krishna Mohan, "Business Correspondence and Report Writing", Mc Graw Hill, 2017.

Course Name: Engineering Mathematics-III

Course Code: BSC06

NEP Vertical_Basket:: Basic Science Courses (BSC)

Preamble:

This course introduces students to various discrete structures concepts that is helpful for understanding many fundamental topics in computer science.

Pre-requisites:

Applied Mathematics-I(BS02)
Applied Mathematics-II(BS04)

Course Objectives:

Student will be able to:

- Compute Laplace Transform of a given function.
- Apply Inverse Laplace Transform to convert frequency domain into time domain.
- Obtain Fourier series of a given periodic functions by decomposing it into sine and cosine series.
- Apply Fourier transforms to solve problems involving periodic and non-periodic functions.
- Solve problems involving eigenvalues and eigenvectors to understand their applications in different contexts.
- Analyze complex functions to determine if they are analytic and apply C-R equations to verify their analyticity

Course Outcomes:

Learner will be able to:
CO1: Compute Laplace Transform of a given function
CO2: Apply Inverse Laplace Transform to convert frequency domain into time domain.
CO3: Obtain Fourier series of a given periodic functions by decomposing it into sine and cosine series
CO4: Apply Fourier transforms to solve problems involving periodic and non-periodic functions.
CO5: Solve problems involving eigenvalues and eigenvectors to understand their applications in different contexts.
CO6: Analyze complex functions to determine if they are analytic and apply C-R equations to verify their analyticity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Tutorial
3	0	3	0

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Laplace Transform	Definition of Laplace transform Laplace Transform (L) of Standard Functions, Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scale Property, Multiplication by t, Division by t, Laplace Transform of derivatives and integrals (All Properties are without proofs). Evaluation of integral using Laplace Transform.	8
2	Inverse Laplace Transform	Formulae of Inverse Laplace Transform, Laplace Inverse using partial fraction, Properties of Laplace Transform, convolution Theorem (without proof).	6
3	Fourier Series	Fourier series of a periodic function in the interval of period 2π, 2L. Half-range Sine and Cosine Fourier series.	8
4	Fourier Transform	Fourier Transform, Fourier Sine & Cosine Transform. Inverse Fourier transform.	6
5	Linear Algebra: Advance Theory of Matrix	Characteristic equation, Eigen values and Eigen vectors. Example based on properties of Eigen values and Eigen vectors. (Without Proof). Cayley-Hamilton theorem (Without proof), Examples based on verification of Cayley- Hamilton theorem and compute inverse of Matrix. Functions of square matrix e.g., $tan(A)$, A^n, k^A,etc	8
6	Complex Variables	Analytic function, C-R equations in polar & cartesian form (without proof), Harmonic function. Finding analytic function if $u\ or\ v\ or\ (u+v)\ or\ (u-v)$ is given, Milne-Thompson method, Orthogonal trajectories.	9
Total			**45**

Text Books:

1. Dr. B. V. Ramana, Higher Engineering Mathematics,12 th ed Tata McGraw
2. Hill New Delhi, India
3. P. N. Wartikar & J. N. Wartikar, A Test Book of Applied Mathematics, Vol I & II, 12th edition Vidyarthi Griha Prakashan.
4. Kanti B Datta, Mathematical methods of Science and Engineering, Cengage Learning, 2012
5. N. P. Bali and Manish Goyal, A Test Book of Engineering Mathematics, Laxmi Publications 2006.

Reference Books:

1. Dr. B. S Grewal , Higher Engineering Mathematics , 44th Edition Khanna Publication
2. Erwin Kreyszig , Advanced Engineering Mathematics , 10th Edition John Wiley & sons.
3. C. R. Wylie & L. C. Barrett, Advanced Engineering Mathematics, 6Th Edition, Tata McGraw Hill New Delhi, India
4. H K Das , Advanced Engineering Mathematics , 22nd edition S Chand
5. Dr. B. S. Tyagi , Functions of A Complex Variable , Kedar Nath Ram Nath ,2021.

Course Name: Electronics Devices & Circuits

Course Code: PCEC01T

NEP Vertical_Basket:: (PC-PCC

Preamble:

Electronic Devices and Circuits is a fascinating subject that delves into the design, analysis, and applications of electronic devices and circuits. This subject is critical to the field of electronics engineering, as it provides a fundamental understanding of the behavior of electronic devices and their interaction with circuits. In this subject, students will learn about a wide range of electronic devices such as diodes, transistors, operational amplifiers, Filters, Oscillators, and timers. Electronic Devices and Circuits is a crucial subject for any student who wants to pursue a career in electronics engineering. It lays the foundation for understanding advanced topics such as microelectronics, integrated circuit design, and electronic system design. Throughout this course, students will be challenged to think critically, solve problems, and apply their knowledge to real-world applications. With a strong grasp of the concepts covered in this subject, students will be well-prepared to tackle the challenges of the rapidly evolving field of electronics engineering.

Pre-requisites:

1. Understanding of mathematics, including algebra, calculus, and trigonometry.
2. Knowledge of physics, including electricity and magnetism.
3. Understanding of electronic components such as resistors, capacitors, and inductors.
4. Knowledge of circuit analysis techniques such as Kirchhoff's laws, Ohm's law, and nodal and mesh analysis.

Course Objectives:

- To deliver the knowledge about physics of basic semiconductor devices and circuits.
- To enhance comprehension capabilities of students through understanding of electronic devices and circuits
- To introduce and motivate students to the use of advanced microelectronic devices.
- To analyze and design electronic circuits using semiconductor devices.

Course Outcomes:

After successful completion of the course students will be able to:

CO1: Demonstrate an understanding of the fundamentals of discrete and integrated circuits.
CO2: Analyze MOSFET and BJT based amplifiers using AC, DC, and frequency analysis.
CO3: Understanding the need and applications of Operational Amplifiers in electronic circuits.
CO4: Apply the concepts of feedback while designing Operational amplifiers and Oscillator circuits.
CO5: Designing timer circuits for various applications.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Unit No.	Contents	No. of Hours
1		**Introduction to BJT and MOSFET**	06
	1.1	Introduction to BJT, Configurations of BJT, Input and Output characteristics of BJT in CE configuration.	
	1.2	DC Analysis: Concept of DC load line, Q point and regions of operations, Analysis of Voltage Divider Biasing Circuits in CE configuration	
	1.3	MOSFET-Construction and working, Characteristics of MOSFET-Transfer and Drain Characteristics, Regions of Operation	
	1.4	DC Analysis of different Biasing Circuits	
2		**AC Analysis and Frequency Response of MOSFET Amplifiers**	06
	2.1	AC analysis: Small Signal AC model of MOSFET, Small signal analysis: Input impedance, output impedance, voltage gain for voltage divider circuit.	
	2.2	Frequency Analysis: Effects of coupling, bypass, and parasitic capacitors on frequency response of single stage amplifier, Miller effect and Miller capacitance.	
	2.3	Low frequency and high frequency analysis of CS (E-MOSFET) amplifier.	
3		**Introduction to Op-Amp**	06
	3.1	Introduction and concept of Differential amplifier. Block diagram of Op-Amp. Ideal and practical characteristics of Op-Amp. Op-Amp Parameters.	
	3.2	Configurations of Op-Amp: Open loop and closed loop, Inverting and Non-inverting Op-Amp and buffer.	
	3.3	Summing amplifier, difference amplifiers and Instrumentation amplifiers using Op-Amp.	
4		**Linear Applications of Operational Amplifier**	06
	4.1	Voltage to current (V-I) and current to voltage (I-V) converter	
	4.2	Integrator & Differentiator (Ideal & practical)	
	4.3	Active Filters: First and Second order active, low pass, high pass, band pass, band reject and Notch filters (Second order Derivation is not expected)	
	4.4	Concept to Positive and Negative feedback, Barkhausen's criteria for sustained oscillations. Sine Wave Oscillators: RC phase shift oscillator, Wien bridge oscillator.	

Module No.	Unit No.	Contents	No. of Hours
5		**Non-Linear Integrated Circuits**	06
	5.1	Comparators: Inverting comparator, non-inverting comparator, zero crossing detectors, window detector.	
	5.2	Schmitt Triggers: Inverting Schmitt trigger, non-inverting Schmitt trigger	
	5.3	IC 555 Timer: Astable, Monostable, Bistable Multivibrator.	
Total			**30**

Text Books:

1. Donald A. Neamen, Electronic Circuit Analysis and Design, TATA McGraw Hill, 2nd Edition
2. Adel S Sedra, Kenneth C. Smith and Arun N Chandorkar, Microelectronic Circuits Theory and Applications||, International Version, OXFORD International Students Edition, Fifth Edition.
3. D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition.

Reference Books:

1. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall,4th Edition.
2. Boylestad," Electronic Devices and Circuit Theory", Pearson
3. David A. Bell, Electronic Devices and Circuits||, Oxford, Fifth Edition.
4. Muhammad H. Rashid, Microelectronics Circuits Analysis and Design, Cengage
5. S. Salivahanan, N. Suresh Kumar, —Electronic Devices and Circuits||, Tata McGraw Hill
6. Millman and Halkies, —Integrated Electronics||, TATA McGraw Hill.
7. David A. Bell, "Operation Amplifiers and Linear Integrated Circuits", Oxford University
8. Press, Indian Edition

Course Name: Electronics Devices & Circuits Lab

Course Code: PCEC01P

NEP Vertical_Basket:: (PC-PCC

Preamble:

The Lab of Electronic Devices and Circuits is an essential component of the Electronic Devices and Circuits course. It provides students with hands-on experience in designing, building, and testing electronic circuits using a variety of electronic devices. Through this lab, students will learn how to use electronic components such as diodes, transistors, operational amplifiers, and digital logic gates to create circuits that perform specific functions. They will also gain experience in using test equipment such as oscilloscopes, function generators, and multimeters to measure circuit performance. The Lab of Electronic Devices and Circuits is an excellent opportunity for students to apply the concepts they have learned in the classroom to real-world situations. They will be challenged to think critically, solve problems, and troubleshoot issues that arise during circuit design and testing. By the end of this lab, students will have gained valuable skills in electronic circuit design, prototyping, and testing. These skills will be essential for their future careers in electronics engineering, where hands-on experience is highly valued. It is important to note that safety is a critical component of the Lab of Electronic Devices and Circuits, and students will be required to follow all safety protocols and guidelines to ensure their safety and the safety of those around them.

Pre-requisites:

1. Understanding of mathematics, including algebra, calculus, and trigonometry.
2. Knowledge of physics, including electricity and magnetism.
3. Understanding of electronic components such as resistors, capacitors, and inductors.
4. Knowledge of circuit analysis techniques such as Kirchhoff's laws, Ohm's law, and nodal and mesh analysis.

Course Objectives:

- To deliver the knowledge about physics of basic semiconductor devices and circuits.
- To enhance comprehension capabilities of students through understanding of electronic devices and circuits
- To introduce and motivate students to the use of advanced microelectronic devices.
- To analyze and design electronic circuits using semiconductor devices.

