AISSMS
COLLEGE OF ENGINEERING
ज्ञानम् सकलजनहिताय
An Autonomous Institute Affiliated with
Savitribai Phule Pune University
Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes

Savitribai Phule Pune University

All India Shri Shivaji Memorial Society's

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science and Technology

National Education Policy (NEP) Compliant Curriculum

S.Y.B. Tech. Computer Engineering

(2025 Pattern)

(With effect from Academic Year 2026-27)

www.aissmscoe.com

Institute Vision and Mission

Vision

Service to society through quality education

Mission

- Generation of national wealth through education and research
- Imparting quality technical education at the cost affordable to all strata of the society
- Enhancing the quality of life through sustainable development
- Carrying out high-quality intellectual work
- Achieving the distinction of the highest preferred engineering college in the eyes of the stakeholders

Department Vision and Mission

Vision

Contributing to the welfare of society through technical and quality education

Mission

- To cultivate technologically proficient and self-reliant professionals through a dynamic, industry-relevant curriculum.
- To inspire innovative thinking and foster collaborative research that drives meaningful contributions to society.
- To offer a cutting-edge computing environment and diverse learning opportunities through our Centre of Excellence.
- To develop leadership capabilities and ethical values, promoting holistic growth and personal development.

Knowledge and Attitude Profile (WK)

WK Code	Description
WK1	Systematic theory-based understanding of natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Mathematics, numerical analysis, statistics and computing concepts supporting modelling and analysis in engineering.
WK3	Engineering fundamentals required for the engineering discipline.
WK4	Specialist engineering knowledge providing theoretical frameworks for practice areas in the discipline.
WK5	Knowledge supporting engineering design including sustainability, efficient resource use and environmental considerations.
WK6	Knowledge of engineering practice and technologies in the discipline.
WK7	Knowledge of the role of engineering in society including sustainability and public safety.
WK8	Engagement with current research literature and application of critical thinking to emerging issues.
WK9	Professional ethics, inclusive behaviour, responsibilities and norms of engineering practice.

Program Outcomes (POs)

POs	Description
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

A Computer engineering graduate will be able to:

PSO1. **Technical Proficiency and Domain Expertise**: Graduates will be able to apply comprehensive knowledge of computer science to analyze, design, and develop efficient computer-based systems and solutions in diverse domains such as algorithms, system software, web technologies, data science, artificial intelligence, computer networks, and cybersecurity.

PSO2. **Analytical and Problem-Solving Competence**: Graduates will be able to identify, analyze, and formulate solutions to real-world problems using modern computing tools, technologies, and software engineering principles to build reliable, scalable, and efficient software systems.

PSO3. **Professional Growth and Lifelong Learning**: Graduates will be able to exhibit professional excellence, leadership qualities, and an entrepreneurial mindset, with a commitment to continuous learning and adaptability in multidisciplinary, research, and industrial environments.

Program Educational Objectives (PEOs)

PEO1. Graduates will demonstrate strong analytical and problem-solving skills to excel in diverse roles across the IT industry.

PEO2. Graduates will apply theoretical and technical knowledge to design and implement effective, data-driven solutions for real-world problems.

PEO3. Graduates will pursue higher education, research, and professional development to achieve excellence in their chosen careers.

PEO4. Graduates will uphold ethical values, professional integrity, and social responsibility while contributing to sustainable societal growth.

B.Tech. Degree Options as per NEP 2020

A. B.Tech. Robotics and Automation Engineering Degree with **Multidisciplinary Minor** (160–176 credits).

B. B.Tech. **Honours Degree in the chosen major Engineering/Technology discipline with Multidisciplinary Minor (180–194 credits)**:

- Enables students to take up **five to six additional courses** in the same Engineering/Technology discipline, amounting to **18 to 20 credits**, distributed over **Semesters III to VIII**.
- The decision regarding the mechanism of distribution of these **18-20 credits** over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. / Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.

C. B.Tech. **Honours with Research Degree in the chosen major Engineering/Technology discipline with Multidisciplinary Minor (180–194 credits)**:

- The students will work on **a research project or dissertation for 18 credits** in the fourth year in the respective Major Engg. / Tech. Discipline.
- The decision regarding the distribution of 18 credits for Research Project in **Semesters VII and VIII** of the Fourth Year will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.
- **These 18 Credits will be over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. / Tech. Program.

D. B.Tech. Degree in the chosen major Engineering/Technology discipline with **Double Minor (Multidisciplinary and Specialization Minor) (180–194 credits)**:

- Students would take **up five-six additional courses of 18 to 20 credits** in **another Engg. / Tech.** discipline/ Emerging Areas Specialization.
- Distributed over **semesters III to VIII**.
- The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg. /Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.

Note:

- *The **B.Tech. Degree with Multidisciplinary Minor (Option a)** shall be the **default degree pathway** for all students.*
- *Students may **opt for any one** of the following additional degree options:*

  ***(b) B.Tech. Honours**,*

  ***(c) B.Tech. Honours with Research**, or*

  ***(d) B.Tech. Degree with Double Minor**.*
- *The options under **(b), (c), and (d) are mutually exclusive**, and a student shall be allowed to **choose only one option**.*
- *Students who do not opt for options (b), (c), or (d) shall **continue under the default pathway (Option a)**.*

Academic Regulations and Evaluation Scheme

A. Definition of Credit:

Course Component	Weekly Contact Hours	Credits
Lecture (L)	1 Hour / Week	1
Tutorial (T)	1 Hour / Week	1
Practical (Lab)	2 Hours / Week	1

B. Range of credits:

A student must earn a total of **160 to 176 credits** to be eligible for the award of an **Undergraduate Degree in Engineering**, which includes Multidisciplinary Minor(s) comprising **14 credits** within the prescribed credit range.

In addition to the core credit requirements, a student may obtain:

- **Undergraduate Degree** with **Honours** by earning an additional **18 to 20 credits**,
  Or
- **Undergraduate Degree** with **Honours with Research** by earning research project/dissertation of **18 credits across Semesters VII and VIII**.
  Or
- **Double Minor** by completing an additional **18 to 20 credits**, and/or
  These additional qualifications are awarded only upon successful completion of the specified extra credits beyond the minimum degree requirement.

C. Multiple Entry and Exit

A student shall be eligible to receive a **Diploma in Computer Engineering** upon successful completion of the **Second Year (S.Y. B.Tech.) in Robotics and Automation Engineering**, along with completion of an **internship of 8 credits** during the summer term in the relevant discipline.

D. General Guidelines for Examination (CCA)

The examination shall be conducted in THREE parts viz. Continues Comprehensive Assessment (CCA), In Semester Examination (ISE) and End Semester Examination (ESE).

(i) Continuous Comprehensive Assessment (CCA): 20 Marks (Any TWO)

CCA focuses on continuously assessing a student's performance throughout the semester. Apart from classroom and laboratory learning, CCA activities can be undertaken to accelerate the attainment of the various outcomes in the course: The significance of CCA lies in its ability to provide a more accurate and all-round understanding of a student's abilities, skills, and knowledge. CCA promotes experiential learning, participatory learning, collaborative learning, active learning, self-learning, peer to peer learning, etc. As part of the CCA framework, students are required to undertake ANY TWO ACTIVITIES from the prescribed set Guidelines: To be evaluated based on rubrics.

(ii) In-semester Examination (ISE): 30 Marks

In-semester examination will be of 30 marks based on Unit I and II.

Course Content	Questions	Marks	Total Marks	Duration
Unit I	Q.1 or Q.2	15	30	1 Hour
Unit II	Q.3 or Q.4	15		

(iii) End-semester Examination (ESE)

Examination will be carried out on unit III, IV and V carrying following marks weightage:

Course Content	Questions	Marks	Total Marks	Duration
Unit III	Q.1 or Q.2	16	50	2 Hours
Unit IV	Q.3 or Q.4	17		
Unit V	Q.5 or Q.6	17		

S.Y.B. Tech. Computer Engineering (2025 Pattern)

ABBRAVIATIONS

Sr No	Abbreviation	Full Form
1	BSC	Basic Science courses
2	ESC	Engineering Science courses
3	PCC	Programme Core Courses
4	PEC	Programme Elective courses
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective other than particular Programme
7	VSE	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	HSM	Humanities Social Science and Management
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	CCC	Liberal Learning Courses
14	CCA	Continuous Comprehensive Assessment
15	ISE	In-semester Examination
16	ESE	End-semester Examination

B. Tech. Computer Engineering (2025 Pattern)

Semester-wise Credit Distribution across Programme Domains

Sr. No	Domains	Code	SEM-I	SEM-II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM-VIII	Credits
1	**BSC/ESC**										
	Basic Science courses	BSC	8	8	0	0	0	0	0	0	**16**
	Engineering Science courses	ESC	9	6	0	0	0	0	0	0	**15**
2	**Program Courses (PC)**										
	Programme Core Courses	PCC	0	3	12	12	8	8	8	0	**51**
	Programme Elective Courses	PEC	0	0	0	0	4	8	4	4	**20**
3	**Multidisciplinary Courses (MDM)**										
	Multidisciplinary Minor	MDM	0	0	2	2	4	2	2	2	**14**
	Open Elective other than particular Programme	OEC	0	0	2	2	2	0	0	0	**6**
4	**Skill Courses**										
	Vocational and Skill Enhancement Course	VSE	1	1	1	1	2	2	0	0	**8**
5	**Humanities Social Science and Management (HSSM)**										
	Ability Enhancement Course	AEC	2	0	0	2	0	0	0	0	**4**
	Entrepreneurship/Economics/ Management courses	HSM	0	0	2	2	0	0	0	0	**4**
	Indian Knowledge System	IKS	0	2	0	0	0	0	0	0	**2**
	Value Education Course	VEC	0	0	2	1	0	0	0	0	**3**
6	**Experiential Learning Courses (ELC)**										
	Research Methodology	ELC	0	0	0	0	0	0	4	0	**4**
	CEP	ELC	0	0	1	0	0	0	0	0	**1**
	Project	ELC	0	0	0	0	0	2	2	0	**4**
	Internship	ELC	0	0	0	0	0	0	0	12	**12**
7	**Co-curricular Courses (CC)**										
	Liberal Learning Courses	CCC	2	2	0	0	0	0	0	0	**4**
		Total	**22**	**22**	**22**	**22**	**20**	**22**	**20**	**18**	**168**

Multidisciplinary Minor

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25ETMDM201	Digital Electronics	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-IV	25ETMDM202	Microprocessor	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-V	25ETMDM301	Embedded Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-VI	25ETMDM301L	Electromagnetic Theory	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-VI	25ETMDM302	Digital Signal Processing	-	2	-	-	-	-	-	-	25	25	-	1	-	01
SEM-VII	2ETIMDM401	Control Systems	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-VIII	25ETMDM402	Digital Signal Processing	2	-	-	20	30	50	-	-	-	100	2	-	-	02
			13	**2**	**00**	**120**	**180**	**300**	**-**	-	**25**	**625**	**13**	**1**	**-**	**14**

Open Elective Baskets

BASKET NO	BASKET	SEM-III	SEM-IV	SEM-V
1	**Leadership, Management & Innovation**	Principles of Management and Organizational Behaviour	Leadership and Team Dynamics	Supply Chain Management
2	**Sustainability and Green Technologies**	Circular Economy for Sustainable Development	Green Practices and ESG Frameworks	Sustainable Technologies and Carbon Management
3	**Entrepreneurship & Business**	Start-up Management and Venture Creation	Innovation and Business Strategy	Digital Marketing
4	**Holistic Development & Well-Being**	Health and Nutrition for Professionals	Stress Management and Mental Well-Being	Lifestyle Management and Preventive Healthcare
5 (A)	**Global Languages**	French Language Module – I	French Language Module – II	French Language Module – III
5 (B)		German Language Module – I	German Language Module – II	German Language Module – III
5 (C)		Japanese Language Module -I	Japanese Language Module -II	Japanese Language Module -III

Honor offered by Computer Engineering:
Deep Learning

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25COHNR201	Machine Learning	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-III	25COHNR201L	Machine Learning Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-IV	25COHNR202	Deep Learning	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-IV	25COHNR202L	Deep Learning Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-V	25COHNR301	Natural Language Processing	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-V	25COHNR301L	Natural Language Processing Lab.	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-VI	25COHNR302	Computer Vision	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-VI	25COHNR302L	Computer Vision Lab.	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-VII	25ETHNR401	Generative Adversarial Networks (GANs)	2	-	-	20	30	50	-	-	-	100	2	-	-	02
	Total		**14**	**8**	**-**	**100**	**150**	**250**	**75**	**50**	**-**	**600**	**14**	**04**	**-**	**18**

Double Minor: Cybersecurity

Semester	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
SEM-III	25COMNR201	Introduction to Cybersecurity	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-III	25COMNR201L	Introduction to Cybersecurity Lab	-	2	-	-	-	-	25	-		25	-	1	-	01
SEM-IV	25COMNR202	Network Security	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-IV	25COMNR202L	Network Security Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-V	25COMNR301	Ethical Hacking	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-V	25COMNR301L	Ethical Hacking Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-VI	25COMNR302	Digital Forensics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-VI	25COMNR302L	Digital Forensics Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-VII	25COMNR401	Cloud Security	2	-	-	20	30	50	-	-	-	100	2	-	-	02
			14	**8**		**100**	**150**	**250**	**75**	**25**	**0**	**600**	**14**	**4**	**0**	**18**

Double Minors offered by Each Department

Offering Department	Double Minor Offered	Sem-III	Sem-IV	Sem-V	Sem-VI	Sem-VII
AI &ML Engineering	**Blockchain Technology**	Fundamentals of Blockchain Technology	Smart Contracts and Decentralized Applications	Blockchain Security and Cryptography	Decentralized AI and Web3 Technologies	Blockchain Applications and Emerging Trends
Chemical Engineering	**Environmental Engineering**	Air Pollution Control	Wastewater Treatment	Solid Waste Management	Climate Change and Sustainability	Mini Project
	Energy Engineering	Introduction of Energy	Bio-energy	Electrochemical Energy	Hydrogen Fuel	Mini Project
Civil Engineering	**Infrastructure Engineering**	Introduction to Infrastructure Engineering	Fundamentals of Infrastructure Engineering	Smart Transportation & Urban Infrastructure	Sustainable & Resilient Infrastructure Systems	Emerging Technologies in Infrastructure Engineering
Computer Engineering	**Cybersecurity Engineering**	Introduction to Cybersecurity	Cryptography and Network Security	Ethical Hacking	Digital Forensics	Cryptography & Data Protection
Electrical Engineering	**Renewable Energy systems**	Renewable Energy Sources for Sustainable Development	Solar Photovoltaic Systems	Wind Energy Conversion Systems	Power Electronics and Control for RES	Renewable Energy: Policies, Planning & Audit
E&TC Engineering	**Communication Engineering**	Analog Communication	Digital Communication	Cellular Networks	Mobile Computing	Optical & Microwave Communication
VLSI D&T Engineering	**Semiconductor IC Design**	Digital Electronics	System Design using Verilog	Digital CMOS Design	Analog CMOS Design	AI for VLSI
Mechanical Engineering	**Mechanical Systems Engineering**	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
Mechanical Sandwich Engineering	**Mechanical Systems Engineering**	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
Robotics and Automation Engineering	**Robotics and Automation Engineering**	Fundamentals of Robotics and Automation	Programming for Robotics	Sensors and Actuators in Robotic Systems	Introduction to Robot Kinematics	Robot Simulation and Application

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(w.e.f. Academic Year: 2026-2027)

Curriculum Structure: Semester III

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25COPCC201	Engineering Mathematics for Computer Science	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC202	Object Oriented Programming	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC203	Algorithm Analysis and Data Structures	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	25ETMDM201	Multidisciplinary Minor - I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	25OEC201	Open Elective Course – I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25COPCC201L	Engineering Mathematics for Computer Science Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25COPCC202L	Object-Oriented Programming Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25COPCC203L	Data Structures & Algorithms Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
VSEC	*25COVSE201*	*Vocational and Skill Enhancement Course-I*	-	2	-	-	-	-	-	25	-	25	-	1	-	01
HSSM	*25HSM201*	*Entrepreneurship/Economics/ Management Course-I*	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC201	Universal Human Values	-	-	2	-	-	-	-	-	50	50	-	-	2	02
ELC	25COELC201	Community Engagement Project	-	2	-	-	-	-	-	-	25	25	-	1	-	01
	Total		**13**	**10**	**04**	**100**	**150**	**250**	**75**	**25**	**125**	**725**	**13**	**05**	**04**	**22**

***L:** Lecture**, P:** Practical**, T:** Tutorial **CCA:** Comprehensive Continuous Assessment**; ISE:** In-semester Examination; **ESE:** End Semester Examination**; PR:** Practical Examination**, OR:** Oral Examination, **TW:** Term Work*

Multidisciplinary Minor-I:

Sr. No.	Course Code	Course Name
1	25ETMDM201	Digital Electronics

Open Elective-I

Basket No.	Course Code	Course Name
1	25OEC201A	Principles of Management and Organizational Behaviour
2	25OEC201B	Circular Economy Sustainable Development
3	25OEC201C	Start-up Management and Venture Creation
4	25OEC201D	Health and Nutrition for Professionals
5 (A)	25OEC201E	French Language Module-I
5 (B)	25OEC201F	German Language Module-I
5 (C)	25OEC201G	Japanese Language Module-I

Vocational and Skill Enhancement Course-I:

Sr. No.	Course Code	Course Name
1	25COVSE201	Mobile Application Development

Entrepreneurship/Economics/Management Courses (HSSM)-I:

Sr. No.	Course Code	Course Name
1.	25HSM201A	Engineering Economic Analysis
2.	25HSM201B	Entrepreneurship
3.	25HSM201C	Project Management
4.	25HSM201D	Financial Accounting

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(w.e.f. Academic Year: 2026-2027)

Curriculum Structure: Semester IV

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25COPCC204	Software Engineering	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC205	Database Management System	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC206	Advanced Data Structure	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	*25COMDM202*	*Multidisciplinary Minor-II*	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	*25OEC202*	*Open Elective Course-II*	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25COPCC204L	Software Engineering Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
PCC(L)	25COPCCC205L	Database Management System Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25COPCC206L	Advanced Data Structure Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
VSEC	25COVSE202	Web Application Development	-	2	-	-	-	-	25	-	-	25	-	1	-	01
ACE	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	50	2	-	-	02
HSSM	*25HSM202*	*Entrepreneurship/Economics/ Management Course-II*	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	25	-	-	1	01
	Total		**15**	**08**	**03**	**100**	**150**	**250**	**50**	**75**	**100**	**725**	**15**	**04**	**03**	**22**

L: *Lecture****, P:*** *Practical****, T:*** *Tutorial* ***CCA:*** *Comprehensive Continuous Assessment****; ISE:*** *In-semester Examination;* ***ESE:*** *End Semester Examination****; PR:*** *Practical Examination****, OR:*** *Oral Examination,* ***TW:*** *Term Work*

Multidisciplinary Minor-II:

Sr. No.	Course Code	Course Name
1	25COMDM202	Microprocessor

Open Elective-II:

Basket No.	Sr. No.	Course Code	Course Name
1	1	25OEC202A	Leadership and Team Dynamics
2	2	25OEC202B	Green Practices and ESG Frameworks
3	3	25OEC202C	Innovation and Business Strategy
4	4	25OEC202D	Stress Management and Mental Well-Being
5 (A)	5	25OEC202E	French Language Module-II
5 (B)	6	25OEC202F	German Language Module-II
5 (C)	7	25OEC202G	Japanese Language Module-II

Vocational and Skill Enhancement Course-II:

Sr. No.	Course Code	Course Name
1	25COVSE202	Web Application Development

Entrepreneurship/Economics/Management Courses (HSSM)-II:

Sr. No.	Course Code	Course Name
1.	25HSM202A	Business Fundamentals for Entrepreneurs
2.	25HSM202B	Entrepreneurship Essentials
3.	25HSM202C	Financial Management for Managers
4.	25HSM202D	Business Intelligence and Analytics

Modern Indian Language (MIL)

Sr. No.	Course Code	Course Name
1	25AEC201A	Marathi
2	25AEC201B	Sanskrit

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC): Engineering Mathematics for Computer Science									**Course Code: 25COPCC201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Fundamentals of algebra, trigonometry, coordinate geometry, functions, limits, basic differentiation & integration, and introductory matrices and probability.

Course Objectives:

1. Provide strong foundational knowledge of engineering mathematics required for computer engineering applications.
2. Develop the ability to apply linear, Laplace transform and differential equations to model and solve engineering problems.
3. Enrich analytical and logical thinking skills essential for real world problem.
4. Introduce probability, statistics, and data analysis techniques for handling uncertainty and real-world data.
5. Enable students to use discrete mathematical structures for solving in computation problem.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Solve engineering problems using linear differential equations.

CO2. Apply discrete mathematical structures in complex problem.

CO3. Analyze data and uncertainty using probability and statistics

CO4. Solve engineering problems using Laplace transform.

CO5. Use Vector calculus for optimization and mathematical modeling.

Course Contents

Unit I	**Linear Differential Equations**	**08 Hours**

LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, Short-cut methods, Method of variation of parameters, Cauchy's and Legendre's DE. Modeling of problems on bending of beams, whirling of shafts and mass spring systems.

Unit II	**Discrete Mathematics**	**08 Hours**

Logic and proof techniques, Sets, relations, functions, Boolean algebra, Combinatory, Graphs and trees, case study on, Networks, databases

Unit III	**Probability and Statistics**	**08 Hours**

Probability theory and random variables, Probability distributions, Expectation, Basics of statistical
inference, variance, Correlation and regression, Applications: Data analysis, ML basics.

Unit IV	**Laplace Transform**	**08 Hours**

Introduction, Laplace Transform of some standard and special functions, Region of convergence and Properties, properties and theorems of Laplace Transformation. Inverse Laplace Transform, Application: Signals, Control system.

Unit V	**Vector Calculus for Engineering Modeling**	**08 Hours**

Vector Differentiation: Vector differential operators, Gradient, Divergent, Curl, Directional Derivatives, Solenoidal and Irrational fields, Scalar Potential.
Vector Integration and Applications: Introduction to Line Integral, Work-done, Green's Lemma.

Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1	**10 Marks**

Application Based Course Activities (any one)

1. Study on LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral.
2. Study on Cauchy's and Legendre's DE. Modeling of problems on bending of beams, whirling of shaft and mass spring systems
3. Probability theory and random variables, Probability distributions
4. Expectation, Basics of statistical inference, variance, Correlation and regression, Applications: Da analysis, ML basics.

CCA2	**10 Marks**

Case Study/Survey
List of Case Study:

- Laplace Transform of some standard and special functions.
- Region of convergence and Properties, properties and theorems of Laplace Transformation.
- Inverse Laplace Transform, Application: Signals, Control system

CCA3	**10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Erwin Kreyszig – Advanced Engineering Mathematics
2. Gilbert Strang – Linear Algebra and Its Applications

Reference Books

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. K. A. Stroud, Engineering Mathematics, Palgrave Macmillan.
3. Thomas & Finney, Calculus and Analytic Geometry, Pearson Education.
4. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.
5. Walpole – Probability and Statistics for Engineers Kenneth Rosen – Discrete Mathematics and Its Applications

Online References (MOOC / NPTEL Courses)

1. Engineering Mathematics – I, By Prof. Jitendra Kumar, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma79
2. Discrete Mathematical Structures, By Prof. Kamala Krithivasan IIT Madras: https://nptel.ac.in/courses/106106094
3. Probability and Statistics, By Prof. Somesh Kumar: IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ma74

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC): Object Oriented Programming										**Course Code: 25COPCC202**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Programming and Problem Solving.

Course Objectives:

1. To explore and understand the principles of Object-Oriented Programming (OOP).
2. To apply the object-oriented paradigm in program design.
3. To provide object-oriented programming insight using Java.
4. To develop the ability to design modular, reusable, and maintainable Java applications using OOP concepts.
5. To enhance problem-solving skills by applying Java features such as exception handling, multithreading.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Apply fundamental programming constructs, object-oriented constructs in Java for Implementing an application.

CO2. Apply fundamental object-oriented constructs like class, objects, array of objects in Java for Implementing an application.

CO3. Apply object-oriented features like Inheritance, Polymorphism, Dynamic binding, Exception handling, multi-threading in Java for implementing an application

CO4. Design and develop modular Java applications using packages, interfaces, and string handling concepts to achieve abstraction, reusability, and maintainability.

CO5. Implement robust Java applications using advanced exception handling mechanisms and I/O streams for file handling and object serialization in real-world scenarios.

Course Contents

Unit I	**Introduction to Object Oriented Programming**	**08 Hours**

Introduction to programming paradigms, Benefits of OOP, Fundamentals of object-oriented programming, Overview of Java Language: simple Java program structure: documentation section, package statement, import statements, class definition, main method class Implementing Java Program, JVM, Data types, Primitive Types vs. Reference type, Typical Java Development Environment, and Memory Concepts. Need of object-oriented programming, Namespaces, objects, classes, data members, methods, messages, data encapsulation, data

abstraction and information hiding, inheritance, polymorphism., Java as object-oriented programming

language. Control Statements: Case Study: Analyze the object -oriented features in Java with other object-oriented programming languages.

Unit II	**Introduction to Classes, Objects and Arrays**	**08 Hours**

Defining a Class, Field declaration, method declaration and definition, instantiating an object of a Class, accessing class members, declaring methods with multiple parameters, argument passing, object as a parameter, returning objects, assigning object reference variables, set methods and get methods, constructors, this keyword, Constructors, static methods, scope of declaration, method overloading and Java API packages. Arrays: declaring and creating arrays in Java, examples using arrays, passing arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments and Multi-Threading concepts.

Unit III	**Inheritance and Polymorphism**	**08 Hours**

Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, types of Inheritance, constructors in subclasses, object class. Polymorphism: Abstract classes and methods, final methods and classes, dynamic binding, polymorphism examples and Interfaces. Exception handling: fundamentals, Exception Types, using try-catch, Multiple try-catch clauses, Nested try statements, throw, throws, finally, Built-in Exceptions Multithreading: Java Thread Model, Main Thread, creating a Thread, Creating Multiple Threads.

Unit IV	**Packages and Interfaces**	**08 Hours**

Defining a package, accessing a package, Understanding CLASSPATH, importing packages, Differences between classes and interfaces, defining an interface, implementing interface, Variables in interface, Extending interfaces. Strings: Mutable and Immutable Strings. Creating Strings. Operations on Strings.

Unit V	**Exception Handling & I/O Streams**	**08 Hours**

Mechanism - Exception-Object, Throwing an Exception, and Exception Handler. Catch or Specify policy. Types of Exception - Checked Vs Unchecked, Built-in vs User defined. Catching an Exception – try catch-finally. Specifying an Exception - throws. Manually throwing an Exception - throw. Custom Exceptions. Chained Exceptions. I/O Streams: Byte, Character, Buffered, Data, and Object Streams. Standard Streams. File I/O Basics, Reading and Writing to Files. Serializing Objects.

	Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1	**10 Marks**

Application Based Course Activities (any one)

1. Implementation of class, object
2. Implementation of Multiple inheritance
3. Implementation of Multilevel inheritance
4. Implementation of in built classes

CCA2	**10 Marks**

Case Study/Survey
List of Case Study:

- Demonstrate an interactive Banking/Library management system using class, objects, array of objects.

- Design a simple Online Payment System using packages for modularization and interfaces for abstraction, enabling different payment methods.
- Demonstrate online Banking/Library system using Inheritance, Exception handling.

CCA3	**10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. E Balaguruswamy, (2023). Programming with Java: A Primer. 7th edition. India: McGraw Hill Education.
2. Herbert Scheldt, (2021). Java: The complete reference, 13th edition. McGraw-Hill Education.
3. S. Harrington, “Computer Graphics”, 2ndEdition, McGraw-Hill Publications, 1987, ISBN 0 – 07–100472
4. Donald D. Hearn and Baker, “Computer Graphics with OpenGL”, 4thEdition, ISBN-13: 9780136053583.

Reference Books

1. K. Sierra, Sun Certified Programmer for Java 5, Wiley India, 2006. K. Sierra and B. Bates, Head First Java (Java 5), 2nd Edition, O’Reilly, 2003. H.M.
2. Dietel and P.J. Dietel, Java: How to Program, 6th Edition, Pearson Education, 2007. C.S. Horstmann and Cornell, Java 2 Vol-1 Fundamentals, 7th Indian Reprint, Pearson Education, 2006.
3. E. Balagurusamy, Programming with Java: A Primer, 4th Edition, Tata McGraw Hill, 2010.

Online References

1. Fundamentals of Object-Oriented Programming by Prof. Balasubramanian Raman, IIT, Rookee
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs34
2. Programming in Java, IIT Kharagpur, Prof. Debasis Samanta
   https://nptel.ac.in/courses/106105191

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC): Algorithm Analysis and Data Structures									**Course Code: 25COPCC203**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

The course aims to

1. To understand the standard and abstract data representation methods.
2. To acquaint with the structural constraints and advantages in usage of the data.
3. To understand the memory requirement for various data structures.
4. To understand various data searching and sorting methods with pros and cons.
5. To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

At the end of the course, students will be able to:

CO1. To discriminate the usage of various structures in approaching the problem solution.

CO2. To design the algorithms to solve the programming problems.

CO3. To use effective and efficient data structures in solving various Computer Engineering domain problems.

CO4. To analyses the problems to apply suitable algorithms and data structure.

CO5. To use appropriate algorithmic strategy for better efficiency..

Course Contents

Unit I	**Introduction to Algorithms and Notations**	**08 Hours**

Algorithms- Problem Solving, Introduction to Algorithms, Characteristics of algorithms, Algorithm design tools: Pseudo code and flowchart, Analysis of Algorithms, Complexity of algorithms- Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, standard measures of efficiency.

Unit II	**Algorithm design strategies**	**08 Hours**

Algorithmic Strategies- Introduction to algorithm design strategies. Divide and Conquer, Greedy strategy, Backtracking, Dynamic Programing etc. Applications of basic Algorithmic Strategies.

Unit III	**Introduction of Basic Data structures**	**08 Hours**

Data Structures- Data structure, Abstract Data Types (ADT), Concept of linear and Non-linear, static and dynamic, persistent and ephemeral data structures, and relationship among data, data structure and algorithm, From Problem to Program. Sequential Organization, Linear Data

Structure Using Sequential Organization, Array as an Abstract Data Type. Introduction to Arrays, linked list, Tree and Graph.

Unit IV	**Arrays and its application**	**08 Hours**

Different types of arrays, Memory Representation and Address Calculation, inserting an element into an array, deleting an element, Multidimensional Arrays, Two-dimensional arrays-dimensional arrays, Concept of Ordered List, Single Variable Polynomial, Representation using arrays, Polynomial as array of structure, Polynomial addition, Polynomial multiplication, Sparse Matrix, Sparse matrix representation, Sparse matrix addition, Transpose of sparse matrix, String Manipulation Using Array.

Unit V	**Algorithm Analysis of data structure**	**08 Hours**

Stacks- concept, Primitive operations, Stack Abstract Data Type, Representation of Stacks Using Sequential Organization, stack operations, Multiple Stacks. Linked Lists, Realization of linked list using arrays, Dynamic Memory Mana segment, linked list using dynamic memory management, Linked List Abstract Data Type, linked list operations.
Space and time complexity of different algorithm design strategies. Divide and conquer.
Quick sort, Merge sort, Bubble sort, selection sort. Binary search analysis. Different data structure.

Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1	**10 Marks**

Application Based Course Activities (any one)
1. Study of notation.
2. Study of Space complexity and Time complexity
3. Example solving on Backtracking.
4. Example solving Dynamic Programing

CCA2	**10 Marks**

Case Study/Survey
List of Case Study:
- Applications of basic Algorithmic Strategies.
- Calculate time and space complexity
- Calculate time and space complexity..

CCA3	**10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Algorithm Design, Jon Kleinberg (Cornell University) and Éva Tardos (Cornell University) Publisher: Pearson, ISBN-13:
2. Introduction to Algorithms, Thomas H. Cormen Charles E. Leiserson Ronald L. Rivest Clifford Stein, The MIT Press Cambridge, Massachusetts London, England.

Reference Books

1. Algorithm Design Techniques, by Narasimha Karumanch, Publisher, CareerMon
2. A Common-Sense Guide to Data Structures and Algorithmsby Jay Wengrow.

Online References

1. NPTEL Course on Design and analysis of algorithms by Prof. Madhavan Mukund, Chennai Mathematical Institute
   https://nptel.ac.in/courses/106106131
2. NPTEL Course on Design and analysis of algorithms by Prof. Madhavan Mukund Chennai Mathematical Institute
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs67
3. NPTEL Course on Introduction to Algorithms and Analysis by Prof. Sourav Mukhopadhyay, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_cs10

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (Multidisciplinary Minor-I): Digital Electronics									**Course Code: 25ETMDM201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic gates, Number Systems and their conversations

Course Objectives:

To make students understand
1. K-map and its use to design the various applications of combinational digital circuits.
2. Sequential logic using flip flops and their applications viz. counters, shift registers.
3. The concepts of sequential circuits and apply them in state machines.
4. The digital logic families.
5. Memory systems and data converters.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Design combinational logic circuits.

CO2. Explain different sequential circuits.

CO3. Develop finite state machine models.

CO4. Illustrate performance parameters of digital ICs.

CO5. Describe memory systems and data converters..

Course Contents

Unit I	**Combinational Logic Design**	**06 Hours**

Definition of combinational logic, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (up to 4 variables), don't care conditions.
Design Examples: Full adder, Full Subtract or, 1-bit comparator. Multiplexers, Multiplexer trees, DE multiplexer, DE multiplexer trees.

Unit II	**Sequential Logic Design**	**06 Hours**

1-Bit Memory Cell/latch, Difference between combinational and sequential circuits. Flip-Flops: SR Flip-Flop, JK Flip-Flop, D Flip-Flop, T Flip-Flop. Characteristic table and Excitation Table for flip flops. Introduction to Registers, Shift registers & Counters: Asynchronous (ripple) counters, Synchronous counters, up/down counters, concept of Mod-N counter.

Unit III	**State Machines**	**06 Hours**

Moore and Mealy machines, State diagram, State table, State reduction, State assignment, finite state machine implementation.

Unit IV	Digital Logic Family	06 Hours
Digital Logic Family: Performance parameters of digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation. Comparison of different TTL logic families, Comparison of CMOS and TTL.		
Unit V	**Memory Systems and Data Converters**	**06 Hours**
Introduction to memory systems: RAM and ROM concepts. Types of RAM: SRAM and DRAM. Types of ROM: PROM, EPROM, EEPROM. **Data Converters:** Need for data conversion, Digital-to-Analog Converter (DAC) basics, Analog-to-Digital Converter (ADC) basics.		
	Total Hours	**30**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1 List of Course Activity	10 Marks

Application Based Course Activities (any one)

1. Design Full adder, Full Subtract or, 1-bit comparator. Multiplexers, Multiplexer trees, DE multiplexer, DE multiplexer trees.
2. Design Bit Memory Cell/latch.
3. Difference between combinational and sequential circuits.

Differentiate SR Flip-Flop, JK Flip-Flop, D Flip-Flop, T Flip-Flop.

CCA2 Case Study/Survey	10 Marks

List of Case Study:

1. **Case Studies:** Comparison of different TTL logic families, Comparison of CMOS and TTL
2. **Case Studies:** Applications of Digital-to-Analog Converter (DAC) and Analog-to-Digital Converter (ADC).
3. **Case Studies**: Report on Types of ROM: PROM, EPROM, EEPROM.

CCA3 Seminar: Any topic from unit 1 to 5	10 Marks

Seminar: Any topic from unit 1 to 5

Text Books

1. R.P. Jain, “Modern Digital Electronics”, Tata Mc Graw Hill Publication.
2. Thomas Floyd, “Digital Fundamentals”, Pearson Publication, India.
3. Anil K.Maini, “Digital Electronics Principles, Devices and Applications”, Wiley Publication.

Reference Books

1. John. F. Wakerly,"Digital Design-Principles and Practices”, Pearson Publication.
2. M. M. Mano, "Digital Design, “Prentice Hall India.
3. Stephen Brown, “Fundamentals of digital logic design with VHDL", Tata Mc Graw Hill Publication.

Online References

NPTEL Courses

1. Digital circuits, By Prof. Santanu Chattopadhyay, IIT Kharagpur.
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee110
2. Digital Electronic Circuits, by Prof. Goutam Saha, IIT Kharagpur.
   https://nptel.ac.in/courses/108105132

3. Digital Design with Verilog, By Prof. Chandan Karfa, Prof. Aryabartta Sahu, IIT Guwahati https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs24

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 1): Principles of Management and Organizational Behavior									**Course Code: 25OEC201A**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

1. Basic knowledge of Engineering Mathematics
2. Fundamentals of Economics and Accounting
3. Analytical and quantitative reasoning skills

Course Objectives:

1. To introduce the fundamental concepts, functions, and theories of management.
2. To develop an understanding of organizational behavior and individual dynamics at the workplace.
3. Evaluate leadership styles, communication processes, and team dynamics.
4. Apply decision-making, planning, organizing, and controlling techniques in practical scenarios.
5. Assess organizational culture, change management processes, and conflict resolution strategies.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain core management functions and classical as well as modern management theories.

CO2. Analyze individual behavior, personality, perception, and motivation in organizational settings.

CO3. Apply capital budgeting methods for evaluating engineering investment decisions.

CO4. Evaluate cost of capital and capital structure decisions.

CO5. Apply working capital and financial planning concepts for engineering projects..

Course Contents

Unit I	**Introduction to Management**	**06 Hours**

Definition and nature of management; functions of management (planning, organizing, staffing, directing, controlling); levels of management; managerial roles and skills; evolution of management thought (classical, behavioral, modern approaches); principles of management.

Unit II	**Planning and Organizing**	**06 Hours**

Planning process; types of plans; decision-making process and techniques; organizing principles; organizational structure (line, functional, matrix); delegation, authority, and responsibility; centralization and decentralization.

Unit III	**Individual Behavior in Organizations**	**06 Hours**

Foundations of organizational behavior; personality and attitudes; perception and attribution; learning theories; motivation theories (Maslow, Herzberg, McGregor, etc.); job satisfaction and employee engagement.

Unit IV	**Group Behavior and Leadership**	**06 Hours**

Group dynamics; team development; communication process and barriers; leadership theories and styles; power and politics; conflict management; negotiation techniques; organizational culture.

Unit V	**Organizational Change and Development**	**06 Hours**

Organizational change and resistance to change; change management models; organizational development; stress management; ethics and corporate social responsibility; contemporary issues in management; digital transformation and innovation in organizations.

	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Case Study Analysis**
   Students analyze a real organizational problem related to planning, leadership, motivation, or change management and present solutions.
2. **Group Discussion & Presentation**
   Teams discuss management topics such as leadership styles, organizational culture, or conflict management and deliver presentations.
3. **Role Play / Management Simulation**
   Students perform role plays on manager–employee communication, negotiation, decision-making, or team management scenarios.
4. **Mini Project on Organizational Study**
   Students visit or study an organization/startup and prepare a report on management practices, hierarchy, communication, and work culture.
5. **Hands-on Activity using Planning & Decision Tools**
   Students prepare organizational charts, decision trees, SWOT analysis, project planning schedules, or management process flowcharts using practical examples.

Text Books

1. Robbins, S. P. & Coulter, M., Management, Pearson Education.
2. L. M. Prasad, Principles and Practice of Management, Sultan Chand & Sons.

Reference Books

1. Robbins, S. P. & Judge, T. A., Organizational Behavior, Pearson Education.
2. Koontz, H. & Weihrich, H., Essentials of Management, McGraw Hill.
3. K. Aswathappa, Organizational Behavior, Himalaya Publishing House.
4. Harold Koontz & Cyril O'Donnell, Principles of Management, McGraw Hill.
5. P. Subba Rao, Management and Organizational Behavior, Himalaya Publishing House.

NPTEL/MOOCS

1. NPTEL course on Principles of Management by Prof. Susmita Mukhopadhyay, Prof. S. Srinivasan, IIT Kharagpur.
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg88
2. NPTEL course on Organizational Behaviour by Prof. M. P. Ganesh, IIT Hyderabad.
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg51

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 2): Circular Economy for Sustainable Development									**Course Code: 25OEC201B**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Entrepreneurship, market survey, innovation.