Course Outcomes:

After successful completion of the course students will be able to:
CO1: Demonstrate an understanding of the fundamentals of discrete and integrated circuits.
CO2: Analyze MOSFET and BJT based amplifiers using AC, DC, and frequency analysis.
CO3: Understanding the need and applications of Operational Amplifiers in electronic circuits.
CO4: Apply the concepts of feedback while designing Operational amplifiers and Oscillator circuits.
CO5: Designing timer circuits for various applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	02	-	01

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested list of Practicals:

Sr. No.	Experiment Title
1	Use of online tools and simulators for electronic devices and circuits
2	Input and Output Characteristics of BJT
3	Transfer and Drain Characteristics of Enhancement Type MOSFET
4	MOSFET Biasing circuits
5	Frequency response of Single stage MOSFET amplifier (CS)
6	Voltage series negative feedback Circuit
7	RC oscillators: Phase Shift Oscillators
8	RC oscillators: Wien Bridge Oscillators
9	LC Oscillators: Hartley and Colpitts Oscillators
10	Inverting, non-inverting, summing, difference amplifiers using Op-Amp (IC 741)
11	Schmitt Trigger using (IC 741)
12	IC 555 Timer: Astable, Monostable Multivibrator

Text Books:

4. Donald A. Neamen, Electronic Circuit Analysis and Design, TATA McGraw Hill, 2nd Edition
5. Adel S Sedra, Kenneth C. Smith and Arun N Chandorkar, Microelectronic Circuits Theory and Applications||, International Version, OXFORD International Students Edition, Fifth Edition.
6. D. Roy Choudhury and S. B. Jain, "Linear Integrated Circuits", New Age International Publishers, 4th Edition.
7. Ramakant A. Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Pearson Prentice Hall,4th Edition.

Reference Books:

1. Boylestad," Electronic Devices and Circuit Theory", Pearson
2. David A. Bell, Electronic Devices and Circuits||, Oxford, Fifth Edition.
3. Muhammad H. Rashid, Microelectronics Circuits Analysis and Design, Cengage
4. S. Salivahanan, N. Suresh Kumar, —Electronic Devices and Circuits||, Tata McGraw Hill
5. Millman and Halkies, —Integrated Electronics||, TATA McGraw Hill.
6. David A. Bell, "Operation Amplifiers and Linear Integrated Circuits", Oxford University Press, Indian Editio

Course Name: Electrical Circuit and Analysis

Course Code: PCEC02T

NEP Vertical_Basket:: PC-PCC

Preamble

Understanding how circuits work and being able to analyze their response is essential for engineers and technicians in many fields like electronics, telecommunications, electrical, and control systems. In this subject, we will explore the fundamental principles and laws for analysis of electrical circuits. We will learn various methods such as complex algebra, time domain and frequency domain to analyze circuit response. We will also study advanced topics such as coupled circuits, transient analysis, Laplace transform, two-port networks, and network functions. By the end of this course, the learner will have gained a deep understanding of electrical networks and be able to analyze and design networks for a variety of practical applications.

Course Objectives:

- To understand D.C. electrical Circuits and coupled circuits.
- To understand time domain behaviour of electrical circuits.
- To understand frequency domain response of electrical circuits.
- To evaluate network parameters of given electrical network.
- To understand the working of single-phase transformers.

Course Outcomes:

Learner will be able to:

CO1: Students will be able to apply their understanding of network theorems in analyzing complex DC circuits.

CO2: Students will be able to understand j-domain conversion & analysis of simple AC circuits.

CO3: Students will be able to understand various factors of magnetically coupled circuit and its analysis.

CO4: Students will be able to understand time domain and frequency domain response of electrical circuits and thereby understand the behavior of electrical networks.

CO5: Students will be able to evaluate various network parameters of network and thereby understand inter relationship between parameters.

CO6: Students will be able to understand types & illustrate the working/construction of single-phase transformer.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

Detailed Syllabus:

Module No.	Module Name	Content	Hours
1	DC Circuits	Basics of Circuit Analysis, Kirchhoff's Laws, Independent and dependent voltage and current Sources, Source Transformation, Mesh and Nodal Analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem (Problems with dependent sources) Basics of series and parallel resonance circuit.	7
2	Magnetically Coupled Circuits	Conversion of L & C in j-domain form, Introduction to Magnetic Circuits, Self and Mutual inductances, dot convention, transformation and coupled circuits, co-efficient of coupling, Analysis of coupled Circuit using Loop Analysis.	4
3	Transient Analysis (Time Domain Analysis)	Introduction to Transient state & steady state, Initial & Final conditions, Transient behavior of R, L & C Transient and Steady state analysis of R-C, R-L and R-L-C Circuits using standard differential equations.	4
4	Laplace transform (Frequency Domain Analysis)	Introduction to Laplace Transform, Representation of time domain parameters in frequency domain, Analysis of circuit using Laplace transform.	5
5	Two Port Network	Network Functions of one port and two port Network, Two port network parameters, Z, Y, ABCD, h and g parameters, Inter-relationship between parameters. Inter connection of two port networks.	7
6	Single Phase Transformer	Construction, Type of Transformer, Working principle of single-phase transformer classification of Transformer, EMF equation of a transformer, Applications of Transformers	3
Total			**30**

Text Books:

1. Ravish Singh "Electrical Network Analysis and Synthesis Tata McGraw Hill, (Revised Second Edition) V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. B.L.Theraja "Electrical Engineering " Vol-I and II.
3. S.N.Singh, "Basic Electrical Engineering" PHI , 2011Book
4. Network Analysis, M. E. Van Valkenburg/T.S. Rathore, Pearson Education, 3rd Edition (2019).
5. Circuits and Networks: Analysis and Synthesis, A. Sudhakar and S.P. Shyammohan McGraw Hill Education (India) Private Limited; 5th edition (2015).

Reference Books:

1. Circuit Theory Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., Seventh - Revised edition (2018)
2. MahmoodNahvi and Joseph A. Edminister, "Schaum's Outline of Electrical Circuits",McGraw-Hill Education, 7 th Edition (2017).
3. Problems and Solutions of Electrical Circuit Analysis, R.K. Mehta & A.K. Mal, CBS Publishers and Distributors Pvt Ltd (2015).
4. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
5. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
6. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
7. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004

Course Name: Electrical Circuit and Analysis lab

Course Code: PCEC02P

NEP Vertical_Basket:: PC-PCC

Preamble

Understanding how circuits work and being able to analyze their response is essential for engineers and technicians in many fields like electronics, telecommunications, electrical, and control systems. In this subject, we will explore the fundamental principles and laws for analysis of electrical circuits. We will learn various methods such as complex algebra, time domain and frequency domain to analyze circuit response. We will also study advanced topics such as coupled circuits, transient analysis, Laplace transform, two-port networks, and network functions. By the end of this course, the learner will have gained a deep understanding of electrical networks and be able to analyze and design networks for a variety of practical applications.

Course Objectives:

- To understand D.C. electrical Circuits and coupled circuits.
- To understand time domain behaviour of electrical circuits.
- To understand frequency domain response of electrical circuits.
- To evaluate network parameters of given electrical network.
- To understand the working of single-phase transformers.

Course Outcomes:

Learner will be able to:

CO1: Students will be able to apply their understanding of network theorems in analyzing complex DC circuits.

CO2: Students will be able to understand j-domain conversion & analysis of simple AC circuits.

CO3: Students will be able to understand various factors of magnetically coupled circuit and its analysis.

CO4: Students will be able to understand time domain and frequency domain response of electrical circuits and thereby understand the behavior of electrical networks.

CO5: Students will be able to evaluate various network parameters of network and thereby understand inter relationship between parameters.

CO6: Students will be able to understand types & illustrate the working/construction of single-phase transformer.

ISA:

At least 10 experiments covering entire syllabus of Electrical Circuit and Analysis should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiment must be graded from time to time. Practical and Oral exam will be based on the entire syllabus.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

Suggested List of Experiments

1. To study and design dependent voltage and current sources.
2. To measure output voltage across load resistor/current through load resistor and verify the result using Mesh analysis.
3. Verification of Superposition Theorem.
4. Verification of Thevenin's & Norton's Theorem.
5. Verification Maximum Power Transfer Theorem.
6. To study transient response of R-C circuit.
7. Determination of open circuit (Z) parameters of Two port Network.
8. Determination of short circuit (Y) parameters of Two port Network.
9. To find resonance conditions in a R-L-C series resonance circuit.
10. To demonstrate cut-out sections of single-phase transformer and verify its Voltage ratio.
11. Problem based learning experiments.

Simulation Experiments

1. Verification of Theorems on Multisim
2. Study of Step Up and Step-Down Transformers of Tinker cad
3. Transient Responses of Series R-L-C, R-L, And R-C Circuits with Sine and Step Inputs using MATLAB Simulink
4. Understanding Series and parallel resonance using LT spice/Multisim

Text Books:

1. Ravish Singh "Electrical Network Analysis and Synthesis Tata McGraw Hill, (Revised Second Edition) V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. B.L.Theraja "Electrical Engineering " Vol-I and II. 2. S.N.Singh, "Basic Electrical Engineering" PHI , 2011Book
3. Network Analysis, M. E. Van Valkenburg/T.S. Rathore, Pearson Education, 3rd Edition (2019).
4. Circuits and Networks: Analysis and Synthesis, A. Sudhakar and S.P. Shyammohan McGraw Hill Education (India) Private Limited; 5th edition (2015).

Reference Books:

1. Circuit Theory Analysis and Synthesis, A. Chakrabarti, DhanpatRai& Co., Seventh - Revised edition (2018)
2. MahmoodNahvi and Joseph A. Edminister, "Schaum's Outline of Electrical Circuits",McGraw-Hill Education, 7 th Edition (2017).
3. Problems and Solutions of Electrical Circuit Analysis, R.K. Mehta & A.K. Mal, CBS Publishers and Distributors Pvt Ltd (2015).
4. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
5. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
6. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
7. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004

Course Name: Data Structure

Course Code: PCEC03T

NEP Vertical_Basket: PC-PCC

Preamble:

Data Structures deals with the organization, management, and manipulation of data. This course covers basic data structures and their algorithms, design and analysis principles, and real-world applications. By the end, students will be able to apply their knowledge to solve complex problems.

Pre-requisites:

1. ES04T (Structured Programming)
2. ES05T (Object Oriented Programming)

Course Objectives:

- To understand the need and significance of Data structures as a computer Professional.
- To teach concept and implementation of linear and Nonlinear data structures.
- To analyze various data structures and select the appropriate one to solve a specific real-world problem.
- To introduce various techniques for representation of the data in the real world.
- To teach various hashing techniques.

Course Outcomes:

Learner will be able to:
CO1: Define different types of data structures and operations.
CO2: Implement linear data structure like stack or queue with operations.
CO3: Analyze the different types of linked lists like singly, doubly, and circular with operations. CO4: Create and manipulate different types of trees with their properties and operations.
CO5: Create and represent graphs, including vertices, edges, adjacency matrix/ list, and traversal algorithms.
CO6: Apply different hashing techniques to efficiently retrieve and manipulate data.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Data Structures	Introduction to Data Structures, Concept of ADT, Types of Data Structures-Linear and Nonlinear, Operations on Data Structures.	2
2	Stack and Queue	Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Correctness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion. Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Double Ended Queue.	7
3	Linked List	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List.	7
4	Trees	Introduction, Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding, Search Trees-AVL, rotations in AVL Tree, Introduction of B Tree, B+ Tree.	7
5	Graphs	Introduction, Graph Terminologies, Representation of Graph, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS), MST using Kruskal's and Prim's Algorithm.	5
6	Hashing	Hashing, Hash Functions, Collision resolution Techniques.	2
Total			**30**

Text Books:

1. Reema Thereja," Data Structures using C", 2nd edition, Oxford Press, 2014
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", First Edition, Pearson Publication, 2019

Reference Books:

1. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2ndEdition, CENGAGE Learning, 2004.
2. P.S. Deshpande, O.G. Kakde, "C and Data Structures", First Edition, Dreamtech Press, 2003
3. E. Balagurusamy, "Data Structure Using C", First Edition, Tata McGraw-Hill Education India, 2013

Course Name: Data Structure Lab

Course Code: PCEC03P

NEP Vertical_Basket:: PC-PCC

Preamble:

The subject explores the fundamental concepts and practical applications of organizing and manipulating data efficiently. Through hands-on experiments and problem-solving, it aims to develop students' skills in implementing and analyzing various data structures.