Course Objectives:

1. Understand the fundamentals principles of circular economy, sustainability, environmental systems, and resource cycles.
2. Apply sustainable development goals (SDGs), life-cycle thinking, and circular economy models in real-world contexts.
3. Develop the ability to assess materials, energy, and waste flows in businesses and communities to optimize resource use and reduce environmental impact.
4. Examine environmental governance, global sustainability policies, and circular strategies for industry and society.
5. Foster creative and practical solutions for sustainable consumption, production, and cleaner technologies.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the fundamental principles of circular economy and sustainable development, and differentiate between linear and circular economic systems.

CO2. Analyze global environmental challenges and evaluate the role of Sustainable Development Goals (SDGs) in addressing sustainability issues.

CO3. Apply life cycle thinking, material flow analysis, and resource efficiency tools to assess environmental impacts of products and processes.

CO4. Design and evaluate circular business models incorporating strategies such as reuse, recycling, remanufacturing, and extended producer responsibility.

CO5. Assess sustainability policies, governance mechanisms, and technological interventions to propose practical solutions for sustainable development.

Course Contents

Unit I	**Fundamentals of Circular Economy and Sustainable Development**	**06 Hours**

Concept of sustainable development; evolution of sustainability; environmental, social and economic dimensions (Triple Bottom Line); limitations of the linear economy (take–make–dispose model); principles of circular economy; relationship between circular economy and sustainability; planetary boundaries; ecological footprint; overview of global sustainability

challenges; introduction to Sustainable Development Goals (SDGs) and their relevance to industry and society.		
Unit II	**Resource Efficiency and Life Cycle Approaches**	**06 Hours**
Resource scarcity and resource efficiency; material flow analysis (MFA); life cycle thinking; Life Cycle Assessment (LCA) methodology and stages (goal and scope definition, inventory analysis, impact assessment, interpretation); carbon footprint and water footprint; eco-efficiency and resource productivity indicators; waste hierarchy (reduce, reuse, recycle, recover); strategies for decoupling economic growth from resource consumption		
Unit III	**Circular Business Models and Industrial Applications**	**06 Hours**
Circular business model innovation; product life extension strategies; reuse, repair, refurbishment and remanufacturing; recycling technologies; product-as-a-service (PaaS); sharing economy; eco-design and design for environment (DfE); reverse logistics and closed-loop supply chains; Extended Producer Responsibility (EPR); industrial symbiosis; sustainable manufacturing practices.		
Unit IV	**Policy, Governance and Sustainable Development Frameworks**	**06 Hours**
Environmental governance and regulatory frameworks; national and international sustainability policies; climate change mitigation and adaptation strategies; green finance and sustainable investment; Environmental, Social and Governance (ESG) reporting; corporate social responsibility (CSR); sustainable procurement practices; role of government, private sector and civil society in promoting circular economy; global environmental agreements and initiatives.		
Unit V	**Tools, Technologies and Case Studies in Circular Economy**	**06 Hours**
Emerging technologies enabling circular economy (IoT, Artificial Intelligence, blockchain for traceability); digitalization and smart resource management; sustainable supply chain management; urban circular systems and smart sustainable cities; waste-to-energy and waste-to-resource technologies; sectoral applications (manufacturing, agriculture, construction, energy); case studies of successful circular economy initiatives; challenges and future prospects of sustainable development.		
	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Waste Audit & Recycling Survey**
   Students conduct a survey of waste generation in campus/home and suggest recycling or reuse strategies based on circular economy principles.
2. **Life Cycle Assessment (LCA) Mini Study**
   Analyze the life cycle of a product (plastic bottle, mobile phone, paper bag, etc.) and identify environmental impacts and sustainability improvements.
3. **Case Study Presentation on Circular Economy Models**
   Teams study companies practicing circular economy, green manufacturing, or sustainable business models and present findings.
4. **Hands-on Eco-Design / Upcycling Activity**
   Students create useful products from waste or redesign an existing product using eco-design and sustainability concepts.
5. **Sustainability Policy & SDG Mapping Project**
   Students map business/industrial activities with Sustainable Development Goals (SDGs) and prepare reports on sustainable practices.

Text Books

1. Kirchherr, J., Reike, D., & Hekkert, M. – Conceptualizing the Circular Economy: An overview (Journal/Book compendium)
2. Ellen MacArthur Foundation – Towards the Circular Economy (Vol. 1–3)
3. (Open-access foundation reports widely used in curricula)
4. Pearce, D. & Turner, R. K. – Economics of Natural Resources and the Environment
5. Bruntland Commission Report – Our Common Future (UN document foundational to sustainability thought)

Reference Books

1. Bocken, N. M. P., et al. – Product Design and Business Model Strategies for a Circular Economy
2. Geissdoerfer, M., et al. – The Circular Economy: A Critical Literature Review
3. McDonough, W. & Braungart, M. – Cradle to Cradle: Remaking the Way We Make Things
4. UNEP / UN Documents – Global Environmental Outlook Reports (for SDG policy context)
5. Geyer, R., et al. – Industrial Ecology and Circularity

MOOC / NPTEL Courses

1. Coursera: Sustainability and Circular Economy, Michael J. Readey, University of Colorado Boulder
   https://www.coursera.org/learn/sustainability-and-the-circular-economy
2. NPTEL, Environment and Development, Prof. By Prof. Ngamjahao Kipgen, IIT Guwahati
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs83
3. NPTEL, Education for Sustainable Development, By Prof. Atasi Mohanty, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_hs61
4. NPTEL, Environmental Planning and Management, By Prof. Sonal K. Thengane, IIT Roorkee
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge08
5. NPTEL5 Corporate social responsibility by Prof. Aradhna Malik, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg54

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 3): Start-up Management &Venture Creation										**Course Code: 25OEC201C**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Entrepreneurship, market survey, innovation

Course Objectives:

1. Understand the fundamentals of startup management and venture creation.
2. Develop the ability to identify, evaluate, and validate startup ideas.
3. Gain knowledge of business models, funding mechanisms, and startup operations.
4. Understand legal, ethical, and IPR aspects related to startups.
5. Build entrepreneurial skills, teamwork, leadership, and lifelong learning orientation.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain concepts, types, and lifecycle stages of start-ups and new ventures.
CO2. Identify and analyze start up opportunities using market and customer discovery tools.
CO3. Develop suitable business models and assess technical and financial feasibility of ventures.
CO4. Apply knowledge of funding, legal, IPR, and government policies for startup creation.
CO5. Prepare and present a startup business plan demonstrating teamwork, communication, ethics, and lifelong learning.

Course Contents

Unit I	**Introduction to Startups & Venture Creation**	**06 Hours**

Startup: Definition, characteristics, and types, Startup vs MSME vs traditional business, Startup lifecycle and growth stages, Role of startups in innovation and economic development Case studies of successful startups (Indian & global).

Unit II	**Idea Generation, Opportunity & Market Validation**	**06 Hours**

Entrepreneurial mindset and ideation techniques, Problem identification and solution fit, Design Thinking and Lean Startup approach, Customer discovery and validation, Market analysis and value proposition development.

Unit III	**Business Models & Feasibility Analysis**	**06 Hours**

Business Model Canvas and Lean Canvas, Technical, market, and financial feasibility, Cost structures, revenue models, and break-even analysis, Risk analysis and mitigation strategies, Sustainability and ethical considerations in startups

Unit IV	**Startup Ecosystem, Funding & Legal Aspects**	**06 Hours**

Startup ecosystem in India and globally, Government initiatives: Startup India, MSME, SIDBI, DPIIT, Sources of funding: bootstrapping, angel investors, venture capital, crowdfunding, Legal aspects: company registration, compliance, Intellectual Property Rights (IPR): patents, trademarks, copyrights.

Unit V	**Startup Operations, Scaling & Business Plan**	**06 Hours**

Team formation, leadership, and culture, Operations and scaling strategies, Marketing, branding, and customer acquisition Business plan preparation and pitch deck, Future trends, failure analysis, and lifelong learning for entrepreneurs.

	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Start-up Idea Pitching Activity**
   Students develop and present innovative startup ideas addressing real-world problems using value proposition concepts.
2. **Business Model Canvas Workshop**
   Hands-on preparation of Business Model Canvas (BMC) for a startup including customer segments, revenue streams, and value proposition.
3. **Market Survey & Customer Validation**
   Students conduct field/online surveys to identify customer needs, validate startup ideas, and analyse market opportunities.
4. **Prototype / Product Demonstration**
   Teams create a basic prototype, mock-up, or digital model of a product/service and demonstrate its functionality and usefulness.
5. **Startup Business Plan Preparation**
   Students prepare a practical business plan including funding requirements, marketing strategy, operational plan, and financial feasibility analysis.

Text Books

1. S. S. Khanka – Entrepreneurial Development, S. Chand & Company.
2. Vasant Desai – Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.

Reference Books

1. Steve Blank & Bob Dorf – The Startup Owner's Manual, Wiley.
2. Alexander Osterwalder & Yves Pigneur – Business Model Generation, Wiley.
3. Barringer & Ireland – Entrepreneurship: Successfully Launching New Ventures, Pearson.
4. Peter F. Drucker – Innovation and Entrepreneurship, Harper Business.
5. Steve Blank & Bob Dorf – The Startup Owner's Manual, Wiley.

MOOC / NPTEL Courses

1. NPTEL1, Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
2. NPTEL2, Entrepreneurship Essentials by Prof. Manoj Kumar Mondal, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ge08

3. NPTEL3, Innovation, Business Models and Entrepreneurship, By Prof. Vinay Sharma, Prof. Rajat Agrawal, IIT Roorkee: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
4. NPTEL4, Entrepreneurship Essentials, By Prof. Manoj Kumar Mondal, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ge03
5. Coursera: Technology & Entrepreneurship Specialization, Brent Sebold, Arizona State University https://www.coursera.org/specializations/technology-and-entrepreneurship

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 4): Health and Nutrition for Professionals									**Course Code: 25OEC201D**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Course Objectives:

1. To understand the importance of nutrition and healthy lifestyle for professionals.
2. To create awareness about balanced diet and nutritional requirements.
3. To understand lifestyle diseases and their prevention.
4. To develop healthy habits for stress management and productivity.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the basic concepts of health and nutrition.
CO2. Understand nutritional requirements and balanced diet.
CO3. Identify lifestyle diseases and preventive measures.
CO4. Apply principles of healthy living and stress management.
CO5. Analyze the role of nutrition in improving professional productivity.

Course Contents

Unit I	**Introduction to Health and Nutrition**	**06 Hours**

Concept of health and wellness
Dimensions of health (physical, mental, social)
Importance of nutrition for professionals
Nutrients and their functions
Macronutrients and micronutrients

Unit II	**Balanced Diet and Nutritional Requirements**	**06 Hours**

Concept of balanced diet
Dietary guidelines
Recommended dietary allowance (RDA)
Nutritional needs during childhood, adolescence, adulthood and old age
Special Nutritional needs for working professionals
Vegetarian vs non-vegetarian diets
Food pyramid and healthy eating habits

Unit III	**Lifestyle Diseases**	**06 Hours**

Causes of lifestyle diseases
Obesity, diabetes, hypertension, heart disease
Role of diet in prevention of diseases

Importance of physical activity
Nutritional management of common diseases
Prevention through healthy diets and lifestyle

Unit IV	Health Management for Professionals	06 Hours

Work-life balance
Stress and its management
Role of exercise and yoga
Sleep and mental health
Ergonomics and workplace health

Unit V	Food Safety and Healthy Lifestyle	06 Hours

Food hygiene and sanitation
Food adulteration
Safe food handling practices
Sustainable and healthy eating habits
Nutrition for long-term health and productivity
Importance of hydration
Healthy snacking options at work

	Total Hours	30

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Balanced Diet Planning Activity**
   Students prepare a daily/weekly balanced diet chart for different age groups or working professionals based on nutritional requirements.
2. **Nutritional Analysis Survey**
   Conduct a survey on eating habits, junk food consumption, hydration, or lifestyle diseases and analyze the collected data.
3. **Healthy Recipe Preparation / Demonstration**
   Students prepare and present nutritious, low-cost, and healthy food recipes promoting balanced nutrition and food safety.
4. **Fitness, Yoga & Stress Management Activity**
   Practical sessions on yoga, exercise routines, meditation, posture correction, and stress management techniques for healthy living.
5. **Food Safety & Awareness Campaign**
   Students create posters, presentations, or awareness drives on food hygiene, adulteration detection, healthy snacking, and lifestyle disease prevention.

Text Books

1. Srilakshmi, B., Human Nutrition, New Age International (P) Ltd., Publishers, New Delhi.
2. Joshi, Shubhangini A., Nutrition and Dietetics: With Indian Case Studies, 5th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2021.

Reference Books

1. Swaminathan, M., Food and Nutrition, Bangalore Printing & Publishing Co. Ltd., Bangalore.
2. (You may verify the exact edition/year available in your library before finalizing.)
3. Swaminathan, M., Essentials of Food and Nutrition, Vol. I & II, Ganesh & Co., Madras, 1974.

MOOC / NPTEL Courses /Online Resources:

1. Adolescent Health and Well-Being: A Holistic Approach by by Prof. Sumanas Samanta, Prof.

Parmeshwar Satpathy, IIT Kharagpur:
https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge102

2. Diet Management in Health and Disease by Dr. Vipparti Vijaya Lakshmi, The English and Foreign Languages University:
https://onlinecourses.swayam2.ac.in/e-learning/preview/cec25_hc01
3. Food and Nutrition by Dr. Asna Urooj, University of Mysore:
https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_ag02

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 5 (A)): French Language Module-I									**Course Code: 25OEC201E**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Course Objectives:

1. To introduce students to basic French pronunciation and vocabulary.
2. To develop elementary listening and speaking skills in French.
3. To familiarize students with simple French sentence structures.
4. To enable students to communicate in everyday situations.
5. To develop readiness for beginner-level French language learning.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Understand basic French vocabulary and pronunciation.
CO2. Introduce themselves using simple French expressions.
CO3. Read and write basic French sentences.
CO4. Communicate in simple everyday situations.
CO5. Demonstrate awareness of French culture and etiquette.

Course Contents

Unit I	**Introduction au français (Introduction to French)**	**06 Hours**

French alphabet and pronunciation
Greetings and introductions
Numbers (1-100), days and months
Classroom expressions

Unit II	**Parler de ses loisirs et de sa famille (Talking about his hobbies and his family)**	**06 Hours**

Talking about a hobby ,(Vocab: Activities, expressions + Aimer)
Family and friends
(Grammar: Subject pronouns, ER ending verbs, Family relations)

Unit III	**La France (France)**	**06 Hours**

Reading about French city, Asking simple questions about France,
Writing a post card
(Vocab: Information on France and it's cities, interrogative words.)

Unit IV	**Au café! (At the cafe!)**	**06 Hours**

Ordering in French
Fruits and vegetables
Quantities
Expressions of politeness

Unit V	Faire une invitation (Make an invitation)	06 Hours
Letter writing Organizing a party Accepting / refusing an invitation Role play activities		
	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Self-introduction in French:** Students introduce themselves using simple French sentences.
2. **Greetings and Classroom Conversation:** Students practice basic greetings and classroom expressions in French.
3. **Listening Comprehension Exercise:** Students listen to short French audio clips and answer simple questions.
4. **Picture Description in French:** Students describe a given picture using basic French vocabulary.
5. **French Culture Presentation:** Students give a short presentation on French culture, food, or festivals.

Text Books

1. Alter Ego A1 – Hachette (Goyal Publishers)
2. Latitude 1 – Didier (Goyal Publishers)

Reference Books

1. Myrna Bell Rochester, “Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast”, McGraw Hill, ISBN-13 : 978-0071453875
2. Eugene Jackson, Antonio Rubio, Julien J. Lafontant, Pamela Haze, “French Made Simple”, Crown Publication, ISBN-13 : 978-0767918596
3. Claire Miquel, “Communication Progressive du Français A1”, Cle International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002
4. Ranjit, Mahita & Singh, Monica, Apprenons le frangais', Part 1, Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007
5. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le francais) 1., Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007

Online Resources

1. https://www.elearningfrench.com/
2. https://www.laits.utexas.edu/fi/index.html
3. https://blog.rosettastone.com/french-accent-marks/
4. https://www.frenchcircles.ca/online-free-french-resources/
5. Proficiency course in French By Prof. Nirupama Rastogi (Retd): https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_lg04
6. Foundations of French by Ramya Jagannathan: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg73
7. The Complete French Course : Learn French – Beginners : https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025
8. Complete French Course: Learn French for Beginners: https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (OE-1) (Basket No 5 (B)): German Language Module-I									**Course Code: 25OEC201F**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Course Objectives:

1. To introduce students to basic German pronunciation and vocabulary.
2. To develop elementary communication skills in German.
3. To familiarize students with simple German sentence structures.
4. To enable students to communicate in everyday situations.
5. To develop awareness about German culture and traditions.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Understand basic German pronunciation and vocabulary.
CO2. Communicate using simple expressions.
CO3. Read and write elementary German sentences.
CO4. Use common phrases in daily situations.
CO5. Demonstrate awareness about German culture.

Course Contents

Unit I	**Willkommen! (Welcome!)**	**06 Hours**

Topics and Vocabulary

- Greetings
- Introductions
- Numbers
- Countries & languages

Grammar

- Alphabet
- Pronunciation
- Personal pronouns

Skills

- Speaking: self-introduction
- Listening: simple conversations
- Reading: name cards, dialogues
- Writing: short introduction paragraph

Unit II	**Familie, Freunde und ich (Family, Friends and I)**	**06 Hours**

Topics and Vocabulary

- Family members
- Hobby and work

Grammar

- Nominative case
- Articles- der, die, das
- • Regular verb conjugation

Skills
- Speaking: describe family, ask about profession, introduce others
- Reading: small paragraphs about nuclear and joint families

Activity
- Family tree presentation

Unit III	Orte und Dinge (Places and things)	06 Hours

Topics and Vocabulary
- Household objects
- Classroom objects
- Office equipment
- Nature vocabulary
- Public places

Grammar
- Sentence structure
- Definite articles- der, die, das
- Indefinite articles- ein, eine, ein
- Negative markers- kein, keine, kein, nicht

Skills
- Speaking: describing surroundings and objects
- Reading: simple descriptive passages and labels
- Writing: short descriptions using simple sentences

Activities
- Vocabulary Hunt
- Mystery Object Game
- Picture Description

Unit IV	Studentenleben & Alltag (Student life & everyday life)	06 Hours

Topics and Vocabulary
- Daily routine
- University life
- Subjects
- Time expressions

Grammar
- Time
- Nominative case- personal pronouns
- Nominative case- possessive Pronouns

Skills
- Speaking and Writing: daily routine discussion

Listening: Schedules at university and at the work place

Unit V	Revision & Mini Project	06 Hours

Integrated Skills

Students prepare:
- Self-introduction
- Poster
- Dialogue
- Simple presentation

Suggested Project

My dream study trips to Germany/ Cultural connectivity between Germany and India/ Any other topic related to German language and culture.

Assessment

- Speaking viva
- Listening test
- Vocabulary quiz
- Listening exercises
- Pronunciation practice
- Role play activities

Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Self-introduction in German:** Students introduce themselves using simple German sentences.
2. **Greetings and Basic Conversation:** Students practice greetings and everyday expressions in German.
3. **Listening Comprehension Exercise:** Students listen to short German audio clips and answer questions.
4. **Picture Description in German:** Students describe simple pictures using basic German vocabulary.
5. **German Culture Presentation:** Students present topics related to German culture, food, or festivals.

Text Books

1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette, ISBN: 9788183077033, (Goyal Publishers)
2. Monika Reimann Daniela Niebisch , Sylvette Penning-Hiemstra , Angela Pude , Franz Specht , Monika Bovermann, “ Schritte international Neu 1: Deutsch als Fremdsprache / Kursbuch + Arbeitsbuch mit Audios online”, Hueber Publications, GOYAL Publishers & Distributors Pvt. Ltd, ISBN-13 : 978-3193610829

Reference Books

1. Deepak Kushwaha, “German Made Easy Part 1 + German Made Easy Part 2 with Answer”, Goyal Publishers
2. Arnold Leitner, “German Made Simple”, Crown Publications, Penguin Random House India Pvt Ltd
3. Kurs Und Ubungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers
4. Funk and Kuhn, “Studio D A1Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India)

Online Resources

1. Learn German Language: Complete German Course – Beginners (Udemy)
2. Complete German Course: Learn German for Beginners : https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/?couponCode=PMNVD2025
3. German A1 - German For Complete Beginners! : https://www.udemy.com/course/german-for-complete-beginners/?couponCode=PMNVD2025
4. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528

5. Practise German for free (Goethe-Institut Resources) : https://www.goethe.de/en/spr/ueb.html
6. Duolingo German : https://www.duolingo.com/course/de/en/Learn-German

Course: Japanese Language Module-I			Code: 25OEC201G	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** No prerequisite required.