Pre-requisites:

1. ES04P (Structured Programming Lab) / ES05P (Object Oriented Programming Lab)

Course Objectives:

- To implement basic data structures such as arrays, linked lists, stacks and queues
- Solve problem involving graphs, and trees.
- To develop application using data structure algorithms

Course Outcomes:

Learner will be able to:
CO1: Implement Stack and be able to handle operations like insertion, deletion and traversing on them.
CO2: Implement different types of queues and be able to handle operations like insertion, deletion and traversing on them
CO3: Implement different types of linked list like Singly linked list, Circular linked list and Doubly linked list
CO4: Create and manipulate binary search tree with their properties and
operations. CO5: Implement graph traversal techniques such as DFS and BFS

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Learners are expected to perform minimum 12 practical based on the following suggested topics.

Sr. No.	Suggested Topic(s)	Number of Practicals
1	Implementation of stack using array	1
2	Stack Applications (Correctness of parenthesis, Infix to postfix conversion and Evaluation of postfix expression)	3
3	Implementation of different types of queues using array (Linear queue, Circular queue, Priority queue, Double Ended queue)	4
4	Implementation of different types of linked list (Singly linked list, Doubly linked list and Circular linked list)	3
5	Implementation of stack and queue using linked list	2
6	Implementation of binary search tree	1
7	Implementation of graph traversal techniques (DFS and BFS)	2

Textbooks:

1. Reema Thereja," Data Structures using C", 2nd edition, Oxford Press, 2014
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", First Edition, Pearson Publication, 2019

Reference Books:

1. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2ndEdition, CENGAGE Learning, 2004.
2. P.S. Deshpande, O.G. Kakde, "C and Data Structures", First Edition, Dreamtech Press, 2003
3. E. Balagurusamy, "Data Structure Using C", First Edition, Tata McGraw-Hill Education India, 2013

Course Name: Python Programming

Course Code: VSEC04T

NEP Vertical_Basket:: Skill Courses (SC)

Preamble:

Python is a popular, easy-to-learn, and powerful programming language with efficient high-level data structures and a simple yet effective approach to object-oriented programming. Its elegant syntax and dynamic typing make it ideal for scripting and rapid application development across multiple platforms. Python's built-in high-level data types, such as lists, tuples, and dictionaries, enable it to handle a more extensive problem domain than other languages, such as Awk or Perl. Additionally, Python's modules can be split into reusable components, which provides versatility across various domains, including gaming, statistical data analysis and visualization, and speech and face recognition.

Python's interpreted nature eliminates the need for compilation and linking, resulting in time savings during program development. The interpreter's interactive capability enables experimentation and testing of functions during program development. Python can be used for a wide variety of purposes, including web development, data analysis, machine learning, artificial intelligence, scientific computing, and more. In this subject, you will learn the basics of Python programming, including syntax, data types, control structures, functions, modules, and file handling.

Pre-requisite:

1. Structured Programming
2. Object Oriented Programming

Course Objectives:

- Describe the core syntax and semantics of Python programming language.
- Explore file handling in Python.
- Infer the Object-oriented Programming concepts in Python.
- Formulate GUI Programming and Databases operations in Python.

Course Outcomes:

After successful completion of the course students will be able to:

CO1: Describe syntax and semantics in Python.
CO2: Illustrate different file handling operations.
CO3: Interpret object-oriented programming in Python.
CO4: Design GUI Applications using Python.
CO5: Understand databases using Python.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Unit No.	Contents	No. of Hours
1		**Introduction to Python Programming**	08
	1.1	Introduction to Python, Python Syntax, Comments, Variables (Local and Global), data types, Python Operators, Input Statements in python	
	1.2	Strings, Lists, Tuples, Dictionaries, Sets, Accessing Elements, Properties, Operations, and methods on these data structures.	
2		**Functions and File Handling**	06
	2.1	Built-in-functions, library functions, Defining and calling the functions, Return statements, Passing the arguments, Lambda Functions, Recursive functions, Modules and importing packages in python code.	
	2.2	File Handling, Read Files, Write/Create Files, Delete files	
3		**Object Oriented Programming**	08
	3.1	Classes and Objects, Public and Private Members, Class Declaration and Object Creation, Object Initialization, Class Variables and methods, Accessing Object and Class Attributes.	
	3.2	Inheritance, Constructor in Inheritance, Exception Handling	
4		**Graphical user Interface and Database Handling**	08
	4.1	Graphical User Interface using Tkinter Library module, creating simple GUI, Buttons, Labels, entry fields, widget attributes.	
	4.2	Database connection, Create, Append, update, delete records from database	
		Total	**30**

Text Books:

1. Yashvant Kanetkar, "Let us Python: Python is Future, Embrace it fast", BPB Publications; 1st edition (8 July 2019).
2. Dusty Phillips, "Python 3 object-oriented Programming", Second Edition PACKT Publisher, August 2015.
3. John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).
4. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press
5. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox publication
6. Introduction to computing and problem solving using python, E Balagurusamy, McGraw Hill Education

Reference Books:

1. Eric Matthes, "Python Crash Course A hands-on, Project Based Introduction to programming" No Starch Press; 1st edition (8 December 2015).
2. Paul Barry, "Head First Python" O'Reilly; 2nd edition (16 December 2016)
3. Zed A. Shaw, "Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly
4. Beautiful World of Computers and Code", Addison Wesley; 3rd edition (1 October 2013).
5. Andreas C. Mueller, "Introduction to Machine Learning with Python", O'Reilly; 1st edition (7 October 2016)
6. David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media; 3rd edition (10 May 2013).

Course Name: Python Programming Lab

Course Code: VSEC04P

NEP Vertical_Basket: Skill Courses (SC)

Preamble:

Python is a well-known, simple-to-learn, and successful programming language that has good high-level data structures and a straightforward but efficient approach to object-oriented programming. Its graceful syntax and dynamic typing make it the best language for scripting and quick platform-agnostic application development. Python has high-level data types like lists, tuples, and dictionaries built in, Python can handle a wider range of problem domains than comparable languages like Awk or Perl.
Python can be used for a wide variety of purposes, including web development, data analysis, machine learning, artificial intelligence, scientific computing, and more. In this lab, students will learn the basics of Python programming, including syntax, data types, control structures, functions, modules, and file handling.

Pre-requisite:

1. Structured Programming
2. Object Oriented Programming

Course Objectives:

- Understand the basic syntax and structure of Python programming language
- Define and use variables and data types in Python
- Use control structures such as conditional statements and loops to write Python programs
- Understand the concept of object-oriented programming and write Python programs using classes and objects
- Work with built-in Python modules and libraries
- Write Python programs that interact with files and databases
- Debug and test Python programs using various tools and techniques

Course Outcomes:

After successful completion of the course students will be able to:

CO1: Students will be able to write Python programs using the correct syntax and structure, and will be familiar with Python's built-in functions and libraries.
CO2: Students will be able to define and use variables and data types in Python, and will understand the use of control structures such as conditional statements and loops.
CO3: Students will be able to write functions in Python and understand the concepts of parameter passing and return values, and will be able to use functions to solve problems.
CO4: Students will understand the concepts of object-oriented programming and be able to write Python programs using classes and objects.
CO5: Students will be able to work with built-in Python modules and libraries, and understand how to use them to solve problems.
CO6: Students will be able to debug and test Python programs using various tools and techniques, and will understand the importance of testing in the software development process.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested list of Practicals:

Sr. No.	Experiment Title
1	1) Write a Python program to add two numbers stored in a variable. Take input from the User. 2) Write a Python program to find the number is even or odd. Take input from the User. 3) Write a Python program to find the area of triangle.
2	1) Write a Python program to find whether the student will pass the IA exam or not. Take IA1 and IA2 marks from the user. Average the IA marks. If IA average is greater or equal to 7.5, he/she will pass the exam. 2) Rohan takes 10000 rupees bank loan from the bank. The interest rate is 10% per year. How much interest he must pay after 3 years? Write a Python program and take input from user. 3) A student will get admission in a college if he/she has CET merit rank less than 1000 and if his/her CET percentile is greater than 90. Write a Python program for the given problem statement and take input from the user.
3	1) Write a python program to arrange the numbers in ascending order. 2) Write a python program to arrange the numbers in descending order. 3) Write a python program to check whether the numbers are in the ascending order or not. 4)
4	1) Write a python program to find even numbers from the list. 2) Write a python program to find odd numbers from the list. 3) Write a python program to make a single unique list from the given list: num1=[1,3,2,8,7] num2=[3,8,9,6,10] 4) Write a python program to find how many times the number 7 is repeated in the roll number list: roll_num=[1,3,7,4,9,7,2,14,7,10,17,15,7,21]

5	1) Write a python program which can take your name as an input and password. If password is matched with the correct password (which you have mention in the program), Print the "Hello "with the name. If user entered wrong password, allow him/her 3 chance to re-enter the password. 2) Write a python program which can take your name as an input and password. If password is matched with the correct password (which you have mention in the program), Print the "You can use Calculator "with the name. If user entered wrong password, allow him/her 3 chance to re-enter the password. If password match then the user can use calculator (addition, Subtraction, Multiplication, and division operation).
6	1) Design number guessing game using Python Programming. Design quiz which has MCQ type questions. Calculate the final score and percentage and print it.
7	Design a Simple GUI calculator using Tkinter
8	Write a python program which can take multiple data entries from the user and save the data in text file. Perform read, write and append operations on the file using file handling concepts.
9	Write a python program for Mysql Database Connection • create a database TESTDB. • create a table EMPLOYEE in TESTDB. ▪ This table has fields FIRST_NAME, LAST_NAME, AGE, SEX and INCOME. • User ID "testuser" and password "test123" are set to access TESTDB. • Install Python module properly on machine. • Python code for connecting with MySQL database "TESTDB" • create tables or records into the database tables • Perform various operation like read, write and delete
10	Project Detecting Fake News with Python
11	Project Color Detection with OpenCV and Pandas
12	Write a Python program to design smart desktop assistant which takes voice command as input and access youtube, google.com, Wikipedia, music files and whatapp

Reference Books:

7. Eric Matthes, "Python Crash Course A hands-on, Project Based Introduction to programming" No Starch Press; 1st edition (8 December 2015).
8. Paul Barry, "Head First Python" O'Reilly; 2nd edition (16 December 2016)
9. Zed A. Shaw, "Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly
10. Beautiful World of Computers and Code", Addison Wesley; 3rd edition (1 October 2013).
11. Andreas C. Mueller, "Introduction to Machine Learning with Python", O'Reilly; 1st edition (7 October 2016)
12. David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media; 3rd edition (10 May 2013).

Detailed Syllabus of Multidisciplinary Minor Courses

Course Name: Introduction to Bioinformatics

Course Code: MDMBI01

NEP Vertical_Basket: MDC_MDM

Preamble:

This course is designed with the objective of equipping students with a robust understanding of the integration between biology and computational science, key bioinformatics concepts, methodologies, and applications. Through a combination of theoretical knowledge and practical applications, students will develop a holistic understanding of how computational methods can enhance the comprehension of biological processes. It also emphasizes on real-world biological questions and research challenges, empowering them to make meaningful contributions to the rapidly evolving field of bioinformatics

Course Objectives:

- To enable learners to understand the basic principles of bioinformatics.
- Build foundational understanding of biology, types of biological data, and the role of computing in biology.

Course Outcomes:

Student will be able to:

CO1: Explain foundational molecular biology concepts and their relevance to bioinformatics, including DNA, RNA, proteins, and gene functions.

CO2: Access, compare, and utilize various biological databases and sequence file formats to retrieve and analyze genomic and proteomic data effectively.

CO3: Apply key sequence alignment algorithms and computational techniques to analyze biological sequences and construct phylogenetic relationships.

CO4: Implement bioinformatics algorithms and data structures to solve problems in genomics, proteomics, and systems biology, including gene prediction and motif discovery.

CO5: Evaluate current applications and emerging trends in bioinformatics, including personalized medicine, big data analytics, ethical issues, and the integration of AI/ML technologies in biological research.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Tutorial	Theory	Tutorial
MDMBI01	3	1	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory (MDMBI01)	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Basics of Molecular Biology	Structure and function of DNA, RNA, and proteins Central Dogma of Molecular Biology (Replication, Transcription, Translation) Codons and genetic code Types of genes (structural, regulatory) Mutations and their biological effects.	8
2	Biological Databases	Types: Primary, Secondary, Specialized databases, GenBank, EMBL, DDBJ – comparative study, UniProt, PDB, RefSeq, Ensembl, Sequence file formats (FASTA, GenBank, GFF, SAM/BAM), Querying biological databases (using NCBI Entrez, EBI search tools)	8
3	Sequence Analysis	Types of biological sequences: DNA, RNA, Protein,Pairwise and Multiple Sequence Alignment (MSA),Scoring matrices (PAM, BLOSUM),Tools: BLAST, FASTA, ClustalW, Applications: gene finding, phylogeny, structure prediction	8
4	Genomics & Human Genome Project	Genome organization and structure, Sequencing techniques: Sanger, Next Generation Sequencing (NGS), Nanopore, Applications: disease gene identification, forensic genomics, Human Genome Project: goals, achievements, ethical issues, Comparative genomics	12
5	Applications of Bioinformatics	Bioinformatics in personalized medicine, Drug discovery and vaccine design, Agriculture and animal genomics Role of AI/ML in bioinformatics	9
Total			**45**

Books and Resources:

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004
2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

Course Title: Foundations of Innovation and Entrepreneurship

Course Code: MDMIE01

NEP Vertical_Basket: MDC_MDM

Preamble:

This course provides a foundational understanding of how innovation emerges, how entrepreneurs identify and act on opportunities, and how new ventures can be developed to address real-world challenges. It explores the intersection of creativity, strategic thinking, and risk-taking, emphasizing both individual initiative and collaborative problem-solving.
Pre-requisites: NIL

Course Objectives:

- To introduce the foundational concepts of innovation and entrepreneurship.
- To build awareness of opportunity recognition, creativity, and idea validation.
- To expose students to business modelling and startup ecosystems.

Course Outcomes:
Students will be able to:
CO1: Understand key entrepreneurial trends and innovation drivers
CO2: Apply ideation tools to enhance entrepreneurial ideas.
CO3: Create basic business models using modern tools.
CO4: Evaluate entrepreneurial case studies and pitch early-stage ideas and take critical feedback.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Tutorial	Theory	Tutorial
MDMBI01	3	1	3	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Entrepreneurship	• Definition, importance, and scope • Types of entrepreneurs • Entrepreneurial mindset and characteristics	8
2	Innovation Basics	• Types of innovation (product, process, business model) • Disruptive vs. incremental innovation Design Thinking fundamentals	8
3	Idea Identification & Evaluation	• Creativity and ideation tools (brainstorming, SCAMPER, mind-mapping) • Problem-solving frameworks • Validating ideas	10
4	Business Case presentation	• Business Model Canvas • Value Proposition Design • Customer Segments and Customer Discovery	6
5	Leveraging the Entrepreneurial Ecosystem	• Role of incubators, accelerators, and funding bodies • Startup India, Atal Innovation Mission, etc	7
		Total	**45**

Tutorials (1 Credit):

- Case studies on startups
- Group exercises on ideation
- Hands-on practice with the Business Case presentation
- Ideation workshops
- Business culture studies exercises
- Group discussion and presentations

Reference books:

- Steve Blank, The Startup Owner's Manual, K&S Ranch Publishing Inc
- Alexander Osterwalder, Business Model Generation, John Wiley and Sons
- Peter F. Drucker, Innovation and Entrepreneurship, HarperCollins Publishers Inc

Course Name: Introduction to Business Development and Marketing Principles

Course Code: MDMBD01

NEP Vertical_Basket: MDC_MDM

Preamble:
The objective of this course is to introduce engineering students to the fundamentals of business development and marketing using a customer centric lens. Students will learn how to conceptualize a basic business idea, understand market needs, and align engineering innovations with customer demand.

Pre-requisites:
None

Course Objectives:

- Understand basic business structures and concepts.
- Identify customer needs and conduct basic market research.
- Learn fundamentals of marketing strategy in a technology-driven world.
- Appreciate the role of engineering in business innovation.

Course Outcomes:
Students will be able to:

CO1: Explain key concepts in business development and marketing relevant to engineers.
CO2: Conduct simple market research and competitor analysis for a tech-based idea.
CO3: Draft a basic value proposition and elevator pitch.
CO4: Identify business opportunities through innovation in telecom and electronics domains.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	1(Tutorial)	3	1(Tutorial)

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Foundations of Business	Types of businesses, vision-mission-goals, legal forms of business, introduction to entrepreneurship.	8
2	Marketing Essentials	Needs vs wants, Segmentation, targeting, positioning, Marketing mix (4Ps), digital vs traditional marketing.	8
3	Customer Focus	Basics of customer journey, personas	7
4	Technology Product Planning	Basics of product lifecycle, innovation funnel, idea screening.	10
5	Market Research Basics	Research Types, Research steps, Sampling,, Surveys, interviews, SWOT, competitor analysis.	6
6	Business Idea Pitch	Business idea pitch, value proposition canvas, storytelling.	6
		Total	**45**

Textbooks:

1. Marketing Management by Kotler

Reference Books:

1. Marketing Basics PDF by MIT OpenCourseWare

Course Name: Fundamentals of Robotics and Control

Course Code: MDMRB01

NEP Vertical_Basket: MDC_MDM

Preamble:

This course introduces the foundational principles of robotics, including kinematics, dynamics, and control systems. The course explores real-world robotic applications and the growing role of automation in modern industries. Students will gain hands-on experience with robotic systems and process automation tools. The course integrates Robotic Process Automation (RPA) to bridge physical and digital automation domains.

Course Objectives:

- Understand the foundational principles of robotics, including kinematics, dynamics, and control of robotic systems.
- Apply basic control strategies such as PID to robotic manipulators and mobile robots
- Explore the role of Robotic Process Automation (RPA) as a complementary software-based automation technique and build simple RPA workflows.

Pre-requisites:

1. Engineering Mathematics-I
2. Engineering Mathematics-II
3. Structured Programming
4. Object Oriented Programming

Course Outcome:

The students will be able to:

CO1: Explain the components and types of robotic systems and their applications.
CO2: Derive and apply forward and inverse kinematics for simple manipulators.
CO3: Analyze and implement feedback control systems, including PID controllers
CO4: Simulate basic robotic arm motion and trajectory control using software tools..
CO5: Describe the fundamentals of Robotic Process Automation (RPA) and its uses in industry.
CO6: Develop a basic RPA workflow to automate a simple rule-based software task.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
3	2	3	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose a revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Introduction to Robotics	Types of robots: manipulators, mobile robots, humanoids Robot anatomy: joints, links, actuators, sensors Applications in manufacturing, healthcare, and services	06
02	Kinematics of Robotic Manipulators	Coordinate systems and transformations, Denavit–Hartenberg (D-H) parameters, Forward and inverse kinematics for 2-DOF and 3-DOF arms	09
03	Dynamics and Trajectory Planning	Basic concepts in robot dynamics (torque, inertia – overview), Joint and Cartesian trajectory planning, Linear and cubic interpolation	06
04	Control of Robotic Systems	Introduction to control systems, PID control: tuning, implementation, and real-time control, Stability and feedback concepts	08
05	Introduction to Robotic Process Automation	What is RPA, Difference from physical robotics, Components of an RPA system: bots, orchestrators, recorders, Overview of popular RPA tools (e.g., UiPath)	06
06	RPA Workflow Design and Integration	Creating simple bots to automate tasks (e.g., Excel, web forms), Control structures, data handling, and triggers in RPA, Conceptual integration: using RPA to initiate physical robot actions	10
Total			**45**

Suggested List of Value-Added Home Assignments:

1. Research a real-life robotic system (e.g., Da Vinci surgical robot, warehouse AGVs, Boston Dynamics' Spot). Analyze its components, sensing and actuation methods, and control logic. Propose a reconfiguration or redesign for a different application.

2. Design a 2-DOF or 3-DOF manipulator in MATLAB or Python. Simulate a simple pick-and-place routine.
3. Design a time-optimized trajectory considering joint velocity and acceleration limits for trajectory planning for a Robotic Painter
4. Implement a PID controller to stabilize an inverted pendulum model. Simulate using MATLAB/Python
5. Identify a repetitive digital task in your daily academic/work life. Automate them using tools
6. Create an RPA bot that responds to an email, form submission, or file upload.

Reference Books / Articles

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2003.
2. John J. Craig, Introduction to Robotics–Mechanics &Control Pearson Education, India, Third Edition, ,2009.
3. Katsuhiko Ogata, Modern Control Engineering
4. Alok Mani Tripathi, Learning Robotic Process Automation
5. Fu, Gonzales and Lee, Robotics, Robotics, McGraw Hill, SecondEdition,2011.
6. Staughard, Robotics and AI, Prentice Hall of India.
7. Grover, Wiess, Nagel, Oderey Industrial Robotics, , McGraw Hill.
8. Walfram Stdder, Robotics and Mechatronics, Mc Graw Hill, New York 2008.
9. Saeed B Niku, Introduction to Robotics, Pearson Education.
10. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

Detailed Syllabus of Second Year Semester - IV

Course Name: Design Thinking

Course Code: EEMC01

NEP Vertical _Basket: HSSM_EEMC

Category: Entrepreneurship/Economics/Management

Preamble:

Design thinking is a powerful tool for rethinking and revitalizing strategy—and for driving organizational performance. By placing customers' needs at the center of a product, service, process, or business model, you can reframe strategic challenges and develop more effective solutions. Drawing on right-brained creativity and left-brained analytics, the course on design thinking enables you to broaden your strategic perspective, find novel opportunities for innovation, and keep your business moving forward.

Course Objectives:

- To impart knowledge on the concepts of Design Thinking
- To impart knowledge on the phases of Design Thinking
- To apply Design Thinking concepts

Course Outcomes:

Learner will be able to:
CO1: Understand the concepts of design thinking approaches.
CO2: Create design thinking teams and conduct design thinking sessions.
CO3: Apply both critical thinking and design thinking in parallel to solve problems.
CO4: Apply design concept to their daily work.