- **Course Objectives:** The objectives of the course are-
  1. To identify basic Japanese pronunciation, scripts, and vocabulary.
  2. To develop pre-elementary listening and speaking skills in Japanese.
  3. To construct simple Japanese sentences using basic grammar.
  4. To apply simple Japanese expressions in everyday communication.
  5. To develop awareness of Japanese culture and etiquette.

- **Course Outcomes:** At the end of the course, students will be able to

  CO1. Identify basic Japanese pronunciation, scripts, and vocabulary.

  CO2. Use simple Japanese expressions for basic communication.

  CO3. Read and write basic Japanese characters and sentences.

  CO4. Participate in elementary conversations using simple Japanese expressions.

  CO5. Demonstrate awareness of Japanese culture and etiquette.

- **Course Contents:**

Unit I	**Nihongo nyūmon (Introduction to Japanese)**	**8 Hours**
Hiragana, Greetings and introductions, Numbers and dates, Pronunciation practice		
Unit II	**Kihon-tekina bunpō to goi (Basic Grammar and Vocabulary)**	**6 Hours**
Sentence patterns, Basic Particles, Basic verbs, Pronouns and nouns		
Unit III	**Nichijō no komyunikēshon (Everyday Communication)**	**4 Hours**
Self-introduction, Family and hobbies, Daily activities, Asking simple questions		
Unit IV	**Dokkairyoku to sakubun nōryoku (Reading and Writing Skills)**	**6 Hours**
Reading simple scripts, Daily Vocabulary, Writing practice, Sentence construction		
Unit V	**Risuningu to supīkingu no renshū (Listening and Speaking Practice)**	**6 Hours**
Japanese culture, Pronunciation practice, Role play activities, Guided communication, activities.		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. **Self-introduction in Japanese:** Students introduce themselves using simple Japanese expressions.
  2. **Greetings and Classroom Conversation:** Students practice basic greetings and classroom communication in Japanese.
  3. **Listening Comprehension Exercise:** Students listen to short Japanese audio clips and answer simple questions.
  4. **Picture Description in Japanese:** Students describe pictures using simple Japanese vocabulary.
  5. **Japanese Culture Presentation:** Students present topics related to Japanese culture, food, or festivals.

- **Text Books:**
  1. 3A Corporation, “Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary”, ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India
  2. Eri Banno, Yoko Ikeda, Yutaka Ohno, Chikako Shinagawa, Kyoko Tokashiki, “Genki 1 Textbook: An Integrated Course in Elementary Japanese”, ISBN-13 : 978-4789014403

- **Reference Books:**
  1. The Japan Foundation, “Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities”, Goyal Publishers
  2. The Japan Foundation, “Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences”, Goyal Publishers, ISBN-13: 9788183078047
  3. The Japan Foundation, “Marugoto Starter (A1) Katsudoo”, Goyal Publishers
  4. “Japanese for Busy People,3rd edition”, Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011.,
  5. Tae Kim, “A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar”, Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
  6. Nyumon Nihongo- ALC Press, U.K
  7. Nihongo Soomatome N5, ASK Publishing, Tokyo

- **MOOC / NPTEL Courses /Online Resources Online Resources:**
  1. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course
  2. JF-Japanese e-learning : https://minato-jf.jp/
  3. Introduction to Japanese Langauge : Prof Vatsala Misra (NPTEL) : https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83
  4. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC(L)): Engineering mathematics for Computer Science Lab										**Course Code: 25COPCC201L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	-	25	25	-	1	-	1

Prerequisite:

Programming & Problem Solving

Course Objectives:

1. Provide strong foundational knowledge of engineering mathematics required for computer engineering applications.
2. Implement set operations in python
3. Develop the ability to apply probability to model and solve engineering problems.
4. Enrich analytical and logical thinking skills essential for real world problem.
5. Enable students to use discrete mathematical structures for solving in computation problem.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Solve engineering problems using set theory by implementing it.

CO2. Apply discrete mathematical structures in complex problem.

CO3. Write a code to compute gradient, divergence, curl, and analyze

CO4. Implement data analytic algorithms.

CO5. Implement of different mathematical formulae.

List of Experiments:

1. Write a program in python/JAVA to implement Set Operations using Python or SQL to perform union, intersection, difference, and Cartesian product on datasets.
2. Write a program in python/JAVA for Checking Relation Properties: Developing algorithms to verify if a given set of ordered pairs represents a reflexive, symmetric, transitive, or equivalence relation.
3. Write a program in python/JAVA for implementing injective, surjective, and bijective functions to map inputs to outputs in data transformation scenarios.
4. Write a program in python/JAVA to calculate the mean (expectation), median, and mode of a dataset.
5. Write a program in python/JAVA to Compute the variance and standard deviation to understand data spread and identify outliers.
6. Write a program in python/JAVA to calculate the probability of events based on sample spaces, such as drawing specific cards from a deck.
7. Write a program in python/JAVA to compute gradient, divergence, curl, and analyze fields.

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC(L)): Object Oriented Programming Laboratory										**Course Code: 25COPCC202L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	-	25	25	-	1	-	1

Prerequisites:

Principles of Programming Languages

Course Objectives:

1. To explore & understand the principles of Object-Oriented Programming (OOP)
2. To apply the object-oriented paradigm in program design
3. To provide object-oriented programming insight using Java
4. To implement foundation for computer graphics concepts and implementation.
5. To implement any application using oops concepts.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Apply fundamental programming constructs, object-oriented constructs in Java for implementing an application.

CO2. Apply fundamental object-oriented constructs like class, objects, array of objects in Java for Implementing an application.

CO3. Apply object-oriented features like Inheritance, Polymorphism, Dynamic binding, Exception handling, multi-threading in Java for implementing an application

CO4. Understand basic concepts in computer graphics and implement them by applying object-oriented features.

CO5. To Apply oops concepts for application.

Lab Assignments/Activities: (Any 6)

1. Implement a robust Java calculator program that captures user input dynamically, processes mathematical operations using conditional logic and looping constructs, and ensures efficient error handling.
2. Develop a Java program for an E-commerce order processing where some products are initialized through multiple constructors, overloaded constructors, where users can input some product details manually, the system computes total order cost dynamically, applies discount policies based on conditions, and presents a detailed invoice summarizing the purchase.
3. Develop a Java program that implements a simple hotel room booking system using two-dimensional arrays. The system allows users to: View available and booked rooms, Book a room by selecting a floor and room number and exit the system when finished.

4. Create a Java program demonstrating single inheritance where a subclass extends a superclass and calls its methods.
5. Implement Multiple Inheritance using interface in Java to demonstrate polymorphism.
6. Develop a Java program for simulation of any real time application with required functionalities. For e.g. ATM machine with functionalities like checking account balance, withdrawing, and depositing money. Use try, catch, and finally blocks to handle potential exceptions such as insufficient funds (throwing Arithmetic Exception) and invalid input (throwing Illegal Argument Exception). Ensure that the application continues to run smoothly after handling exceptions.
7. Create a multi-threaded Java application that simulates any real time application with required functionalities. For e.g. Basic chat system in which each user (thread) sends and receives messages. Use is Alive () to check the status of threads and join () to ensure proper synchronization. Implement thread priorities to handle high-priority messages and demonstrate thread suspension, resumption, and stopping.
8. Implement a robust Java calculator program that captures user input dynamically,
9. processes mathematical operations using conditional logic and looping constructs, and ensures efficient error handling.

Operating System recommended

64-bit Open source Linux or its derivative, Suggested free open source: Strum, Madelia, Smart Draw, CF Engine Configuration Tool, Puppet Configuration Tool,Selenium,JUni

Virtual Laboratories

Programming In Java:
https://onlinecourses.nptel.ac.in/noc25_cs57/preview https://nptel.ac.in/courses/106105175

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC(L)): Data Structures and Algorithms Laboratory										**Course Code: 25COPCC203L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	-	25	25	-	1	-	1

Prerequisite:

Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. To understand the standard and abstract data representation methods.
2. To acquaint with the structural constraints and advantages in usage of the data.
3. To understand the memory requirement for various data structures.
4. To operate on the various structured data.
5. To understand various data searching and sorting methods with pros and cons.
6. To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

At the end of the course, students will be able to:

CO1. To discriminate the usage of various structures in approaching the problem solution.

CO2. To design the algorithms to solve the programming problems.

CO3. To use effective and efficient data structures in solving various Computer Engineering domain problems.

CO4. To analyze the problems to apply suitable algorithms and data structure.

CO5. To use appropriate algorithmic strategy for better efficiency

List of Experiments:

Group A

1. In Second Year Computer Engineering class of M students, set A of students play cricket and set B of students play badminton. Write C/C++ program to find and display-
   - Set of students who play either cricket or badminton or both
   - Set of students who play both cricket and badminton
   - Set of students who play only cricket
   - Set of students who play only badminton
   - Number of students who play neither cricket nor badminton
     (Note- While realizing the set duplicate entries are to avoided)

2. Write C/C++ program to store marks scored for first test of subject 'Data Structures and Algorithms' for N students. Compute
   - The average score of class
   - Highest score and lowest score of class
   - Marks scored by most of the students

- list of students who were absent for the test

3. Department library has N books. Write C/C++ program to store the cost of books in array in ascending order. Books are to be arranged in descending order of their cost. Write function for
   - Reverse the contents of array without using temporary array.
   - Copy costs of books those with cost less than 500 in new array
   - Delete the duplicate entries using temporary array
   - Delete duplicate entries without using temporary array
   - Count number of books with cost more than 500.

4. Set A= (1,3, a, s, t, i} represent alphanumeric characters permitted to be used to set the password of length 4. Write C/C++ program to generate all possible passwords.

5. A magazine committee is to be formed that consists of any 3 members to be selected from {Nikhita, Aboli, Megha, Sanika, Pratik, Saurabh}. Write C/C++ program to list all possible committees.

6. It is decided that weekly greetings are to be furnished to wish the students having their birthdays in that week. The consolidated sorted list with desired categorical information is to be provided to the authority. Write C++ program for array of structures to store students PRNs with date and month of birth. Let Array A and Array be the two arrays for two SE Computer divisions. Arrays are sorted on date and month. Merge these two arrays into third array Array_SE_Comp_DOB resulting in sorted information about Date of Birth of SE Computer students.

7. A magic square is an n * n matrix of the integers 1 to n2 such that the sum of each row, column, and diagonal is the same. The figure given below is an example of magic square for case n=5. In this example, the common sum is 65. Write C/C++ Program for magic square.

8. An m x n matrix is said to have a saddle point if some entry a[i][j] is the smallest value in row i and the largest value in j. Write C/ C++ function that determines the location of a saddle point if one exists.

9. Write C++ program for sparse matrix realization and operations on it- Transpose, Fast Transpose and addition of two matrices.

10. Write C++ program for string operations- copy, concatenate, check substring, equal, reverse and length.

Group B

11. Second year Computer Engineering class, set A of students like Vanilla Ice-cream and set B of students like butterscotch ice-cream. Write C/C++ program to store two sets using linked list. compute and display-
    - Set of students who like either vanilla or butterscotch or both
    - Set of students who like both vanilla and butterscotch
    - Set of students who like only vanilla not butterscotch
    - Set of students who like only butterscotch not vanilla

- Number of students who like neither vanilla nor butterscotch

12. Write C++ program for storing binary number using doubly linked lists. Write functions-
    a) to compute 1‘s and 2‘s complement b) add two binary numbers

Group C

13. A palindrome is a string of character that’s the same forward and backward. Typically, punctuation, capitalization, and spaces are ignored. For example, ‖Poor Dan is in a droop‖ is a palindrome, as can be seen by examining the characters —poor danisina droop‖ and observing that they are the same forward and backward. One way to check for a palindrome is to reverse the characters in the string and then compare with them the original-in a palindrome, the sequence will be identical. Write C++ program with functions-
    - To check whether given string is palindrome or not that uses a stack to determine whether a string is a palindrome.
    - to remove spaces and punctuation in string, convert all the Characters to lowercase, and then call above Palindrome checking function to check for a palindrome
    - to print string in reverse order using stack

14. Implement C++ program for expression conversion as infix to postfix and its evaluation using stack based on given conditions
    - Operands and operator, both must be single character.
    - Input Postfix expression must be in a desired format.
    - Only '+', '-', '*' and '/ ' operators are expected.

15. Implement C++ program for expression conversion-
    a) infix to prefix, b) prefix to postfix,
    c) prefix to infix, d) postfix to infix and e) postfix to prefix.

Group D

16. Write C++ program to store first year percentage of students in array. Write function for sorting array of floating-point numbers in ascending order using
    a) Selection Sort b) Bubble sort and display top five scores.

17. Write C++ program to store second year percentage of students in array. Write function for sorting array of floating-point numbers in ascending order using
    a) Insertion sort b) Shell Sort and display top five scores.

18. Write C++ program to store first year percentage of students in array. Sort array of floating point numbers in ascending order using quick sort and display top five scores.

19. Write C++ program to store XII percentage of students in array. Sort array of floating point numbers in ascending order using bucket sort and display top five scores.

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (Vocational and Skill Enhancement Course-I): Mobile Application Development									**Course Code: 25COVSE201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	25	-	25	-	1	-	1

Prerequisite:

Basic knowledge of programming concepts, Basic knowledge of computers and mobile devices

Course Objectives:

1. To introduce basic concepts of mobile application development.
2. To develop simple mobile user interfaces using Android tools.
3. To implement basic interactivity using events in mobile applications.
4. To provide basic knowledge of storing and retrieving data in mobile apps.
5. To enable students to develop simple Android applications.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain basic concepts of mobile computing and Android development.
CO2. Design simple mobile user interfaces using Android layouts and widgets.
CO3. Implement event handling and user interaction in Android applications.
CO4. Store and retrieve data using basic Android storage techniques.
CO5. Develop simple Android applications using Android Studio.

List of Experiments:

1. Install Android Studio and create a simple Android application.
2. Design a simple UI using Text View and Linear Layout.
3. Create a registration form using Edit Text and Button.
4. Implement button click event to display a message.
5. Design a UI using Relative Layout or Constraint Layout.
6. Create two activities and pass data using Intent.
7. Implement menu options in an Android application.
8. Store and retrieve data using Shared Preferences.
9. Create a simple SQLite database and insert data.
10. Retrieve and display data from SQLite database.
11. Develop a simple calculator mobile application.
12. Mini Project: Simple app such as To-Do List / Student Info App.

Textbooks

1. Wei-Meng Lee, Beginning Android Application Development, Wiley.
2. Bill Phillips, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch

Reference Books
1. Reto Meier, Professional Android Application Development, Wiley. 2. Android Developer Documentation – developer.android.com.
MOOC / NPTEL Courses
• Android Mobile Application Development, By Dr. Himanshu N. Patel: https://onlinecourses.swayam2.ac.in/e-learning/preview/nou21_ge41 • Mobile Computing, IIIT Delhi, Prof. Pushpendra Singh: https://nptel.ac.in/courses/106106147

Course: Entrepreneursip/Economics/ Management Course-I				Code: 25HSM201
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	2	2	Term work	Marks: 50

GUIDELINES FOR SELECTING HSM COURSE

1. HSSM courses shall be offered through Institute-approved Swayam/ NPTEL courses. The minimum duration of the course must be **8 weeks**.
2. Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students 'in true letter and spirit'. The faculty has to register for the selected course as a course mentor.
3. Students shall complete the prescribed online lectures, assignments, and learning activities during the semester.
4. Swayam/ NPTEL certification examination is optional and students shall not be required to pay certification fees for successful completion of the course.
5. Any plagiarism, misrepresentation of course completion, or submission of forged certificates shall be treated as academic misconduct.
6. The decision of the Institute regarding course mapping, evaluation, and award of credits shall be final.

SELECTION OF HSSM COURSE

List of Courses to be opted (Any one) under HSSM-I

1. Engineering Economic Analysis – IIT Roorkee, Prof. P. K. Jha :https://nptel.ac.in/courses/112107209
2. Entrepreneurship – IIT Madras, Prof. C. Bhaktavatsala Rao: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg114
3. Project Management – IIT Kanpur, Prof. Raghu Nandan Sengupta: https://nptel.ac.in/courses/110104073
4. Financial Accounting, IIT Bombay Prof. Varadraj Bapat: https://nptel.ac.in/courses/110101131

Assessment of HSSM Course:

1. Term Work (50 Marks) shall be evaluated by the Faculty Mentor based on:
    - 25 Marks: NPTEL assignment score
    - 25 Marks: Institute level examination.
    - For DSE students there will be 50 Marks institute level end semester

examination.

2. During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course. The cumulative marks obtained in the online assignments shall be proportionately converted to a maximum of 25 marks for the purpose of term work assessment.

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (VEC): Universal Human Values									**Course Code: 25VEC201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	-	2	-	-	-	50	-	-	50	-	-	2	2

Prerequisite:

The course requires openness to self-reflection and willingness to understand ethical and value-based perspectives in personal and professional life.

Course Objectives:

1. To help students understand the importance of human values in personal & professional life.
2. To develop ethical awareness and responsible decision-making.
3. To create harmony between individual, society, and nature.
4. To encourage engineers to contribute towards sustainable and value-based development.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the concept of human values and self-exploration, and recognize their importance in personal life, professional life, and the role of engineers in society.

CO2. Understand the importance of sustainable development, environmental responsibility, and ecological balance, and evaluate the impact of technology on society and nature.

CO3. Apply values such as trust, respect, empathy, and responsibility to maintain harmony in family and society and practice ethical behavior in social interactions.

CO4. Demonstrate professional ethics, value-based decision making, leadership, and teamwork in engineering practice for the welfare of society.

CO5. Understand the relationship between self and body, differentiate their needs, and develop self-awareness and balanced lifestyle practices for personal well-being.

Course Contents

Unit I	**Introduction to Human Values**	**06 Hours**

Meaning and importance of human values, Basic needs of values, need for value based education in Engineering, Types of Human Values, Importance of human values to full fill happy and successful life, Values in personal life and professional life,, Factors affecting human values- Cultural, societal factors, personal factors , experiences, Concept of self-exploration, How to cultivate both values and skill in person's life that navigate him to face life's challenges and opportunities, Role of Engineer in society. Technology and values.

Unit II	**Harmony in Nature**	**06 Hours**

Understanding of harmony in Nature, Four orders of nature, Physical, Bio, Animal, Human order, interconnectedness and mutual fulfilment among four orders. Basic characteristic of nature, perseverance, bravery, Generosity, recyclability and self-regulation in nature, Holistic perception of harmony at all levels of existence, human being as a cause of imbalance in nature-pollution,

depletion of resources, and role of technology in nature. Understanding existence of human being as a co-existence of mutually interacting units -in all pervasive space. Sustainable development, Environmental responsibility, Resource conservation, Ecological balance, Technology and its impact on society.

Unit III	**Harmony in Family and Society**	**06 Hours**

Family as the basic unit of society: role of family in developing values, mutual understanding, and responsibility. Values in relationships: trust, respect, affection, care, guidance, and gratitude in maintaining harmony in family and society. Ethical behavior in society: honesty, responsibility, empathy, cooperation, and respect for diversity in social interactions. Social harmony and responsible citizenship: duties and responsibilities of individuals towards society and community. Professional ethics and social responsibility: role of engineers and professionals in promoting ethical practices and sustainable development. Role of values in building a harmonious society: importance of value-based decision making in personal, social, and professional life.