Course Scheme:

Contact Hours		Credits Assigned	
Theory+ Practical		Theory + Practical	
3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory & Tutorial	50	-	50	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by

a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content
1	Design Thinking Overview	What is different about design thinking, Design thinking skills, Design thinking mindset, Principles of Design thinking
2	General Approaches to Design Thinking	The basics of Design thinking, Design thinking frameworks, Design thinking team, Design thinking workshops and meeting – Characteristics and types
3	Design Thinking approach in stages	Apply design thinking framework, empathize with customers/users, Define the problem, Ideate, Prototype, Test solution.
4	Design Thinking Techniques	Listening and emphasizing techniques – Engagement, Observation, showing empathy, Define and ideation techniques – Unpacking, Personas, Pattern recognition and connecting the dots, Prototype, and testing techniques – Types of prototypes, forms of testing in design thinking,
5	General Design Thinking Practices	Use of diagrams and maps in design thinking – empathy map, affinity diagram, mind map, journey map. Story telling techniques – Improvisation, scenarios, K-scripts
6	Adopt and Adapt Design thinking	Cautions and pitfalls – assumptions, pitfalls and cautions in design thinking workgroups, Best practices
		Total Hours=30

Suggested list of Practical

1. Creating an Empathy Map Canvas by interviewing the users (10M)
2. To create User Personas and user pain points to understand users on an individual basis (10M)
3. Customer Journey Mapping to understand Customer Experience (5M)
4. Framing of Problem Statement and analysis (5M)
5. Brainstorming of ideas through post-it notes (10M)
6. Creating low fidelity prototypes/ paper prototypes/drawings (10M)

Reference Books:

1. Tim Brown, "Change by Design - How Design Thinking Transforms Organizations and Inspires Innovations"
2. Larry J.Leifer, Michael Lewerick, and Patrick, "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods"

Course Name: Engineering Mathematics-IV

Course Code: OEC10

NEP Vertical_Basket: Multidisciplinary Courses - Open Electives (OE)

Preamble:

This course introduces students to Engineering Mathematics-IV, with detailed Mathematical introduction to Complex Integration, Vector Spaces and Statistical Techniques like Probability Distribution, Correlation and Regression which are widely applicable in Biomedical Engineering. This Course will also offer in-depth understanding of fundamental and theoretical underpinnings, applications, best practices, and research activities.

Pre-requisites:

Engineering Mathematics -I(BS02)
Engineering Mathematics-II(BS04)
Engineering Mathematics-III(BS43)

Course Objectives:

- To understand complex Integration concept and apply to evaluate integrations.
- Understanding the fundamentals of linear algebra with advanced matrices and Vector Space, Statistical Techniques like Probability Distribution and Correlation and Regression to solve real world problems.
- To create a strong foundation by studying the basics of Engineering Mathematics and interfacing to various peripherals which will lead to a well-designed based System.
- To provide students with the sound foundation of Mathematics, Science, and Engineering fundamentals necessary to formulate, solve and analyze engineering problems and prepare them for Graduate studies.
- To impart knowledge of interfacing techniques and educate the student in the domain of Biomedical Engineering.

Course Outcomes:
Student will be able to:
CO1: Develop the ability to understand the basics of Complex Integration and Residues.
CO2: Apply the knowledge of z transform for complex sequences.
CO3: Calculate probabilities and other measures using probability distributions.
CO4: Understand the basics of Vector Spaces used in the field of Machine learning, AI and Data Science.
CO5: Apply the knowledge of vector integration to solve engineering problems.
CO6: Apply the basic statistical techniques Correlation and Regression lines for the field of Data analysis.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Complex Integration	Line Integral, Cauchy 's Integral theorem (without proof), Cauchy 's Integral formula (without proof). Taylor 's and Laurent 's series Definition of Singularity, Zeroes, poles. Residues, Cauchy 's Residue Theorem (without proof)	8
2	Z Transform	Z-Transform of a sequence, Properties of Z-Transform, Examples based on properties of Z-Transform Inverse Z- Transform, Inverse Z-Transform using Binomial method. Inverse Z-Transform using convolution theorem.	6
3	Vector Spaces	n-dimensional vector space, Norms, Inner product, Cauchy-Schwarz Inequality (with proof). Vector spaces over a real field, Subspaces, Orthonormal basis, Gram-Schmidt process for vectors.	7
4	Vector Integration	Gradient, Divergence, and Curl, Line Integral, Green's Theorem in a plane	8
5	Probability Distribution	Random Variable: Probability distribution for discrete and continuous random variable, Bayes Theorem (without proof) Expectation, Variance, Probability distributions: Poisson and Normal distributions.	8

Module No.	Module Name	Content	No. of Hours
6	Statistical Techniques	Statistical Techniques Covariance, Karl Pearson 's Coefficient of correlation (r). Spearman 's Rank correlation coefficient (R) (repeated and non-repeated ranks), Lines of regression, Fitting of first- and second-degree curves.	8
Total			**45**

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition.
2. Dr. B V Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006
3. P N Wartikar and J N Wartikar "*Textbook of Applied Mathematics Volume I & II, Vidyarthi* GhrihaPrakashan Pune 2005 9th Edition.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition.
2. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
3. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition.
4. Kenneth Hoffman. "Linear Algebra", Pearson 2018.
5. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", Tata McGraw India, 6th Edition.
6. Seymour Lipschutz,"Schaum's Outline of Probability and Statistics", Tata McGraw India ,1st Edition.
7. T. Veerarajan, "Probability, Statistics and Random processes", Tata McGraw India, 2nd Edition.
8. Robert Weinstock, "Calculus of variation with application to physics and Engineering", Dover
9. Publications, New York, 1st Edition.

Course Name: Computer Organization & Architecture

Course Code: ESC09T

NEP Vertical_Basket: Engineering Science Courses (ESC)

Preamble:

A professional in any field of computing should not regard the computer as just a black box that executes programs by magic. All students of computing should acquire some understanding and appreciation of a computer system's functional components, their characteristics, their performance, and their interactions. Students need to understand the addressing modes, instruction set of a microprocessor and should be able to develop simple application programs.

Pre-requisite:

- Digital Electronics
- Fundamental concepts of processing

Course Objectives:

- To introduce the learner to the design aspects this can lead to maximized performance ofa Computer.
- To introduce the learner to various concepts related to Parallel Processing
- To highlight the various architectural enhancements in modern processors.

Course Outcomes:

After successful completion of the course students will be able to:
CO1: Understand the fundamentals of computer systems and define the performance metrics of a computer.
CO2: Distinguish between hardwired and microprogrammed control unit design Philosophies
CO3: Apply the understanding of instruction set of microprocessors to develop assembly language programs
CO4: Explain the design considerations of Processor, Memory in computer system
CO5: Explain the design considerations of Processor, I/O in computer system
CO6: Analyze the advantages and limitations of Parallelism in systems

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Unit No.	Contents	No. of Hours
1		**Introduction to Computer Organization**	04
	1.1	Fundamental Units of a Computer	
	1.2	Introduction to Buses	
	1.3	Number Representation methods- Integer and Floating-point, Booth's Multiplier, Restoring and Non-Restoring Division	
	1.4	Basic Measures of Computer Performance - Clock Speed, CPI, MIPs andMFlops	
2		**Processor Organization and Architecture**	06
	2.1	CPU Architecture, Register Organization, Instruction cycle, InstructionFormats, Addressing Modes	
	2.2	Control Unit Design- Hardwired and Micro-programmed Control: Verticaland Horizontal Micro-Instructions, Nano-programming	
3		**8086 Microprocessor**	06
	3.1	Architecture and PIN configuration of 8086	
	3.2	Instruction set of 8086	
	3.3	Assembler directives and assembly language programming with 8086	
4		**Memory Organization**	06
	4.1	Classification of Memories-Primary and Secondary Memories, RAM (SRAM and DRAM) and ROM (EPROM, EEPROM)	
	4.2	Memory Hierarchy, Cache Memory Concepts, Mapping Techniques, Write Policies	
	4.3	Virtual Memory Management-Concept, Paging, PageReplacement policies	
5		**Input/Output Organization**	04
	5.1	Types of I/O devices and Access methods, Types of Buses, Bus Arbitration	
	5.2	Direct Memory Access (DMA)	
6		**Parallelism**	04
	6.1	Introduction to Parallel Processing Concepts, Flynn's classification, Amdahl's law	
	6.2	Pipelining - Concept, Speedup, Efficiency, Throughput, Types of Pipeline hazards and solutions	
		Total	30

Textbooks:

1. William Stallings, "*Computer Organization and Architecture: Designing forPerformance*", Eighth Edition, Pearson.
2. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization", McGraw Hill, 2002.

Reference Books:

1. J.P. Hayes, "Computer Architecture and Organization", McGraw-Hill, 1998.
2. B. Govindarajulu, "*Computer Architecture and Organization: Design Principles andApplications*", Second Edition, Tata McGraw-Hill.
3. D. A. Patterson and J. L. Hennessy, "Computer Organization and Design - TheHardware/Software Interface", Morgan Kaufmann, 1998.

Course Name: Computer Organization & Architecture Lab

Course Code: ESC09P

NEP Vertical_Basket: Engineering Science Courses (ESC)

Preamble:

A professional in any field of computing should not regard the computer as just a black box that executes programs by magic. All students of computing should acquire some understanding and appreciation of a computer system's functional components, their characteristics, their performance, and their interactions. Students need to understand the computer architecture to make best use of the software tools and computer languages they use to create programs. In this introduction, the term architecture is taken to include instruction set architecture, organization, or micro architecture (the internal implementation of a computer at the register and functional unit level), and system architecture (the organization of the computer at the cache, and the bus level).

Pre-requisite:

- Digital Electronics- logic gates
- Fundamentals of different programming languages

Course Objectives:

- To introduce learners with basic principles about computer architecture, machine language, and low-level programming.
- To introduce learners with enough assembly language to enhance their knowledge on today's most widely used microcomputer family.
- To Improving learners systems programming skills through programming exercises carried out by students.
- Learners are expected to implement solutions to problems using the concepts they will take through the course.

Course Outcomes:

After successful completion of the course students will be able to:
CO1: Understand instruction set/format of a microprocessor.
CO2: Understand concept of assembly language and embedded C programming.
CO3: Develop assembly language and embedded C program for simple applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested list of Practicals:

Sr. No.	Practicals
1	Introduction to assembler directives
2	Introduction to assembler like TASM, MASM etc.
3	ALP using ADD, SUB, MUL, DIV instructions
4	ALP using AND, OR, XOR instructions
5	ALP for BCD to ASCII & ASCII to BCD conversion
6	ALP for HEX to ASCII & ASCII to HEX conversion
7	ALP to find out smallest & largest of the array
8	ALP to sort the array in ascending & descending order
9	ALP using BIOS routine for keyboard interface
10	ALP using BIOS routine for display interface

Course Name: Control Systems Engineering

Course Code: PCEC04T

NEP Vertcal_Basket: PC-PCC

Preamble:

Control systems are widely used in various fields, such as aerospace, automotive, chemical, and electrical engineering. In this subject, we will study the principles of Control Systems, including modelling of physical systems using differential equations, transfer function representation, stability analysis, and performance measures such as transient response and steady-state error. By the end of this course, learner will gain a deep understanding of Control Systems and be able to design and implement feedback control systems for a wide range of practical applications.

Pre-requisite:

Engineering Mathematics 1,2,3

Course Objectives:

1. To develop the understanding of fundamental principles of control systems.
2. To disseminate the basic methods for time-domain and frequency-domain analysis of control systems.
3. To develop the concept of stability and its assessment for linear-time-invariant systems.