Unit IV	**Holistic Development and Professional Ethics**	**06 Hours**

Holistic approach to life and education: integration of intellectual, emotional, ethical, and social development for balanced personal and professional growth. Human values and ethical principles: understanding honesty, integrity, empathy, responsibility, and respect in personal and social life. Professional ethics: ethical conduct in professional practice, integrity in work, accountability, and commitment to societal welfare. Ethical decision making: identifying ethical dilemmas and applying value-based reasoning in professional situations. Social and environmental responsibility of professionals: contribution of engineers and professionals towards sustainable development and societal well-being. Role of values in leadership and teamwork: importance of trust, cooperation, and ethical behaviour in professional environments.

Unit V	**Harmony Between Self and Body**	**06 Hours**

Understanding the Self and the Body: distinction between the conscious self (I) and the physical body. Self–body coexistence: relationship between the self as the experiencer and the body as the instrument of action. Needs of the self and the body: physical needs (food, rest, health) and psychological needs (happiness, values, purpose). Harmony in the individual: maintaining balance between mental well-being and physical health through responsible living. Role of self-awareness and self-regulation: understanding thoughts, emotions, and behavior for a balanced life. Importance of healthy lifestyle: discipline, proper habits, and value-based living for overall well-being.

	Total Hours	**30**

Activities for term work Evaluation:

1. Group Discussion on Human Values and Ethics
2. Case Study Analysis on Ethical Issues in Society and Profession
3. Reflective Journal Writing on Self-Development and Values
4. Role Play / Skit on Social Responsibility and Moral Values
5. Poster Presentation on Environmental Awareness and Sustainability
6. Debate on Contemporary Ethical and Social Issues
7. Community Service / Social Outreach Activity Report
8. Seminar / Presentation on Professional Ethics and Leadership
9. Essay Writing on Family Values, Harmony, and Responsibility
10. Participation in Workshops, Expert Talks, and Value-Based Activities

Text Books

1. R. R. Gaur, R. Sangal, and G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi.

2. R. R. Gaur, R. Sangal, and G. P. Bagaria, Universal Human Values – Understanding Harmony AICTE / Excel Books.

Reference Books

1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering McGraw Hill.
2. Charles B. Fleddermann, Engineering Ethics Pearson.

Online References

1. Exploring Human Values – Visions of Happiness & Perfect Society- A. K. Sharma, IIT Kanpur
2. Moral Thinking – An Introduction to Values and Ethics: Prof. Vineet Sahu, IIT Kanpur

MOOC / NPTEL Courses

1. Human values and Professional Ethics, By Dr. Kounsar Jan, Deptt of education University of Kashmir
   https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125
2. Moral Thinking – An Introduction to Values and Ethics by Prof. Vineet Sahu, IIT Kanpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs169

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name: **Community Engagement Project**									**Course Code:** **25COELC201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	25	-	-	25	-	1	-	1

Prerequisite:

1. It is an experiential learning approach that combines community service, community development, education and learning.
2. Project involves students in community development and service activities and applies the experience to personal and academic development.
3. The targeted contribution of college students to the village/local development will benefit the community.

Course Objectives:

1. Establish a mutually beneficial relationship between the college and the community.
2. Opportunities to engage with their local community, fostering empathy, teamwork, and problem- solving skills while contributing positively to their surroundings.
3. An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
4. The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
5. The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Identify and analyze local community needs and challenges by engaging with stake-holders and evaluating real-world problems.

CO2. Design and implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3. Reflect and evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

Guidelines:

1. A group of 3 to 4 students or a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
2. Each group is allotted to a faculty member of the department as a mentor.
3. The group of students will be associated with a government official / village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
4. The Community Engagement Project should be different from the regular programmes of NSS/NC- C/Green Club/Hobby Clubs, Special Interests Groups etc.

5. An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.
6. Project report shall be submitted by each student/group of students.
7. An internal evaluation shall also be conducted by a committee constituted by the HoD.
8. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
9. Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e- waste management or any other activity in an area of their studies and as per his/her aptitude.

List of Topics

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall.

- Use and/or miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming, IoT implementations
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Text Books

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student
Projects. Routledge, 1997.

2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

Online References

MOOC / NPTEL/YouTube Links:

NPTEL course: Ecology and Society
https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Web Links:

1. UNESCO: Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service)
https://engineering.purdue.edu/EPICS
3. Ashoka: Innovators for the Public https://www.ashoka.org
4. Design for Change https://www.dfcworld.com

S.Y.B. Tech. Computer Engineering

(2025 Pattern)

Curriculum Structure: Semester IV

(With effect from Academic Year 2026-27)

S.Y.B. Tech. Computer Engineering (2025 Pattern)

(w.e.f. Academic Year: 2026-2027)

Curriculum Structure: Semester IV

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW	Total	L	P	T	Total
PCC	25COPCC204	Software Engineering	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC205	Database Management System	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25COPCC206	Advanced Data Structure	3	-	-	20	30	50	-	-	-	100	3	-	-	03
MDM	*25COMDM202*	*Multidisciplinary Minor-II*	2	-	-	20	30	50	-	-	-	100	2	-	-	02
OEC	*25OEC202*	*Open Elective Course-II*	2	-	-	20	30	50	-	-	-	100	2	-	-	02
PCC(L)	25COPCC204L	Software Engineering Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
PCC(L)	25COPCCC205L	Database Management System Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
PCC(L)	25COPCC206L	Advanced Data Structure Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
VSEC	25COVSE202	Web Application Development	-	2	-	-	-	-	25	-	-	25	-	1	-	01
ACE	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	50	2	-	-	02
HSSM	*25HSM202*	*Entrepreneurship/Economics/ Management Course-II*	-	-	2	-	-	-	-	-	50	50	-	-	2	02
VEC	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	25	-	-	1	01
	Total		**15**	**08**	**03**	**100**	**150**	**250**	**50**	**75**	**100**	**725**	**15**	**04**	**03**	**22**

***L:** Lecture**, P:** Practical**, T:** Tutorial **CCA:** Comprehensive Continuous Assessment**; ISE:** In-semester Examination; **ESE:** End Semester Examination**; PR:** Practical Examination**, OR:** Oral Examination, **TW:** Term Work*

Multidisciplinary Minor-II:

Sr. No.	Course Code	Course Name
1	25COMDM202	Microprocessor

Open Elective-II:

Basket No.	Sr. No.	Course Code	Course Name
1	1	25OEC202A	Leadership and Team Dynamics
2	2	25OEC202B	Green Practices and ESG Frameworks
3	3	25OEC202C	Innovation and Business Strategy
4	4	25OEC202D	Stress Management and Mental Well-Being
5 (A)	5	25OEC202E	French Language Module-II
5 (B)	6	25OEC202F	German Language Module-II
5 (C)	7	25OEC202G	Japanese Language Module-II

Vocational and Skill Enhancement Course-II:

Sr. No.	Course Code	Course Name
1	25COVSE202	Web Application Development

Entrepreneurship/Economics/Management Courses (HSSM)-II:

Sr. No.	Course Code	Course Name
1	25HSM202A	Business Fundamentals for Entrepreneurs
2	25HSM202B	Entrepreneurship and Start-ups
3	25HSM202C	Fundamentals of Accounting and Finance
4	25HSM202D	Business Intelligence and Analytics

Modern Indian Language (MIL)

Sr. No.	Course Code	Course Name
1	25AEC201A	Marathi
2	25AEC201B	Sanskrit

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC): Software Engineering									**Course Code: 25COPCC204**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Principles of Programming Languages

Course Objectives:

1. Provide fundamental knowledge of software engineering principles, processes, and life cycle models used in software development.
2. Enable students to analyze, specify, and model software requirements using standard modeling techniques and UML.
3. Develop the ability to estimate software size, cost, effort, and schedule using industry-accepted estimation models.
4. Introduce techniques for risk management and software configuration management to handle real-world software projects.
5. Equip students with software testing strategies and techniques to ensure software quality and reliability.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain software engineering concepts, software processes, and life cycle models including Agile methodologies.

CO2. Analyze, document, and model software requirements using UML and structured modeling techniques.

CO3. Apply software estimation and scheduling techniques such as LOC, Function Points, and COCOMO for project planning.

CO4. Identify, analyze, and mitigate software risks and apply software configuration management practices

CO5. Apply appropriate software testing strategies and techniques to validate and verify software systems

Course Contents

Unit I	**Introduction to Software Engineering & Process Models**	**08 Hours**

Nature of Software, Software Engineering, Software Myths, The Software Process, Generic Process Model Prescriptive Process Models, Waterfall Model, Incremental Process Model, Evolutionary Process Models Concurrent Models, Specialized Process Models, Formal Methods Model, Unified Process, Agility Principles, Extreme Programming (XP), Scrum

Tools Mapping: Scrum boards (Trello), Agile tools (Jira), UML tools (draw.io)		
Unit II	**Requirements Engineering & Modeling**	**08 Hours**
Requirements Engineering, Eliciting Requirements, Collaborative Requirements Gathering, Quality Function Deployment (QFD), Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements, Scenario-Based Modeling, UML Models, Activity Diagram, Swim-lane Diagrams, Class-Based Modeling, Flow-Oriented Modeling, Behaviora Modeling, State Machine Diagram (with orthogonal states), Requirements Modeling for Web Applications Software Requirements Specification (SRS) **Tools Mapping:** StarUML, draw.io, Lucidchart		
Unit III	**Project Planning and Management**	**08 Hours**
Project Planning Process, Software Scope Definition & Feasibility Analysis, Resource Management, Reusable & Environmental Resources, Software Project Estimation, Decomposition Techniques, Software Sizing Problem-Based Estimation, LOC-Based Estimation, Function Point (FP) Estimation, Object Point (OP) Estimation, Process-Based Estimation, Use-Case-Based Estimation, Reconciling Estimates, Empirical Estimation Models, Structure of Estimation Models, COCOMO II Model, Requirement Traceability Matrix (RTM)		
Unit IV	**Risk and Configuration Management**	**08 Hours**
Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risk Monitoring & Management, RMMM Plan, Software Configuration Management Concepts, SCM Repository, SCM Process Configuration Management for Software Systems.		
Unit V	**Software Testing**	**08 Hours**
Software Testing Fundamentals, Testing Principles, Strategic Approach to Software Testing, Test Strategies of Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for Web Applications Validation Testing, System Testing, White-Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Model-Based Testing, Testing for Specialized Environments & Architectures, Object-Oriented Testing Strategies, Object-Oriented Testing Methods, Test Cases and Class Hierarchy, Testing Concepts for Web Applications, Testing Process Overview, Test Plan, User Interface Testing, Positive Testing & Negative Testing, Art of Debugging **Tools Mapping:** JUnit, Selenium, Postman		
	Total Hours	**40**
Course Activities for Continuous Comprehensive Assessment (CCA): ***(Any Two)***		
CCA1		**10 Marks**
List of Course Activity 1. The Software Process understanding in detail. 2. Study of Generic Process Model, Prescriptive Process Models, Waterfall Model 3. Incremental Process Model diagram and study 4. Evolutionary Process 5. Agility Principles, Extreme Programming (XP), Scrum **Tools Mapping**: Scrum boards (Trello), Agile tools (Jira), UML tools (draw.io)		
CCA2		**10 Marks**
Case Study/Survey • **Tools Mapping**: Get/GitHub, Engine, Puppet • **Tools Mapping:** Projectile, Gantt Project, Avanti • **Tools Mapping**: StarUML, draw.io, Lucidchart		

CCA3	10 Marks

Group Discussion / Seminar / Blog Writing

- Seminar on software phases.
- Seminar on Testing
- Seminar Software development model

Text Books

1. Roger S Pressman “Software Engineering: A Practitioner’s Approach “7 th Edition McGraw- Hill ISBN:0073375977.
2. Ian Somerville “ Software Engineering” 9th edition Pearson Education SBN-13: 978- 0- 13-703515-1, ISBN-10: 0-13-703515-2 , pdf downloadable

Reference Books

1. Pankaj Jaluit “An Integrated Approach to Software Engineering” 3rd Edition Nervosa Publication ISBN: 81-7319-702-4 pdf down loadable
2. Rajiv Mall “Fundamentals of Software Engineering” 3rd edition PHI.

Online References

MOOC / NPTEL Courses:

1. Software Engineering, by Prof. Rajiv Mall, IIT Kharagpur https://nptel.ac.in/courses/106105182

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC): Database Management System									**Course Code: 2COPCC205**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. To introduce the core principles and architectures of database systems.
2. To enhance SQL and PL/SQL skills for efficient database querying.
3. To apply normalization techniques for designing well-structured relational databases.
4. To make students familiar with the basic issues of transaction processing and concurrency control.
5. To explain and apply different NoSQL and MongoDB concepts.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Describe the fundamentals of database management systems, including data models, ER modeling, and database design.
CO2. Demonstrate the use of SQL and PL/SQL for managing and manipulating relational data.
CO3. Apply normalization techniques to enhance database design and maintain data integrity.
CO4. Analyze transaction management concepts and concurrency control techniques to ensure reliable database systems.
CO5. Approach different NoSQL database types and explain their suitability for managing unstructured data.

Course Contents

Unit I	**Introduction to Database System and ER Modeling**	**08 Hours**

Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.
Case Study: Study of Architecture of any DBMS like Oracle or MySQL.

Unit II	**SQL/PL SQL**	**08 Hours**

SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Updating, SQL DML Queries: SELECT Query and clauses, Views: Creating, Dropping, Updating using Indexes, Set Operations, Predicates

and Joins, set membership, Tuple Variables, set comparison, Ordering of Tuples, Aggregate Functions, SQL Functions, Nested Queries.
PL/SQL: Control Statement, Cursor, Stored Procedure and Function, Trigger, Embedded SQL, Dynamic SQL

Unit III	**Relational Database Design**	**08 Hours**

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity, Referential Integrities, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, 2NF, 3NF, BCNF.
Case study: Relational Database Design and Optimization for Hospital Management

Unit IV	**Database Transactions**	**08 Hours**

Transaction concept, Transaction states, ACID properties, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Lock-based, Time-stamp based Deadlock handling, Recovery methods: Shadow- Paging and Log-Based Recovery
Case study: Design Online Shopping Cart Transaction Management In an e-commerce platform, multiple users simultaneously add, update, and purchase products. To ensure data consistency and reliability, the system must handle concurrent transactions effectively

Unit V	**NoSQL Database**	**08 Hours**

Introduction to Distributed Database System- Advantages, disadvantages, CAP Theorem. Types of Data: Structured, Unstructured data & Semi-Structured Data; NoSQL Database: Introduction, need, Features, Types of NoSQL Databases: Key-value store, document store, graph, wide column stores; BASE Properties, Data Consistency model ACID Vs BASE, Comparative study of RDBMS and NoSQL, MongoDB (with syntax and usage): CRUD Operations, Aggregation.
Case study: Study NoSQL Database Selection for a Smart Farming System.

	Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA): ***(Any Two)***

CCA1	**10 Marks**

List of Course Activity

1. Study on Database Languages and Database System Structure
2. Study on Data Models and Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys
3. Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.
4. Study of Architecture of any DBMS like Oracle or MySQL

CCA2	**10 Marks**

Case Study/Survey

- **Case Study**: Study of Architecture of any DBMS like Oracle or MySQL
- **Case study:** Study NoSQL Database Selection for a Smart Farming System.
- **Case study:** Design Online Shopping Cart Transaction Management In an e-commerce platform, multiple users simultaneously add, update, and purchase products. To ensure data consistency and reliability, the system must handle concurrent transactions effectively

CCA3	**10 Marks**

Group Discussion / Seminar / Blog Writing

1. Study on DBMAs

2. Seminar on SQL
3. Seminar on NoSql
4. Study on types of DBMS

Text Books

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 7th Edition, 2020 ISBN 978-0-07-802215-9.
2. Ivan Bayross, "SQL, PL/SQL the Programming Language of Oracle", BPB Publications, 2014 ISBN: 9788176569644.
3. Pramod J. Sadalage and Martin Fowler, "NoSQL Distilled", Addison Wesley, ISBN 10: 0321826620, 2013, ISBN 13: 978-0321826626.

Reference Books

1. C. J. Date, "An Introduction to Database Systems", Addison-Wesley, 8th Edition, 2004, ISBN 0321189566.
2. S. K. Singh, "Database Systems: Concepts, Design and Application", Pearson Education,2009, ISBN 9788177585674.Kristina Chodorow, Michael Dierolf, "MongoDB: The Definitive Guide", O"Reilly Publications, 3rd Edition, 2019 ISBN 9781491954461.

Online References

NPTEL Courses:

1. Introduction to Database Systems, by Prof. Sreenivasa Kumar, IIT Madras https://nptel.ac.in/courses/106106220
2. Data Base Management System, by Prof Dass, IIT Kanpur: http://digimat.in/nptel/courses/video/106105175/L01.html

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC): Advanced Data Structures (ADS)									**Course Code: 25COPCC206**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Programming and Problem Solving , Fundamentals of Programming Languages

Course Objectives:

1. To develop a logic for graphical modeling of real-life problems.
2. To suggest appropriate data structure and algorithm for graphical solutions of the problems.
3. To understand advanced data structures to solve complex problems in various domains.
4. To operate on the various structured data to build the logic to use appropriate data structure in logical and computational solutions.
5. To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

At the end of the course, students will be able to:

CO1. To apply appropriate advanced data structure and efficient algorithms to approach the problems of various domains.

CO2. To design the algorithms to solve the programming problems.

CO3. To use effective and efficient data structures in solving various Computer Engineering domain problems.

CO4. To analyze the algorithmic solutions for resource requirements and optimization

CO5. To use appropriate modern tools to understand and analyze the functionalities confined to the data structure usage.

Course Contents

Unit I	**Searching and Sorting**	**08 Hours**

Searching- Search Techniques, Sequential search, variant of sequential search- sentinel search, Binary search, Fibonacci search.

Sorting- Types of Sorting-Internal and external sorting, General sort concepts-sort order, stability, efficiency, number of passes, Sorting methods- Bubble sort, Insertion sort, Selection sort, Quick sort, Heap sort, Shell sort, Bucket sort, Radix sort, Comparison of All Sorting Methods.

Unit II	**Trees**	**08 Hours**

Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals- in order, preorder, post order, level wise -depth first and breadth first, Operations on binary tree. Binary Search Tree (BST).

BST operations, threaded binary tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary tree, in order traversal of in-order threaded binary tree.

Case Study- Use of binary tree in expression tree-evaluation and Huffman's coding

Unit III	**Linked Lists**	**08 Hours**

Concept, Comparison of sequential and linked organizations, Primitive operations, Realization of Linked Lists, Realization of linked list using arrays, Dynamic Memory Management, Linked list using dynamic memory management, Linked List Abstract Data Type, Linked list operations, Head pointer and header node, Types of linked list- Linear and circular linked lists, Doubly Linked List and operations, Circular Linked List, Singly circular linked list, Doubly circular linked list, Polynomial Manipulations - Polynomial addition, Multiplication of two polynomials using linked list. Generalized Linked List (GLL) concept, representation of polynomials and sets using GLL.
Case Study- Garbage Collection.

Unit IV	**Graphs**	**08 Hours**

Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Introduction to Greedy Strategy, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dijkstra's Single source shortest path, Topological ordering.
Case study- Data structure used in Webgraph and Google map.

Unit V	**Hashing**	**08 Hours**

Hash Table- Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing. Dictionary- Dictionary as ADT, ordered dictionaries. Skip List-representation, searching and operations- insertion, removal.

Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA): ***(Any Two)***

CCA1	**10 Marks**

List of Course Activity

1. Comparison of sequential and linked organizations
2. Dynamic Memory Management, linked list using dynamic memory management.
3. Implementation of Linked list operations
4. Implementation of Doubly circular linked list
5. Polynomial Manipulations - Polynomial addition, Multiplication of two polynomials using linked list.
6. Generalized Linked List (GLL) concept, representation of polynomials and sets using GLL.

CCA2	**10 Marks**

Case Study/Survey

- **Case study-** Data structure used in Webgraph and Google map.
- **Case Study-** Use of binary tree in expression tree-evaluation and Huffman's coding
- **Case Study-** Use of Garbage Collection

CCA3	**10 Marks**

Group Discussion / Seminar / Blog Writing

1. Seminar on abstract data.
2. Seminar on Searching algorithm
3. Seminar on memory management using different data structures.