Course Outcomes:

CO1: Describe basic concepts of control system such as open loop, closed loop, feedback and feed forward systems.
CO2: Develop the mathematical model of different type of systems.
CO3: Analyse systems using state space techniques.
CO4: Analyse stability in time domain using root locus and BIBO stability.
CO5: Examine correlation between stability analysis of systems in time and frequency domain.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Introduction to Control System Analysis	Open loop and closed loop systems; Feedback and feed forward control structure; Examples of control systems.	2
2	Mathematical Modelling of Systems	Transfer function models of systems, Models of electrical systems, Block diagram reduction; Signal flow graph and the Mason's gain rule.	5
3	Transient and steady state behaviour.	Standard test signals; Transient and steady state behaviour of first and second order systems; Type and order of feedback control systems and steady state error analysis	5
4	State Variable Models	State variable models of systems. Concept of state transition matrix; Properties of state transition matrix; Solution of homogeneous systems. Concept of controllability and observability;	6
5	Stability Analysis in Time Domain	Concept of stability; Routh Hurwitz stability criterion; Root-locus concepts; Root locus analysis of control systems.	6
6	Stability Analysis in Frequency Domain:	Relationship between time and frequency domain of systems; Stability margins. Magnitude and phase plot; Method of plotting Bode plot; Stability margins on the Bode plots; Stability analysis using Bode plot.	6
Total			**30**

Text Books:

1. Nise, Control systems Engineering - wse wiley publication
2. Ogatta, Modern Control Engineering - PHI Publication.
3. J.Nagrath and M.Gopal - Control systems Engineering.(New Edition)

Reference Books:

1. S.C. Goya! and U.A.Bakshi - Principles of control systems.
2. Hadi Saadat - Computational aids in control systems using MATLAB.
3. Kuo, Golnaraghi- Automatic Control System- WSE Willey Publication.
4. Rudra pratap -MATLAB FUNDAMENTALS

Course Name: Control Systems Engineering Lab

Course Code: PCEC04P

NEP Vertical_Basket: PC-PCC

Preamble

Control systems are widely used in various fields, such as aerospace, automotive, chemical, and electrical engineering. In this subject, we will study the principles of Control Systems, including modelling of physical systems using differential equations, transfer function representation, stability analysis, and performance measures such as transient response and steady-state error. By the end of this course, the learner will gain a deep understanding of Control Systems and be able to design and implement feedback control systems for a wide range of practical applications.

Pre-requisite:

Engineering Mathematics 1,2,3

Course Objectives:

- To develop the understanding of fundamental principles of control systems.
- To disseminate the basic methods for time-domain and frequency-domain analysis of control systems.
- To develop the concept of stability and its assessment for linear-time-invariant systems.

Course Outcomes:

CO1: Understand basic concepts of control systems such as open loop, closed loop, feedback and feed forward systems.
CO2: Develop the mathematical model of different types of systems.
CO3: Analyse systems using state space techniques.
CO4: Analyse stability in time domain using root locus and BIBO stability.
CO5: Examine correlation between stability analysis of systems in time and frequency domain.

ISA:

At least 10 experiments covering the entire syllabus of Control Systems Engineering should be set to have well predefined inference and conclusion. The experiments should be student centric, and attempts should be made to make experiments more meaningful and interesting. Simulation experiments are also encouraged. Experiments must be graded from time to time. Practical and Oral exams will be based on the entire syllabus.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Experiments is provided; However, Instructor is free to design ownexperiments as per the guidelines

List of Experiments:

1. Familiarization with MATLAB control system tool box, MATLAB/Simulink tool box.
2. Verification of Block reduction rules
3. To solve a differential equation model using simulation software.
4. To find the Steady state error of for a type '0', type '1',Type '2' systems in reponse to standard test signals
5. Determination of step & impulse response for a second order unity Feedback system
6. Stability analysis using Routh Hurwitz Criteria
7. PBL – Quick and accurate weighing system for continuous conveyed materials is important to most of continuous production manufacturing process, especially granular bulk materials. Use a method to make a better estimate of the digital filtering that is required to satisfy a given vibration rejection requirement for better precision and faster response speed.
8. Evaluating the Controllability and Observability of Systems
9. Determination of step & impulse response for a type '0', type '1',Type '2' systems
10. Determination of bode plot using MATLAB control system toolbox for 2nd order system.
11. Determination of root locus plot using MATLAB control system Toolbox for 2nd order system
12. PBL-It is desired to automate insulin infusion and maintain the glucose level based on switching technique. Design a system for the same.
13. PBL- A mass damper system and a spring connected system experience the same force. Give an analysis of their response with reasons. Circuits and systems

Text Books:

1. Nise, Control systems Engineering - wse wiley publication
2. Ogatta, Modern Control Engineering - PHI Publication.
3. J.Nagrath and M.Gopal - Control systems Engineering.(New Edition)

Reference Books:

1. S.C. Goya! and U.A.Bakshi - Principles of control systems.
2. Hadi Saadat - Computational aids in control systems using MATLAB.
3. Kuo, Golnaraghi- Automatic Control System- WSE Willey Publication.
4. Rudra pratap -MATLAB FUNDAMENTALS

Course Name: Web Technology

Course Code: PCEC06T

NEP Vertical_Basket: PC-PCC

Preamble:

This course is designed to provide students with a comprehensive understanding of the principles and practices involved in web technology. It covers topics such as HTML, CSS, JavaScript, web development frameworks, web servers, and web security.

Pre-requisite:

Fundamentals of different programming languages

Course Objectives:

- To design and create web pages using HTML5 and CSS3.
- To implement client side scripting to static web pages.
- To create dynamic web pages using server side scripting.
- To gain ability to develop responsive web applications and explore different web extensions and web services standards

Course Outcomes:

After successful completion of the course students will be able to:
CO1: Implement interactive web page(s) using HTML and CSS.
CO2: Design a responsive web site using JavaScript and demonstrate database connectivity using JDBC

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no:	Module name	Content	No of Hours
1	Introduction to HTML5	Basic structure of an HTML5 document, Creating an HTML5 document, Mark up Tags, Heading-Paragraphs, line Breaks HTML5 Tags - Introduction to elements of HTML, Working with Text, Lists, Tables and Frames, Hyperlinks, Images and Multimedia HTML Forms and other HTML5 controls	5
2	Designing Static Web Pages	Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties) CSS Advanced: Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector	4
3	Bootstrap	Introduction to Bootstrap, downloading and installing Bootstrap. 4.2 The Grid System, CSS Foundations, Navigation Systems, JavaScript Effects. Self-Learning: Bootstrap Customization-Combining Elements in Bootstrap, Customizing by Components, Plugins, and Variables	3
4	Front End Development	Java Script: An introduction to JavaScript–JavaScript DOM ModelDate and Objects-Regular Expressions-Exception HandlingValidation-Built-in objects-Event Handling, DHTML with JavaScriptJSON introduction – Syntax – Function Files – Http Request –SQL	7
5	ReactJS	Introduction to ReactJS, JSX, Class, Component, Props, Events, Conditionals, Lists, Forms, Router, Memo, CSS styling, Sass Styling, React Hooks	4
6	Back End Development	Servlets: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session Handling, Understanding Cookies, Installing and Configuring Apache Tomcat Web Server, Database Connectivity: JDBC perspectives, JDBC program example JSP: Understanding Java Server Pages, JSP Standard Tag Library (JSTL), Creating HTML forms by embedding JSP code.	7
Total			**30**

Text Books:

1. Ralph Moseley , M.T. Savliya , —Developing Web Applications||, Willy India, Second Edition,
2. Achyut S Godbole and AtulKahate, —Web Technologies, Second Edition, Tata McGraw Hill, 2012.
3. Web Technology Black Book||, Dreamtech Press, First Edition, 978-7722-997
4. Robin Nixon, "Learning PHP, MySQL, JavaScript, CSS & HTML5" Third Edition, O'REILLY,2014. (http://www.ebooksbucket.com/uploads/itprogramming/javascript/Learning_PHP_My SQL_Javascript_CSS_HTML5__Robin_Nixon_3e.pdf)

Reference Books:

1. Professional Rich Internet Applications: AJAX and Beyond, Dana Moore, Raymond Budd, Edward Benson, Wiley publications. https://ebooks-it.org/0470082801- ebook.htm
2. Jennifer Kyrnin, —SAMS Teach Yourself Bootstrap in 24 hours||, 1st edition, Pearson Education.
3. Martin Bean, —Laravel 5 Essentials||, PACKT Publishing Ltd 7. Kirupa Chinnathambi, —Learning React|| , Addison-Wesley Professional

Course Name: Web Technology Lab

Course Code: PCEC06P

NEP Vertical_Basket: PC-PCC

Preamble:

This lab is designed to provide hands-on experience in developing web applications using web technologies such as HTML, CSS, JavaScript, and web development frameworks. Students will work on projects that involve creating responsive web designs, developing interactive web pages, and implementing security measures in web applications.

Pre-requisite:

Fundamentals of different programming languages

Course Objectives:

- Develop practical skills in web development
- Apply web development principles and practices in real-world scenarios
- Develop proficiency in HTML, CSS, and JavaScript
- Learn how to use web development frameworks to create web applications
- Implement security measures in web applications

Course Outcomes:
After successful completion of the course students will be able to:

CO1 : Understand instruction set/format of a microprocessor.
CO2 : Understand concept of assembly language programming
CO3 : Develop assembly language program for simple applications.

Guidelines to conduct practical sessions and Mini projects for ISA:

At least 7 experiments covering entire syllabus of EC07T (Web Technology Lab) should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiment must be graded from time to time. . Practical and Oral exam will be based on the entire syllabus.

1. To encourage project-based learning in the curriculum, mini project is mandatory in a group of four students.
2. In addition to the Mini project work each student needs to perform laboratory experiments during lab sessions.
3. Practical assessment should be done on weekly basis and Mini project assessment at least twice in a semester.
4. Preferably certify the practical work during the last practical session.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Experiments:

<table>
<tr><th>Sr. No.</th><th>Experiment Title</th></tr>
<tr><td>1</td><td>a. Installation and Setting of LAMP / WAMP / XAMP.
b. Create Simple web page using HTML5
c. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register Number, Class] aligned in proper order using alignment attributes of Paragraph tag.</td></tr>
<tr><td>2</td><td>a. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
b. Design and Implement web page using CSS3 and HTML5
c. Create a web page with an appropriate image towards the left hand side of the page, when user clicks on the image another web page should open.
d. Create web Pages using Anchor tag with its attributes for external links.
e. Create a web page for internal links; when the user clicks on different links on the web page it should go to the appropriate locations/sections in the same page.</td></tr>
<tr><td>3</td><td>Project 1: Design a webpage to display student Profile page using HTML & CSS.</td></tr>
<tr><td>4</td><td>Create the following table in HTML with Dummy Data:
<table>
<tr><td>Reg. Number</td><td>Student Name</td><td>Year / Semester</td><td>Date of Admission</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>5</td><td>Create a web page which divides the page in two equal frames and place the audio and video clips in frame-1 and frame-2 respectively.
<table>
<tr><td>FRAME-1</td><td>FRAME-2</td></tr>
</table></td></tr>
<tr><td></td><td>Project 2:Design a Gym website using CSS & Java script.</td></tr>
<tr><td>6</td><td>Form Design and Client Side Validation using</td></tr>
</table>

	a. Javascript and HTML5 b. Javascript and JQuery
7	Project 3:Design a Responsive login Page & Registration Page.
8	Develop interactive web pages using JDBC with database connectivity MYSQL
	How to add Image to MySql database using Servlet and JDBC
9	Web page designing using Bootstrap
10	Project 4: Design a Responsive Web site for hall booking System.
11	Project 5: Design a Responsive website for Library management.
12	Project 6 : Individual Mini Project to Design a responsive website

Reference Books:

1. "Web Design with HTML, CSS, JavaScript and jQuery Set" by Jon Duckett
2. "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Niederst Robbins
3. "Responsive Web Design with HTML5 and CSS3" by Ben Frain
4. "Don't Make Me Think: A Common Sense Approach to Web Usability" by Steve Krug
5. "Web Design for Developers: A Programmer's Guide to Design Tools and Techniques" by Brian Hogan

Course Name: Database Management System

Course Code: PCEC07T

NEP Vertical_Basket: PC-PCC

Preamble:

Database Management Systems course is intended to deliver students the elementary concepts of a database management system and enable them to design and implement a database application built over such concepts. It also introduces advanced level areas like transaction processing, concurrency control and recovery management.

Pre-requisite:

Data Structure

Course Objectives:

- To identify, define problem statements and construct conceptual data model for real life applications.
- To build Relational Model from conceptual model (ER/EER).
- To apply SQL to store and retrieve data efficiently.
- To demonstrate notions of normalization for database design.

Course Outcomes:

After successful completion of the course, students will be able to students will be able to:
CO1: Construct problem definition statements for real life applications and implement a database for the same.
CO2: Design conceptual models of a database using ER modelling for real life applications and construct queries in Relational Algebra.
CO3: Map ER diagram into tables in relational model
CO4: Write queries in SQL to retrieve any type of information from a database.
CO5: Analyze and apply concepts of normalization to design an optimal database.
CO6: Querying an XML Document using XML Schema & query tools.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a

panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Unit No.	Contents	No. of Hours
1	1.1	**Database System Concepts and Architecture** Introduction, Characteristics of Databases, File system v/s Database system, Data abstraction and Data Independence, DBMS system architecture, Database Administrator (DBA), Role of DBA	02
2	2.1	**The Entity-Relationship Model** The Entity-Relationship Model Conceptual Modeling of a database, The Entity-Relationship (ER) Model, Entity Type, Entity Sets, Attributes and Keys	05
	2.2	Relationship Types, Relationship Sets, Weak entity Types, Generalization, Specialization and Aggregation	
3		**Relational Model and Relational Algebra**	06
	3.1	Introduction to Relational Model, Relational Model Constraints and Relational Database Schemas, Concept of Keys: Primary Kay, Secondary key, Foreign Key,	
	3.2	Mapping the ER and EER Model to the Relational Model, Introduction to Relational Algebra, Relational Algebra expressions for Unary Relational Operations, Set Theory operations, Binary Relational operation Relational Algebra Queries	
4		**Structured Query Language (SQL)**	08
	4.1	Overview of SQL, Data Definition Commands, Set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Complex Retrieval Queries using Group By, Recursive Queries, nested queries.	
	4.2	Integrity constraints in SQL. Database Programming with JDBC, Security and authorization: Grant & Revoke in SQL Functions and Procedures in SQL and cursors.	
	4.3	Indexing: Basic Concepts, Ordered Indices, Index Definition in SQL	
5		**Relational–Database Design**	05
	5.1	Pitfalls in Relational-Database designs, Concept of normalization	
	5.2	Function Dependencies, First Normal Form, 2nd, 3rd , BCNF, multi valued dependencies	
	5.3	Transaction Concept | States, ACID properties	
6		**Introduction to XML Database**	04
	6.1	XML Document | XML Schema | XML Query Tools	
		Total	30

Text Books:

1. Database System Concepts, Korth, Slberchatz, Sudarshan, McGraw – Hill Publications, Sixth Edition
2. Fundamentals of Database Systems, Elmasri and Navathe, PEARSON Education, Fifth Edition.

Reference Books:

1. Database System Implementation, Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Pearson Education.
2. Database Management Systems Raghu Ramkrishnan and Johannes Gehrke, Tata McGraw Hill.

Course Name: Database Management System Lab

Course Code: PCEC07P

NEP Vertcal_Basket: PC-PCC

Preamble:

Database Management Systems Lab course is intended to deliver students the elementary concepts of a Structured Query Language and enable them to design and implement a database application built over concepts of SQL. It also introduces concepts of Triggers, Joins & views.

Pre-requisite:

Data Structure

Course Objectives:

- To identify, define problem statements and construct conceptual data model for real life applications using SQL.
- To build Relational Model from conceptual model (ER/EER).
- To apply SQL to store and retrieve data efficiently.
- To demonstrate notions of normalization for database design in PostGreSQL, MySQL, et al.

Course Outcomes:

After successful completion of the course, students will be able to students will be able to:
CO1: Construct problem definition statements for real life applications and implement a database in SQL for the same.
CO2: Design conceptual models of a database using ER modelling for real life applications and also construct queries in Relational Algebra using RDBMS concepts.
CO3: Map ER diagram into tables in relational model in RDBMS
CO4: Write queries in SQL to retrieve any type of information from a database.
CO5: Analyze and apply concepts of normalization to design an optimal database in PostGreSQL
CO6: Querying an XML Document using XML Schema & query tools.

ISA:

At least 08 experiments covering the entire syllabus of ELL 407 (Database Management Systems Lab) should be set to have well predefined inference and conclusion. The experiments should be student centric, and attempts should be made to make experiments more meaningful and interesting. Problem Based experiments are highly encouraged. Experiments must be graded from time to time.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Experiments is provided; however, Instructor is free to design ownexperiments as per the guidelines

List of Experiments

Sr. No.	Experiment Title
1	Identify the case study and detail statement of problem. Design an EntityRelationship(ER) / Extended Entity-Relationship (EER) Model & Mapping ER/EER to Relational schema.
2	Create a database using Data Definition Language (DDL)
3	Apply DML commands for the specified system & perform simple queries, string
4	Apply integrity constraints for the specified case study.
5	Program for SQL Commands to implement aggregate functions(SUM, COUNT, AVERAGE, etc)
6	Program for SQL Commands to implement Scalar functions(LEN, UCASE, LCASE, etc)
7	Program for SQL Commands to implement Filter commands(Group By, Having, Where, etc)
8	Program for SQL Commands to implement SET operations(Union, Intersection, etc)
9	Implement various join operations, nested and complex queries.
10	Implementation of views and triggers.
11	Design of XML Schema | XML Document
12	Querying an XML Document
13	Case Study Topic for Special topic Seminar presentation
14	Online/ Offline Certification Course cased on SQL, RDBMS or allied topic

Guidelines for Case Study Topics:

The case study may be chosen on any relevant topic which needs a database as backend. Suggested case studies but not limited to are as follows:

Sr. No.	Experiment Title
1	Supply Chain Management System
2	Food Delivery Management System
3	Company Database Management System

4	University Database Management System
5	Hospital Management System
6	Student Management System
7	Library Management System
8	Aviation Management System
9	Car Parking Management System
10	Vaccination Program Management System

Detailed Syllabus of Multidisciplinary Minor Courses

Course Name: Algorithms and Data Structures in Bioinformatics

Course Code: MDMBI02

NEP Vertical _Basket: MDC_MDM

Preamble:

This course is designed with the objective of equipping students with a robust understanding of the integration between biology and computational science, key bioinformatics concepts, methodologies, and applications. Through a combination of theoretical knowledge and practical applications, students will develop a holistic understanding of how various data structures and algorithms can enhance the comprehension of biological processes. It also emphasizes on real-world biological questions and research challenges, empowering them to make meaningful contributions to the rapidly evolving field of bioinformatics

Course Objectives:

- To enable learners to understand the basic data structures for Bioinformatics.
- Build foundational understanding of various algorithms

Pre-requisites:

Introduction to Bioinformatics (MDMBI01)

Course Outcome:

The students will be able to:

.CO1: Apply fundamental data structures and algorithms (arrays, trees, graphs, hashing, etc.) to solve computational problems in bioinformatics.

CO2: Analyze and implement sequence alignment algorithms for comparing DNA, RNA, and protein sequences, including global, local, and heuristic approaches.
CO3: Construct and interpret phylogenetic trees using distance-based and character-based algorithms for evolutionary analysis.
CO4: Use algorithmic and statistical models, such as HMMs and motif-finding tools, to predict genes and regulatory elements in genomic sequences.
CO5: Design and evaluate scalable bioinformatics workflows and pipelines using big data technologies and cloud platforms for handling large-scale genomic datasets.

Course Scheme:

Contact Hours		Credits Assigned
Theory	Practical	Total
3	1	4

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory+ Tutorial	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose a revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Review of Data Structures and Algorithms	Arrays, strings, stacks, queues, Graphs and trees: DFS/BFS with examples from biological data, Suffix trees, suffix arrays, tries, Hashing techniques for genome indexing	8
02	Sequence Alignment Algorithms	Needleman-Wunsch algorithm (global alignment) Smith-Waterman algorithm (local alignment) Space optimization (Hirschberg's algorithm) Heuristic alignment methods (BLAST internals) Complexity analysis of sequence alignment algorithms Self-Learning Topics: Recent advances in sequence alignment techniques	10
03	Phylogenetic Tree Construction	Multiple Sequence Alignment (MSA) pre-processing Distance-based methods: UPGMA, Neighbor-Joining Character-based methods: Maximum Parsimony, Maximum Likelihood,Tree visualization tools: MEGA, iTOL Self-Learning Topics: Bayesian approaches in phylogenetics	10
04	Gene Prediction and Motif Finding	Regulatory elements in genomes Basics of Hidden Markov Models (HMMs) Motif discovery tools (MEME, FIMO) Promoter and enhancer identification Use of regular expressions in motif searches Self-Learning Topics: Deep learning methods for gene prediction	10
05	Big Data in Bioinformatics	Challenges of large-scale genomic and multi-omics data, Hadoop and Spark frameworks for bioinformatics, Bioinformatics pipelines: Snakemake, Nextflow,Cloud platforms for genomics: AWS, Google Genomics, Case studies: 1000 Genomes Project, Cancer Genome Atlas Self-Learning Topics: Emerging big data technologies in bioinformatics	07

Module No.	Module Name	Module Contents	No. of Hours
Total			**45**

Reference Books / Articles

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004
2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

Course Name: Startup Planning and Development

Course Code: MDMIE02

NEP Vertical_Basket: MDC_MDM

Preamble:
The Startup Planning and Development course is designed to equip aspiring entrepreneurs, innovators, and business leaders with the foundational knowledge and practical skills required to conceive, launch, and scale successful startup ventures.

Pre-requisites: NIL

Course Objectives:

- To develop skills for building, validating, and planning a new venture.
- To understand basic startup finance, legalities, and market strategy.
- To enable students to create business plans and investor pitches.

Course Outcomes:

Student will be able to:

CO1: Design MVPs and apply lean startup methods
CO2: Conduct market and competitor analysis.
CO3: Prepare financial models and pitch decks.
CO4: Understand legal frameworks and intellectual property.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	1(Tutorial)	3	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Lean Startup Methodology	• MVP (Minimum Viable Product) • Pivoting and iteration • Build-Measure-Learn loop	8
2	Market Research and Strategy	• TAM-SAM-SOM analysis • Competitive analysis • Go-to-market strategy	8
3	Startup Finance	• Basics of financial modelling • Unit economics, pricing, and revenue models • Funding sources: bootstrapping, angels, VCs, crowdfunding	10
4	Legal & Regulatory Aspects	• Company formation: types and registration • IPR basics: patents, trademarks, copyrights • Compliance and taxation	6
5	Business Plan Development	• Writing an effective business plan • Pitch deck essentials	7
		Total	**45**

Tutorials (1 Credit):

- Building a mock startup pitch deck
- Simulated investor pitch
- Budgeting and forecasting exercises

Textbooks:

1. Peter Thiel ,Zero to One: Notes on startups, or how to build the future, Crown Business 2014
2. E,ric Ries The Lean Startup, Crown Business 2011
3. Brad Feld ,Venture Deals, Wiley Publications

Course Name: Financial Basics for Engineers and Technopreneurs

Course Code: MDMBD02

NEP Vertical _Basket: MDC_MDM

Preamble:
The objective of this course is to equip students with basic financial skills needed to evaluate and manage technical projects or business ventures. It covers the principles of cost analysis, budgeting, financial statements, and introduction to funding models.