Text Books

1. Advanced Data Structures, by Peter Brass, **Publisher:** Cambridge University Press, **Publication date,** 25 January 2011 **ISBN,**9780511800191.
2. Advanced Algorithms and Data Structures, Marcello La Rocca, May 2021, ISBN 9781617295485

Reference Books

1. Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, Career Monk Publications
2. Fundamentals of Data Structures: DS

Online References

1. Programming and Data Structures, by Prof. Narayanaswamy, IIT, Madras, https://nptel.ac.in/courses/106106130
2. Programming, Data Structures and Algorithms Using Python, by Prof. Madhavan Mukund, Chennai Mathematical Institute https://nptel.ac.in/courses/106106145
3. Data Structures and Algorithms Design, by Nitin Saxena, IIT Kanpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs81

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (MDM-II): Microprocessor (Multidisciplinary Minor-II)									**Course Code: 25COMDM202**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic knowledge of digital electronics, computer organization, number systems, fundamentals of microprocessors (8085/8086), and programming concepts.

Course Objectives:

1. Understand basic architecture of microprocessor and instruction set.
2. Learn system architecture, bus cycles, and I/O organization.
3. Understand memory management (segmentation & paging).
4. Learn protection mechanisms and privilege levels.
5. Understand multitasking, interrupts, and microcontrollers.

Course Outcomes:

At the end of the course, students will be able to:

1. **CO1**: Understand the architecture, features, programmer's model,
2. **CO2:** Analyze bus cycles, system architecture, pin configuration, memory organization, and I/O operations of the 80386 system.
3. **CO3:** Apply concepts of memory management including segmentation, paging, descriptor tables.
4. **CO4:** Evaluate protection mechanisms such as privilege level instructions.
5. **CO5:** Understand and analyze multitasking, task switching, virtual 8086 mode, interrupts, exceptions, and basics of microcontrollers..

Course Contents

Unit I	**Introduction to 80386 and Instruction Set**	**06 Hours**

Brief History of microprocessors, 80386 DX Features and Architecture, Programmers Model, Operating Modes, Addressing Modes and Data Types. Applications Instruction Set: Data Movement Instructions, Binary Arithmetic Instructions, Decimal Arithmetic Instructions, Logical Instructions, Control Transfer Instructions, String and Character Transfer Instructions, Instructions for Block Structured Language, Flag Control Instructions, Coprocessor Interface Instructions, Segment Register Instructions, Miscellaneous Instructions.

Unit II	**Bus Cycles and System Architecture**	**06 Hours**

Initialization – Processor State after Reset, Functional Pin Diagram, Functionality of Various Pins, I/O Organization, Memory Organization (Memory Banks), Basic Memory Read and Write Cycles with Timing Diagram. Systems Architecture – System Registers (System Flags, Memory Management Registers, Control Registers, Debug Registers, Test Registers), System Instructions.

Unit III	Memory Management	06 Hours
Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, GDTR, LDTR, IDTR. Formats of Descriptors and Selector, Segment Translation, Page Translation, Combining Segment and Page Translation..		
Unit IV	**Protection Mechanisms**	**06 Hours**
Need of Protection, Overview of 80386DX Protection Mechanisms: Protection Rings and Levels, Privileged Instructions, Concept of DPL, CPL, RPL, EPL. Inter-Privilege Level Transfers using Call Gates, Conforming Code Segment, Privilege Levels and Stacks, Page Level Protection, Combining Segment and Page Level Protection.		
Unit V	**Synchronous Sequential Circuit Design & HDL**	**06 Hours**
Multitasking – Task State Segment, TSS Descriptor, Task Register, Task Gate Descriptor, Task Switching, Task Linking, Task Address Space. Virtual Mode – Features, Memory Management in Virtual Mode, Entering and Leaving Virtual Mode. Interrupts and Exceptions: Identifying Interrupts, Enabling and Disabling Interrupts, Priority among Simultaneous Interrupts and Exceptions, Interrupt Descriptor Table (IDT), IDT Descriptors, Interrupt Tasks and Interrupt Procedures, Error Code and Exception Conditions. Introduction to Microcontrollers: Architecture of Typical Microcontroller, Difference between Microprocessor and Microcontroller, Characteristics of Microcontrollers, Applications of Microcontrollers.		
	Total Hours	**30**

Course Activities for Continuous Comprehensive Assessment (CCA): *(Any 2)*

CCA1 — **10 Marks**

Application Based Course Activities (any one)

1. List the microprocessors and detail study on family of microprocessor.
2. Draw Functional Pin Diagram and list Functionality of Various Pins
3. Enlist and explain Interrupts and Descriptors

CCA2 — **10 Marks**

List of Case Study:

1. **Case Studies:** Detail study on any five interrupts uses.
2. **Case Studies:** Study of CPL, RPL, EPL with diagrams.
3. **Case Studies**: Protection Mechanisms of any microprocessor

CCA3 — **10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Barry B. Brey, “The Intel Microprocessors: Architecture, Programming and Interfacing”, Pearson Education.
2. Douglas V. Hall, “Microprocessors and Interfacing: Programming and Hardware”, Tata McGraw-Hill.
3. Walter A. Triebel & Avtar Singh, “The 8088 and 8086 Microprocessors: Programming, Interfacing,
Software, Hardware and Applications”, Pearson.

4. Yu-Cheng Liu & Glenn A. Gibson, “Microcomputer Systems: The 8086/8088 Family – Architecture,
Programming and Design”, Pearson.

Reference Books

1. 80386 Microprocessor Handbook, Osborne McGraw-Hill.
2. Microprocessors: The 8086/8088, 80186/80286, 80386/80486 and the Pentium Family, PHI Learning.
3. Microprocessors and Microcomputer-Based System Design, CRC Press.
4. Microprocessors and Multicore Systems, Technical Publications.
5. The Intel Microprocessors, Pearson (for advanced reference).

Online References

MOOC / NPTEL Courses:

1. Microprocessors and Microcontrollers, IIT Kharagpur, Prof. Santanu Chattopadhyay: https://nptel.ac.in/courses/108105102
2. Microprocessors and Microcontrollers, IISc Bangalore, Prof. Krishna Kumar: https://nptel.ac.in/courses/106108100

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 1): Leadership and Team Dynamics									**Course Code: 25OEC202A**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic communication and interpersonal skills

Course Objectives:

1. Introduce concepts of leadership, organizational behavior, and group dynamics.
2. Develop communication, interpersonal, and collaborative leadership skills.
3. Explain leadership styles, motivation theories, and team processes.
4. Enhance conflict resolution, negotiation, and decision-making abilities.
5. Prepare students for leadership roles in multicultural and multidisciplinary organizations.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain leadership theories, organizational behavior, and group dynamics concepts.

CO2. Apply communication and interpersonal skills in team environments.

CO3. Analyze leadership styles, group processes, and motivational approaches.

CO4. Evaluate team effectiveness, conflict management, ethics, and leadership challenges.

CO5. Develop leadership strategies for professional and global organizational environments.

Course Contents

Unit I	**Foundations of Leadership and Organizational Behaviour**	**06 Hours**

Introduction to leadership and team management
Leadership versus management
Leadership myths and leadership development
Organizational behavior fundamentals
Groups and types of groups
Stages of group development
Emotional intelligence and self-awareness.

Unit II	**Leadership Theories and Leadership Development**	**06 Hours**

Trait and behavioral leadership theories
Situational and contingency leadership models
Path-goal theory and Leader-Member Exchange (LMX) theory
Transformational and transactional leadership
Power, influence, and persuasion
Leadership ethics, values, and credibility.

Unit III	**Communication, Motivation, and Interpersonal Behaviour**	**06 Hours**

Communication process and barriers
Verbal and non-verbal communication
Social networks, rumors, and grapevine

Motivation theories and leadership
Transactional analysis and JOHARI Window
Coaching, mentoring, and feedback mechanisms.

Unit IV	Team Dynamics and Conflict Management	06 Hours

Group dynamics and team processes
Team formation and team effectiveness
Cooperation, competition, and cohesiveness
Delegation and empowerment
Conflict management and negotiation
Virtual and multicultural teams.

Unit V	Organizational Ethics and High-Performance Leadership	06 Hours

Organizational justice and ethical behavior
Corporate Social Responsibility (CSR)
Positive organizational scholarship
Building trust and credibility in teams
High-performance team development
Global leadership and leadership challenges in modern organizations

Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Leadership Style Role Play**
   Students perform role plays demonstrating different leadership styles, communication approaches, and conflict management situations.
2. **Team Building & Group Dynamics Activity**
   Practical activities/games to study teamwork, cooperation, delegation, trust-building, and group decision-making.
3. **Case Study Analysis on Organizational Behaviour**
   Analyze real-life organizational situations related to motivation, leadership challenges, ethics, or team conflicts and present solutions.
4. **Communication & Negotiation Workshop**
   Hands-on practice sessions on verbal/non-verbal communication, negotiation skills, feedback mechanisms, and interpersonal behaviour.
5. **Self-Assessment & Leadership Development Report**
   Students prepare a report based on personality tests, emotional intelligence assessment, JOHARI window, or leadership skill evaluation with improvement plans.

Text Books

1. Hughes, R.L., Gannett, R.C., & Murphy, G.J., Leadership: Enhancing the Lessons of Experience, 9th Edition, McGraw Hill Education, 2019.

Reference Books

1. Robbins, S.P., Judge, T.A. & Vohra, N., Organizational Behavior, 18th Edition, Pearson Education, 2019.
2. Parke, U. & Khanna, S., Understanding Organizational Behavior, 4th Edition, Oxford University Press, 2018.

3. Greenberg, J. & Baron, R., Behavior in Organizations, 10th Edition, Pearson-Prentice Hall, 2009.
4. Lathan's, F., Organizational Behavior, 10th Edition, McGraw-Hill, 2004.
5. Cameron, K.S. & Spritzer, G.M., The Oxford Handbook of Positive Organizational Scholarship, Oxford University Press, 2012.
6. Baron, R.A. & Byrne, D., Social Psychology, 10th Edition, Pearson Education, 2004.

Online Resources

1. Organizational Behaviour: Individual Dynamics in Organization by Prof. Abraham Cyril Isaac: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg20
2. Leadership and Team Effectiveness by Prof. Santosh Rangnekar: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg39
3. Leadership & Management: https://swayam-plus.swayam2.ac.in/courses/course-details?id=F_WADHW_26
4. Harvard Business Review Leadership Resources: https://hbr.org/topic/subject/leadership-and-managing-people
5. https://www.edx.org/learn/leadership

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 2): Green Practices & ESG Frameworks									**Course Code: 25OEC202B**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic knowledge of environmental science and sustainability, Understanding of industrial processes and resource utilization, Basic awareness of corporate management and ethics

Course Objectives:

1. To introduce the principles of sustainability and green practices in engineering and industry.
2. To understand Environmental, Social, and Governance (ESG) frameworks used in modern organizations.
3. To analyze environmental impacts and promote sustainable resource management.
4. To study social responsibility and governance practices for sustainable development.
5. To apply ESG reporting standards and sustainability assessment tools in organizations.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the concepts of sustainability, green practices, and ESG frameworks.

CO2. Analyze environmental impacts and adopt green technologies for sustainable development.

CO3. Evaluate social responsibility and stakeholder engagement practices in organizations.

CO4. Understand governance principles, ethical leadership, and regulatory frameworks.

CO5. Apply ESG reporting standards and sustainability assessment methods in industries.

Course Contents

Unit I	**Fundamentals of Sustainability and Green Practices**	**06 Hours**

Concept of sustainability and sustainable development, Environmental challenges: climate change, global warming, biodiversity loss, resource depletion, Principles of green practices and environmental responsibility, Green economy and circular economy concepts, Sustainable Development Goals (SDGs) and global sustainability initiatives, Sustainable consumption and production patterns, Role of engineering and technology in sustainable development, Importance of green practices in industrial and organizational activities.

Unit II	**Environmental Sustainability and Green Technologies**	**06 Hours**

Environmental sustainability and environmental protection strategies, Environmental Impact Assessment (EIA) and its importance, Carbon footprint analysis and greenhouse gas emissions, Carbon management strategies and carbon neutrality initiatives, Renewable energy technologies: solar, wind, hydro, biomass, Energy efficiency and energy conservation methods, Waste management techniques: reduce, reuse, recycle (3R concept), Water resource management and pollution control, Green manufacturing, eco-friendly materials, and cleaner production technologies.

Unit III	Social Responsibility and Sustainable Development	06 Hours
Concept and importance of Corporate Social Responsibility (CSR), Employee welfare, workplace health, and safety standards, Labor rights and fair working conditions, Diversity, equity, and inclusion in organizations, Stakeholder engagement and community development initiatives, social impact assessment and community sustainability programs, Ethical business conduct and responsible supply chain management, Role of organizations in social and economic development.		
Unit IV	**Governance and Ethical Business Practices**	**06 Hours**
Concept and principles of corporate governance, Governance structures and roles of board of directors, Transparency, accountability, and ethical leadership, Risk management and compliance mechanisms, Business ethics and anti-corruption policies, Legal and regulatory frameworks related to corporate governance, Sustainability governance and corporate responsibility policies, Governance practices for long-term organizational sustainability.		
Unit V	**ESG Reporting, Assessment, and Implementation**	**06 Hours**
Introduction to ESG metrics and sustainability performance indicators, ESG reporting frameworks and standards, Global Reporting Initiative (GRI) guidelines, Integrated reporting and sustainability disclosure practices, ESG ratings, benchmarking, and performance evaluation, Green finance, sustainable investments, and climate finance, Implementation of ESG strategies in organizations, Challenges in ESG adoption and reporting, Case studies of ESG implementation in industries and multinational companies.		
	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Campus Green Audit & Waste Segregation Study**
   Students conduct a sustainability audit of the campus/department by analyzing waste generation, segregation practices, energy usage, and water consumption. Submit findings with improvement recommendations.
2. **Carbon Footprint Calculation Project**
   Students calculate the carbon footprint of a household, classroom, or small organization using standard carbon calculators and prepare a report suggesting carbon reduction strategies.
3. **ESG Reporting Case Analysis**
   Students select a company and study its ESG or sustainability report (based on GRI/SDG framework). Prepare a presentation evaluating environmental, social, and governance practices.
4. **Sustainable Product / Process Design Activity**
   Teams design an eco-friendly product, packaging solution, or green operational process applying principles of reduce–reuse–recycle and resource efficiency.
5. **Community Awareness & Social Responsibility Campaign**
   Organize and document an awareness activity such as tree plantation, plastic-free drive, energy conservation campaign, or social impact survey, followed by submission of outcomes and reflections.

Text Books

1. Understanding Sustainability Principles and ESG Policies: Colin Read, Springer Nature, Year: 2023
2. The ESG and Sustainability Deskbook for Business, Kristyn Noeth, Springer, 2024

Reference Books

1. Values at Work: Sustainable Investing and ESG Reporting, Daniel C. Esty, Todd Cort, Palgrave Macmillan, Year: 2020
2. Business Responsibility and Sustainability in India, Bimal Arora, Pawan Budhwar, Divya Jyoti Publisher: Palgrave Macmillan, Year: 2019
3. Looking at and Beyond Corporate Governance in India, Authors: Seema Joshi, Ruchi Kansil Publisher: Springer / Palgrave Macmillan Year: 2023
4. Dharmanomics: An Indigenous and Sustainable Economic Model, Author: Sriram Balasubramanian Publisher: Bloomsbury India, Year: 2024

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 3): Innovation and Business Strategy									**Course Code: 25OEC202C**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic understanding of technology, creativity, and problem-solving concepts.

Course Objectives:

1. Introduce concepts of innovation, creativity, and business strategy.
2. Develop strategic thinking and innovation management skills.
3. Explain business models, entrepreneurship, and technology innovation processes.
4. Familiarize students with sustainability, intellectual property rights, and innovation ecosystems.
5. Prepare students for innovation-driven business and entrepreneurial environments.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain concepts of innovation, creativity, and business strategy.

CO2. Apply innovation management and strategic thinking tools for business problem-solving.

CO3. Analyze business models, technology innovation, and entrepreneurial strategies.

CO4. Evaluate sustainability, intellectual property, and innovation management practices.

CO5. Develop innovative business solutions and strategic growth approaches.

Course Contents

Unit I	**Foundations of Innovation and Creativity**	**06 Hours**

Innovation and creativity: concepts and importance
Innovation in the current business environment
Types of innovation
Schools of innovation
Challenges of innovation
Divergent and convergent thinking

Unit II	**Innovation Management and Design Thinking**	**06 Hours**

Innovation management process
Idea management systems
Design thinking and entrepreneurship
Experimentation and prototyping
Co-creation and idea championship
Incubation and entrepreneurship ecosystems.

Unit III	**Business Models and Strategic Innovation**	**06 Hours**

Business models and value proposition
Entrepreneurship and social entrepreneurship

Blue Ocean Strategy
Strategic positioning and competitive advantage
Business model failure: reasons and remedies
Innovation-driven business growth

Unit IV	**Technology Innovation and Intellectual Property Rights**	**06 Hours**

Technology innovation process
Technology forecasting and planning
Technological innovation management strategies
Management of innovation
Intellectual Property Rights (IPR)
Patents, copyrights, and patents in India.

Unit V	**Sustainable Innovation and Future Business Trends**	**06 Hours**

Sustainability innovation and entrepreneurship
Innovation for sustainable development
SME involvement in sustainability
Material efficiency and sustainable business models
Managing investors for innovation
Future markets and innovation opportunities for India

	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Innovation Idea Pitch Presentation**
   Students identify a real-world problem and present an innovative product, service, or business solution using creativity and design thinking tools.
2. **Business Model Canvas Workshop**
   Teams prepare a Business Model Canvas for a startup or sustainable business idea, explaining value proposition, customer segments, revenue streams, and competitive advantage.
3. **Prototype Development & Demonstration**
   Students create a basic prototype/mock-up of an innovative product or digital solution and demonstrate its functionality and market relevance.
4. **Case Study Analysis on Successful Innovations**
   Analyse companies known for innovation and strategy (e.g., startups or technology firms) and present factors behind their success, business strategy, and innovation practices.
5. **IPR & Patent Search Activity**
   Students perform a patent/trademark search related to a chosen innovation area and prepare a short report on intellectual property protection and commercialization opportunities.

Text Books

1. Krishnan, R.T. & Dabholkar, V., 8 Steps to Innovation: Going from Jugaad to Excellence, HarperCollins India.

Reference Books

1. Drucker, Peter F., Innovation and Entrepreneurship, Routledge.
2. Harvard Business Review Series, Innovation and Entrepreneurship, Harvard Business School Publishing.
3. Osterwalder, A. & Pigneur, Y., Business Model Generation, Wiley.

4. Kim, W. Chan & Mauborgne, Renée, Blue Ocean Strategy, Harvard Business Review Press.
5. Tidd, J. & Bessant, J., Managing Innovation, Wiley Publications.

Online Resources

1. Innovation Business Models and Entrepreneurship by Prof. Vinay Sharma, Prof. Rajat Agrawal https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
2. Entrepreneurship & IP strategy by Prof. Gouri Gargate: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_hs213
3. Managing Innovation by Rishikesha T Krishnan and Vinay Dabholkar: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb19_mg05
4. Business Strategy Specialization by University of Virginia: https://www.coursera.org/specializations/business-strategy
5. Design Thinking for Beginners: Develop Innovative Ideas (Udemy): https://www.udemy.com/course/design-thinking-for-beginners/?couponCode=PMNVD2025
6. Strategic Management Resources: https://www.hbsp.harvard.edu/catalog/collections/strategic-management-resources
7. https://www.edx.org/learn/innovation

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 4): Stress Management and Mental Well Being									**Course Code: 25OEC202D**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

Basic awareness about personal health, emotions, and daily life challenges.

Course Objectives:

1. To introduce the concept of stress, mental health, and wellbeing.
2. To help students identify stressors in academic and professional life.
3. To develop effective coping strategies and stress management skills.
4. To promote emotional intelligence and resilience.
5. To encourage healthy lifestyle habits for long-term wellbeing.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the concepts of stress, mental health, and wellbeing

CO2. Identify sources of stress and analyze their impact

CO3. Apply stress management techniques

CO4. Demonstrate emotional intelligence and coping strategies

CO5. Design a personal wellbeing and stress management plan.

Course Contents

Unit I	**Fundamentals of Stress and Mental Health**	**06 Hours**

Concept and definition of stress and mental wellbeing, Types of stress: Eustress and Distress, Stress response and General Adaptation Syndrome (GAS), Causes and symptoms of stress, Mind–body relationship, Impact of stress on academic performance and productivity. Difference between stress, anxiety, and depression.

Unit II	**Sources of Stress and Emotional Awareness**	**06 Hours**

Academic, professional, social, and personal stressors; Personality types and stress (Type A and Type B personality);
Emotional intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills; Identifying negative thinking patterns.

Unit III	**Stress Management Techniques**	**06 Hours**

Relaxation techniques: Deep breathing, Progressive muscle relaxation; Meditation and mindfulness, Yoga and physical exercises for stress reduction, Time management and goal setting, Positive thinking and cognitive restructuring.

Unit IV	**Mental Wellbeing and Healthy Lifestyle**	**06 Hours**

Importance of sleep, nutrition, and physical activity, managing emotions: anxiety, anger, frustration, Building resilience and self-confidence, Work–life balance, Digital wellbeing and social media stress.

Unit V	**Personal Development and Coping Strategies**	**06 Hours**

Interpersonal communication and relationship management, Coping strategies for change and uncertainty, Conflict management and emotional regulation, Developing a personal wellbeing plan, Case studies on stress management in student and workplace environments.

	Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Stress Diary & Self-Assessment Activity**
   Students maintain a weekly stress journal to identify stress triggers, emotional responses, and coping methods, followed by a reflective analysis report.
2. **Mindfulness and Relaxation Practice Session**
   Conduct guided activities such as meditation, deep breathing, yoga, or progressive muscle relaxation and submit observations on stress reduction outcomes.
3. **Case Study Analysis on Mental Wellbeing**
   Analyse real-life or workplace/student stress management cases and suggest coping strategies, emotional intelligence techniques, and wellbeing solutions.
4. **Work–Life Balance & Digital Wellness Survey**
   Students design and conduct a survey on stress, screen time, sleep, or work–life balance among peers, then present findings with recommendations.
5. **Personal Wellbeing and Stress Management Plan**
   Prepare an individual wellness plan including fitness, sleep, nutrition, time management, and emotional wellbeing strategies for long-term mental health improvement.

Text Books

1. Leahy, Robert L. The Worry Cure. Three Rivers Press, 2006.
2. Carnegie, Dale. How to Stop Worrying and Start Living. Simon & Schuster, 1948.
3. Johnstone, Matthew. I Had a Black Dog. Robinson Publishing, 2005.

Reference Books

1. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books, 1995.
2. Kabat-Zinn, Jon. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. Hyperion, 1994.
3. Covey, Stephen R. The 7 Habits of Highly Effective People. Free Press, 1989.

Online Resources

1. NPTEL course on Stress Management by Prof. Rajlakshmi Guha, IIT Kharagpur: https://nptel.ac.in/courses/121105009
2. NPTEL course on Psychology of Stress, Health and Well-being by Prof. Dilwar Hussain, IIT Guwahati: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs29

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 5(A)): French Language Module-II									**Course Code: 25OEC202E**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

French Language Module-I.

Course Objectives:

1. To strengthen beginner-level communication skills in French.
2. To improve listening, reading and writing abilities.
3. To develop confidence in practical conversations.
4. To introduce travel and public communication vocabulary.
5. To prepare students for DELF A1 level competency.

Course Outcomes:

At the end of the course, students will be able to:
CO1. Use basic French expressions confidently.
CO2. Understand simple dialogues and instructions.
CO3. Read and write short paragraphs.
CO4. Participate in guided conversations.
CO5. Apply French in practical situations.

Course Contents

Unit I	**Voyages (Travel)**	**06 Hours**

Talking about one's dream travel destination
The near future tense
Prepositions
Giving a reason (parce que / car).

Unit II	**Au magasin… au restaurant (At the store… at the restaurant)**	**06 Hours**

Clothes and accessories
Shopping dialogues
French cuisine and some famous dishes
Restaurant communication

Unit III	**La vie quotidienne (Daily life)**	**06 Hours**

Pronominal verbs
Talk about one's routine
Talk about one's favourite outings
Conversation to plan outings.

Unit IV	**Quand j'était petie …(When I was little…)**	**06 Hours**

Past tense (Le passé compose)

Talk about some activities in the past
Past continuous (L'imparfait)
Talk about one's childhood

Unit V	La francophonie (The French-speaking world)	06 Hours

Francophone countries
Talking about seasons and climate
Expressing emotions
Conversations.

	Total Hours	30

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Shopping Role Play:** Students perform shopping conversations using French vocabulary and expressions.
2. **Restaurant Communication Activity:** Students practice ordering food and interacting in French.
3. **Travel Conversation Simulation:** Students perform dialogues related to travel and directions.
4. **Paragraph Writing in French:** Students write short paragraphs on daily routines or hobbies.
5. **French Culture Presentation:** Students present information on French-speaking countries or traditions.

Text Books

1. Véronique M Kizirian, Emmanuelle Daill, Annie Berthet, Catherine Hugot, "Alter Ego+ (A1)", Hachette, ISBN: 9782011558107, (Goyal Publishers)
2. Nathalie Hirschsprung, Tony Tricot, "Cosmopolite 1-A1", Textbook +Workbook (2 Book Set) (Goyal Publishers), ISBN: 9788194434108.

Reference Books

1. Annie Heminway, "Practice Makes Perfect: Complete French Grammar", McGraw-Hill Education, ISBN-13 : 978-1259642371
2. Claire Miquel, "Vocabulaire progressif du francais - Niveau debutant (A1)", Cle International, ISBN-13 : 978-2090380170, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
3. Evelyne Siréjols, "Communication En Dialogues", CLE international, ISBN: 9782090380637 (Goyal Publishers)
4. Myrna Bell Rochester, "Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast", McGraw Hill, ISBN-13 : 978-0071453875
5. Claire Miquel, "Communication Progressive du Français A1", CLE International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002
6. Ranjit, Mahita & Singh, Monica, Apprenons le frangais', Part 2, Saraswati House Pvt. Ltd.,New Delhi. Second Revised Edition, 2007
7. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le francais) Part 2., Saraswati House Pvt. Ltd.,New Delhi. Second Revised Edition, 2007.

Online Resources

1. The Complete French Course : Learn French – Beginners: https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025
2. Francés Introductorio: https://www.coursera.org/learn/frances-introductorio

3. Français Débutant A1: https://www.coursera.org/learn/french-beginner
4. The Complete French Course : Learn French - Low Intermediate: https://www.udemy.com/course/the-complete-french-course-learn-french-low-intermediate/?couponCode=PMNVD2025
5. Complete French Course: Learn French for Beginners: https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (OE-2) (Basket No 5(B)): German Language Module-II									**Course Code: 25OEC202F**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	20	30	50	-	-	-	100	2	-	-	2

Prerequisite:

German Language Module-I.

Course Objectives:

1. To strengthen beginner-level communication skills in German.
2. To improve reading, writing and listening abilities.
3. To develop confidence in practical conversations.
4. To introduce travel and public communication vocabulary.
5. To prepare students for Goethe A1 level competency.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Use beginner-level German expressions confidently.
CO2. Understand simple dialogues and instructions.
CO3. Read and write short passages.
CO4. Participate in practical conversations.
CO5. Apply German in everyday situations.

Course Contents

Unit I	**Wohnen und Leben (Housing and life)**	**06 Hours**

Topics and Vocabulary

- House (different types of houses and things inside a house)
- Furniture
- Renting

Grammar

- Accusative case
- Definite, Indefinite articles in accusative case
- Accusative case – Personal Pronouns
- Accusative case – Possessive Pronouns

Skills

- Speaking: describe room/home
- Reading: advertisements

Writing: a message to friends to invite for celebration

Unit II	**Stadt und Orientierung (City and Orientation)**	**06 Hours**

Topics and Vocabulary

- Places in city
- Means of transport
- Directions

- Travel
- Planning and hotel booking

Grammar
- Types of sentences and formation- statement, interrogative sentence, imperative sentence
- Past tense formation- haben, sein

Skills
- Speaking: asking/giving directions
- Listening: friends planning a trip
- Writing: My last trip
- Reading: trip blogs and experiences

Activity
- Navigation task

Unit III	**Essen und Trinken (Food and Drink)**	**06 Hours**

Topics and Vocabulary
- Food
- Beverages
- Restaurant expressions
- Shopping and cooking

Grammar
- Perfekt tense introduction - haben/sein
- Adjectives

Skills
- Reading and writing: food blogs
- Speaking: ordering food, expressing likes/dislikes

Activity
- café roleplay

Unit IV	**Gesundheit und Körper (Health and body)**	**06 Hours**

Topics and Vocabulary
- Body parts
- Symptoms
- Medicine

Grammar
- Conjunctions
- Modal auxiliary- function, usage, structure

Skills
- Email writing/ message writing- unable to attend an event because of illness
- Reading- health related small text

Activity
- Doctor-patient conversations

Unit V	**Intercultural Communication (Intercultural Communication)**	**06 Hours**

Topics
- German etiquette
- Punctuality
- University culture
- Workplace culture

Skills
- Intercultural awareness

Formal communication

Total Hours	**30**

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Shopping Role Play:** Students perform shopping conversations using German vocabulary and expressions.
2. **Restaurant Communication Activity:** Students practice food ordering conversations in German.
3. **Travel Conversation Simulation:** Students perform dialogues related to travel situations and directions.
4. **Paragraph Writing in German:** Students write short paragraphs on familiar topics in German.
5. **German Culture Presentation:** Students present information about German-speaking countries and traditions.

Text Books

1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette, ISBN: 9788183077033, (Goyal Publishers)
2. Kurs Und Ubungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers.

Reference Books

1. Martin Durrell, “Hammer's German Grammar and Usage”, Fifth Edition: Volume 1, Hodder Education
2. Harriette Lanzer, Anne Lise Gordon, “German Vocabulary Builder”, OUP Oxford
3. Funk and Kuhn, “Studio D A1Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India).

Online Resources

1. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528
2. Practise German for free (Goethe-Institut Resources): https://www.goethe.de/en/spr/ueb.html
3. Learn German Easily: https://learn-german-easily.com/
4. BBC Languages German: https://www.bbc.co.uk/languages/german/
5. Gothe Exam A1 practice material: https://www.goethe.de/ins/mm/en/spr/prf/gzsd1/ueb.html
6. Best Way to Learn German Language: Full Beginner (A1.1): https://www.udemy.com/course/best-way-to-learn-german-full-beginner-starter-kit/?couponCode=PMNVD2025
7. Best Way to Learn German Language: Beginner Level 2 (A1.2) : https://www.udemy.com/course/learn-german-for-the-advancing-beginner-a1-a2/?couponCode=PMNVD2025

Course: Japanese Language Module-II			Code: 25OEC202G	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Japanese Language Module-I

- **Course Objectives:**
  1. To strengthen beginner-level Japanese communication skills.
  2. To improve reading and writing abilities in Japanese.
  3. To develop confidence in practical conversations.
  4. To introduce travel and public communication vocabulary.
  5. Learn about Japanese festivals, food and travel.

- **Course Outcomes:** At the end of the course, students will be able to
  - CO 1. Communicate using beginner-level Japanese expressions.
  - CO 2. Understand short dialogues and passages.
  - CO 3. Read and write basic Japanese sentences.
  - CO 4. Participate in practical conversations.
  - CO 5. Apply Japanese in everyday situations.

- **Course Contents:**

Unit I	Kihon bunpō (tsudzuki) (Basic Grammar Continuation)	8 Hours
Katakana, Adjectives types, Particle usage, Katakana Pronunciation		

Unit II	Jissen-tekina komyunikēshon (Practical Communication)	4 Hours
Culture & Etiquette, Asking directions, Basic Communication		

Unit III	Risuningu to supīkingu no sukiru (Listening and Speaking Skills)	6 Hours
Pronunciation improvement, Listening comprehension, Dialogue practice, Group conversation		

Unit IV	Yomikaki (Reading and Writing)	6 Hours
Numbers, Dates & Time, Vocabulary enhancement, Translation practice		

Unit V	Bunka-teki oyobi shakai-teki komyunikēshon (Cultural and Social Communication)	6 Hours
Japanese culture and etiquette, social conversations, Telephone communication, Presentation activities		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. Shopping Role Play: Students perform shopping conversations using Japanese vocabulary and expressions.
  2. **Restaurant Communication Activity:** Students practice ordering food and basic interaction in Japanese.
  3. **Travel Conversation Simulation:** Students perform dialogues related to travel and directions in Japanese.
  4. **Paragraph Writing in Japanese:** Students write short paragraphs on daily routines or hobbies.
  5. **Japanese Culture Presentation:** Students present information about Japanese traditions or festivals.

- **Text Books:**

1. 3A Corporation, “Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary”, ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India
2. Banno Eri, “Genki: An Integrated Course in Elementary Japanese II Textbook [third Edition]”, ISBN-13 : 978-4789017329, Japan Times

- **Reference Books:**

1. The Japan Foundation, “Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities”, Goyal Publishers
2. The Japan Foundation, “Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences”, Goyal Publishers, ISBN-13: 9788183078047
3. The Japan Foundation, “Marugoto Starter (A1) Katsudoo”, Goyal Publishers
4. “Japanese for Busy People,3rd edition”, Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011.,
5. Tae Kim, “A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar”, Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
6. Timothy G. Stout , Kaori Hakone, “Japanese Kanji for Beginners: (JLPT Levels N5 & N4) First Steps to Learn the Basic Japanese Characters”, Tuttle Publishing UK, Verseas Press India Pvt Ltd.

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course
2. JF-Japanese e-learning: https://minato-jf.jp/
3. Introduction to Japanese Langauge: Prof Vatsala Misra (NPTEL): https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83
4. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online
5. Marugoto online: https://www.marugoto-online.jp/info/
6. JLPT N5 Practice Material: https://www.jlpt.jp/e/samples/sampleindex.html

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC-L): Software Engineering Laboratory										**Course Code: 25COPCC204L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	25	-	25	-	1	-	1

Prerequisite:

Principles of Programming Languages

Course Objectives:

1. To analyses software problems and requirements
2. To model and design software systems
3. To apply testing and risk management techniques.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Ability to analyses requirements
CO2. Ability to model software systems
CO3. Ability to test and manage software projects.

List of Experiments:

Group A

1. Development of Problem Statement Identifying Requirements from Problem Statement
2. Estimation of Project Metrics
3. Identification of Domain Classes

Group B System Modeling & Design (Any three)

4. Modeling UML Use Case Diagrams
5. E-R Modeling
6. State chart and Activity Modeling
7. Modeling UML Class and Sequence Diagrams
8. Modeling Data Flow Diagrams (DFD)

Group C – Testing & Management (Any three)

9. Designing Test Suites
10. Unit Testing and Integration Testing
11. White Box Testing Techniques
12. Black Box Testing Techniques
13. Risk Management

Operating System recommended:

64-bit Open-source Linux or its derivative
Suggested free open source: StarUML,Modelio,SmartDraw
CF Engine Configuration Tool,Puppet Configuration Tool,Selenium,JUni

Virtual Laboratories:
1. https://vlabs.iitkgp.ac.in/coa/ 2. https://erpjietuniverse.in/virtual_lab/Operating_system/labs/index.html 3. https://os-lab-simulator.vercel.app/

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC-L): Database Management System Laboratory										**Course Code: 25COPCC205L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	-	25	25	-	1	-	1

Prerequisite:

Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. To understand and apply the concepts of database design by formulating case studies, creating E-R diagrams, and mapping them to the relational model.
2. To develop and execute SQL queries for creating, modifying, and managing database structures using DDL, DML, DCL, and TCL commands.
3. To implement advanced SQL operations, including aggregate functions, joins, subqueries, views, stored procedures, and triggers, for efficient database management.
4. To explore NoSQL databases by designing and implementing CRUD operations in MongoDB, understanding document-based storage and retrieval.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Apply the concepts of database design by creating E-R diagrams and converting them into relational models

CO2. Develop and execute SQL queries for data manipulation, transaction control, and access management using DCL and TCL commands

CO3. Analyze and implement SQL operations, including joins, views, subqueries, stored procedures, and triggers, to optimize data retrieval and integrity

CO4. Design and Implement CRUD operations in MongoDB, demonstrating an understanding of NoSQL database concepts and their practical applications.

Lab Assignments/Activities:

1. Decide a real time application and formulate a problem statement for the application to be developed. Propose a Conceptual Design using ER features using tools like ERD plus, ER Win etc. (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.) Convert the ER model into a relational model.
2. MySQL Database Operations Implement SQL queries to familiarize students with essential SQL commands in MySQL - to create a new user, create a table considering different data types, Insert, Select, Update, Delete, Drop, Alter, distinct, describe, Truncate command

3. Implementing Data Constraints in MySQL Implement sql queries to provide students with hands-on experience in implementing various data constraints using SQL commands in MySQL. (NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY, and DEFAULT)
4. Exploring SQL Computations done on Table Data and Built-in Functions in MySQL Implement sql queries for different SQL concepts for SQL computation (arithmetic operators, logical operators, pattern matching, IN and NOT IN predicates, and MySQL built-in functions).
5. Exploring SQL Grouping, Database Views Implement SQL queries for different SQL concepts such as grouping data, using the GROUP BY clause, employing the HAVING clause, applying the EXISTS/NOT EXISTS operators, Creating and using Database Views.
6. Subqueries, Join Operations and Set Operations Write SQL queries to demonstrate the different SQL concepts like subqueries, performing various join operations, and using set operators in MySQL.
7. StoredProcedures or Function with Cursors Create and execute stored procedures / function using cursors
8. Database Triggers Implement and test triggers to maintain data integrity in the database.
9. MongoDB Queries: Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc)
10. MongoDB - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable examples using MongoDB.
11. Using the database concepts covered in above assignments, develop an application with the following details:
    - Follow the Software Development Life Cycle and other concepts learnt in the Software Engineering course throughout the implementation.
    - Develop application considering:
    - **Front End:** Java / Perl / PHP / Python / Ruby / .NET / any other language
    - **Back End:** MongoDB / MySQL / Oracle
    - Test and validate the application using Manual / Automation testing.
    - Students should develop the application in a group of 2–3 students and submit the Project Report which will consist of documentation related to different phases of the Software Development Life Cycle:
    - Title of the Project, Abstract, Introduction
    - Software Requirement Specification
    - Conceptual Design using ER features, Relational Model in appropriate normalized form
    - Graphical User Interface, Source Code
    - Testing document
    - Conclusion

Virtual Laboratories:

1. https://dmsl-virtual-lab.vercel.app/
2. https://www.iiitbh.ac.in/dbms-lab
3. https://journals.mriindia.com/index.php/ijeecs/article/view/436

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (PCC-L): Advanced Data Structures Lab										**Course Code: 25COPCC206L**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	25	-	25	-	1	-	1

Prerequisite:

Discrete Mathematics, Data Structures and Algorithms

Course Objectives:

1. Introduces students to the fundamental concepts of algorithms and data structures and their importance in efficient problem solving.
2. To enable students to implement linear data structures using sequential organization such as arrays and perform basic operations on them.
3. To develop practical skills for creating and manipulating different types of linked lists
4. To provide hands-on experience in implementing stack operations and solving problems using stacks.
5. To enable students to implement queue operations and apply queues in solving practical computational problems.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Understand the basic concepts of algorithms and data structures and analyze simple operations.

CO2. Implement linear data structures using sequential memory representation and perform operations such as insertion, deletion and traversal.

CO3. Design and implement singly linked lists and perform various list operations.

CO4. Implement stack data structures and apply them in applications such as expression evaluation

CO5. Implement queue data structures and perform operations such as insertion, deletion and traversal for different applications.

List of Experiments:

Group A

1. A book consists of chapters, chapters consist of sections and sections consist of subsections.
   Construct a tree and print the nodes. Find the time and space requirements of your method.
2. Beginning with an empty binary search tree, construct binary search tree by inserting the values in the order given. After constructing a binary tree -
   Insert new node
   Find number of nodes in longest path Minimum data value found in the tree

Change a tree so that the roles of the left and right pointers are swapped at every node Search a value

3. For given expression eg. a-b*c-d/e+f construct inorder sequence and traverse it using post order traversal (non recursive).
4. Read for the formulas in propositional calculus. Write a function that reads such a formula and creates its binary tree representation. What is the complexity of your function?
5. Given binary tree with n nodes, assign this tree to another [operator=] and then erase all nodes in a binary tree.
6. Convert given binary tree into threaded binary tree. analyse time and space complexity of the algorithm.
7. Consider threading a binary tree using preorder threads rather than in order threads. Design an algorithm for traversal without using stack and analyse its complexity.
8. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.