Pre-requisites:
Introduction to Business Development and Marketing Principles

Course Objectives:

- Learn basic financial terminology and concepts.
- Understand components of a budget and perform break-even analysis.
- Analyse financial viability of a project or startup.
- Gain exposure to funding options.

Course Outcomes:

Student will be able to:

CO1: Interpret and analyze basic financial statements (P&L, balance sheet).
CO2: Prepare a project cost sheet and conduct break-even analysis.
CO3: Explain sources of capital and funding stages for startups.
CO4: Apply budgeting techniques to engineering project proposals

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	1(Tutorial)	3	1(Tutorial)

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Finance	Financial definitions, roles in business, overview of income, expenses, assets, liabilities, cash flows.	8
2	Costing and Budgeting	Types of costs (fixed/variable), project budgeting, break-even analysis, basic forecasting.	8
3	Financial Statements	Structure and interpretation of P&L, balance sheet, cash flow statements.	10
4	Time Value of Money	Simple vs compound interest, Net Present Value (NPV), Internal Rate of Return (IRR) concepts.	6
5	Funding Sources	Equity, debt, bootstrapping, angel investment, venture capital, crowdfunding.	7
6	Financial Decision Making	Financial ratios (ROI, ROE), pricing basics, cost-benefit analysis, breakeven models.	6
Total			**45**

Textbooks:

1. Finance for Non-Finance Managers, by: V.G. Narayanan, Publisher: Cengage India, ISBN: 9789353501786
2. Finance for Non-Financial Managers by Gene Siciliano, McGraw Hill, Second Edition, (pdf available online)

Reference Books:

1. Introduction to Finance - Yale Online Course
2. Investopedia - Financial Statements Guide

Course Name: Machine Vision and Robotic Perception

Course Code: MDMRB02

NEP Vertical _Basket: MDC_MDM

Preamble:

This course introduces the fundamentals of computer vision and perceptual systems in robotics. It focuses on enabling robots to sense, interpret, and act upon their environment using visual inputs. Students will explore feature detection, image processing, 3D vision, and sensor fusion techniques. Hands-on activities and simulations bridge theory with real-world robotic perception applications.

Course Objectives:

- To introduce fundamental concepts in machine vision and perception relevant to autonomous robots.
- To equip students with techniques for image processing, object detection, and feature extraction.
- To develop the ability to integrate vision systems into robotic control and decision-making.

Pre-requisites:

Fundamentals of Robotics and Control (BMMDM1T)

Course Outcome:

The students will be able to:

CO1: Explain the principles of image formation and the role of cameras in robotic vision systems.
CO2: Apply basic image processing techniques for feature extraction and noise reduction.
CO3: Detect and match key visual features for use in localization and object recognition.
CO4: Analyze depth and motion using stereo vision and 3D reconstruction techniques.
CO5: Implement object detection and scene understanding in robotic applications.
CO6: Integrate visual data with other sensor modalities for robust robotic perception.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	2	3	2

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory+ Tutorial	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose a revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by

a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Introduction to Machine Vision	Role of vision in robotics, camera models, perspective projection, image formation, lens distortions	06
02	Image Processing Basics	Grayscale and color models, filtering, edge detection, noise reduction, histogram equalization	08
03	Feature Extraction and Matching	Interest point detection (Harris, FAST), descriptors (SIFT, SURF, ORB), template matching, homographies	07
04	3D Vision and Depth Estimation	Stereo vision, structure from motion, depth cameras, triangulation, visual odometry	08
05	Object Detection and Scene Understanding	Image segmentation, object classification (traditional and CNN-based), scene interpretation, semantic mapping	08
06	Sensor Fusion and Perception Systems	Integration of vision with other sensors (IMU, LIDAR), Kalman and particle filters, SLAM fundamentals, case studies	08
Total			**45**

Suggested List of Value-Added Home Assignments:

1. Design a vision-based system that can detect traffic violations like red-light running or illegal turns using video footage.
2. Use a stereo camera or simulated stereo images to generate a 3D point cloud and reconstruct a small indoor environment.
3. Create a system that inspects manufactured parts (e.g., PCB boards, bottles, machined components) and flags defects or anomalies using image processing.
4. Develop a mobile robot that can autonomously locate and scan barcodes or QR codes placed in a room to log inventory data.
5. Implement a system that uses AprilTags or ArUco markers to help a robot localize itself within an indoor environment.
6. Build a system that allows a robot to respond to hand gestures (like stop, go, turn) using a webcam and gesture recognition model.

Recommended Online Courses:

1. Computer Vision Specialization (by University of Buffalo) https://www.coursera.org/specializations/computer-vision
2. Computer Vision, https://www.udacity.com/course/computer-vision-nanodegree--nd891

3. OpenCVBootcamp,https://opencv.org/university/free-opencv-course/?utm_source=google&utm_medium=cpc&utm_campaign=WW_tut_OBC&utm_term=best%20opencv%20tutorial&gad_source=1&gad_campaignid=21004628838&gbraid=0AAAACbv-xhUM70mKirK31LiktTRipo8G&gclid=Cj0KCQjw9O_BBhCUARIsAHQMjS7VA3JEdz8KONvGanFNC7KAqSt2HModiDtp5hB_PJKX_oKTK80pNxQaAlcVEALw_wcB

Reference Books / Articles

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 1st Edition, 2011.
2. Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer, Second Edition, 2017.
3. Adrian Kaehler and Gary Bradski, Learning OpenCV 4: Computer Vision with Python and OpenCV Library, O'Reilly Media, 1st Edition, 2019.
4. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, Fourth Edition, 2018.
5. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, Second Edition, 2004.
6. Sudeep Sarkar, Computer Vision: A First Course, Cambridge University Press, First Edition, 2022

Detailed Syllabus of Multidisciplinary Courses – Open Elective

Course Name: Professional Competency Development 1

Course Code: OEC14

NEP Vertical_Basket: MC_OE

Category: Open Elective

Preamble:

This course aims to strengthen the programming skills of second-year engineering students by integrating advanced C programming concepts with object-oriented programming using Java. It emphasizes low-level memory management, efficient data handling, and structured programming through pointers, dynamic memory allocation, strings, file handling, and preprocessor directives in C.

The course further introduces core object-oriented principles, including classes, inheritance, interfaces, exception handling, generics, and the Java Collections Framework. Modern Java features such as lambda expressions, streams, and multithreading are included to align learning with current industry practices. Overall, the course equips students with the foundational knowledge and practical skills required for developing efficient, scalable, and maintainable software systems.

Pre-requisite required:

Structured Programming (VSEC01),

Object Oriented Programming (VSEC02)

Course Objectives:

The objectives of this course are to enable students to:

- Understand advanced C programming concepts including pointers, dynamic memory management, strings, structures, and file handling.
- Develop the ability to write efficient and memory-safe programs using low-level programming techniques.
- Apply object-oriented programming principles such as classes, inheritance, polymorphism, interfaces, and abstraction using Java.
- Use Java's type-safe features including generics, exception handling, and the Collections Framework for robust application development.
- Implement modern Java constructs such as lambda expressions, streams, and multithreading to solve real-world problems.
- Design and develop modular, maintainable, and scalable software solutions using appropriate programming paradigms.

Course Outcomes:

Learners will be able to:

CO1: Explain advanced C programming concepts including pointers, arrays, dynamic memory management, strings, and structured data types.

CO2: Develop efficient C programs using file handling, preprocessor directives, function pointers, and bit manipulation techniques.

CO3: Apply object-oriented programming principles such as classes, inheritance, polymorphism, interfaces, and abstraction using Java.

CO4: Implement robust Java programs using exception handling and generics to ensure type safety and reliability.

CO5: Utilize the Java Collections Framework, lambda expressions, and streams to process and manage data effectively.

CO6: Design and implement basic multithreaded applications and perform I/O operations including serialization and simple database connectivity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	75	-	-	75

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Advanced Pointers & Arrays, Dynamic Memory: malloc/calloc/realloc/free	Pointer arithmetic, Pointers to arrays vs array of pointers, multi-dimensional arrays, Function pointers, malloc, calloc, realloc, free, Memory leaks & dangling pointers, Heap vs stack	4
2	Strings, char* and Custom String Functions, Structs, Unions, Enums, Typedef	char* vs char [], Standard functions (strlen, strcpy, etc.), Writing custom implementations, Nested structures, Memory comparison: struct vs union, Enum usage, typedef for readability	4
3	File I/O (Text/Binary) + Command Line Arguments, Preprocessor, Macros, Header Files, Storage Classes, Function Pointers & Bit Manipulation	FILE*, fopen, fclose, fprintf, fscanf, fgets, fputs, Binary I/O: fread, fwrite with structs, Macros, conditional compilation, Header files, storage classes: auto, static, extern, register, Callback functions: Function pointer syntax & usage, Passing functions as parameters (callback-style), Bitwise operators, Bit masking & flags	6
4	OOP Deep Dive: Classes, Inheritance, Overloading/Overriding Interfaces, Abstract Classes & Simple Designs	Class design, constructors, this, inheritance with extends, Method overloading vs overriding, Use of super, interface and implements, Abstract classes vs	4

Module No.	Module Name	Content	No of Hours
		interfaces, Default & static interface methods (Java 8+), Designing small extensible hierarchies	
5	Exceptions & Robust Error Handling, Generics & Type-Safe Utilities	Checked vs unchecked exceptions, try–catch–finally, throws, throw, Custom exceptions (e.g., InvalidInputException), Reading and interpreting stack traces, Generic classes & methods, Bounded types, Wildcards	4
6	Collections Framework Language Usage, Lambdas & Streams	ArrayList, LinkedList, HashSet, LinkedHashSet, HashMap, LinkedHashMap, Iteration with for-each and Iterator, Collections helpers: sort, reverse, frequency, etc., Functional interfaces & lambda expressions, Method references, Streams: stream(), filter, map, collect, forEach, Using streams with collections	4
7	Multithreading Basics & Synchronization, Java I/O, Serialization & Light JDBC	Creating threads via Thread and Runnable, start() vs run(), synchronized methods, Simple race condition examples, File handling, Basic object serialization with Serializable, Basic database connectivity	4
Total			**30**

Tools/ Technologies/ Programming Languages learnt:

- Programming Languages: C, Java.
- Integrated Development Environments (IDEs): Visual Studio Code, Eclipse.
- Code Practice Platforms: LeetCode, HackerRank, CodeSignal.
- Version Control Systems: Git and GitHub.
- Online Learning Platforms with Interactive Coding Environments: Jupyter Notebook, Repl.it.

Textbooks:

1. E. Balagurusamy, "Programming in ANSI C", 8th Edition, McGraw Hill Education, 2019
2. Yashavant Kanetkar, "Let Us C", 17th Edition, BPB Publications, 2023.
3. Herbert Schildt, "JAVA: The Complete Reference", Oracle Press.
4. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press

Reference Books:

1. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall, 1988.
2. Dietal and Dietal, "Java: How to program", Prentice Hall.
3. Stevan Jolzner, "JAVA Programming- Black Book", Dreamtech Press.

Related/ Equivalent MOOC and Associated Certification:

1. Introduction to C Programming
   Platform: NPTEL (National Programme on Technology Enhanced Learning)
   Instructor: Prof. Anupam Basu, IIT Kharagpur

Link: https://nptel.ac.in/courses/106105085

2. Programming in C
   Platform: SWAYAM-NPTEL
   Instructor: Prof. Shriram K. Vasudevan, IIT Madras
   Link: https://nptel.ac.in/courses/106105171

3. Programming in Java
   Platform: SWAYAM-NPTEL
   Instructor: Prof. Debasis Samanta, IIT Kharagpur
   Link: nptel.ac.in/courses/106105191