Group B

9. Write a function to get the number of vertices in an undirected graph and its edges. You may assume that no edge is input twice.
    - Use adjacency list representation of the graph and find runtime of the function
    - Use adjacency matrix representation of the graph and find runtime of the function
10. There are flight paths between cities. If there is a flight between city A and city B, then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list representation of the graph or use adjacency matrix representation of the graph. Justify the storage representation used.
11. You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
12. Tour operator organizes guided bus trips across the Maharashtra. Tourists may have different preferences. Tour operator offers a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by client. On this way, the tourists can see the sights alongside the route travelled from S to F. Client may have preference to choose route. There is a restriction on the routes that the tourists may choose from, the bus has to take a short route from S to F or a route having one distance unit longer than the minimal distance. Two routes from S to F are considered different if there is at least one road from a city A to a city B which is part of one route, but not of the other route.
13. Consider the scheduling problem. n tasks to be scheduled on single processor. Let t1, ..., tn be durations required to execute on single processor is known. The tasks can be executed in any order but one task at a time. Design a greedy algorithm for this problem

and find a schedule that minimizes the total time spent by all the tasks in the system. (The time spent by one is the sum of the waiting time of task and the time spent on its execution.)

Group C

14. Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number.
15. Implement all the functions of a dictionary (ADT) using hashing.
    Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique
    Standard Operations: Insert (key, value), Find(key), Delete(key)
16. For given set of elements create skip list. Find the element in the set that is closest to some given value.
17. The symbol table is generated by compiler. From this perspective, the symbol table is a set of name-attribute pairs. In a symbol table for a compiler, the name is an identifier, and the attributes might include an initial value and a list of lines that use the identifier. Perform the following operations on symbol table:
    - Determine if a particular name is in the table
    - Retrieve the attributes of that name
    - Modify the attributes of that name
    - Insert a new name and its attributes
    - Delete a name and its attributes
18. Given sequence k = k1 <k2 < … < kn of n sorted keys, with a search probability pi for each key ki . Build the Binary search tree that has the least search cost given the access probability for each key.
19. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword

Group E

20. To create ADT that implements the SET concept.
    a. Add (newElement) -Place a value into the set b. Remove (element) Remove the value
    - Contains (element) Return true if element is in collection
    - Size () Return number of values in collection Iterator () Return an iterator used to loop over collection
    - Intersection of two sets, f. Union of two sets, g. Difference between two sets, h. Subset
21. Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject.
    Use heap data structure. analyse the algorithm.

Group F

22. Assume we have two input and two output tapes to perform the sorting. The internal memory can hold and sort m records at a time. Write a program in java for external sorting. Find out time complexity.
23. Department maintains a student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data.
24. Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If it is, then the system displays the employee details. Use index sequential file to maintain the data.

Group G

25. Implement the Heap/Shell sort algorithm implemented in Java demonstrating heap/shell data structure with modularity of programming language.
26. Any application defining scope of Formal parameter, Global parameter, Local parameter accessing mechanism and also relevance to private, public and protected access. Write a Java program which demonstrates the scope rules of the programming mechanism.
27. Write a Java program which will demonstrate a concept of Interfaces and packages: In this assignment design and use of customized interfaces and packages for a specific application are expected.
28. Write a Java program which will demonstrate a concept of cohesion and coupling of the various modules in the program.
29. Write a program on template and exception handling in Java: in this assignment multiple templates are to be designed as a pattern and these patterns to be used to take decisio
30. Write a Java program for the implementation of different data structures using JAVA collection libraries (Standard toolkit library): at least 5 data structures are used to design a suitable application.

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (VSEC): **Web Application Development**									**Course Code:** **25COVSE202**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	2	-	-	-	-	-	-	25	25	-	1	-	1

Prerequisite:

1. Basic knowledge of computer fundamentals and Internet concepts
2. Basic understanding of programming logic and problem-solving
3. Basic knowledge of operating systems and web browsing tools

Course Objectives:

1. To introduce the fundamentals of the Internet, web architecture, and web development technologies.
2. To develop the ability to create structured web pages using Hyper Text Markup Language (HTML).
3. To enable students to design visually appealing and responsive web pages using Cascading Style Sheets (CSS).
4. To provide knowledge of client-side scripting using JavaScript for creating interactive web applications.
5. To develop skills in server-side programming using PHP for handling form data and building dynamic web applications.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the fundamentals of Internet technologies, client–server architecture, and basic concepts of web development.

CO2. Design and develop structured web pages using HTML elements such as tables, images, hyperlinks, and forms.

CO3. Apply CSS and Bootstrap to design visually attractive and responsive web interfaces.

CO4. Develop interactive web pages using JavaScript and manipulate web page elements using the Document Object Model.

CO5. Create dynamic web applications using PHP by processing form data and implementing server-side scripting.

List of Experiments:

1. Create a basic HTML webpage with headings, lists, tables, and images.
2. Design a student registration form using HTML forms.
3. Apply CSS styling to create an attractive webpage.
4. Create a responsive webpage using Bootstrap.
5. Create a responsive webpage using Wordpress
6. Implement JavaScript form validation.
7. Create a dynamic webpage using DOM manipulation

8. Write a JavaScript program for a simple calculator using functions and switch-case.
9. Design a PHP script to display a "Welcome" message and the current date & time.
10. Implement a PHP program for string manipulation (e.g., reverse, length, substring).
11. Create a PHP script to store and display values using arrays.
12. Write a PHP program to accept form input and display it using the POST method.

Text Books:

1. Web Programming with HTML5, CSS, and JavaScript – by John Dean
2. Web Programming with HTML, CSS, Bootstrap, JavaScript, React.JS, PHP, and MySQL – by Larry Sanchez.

Reference Books:

1. Designing with Web Standards – by Jeffrey Zeldman
2. The Web Book:The Ultimate Beginner's Guide to HTML, CSS, JavaScript, PHP and MySQL – by Robert Schifreen
3. PHP, MySQL, JavaScript & HTML5 All-in-One For Dummies – by Steve Suehring and Janet Valade

Online Resources:

1. Modern Application Development – NPTEL, IIT Madras. https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_cs52

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (AEC): **Modern Indian Language (Marathi)**										**Course Code:** **25AEC201A**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
2	-	-	-	-	-	25	25	-	50	2	-	-	2

Course Objectives (अभ्यासक्रमाची उद्दिष्ट्ये):

१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमातील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे
४. लोकशाहीतील **जीवनव्यवहार** आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांची लेखनक्षमता विकसित करणे.

Course Outcomes (अभ्यासक्रम परिणाम):

हा अभ्यासक्रम पूर्ण केल्यानंतर विद्यार्थी पुढील बाबी साध्य करू शकतील :

CO१. मराठी भाषेतील प्रगत भाषिक कौशल्यांचा प्रभावीपणे वापर करून संवाद साधू शकतील.

CO२. प्रसारमाध्यमांतील संज्ञापनाचे विविध प्रकार, स्वरूप व समाजातील त्यांचे स्थान स्पष्ट करू शकतील.

CO३. व्यक्तिमत्त्व विकासामध्ये भाषेचे महत्त्व ओळखून प्रभावी संवादकौशल्य विकसित करू शकतील.

CO४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांतील परस्परसंबंधांचे विश्लेषण करू शकतील.

CO५. प्रसारमाध्यमांसाठी विविध प्रकारचे लेखन कौशल्य आत्मसात करून प्रभावी लेखन करू शकतील.

Course Contents (अभ्यासक्रम विषयवस्तू)

Unit I	**घटक १**	**06 Hours**

मराठी भाषेची आविष्कार रूपे
भाषा आणि व्यक्तिमत्त्व विकास: सहसंबंध
लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे.

Unit II	**घटक २**	**06 Hours**

वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन

आकाशवाणीसाठी भाषणाची संहितालेखन

दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन

समीक्षणात्मक लेखन: पुस्तक समीक्षण, चित्रपट समीक्षण

Unit III	**घटक ३**	**06 Hours**

भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे

नवमाध्यमे आणि समाजमाध्यमांचे प्रकार: ब्लॉग, फेसबुक, ट्विटर

नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर, परिणाम

Unit IV	**घटक ४**	**06 Hours**

वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन, ई-मेल

व्यावहारिक लेखन कौशल्य : अर्जलेखन व पत्रलेखन

Unit IV	**घटक ५**	**06 Hours**

अनुवाद कौशल्य (Translation): इंग्रजी किंवा इतर भाषांमधून मराठीत अनुवाद करणे.

कथा/कादंबरी/संवाद लेखन: सर्जनशील साहित्याची निर्मिती, पटकथा आणि संवाद लेखन.

	Total Hours	**30**

Term Work Evaluation

Subject teacher should frame minimum 10 assignments-based covering on all five units

1. **सारांश लेखन (Summary Writing)**

विद्यार्थ्यांनी उतारा वाचून स्वतःच्या शब्दात एक संक्षिप्त सारांश लिहावा.
Students read a passage and write a **short summary** in their own words.

2. **भाषांतर (Translation Assignment)**

विद्यार्थ्यांनी इंग्रजी भाषेतील मजकूर मराठीमध्ये भाषांतरित करावा.
Students translate text from **English to Marathi**.

Example

- Short technical paragraph translation
- Daily communication sentences

3. **पत्र लेखन (Letter Writing)**

विद्यार्थ्यांनी वेगवेगळ्या प्रकारची औपचारिक व अनौपचारिक पत्रे लिहावी

Types

- औपचारिक पत्र (Formal Letter)
- अनौपचारिक पत्र (Informal Letter)
- अर्ज लेखन

4. **गट्क्रिया (Group Activity)**

विद्यार्थ्यांनी खालीलपैकी एक गट क्रियाकलाप करावा.

Example

- रोड शो
- स्किट प्ले
- एकांकिका

5. **सादरीकरण (Presentation Assignment)**

विद्यार्थ्यांनी तंत्रज्ञान, पर्यावरण, सामाजिक इ . कोणत्याही एका विषयावर सादरीकरण करावे.
Students present a topic in Marathi.

Examples

- तंत्रज्ञानातील नवीन शोध
- पर्यावरण विषयक सादरीकरण

6. गटचर्चा (Group Discussion)

विद्यार्थ्यांनी गटांमध्ये एखाद्या विषयावर चर्चा करावी.
Students discuss a topic in groups.

Example Topics

- सोशल मीडियाचा प्रभाव
- ऑनलाइन शिक्षणाचे फायदे व तोटे

7. मराठी ब्लॉग लिहणे

विद्यार्थ्यांनी त्यांच्या अभ्यासाच्या क्षेत्रातील विकासावर २०० शब्दांपर्यंत ब्लॉग लिहून पोस्ट लिहून सोशल मीडियावर पोस्ट कराव्या.
Write blogs and posts on social media up to 200 words on recent development in their field of study.

8. पुस्तक परीक्षण (Book Review)

विद्यार्थ्यांना मराठी पुस्तक किंवा लेख वाचावे आणि त्यावर समीक्षा लिहावी.
Students read a Marathi book or article and write a **review**.

9. चित्रपट परीक्षण (Marathi film Review)

विद्यार्थ्यांनी उपलब्ध असलेला सामाजिक मराठी चित्रपट पाहावा आणि त्यावर समीक्षा लिहून, ती त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावी.
Social Marathi movie available and write a review on post it on social media of their choice.

10. स्पर्धांमध्ये सहभाग (Participation in Competition)

पुरुषोत्तम, फिरोदिया, दाजीकाका गाडगीळ करंडक, आणि श्रीटेज करंडक या स्पर्धांमध्ये सहभाग नोंदवावा.

Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej
Karandak.

Text Books

१. सायबर संस्कृती: डॉ. रमेश वरखडे
२. व्यावहारिक मराठी: डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर
३. उपयोजित मराठी: संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
४. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, दीपक शिक्रापूरकर, उज्ज्वल मराठे, उत्कर्ष प्रकाशन, पुणे
५. व्यावहारिक मराठी, पुणे विद्यापीठ प्रकाशन, पुणे
६. प्रसारमाध्यमांसाठी लेखन कौशल्य, यशवंतराव चव्हाण मुक्त विद्यापीठ, नाशिक

S.Y.B. Tech. Computer Engineering	
Semester- IV	
Course Name (AEC): **Modern Indian Language (Sanskrit)**	**Course Code:** **25AEC201B**

Teaching Scheme (Hours/Week)			Examination Scheme							Credits			
L	P	T	CCA	ISE	ESE	TW	OR	PR	TOTAL	L	P	T	TOTAL
2	-	-	-	-	-	25	25	-	50	2	-	-	2

Prerequisite:

Basic ability to read Devanagari script is helpful but not mandatory

Course Objectives:

1. To introduce engineering students to the basic structure of the Sanskrit language.
2. To highlight the relevance of Sanskrit in modern fields such as Computational Linguistics and Artificial Intelligence.
3. To encourage appreciation of Indian Knowledge Systems and their applications in modern engineering and research.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Understand the basic structure, phonetics, and grammar of the Sanskrit language.
CO2. Construct simple Sanskrit sentences using basic grammatical rules.
CO3. Interpret selected Sanskrit verses related to science, mathematics, and philosophy.
CO4. Recognize the contributions of ancient Indian scholars to science and engineering.
CO5. Appreciate the relevance of Sanskrit in modern fields such as computational linguistics, knowledge.

Course Contents

Unit I	**Introduction to Sanskrit Language**	**06 Hours**

Importance and historical development of Sanskrit, Characteristics of Sanskrit as a scientific language, Sanskrit alphabet (Varnamala): vowels and consonants, Pronunciation rules and phonetics, Basic introduction to Sanskrit grammar

- पठित अवबोधनम् | गद्यान्श् अपेक्षित कार्य: प्रश्नोत्तरामी तथा निर्देशानुसार कृतयः
- पठित अवबोधनम् | पद्यान्श

Unit II	**Basic Sanskrit Grammar**	**06 Hours**

Introduction to nouns (Subanta), Gender and number (Vachana), Case system (Vibhakti), Introduction to verbs (Dhatu), Present tense forms, Formation of simple sentences
सन्धिकार्यम् समास प्रत्ययाः त्यकार अव्ययाः समय लेखनम् - अनुप्रयुक्त-व्याकरणम्

Unit III	**Reading and Interpretation of Sanskrit Texts**	**06 Hours**

Reading simple Sanskrit shlokas, Vocabulary building for scientific and technical terms, Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature, Practice exercises in sentence construction and translation

Unit IV	**Reading and Interpretation of Sanskrit Texts**	**06 Hours**

Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature Practice exercises in sentence construction and translation
लेखनकौशलम् वृत्तान्तलेखनम्, चित्रपटवर्णनम्, निबन्धलेखनम्

Unit V	**Sanskrit and Modern Science & Technology**	**06 Hours**

Sanskrit and computational linguistics
Logic and knowledge representation in Sanskrit texts
References to engineering concepts in ancient texts
Sanskrit terminology used in mathematics, astronomy, and architecture. Mathematical problems from Lilavati by **Bhaskara II**
Structure of Sanskrit grammar and its relevance to computer science
Applications of Sanskrit in modern research
Overview of Sanskrit influence on Artificial Intelligence and language processing

Total Hours	**30**

Term Work Evaluation

Subject teacher should frame minimum 10 assignments-based covering on all five units

1. Summary Writing: Students read a passage and write a short summary in their own words.
2. Translation Assignment: Students translate text from English to Sanskrit.
3. Short technical paragraph translation
4. Daily communication sentences
5. Letter Writing
6. Group Discussion
7. Book Review
8. Film review
9. Blog writing
10. Participation in a Competition

Text Books

1. सरस्वती - मणिका संस्कृत व्याकरणम
2. नवम तथा दशम कक्षा 'मणिका' पुस्तकम
3. संस्कृत आल्हादः - दादशी कक्षा तथा निभन्धसोपन:

Reference Books

1. Panini Ashtadhyayi – Panini
2. Selected Sanskrit texts related to science and mathematics.

Course: Entrepreneurship/Economics/ Management Course-II				Code: 25HSM202
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	2	2	Term work	Marks: 50

GUIDELINES FOR SELECTING HSM COURSE

1. HSSM courses shall be offered through Institute-approved Swayam/ NPTEL courses. The minimum duration of the course must be **8 weeks**.
2. Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students 'in true letter and spirit'. The faculty has to register for the selected course as a course mentor.
3. Students shall complete the prescribed online lectures, assignments, and learning activities during the semester.
4. Swayam/ NPTEL certification examination is optional and students shall not be required to pay certification fees for successful completion of the course.
5. Any plagiarism, misrepresentation of course completion, or submission of forged certificates shall be treated as academic misconduct.
6. The decision of the Institute regarding course mapping, evaluation, and award of credits shall be final.

SELECTION OF HSSM COURSE

List of Courses to be opted (Any one) under HSSM-II

1. NPTEL course on Business Fundamentals for Entrepreneurs by Prof. Devdip Purkayastha, IIT Bombay : https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg11
2. NPTEL course on Entrepreneurship Essentials by Prof. Manoj Kumar Mondal, Department of Multidisciplinary IIT Kharagpur : https://nptel.ac.in/courses/127105007
3. NPTEL course on Financial Management for Managers by Prof. Anil K. Sharma, IIT Roorkee: https://nptel.ac.in/courses/110107144
4. NPTEL course on Business Intelligence and Analytics by Prof. Saji K Mathew, Department of Management Studies IIT Madras: https://nptel.ac.in/courses/106106361

Assessment of HSSM Course:

1. Term Work (50 Marks) shall be evaluated by the Faculty Mentor based on:
   - 25 Marks: NPTEL assignment score
   - 25 Marks: Institute level examination.

2. During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course. The cumulative marks obtained in the online assignments shall be proportionately converted to a maximum of 25 marks for the purpose of term work assessment.

S.Y.B. Tech. Computer Engineering													
Semester- IV													
Course Name (VEC): Indian Constitution and Governance									**Course Code: 25VEC202**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
-	-	1	-	-	-	25	-	-	25	-	-	1	1

Prerequisite:

Basic awareness of Indian history, civic studies at school level, and general understanding of social and political systems.

Course Objectives:

1. To introduce students to the philosophy, features, and framework of the Indian Constitution.
2. To understand the structure, powers, and functions of the Union and State governments.
3. To explain Fundamental Rights, Duties, and Directive Principles and their role in democracy.
4. To familiarize students with constitutional bodies and governance mechanisms in India.
5. To develop awareness of contemporary issues related to constitutional values, governance, and citizenship.

Course Outcomes:

At the end of the course, students will be able to:

CO1. Explain the historical background, features, and structure of the Indian Constitution.
CO2. Describe Fundamental Rights, Directive Principles, and Fundamental Duties and their significance.
CO3. Apply constitutional provisions to analyze the functioning of Union and State governments.
CO4. Analyze the role of constitutional and statutory bodies in Indian governance.
CO5. Evaluate contemporary governance issues with reference to constitutional values and ethics.

Course Contents

Unit I	**Introduction to Indian Constitution**	**03 Hours**

Meaning and importance of Constitution Historical background and making of the Indian Constitution Salient features of the Indian Constitution Preamble: objectives and significance Citizenship – provisions and amendments

Unit II	**Fundamental Rights, Duties, and Directive Principles Fundamental Rights**	**03 Hours**

Types, scope and limitations Right to Equality, Freedom, Religion, Constitutional Remedies Directive Principles of State Policy – objectives and classification Fundamental Duties and their relevance Relationship between Fundamental Rights and DPSPs

Unit III	**Union and State Government Structure Union Government**	**03 Hours**

President, Vice-President, Prime Minister, Council of Ministers Powers and functions of Parliament State Government: Governor, Chief Minister, State Legislature Center–State relations: legislative, administrative, and financial

Unit IV	Constitutional and Statutory Bodies Election Commission of India	03 Hours
Composition, powers, and functions Union Public Service Commission (UPSC) and State Public Service Commissions (SPSC): roles and responsibilities Comptroller and Auditor General (CAG) of India: duties and significance in financial accountability Finance Commission: composition, functions, and role in center–state financial relations Judiciary in India: structure, jurisdiction, and role of the Supreme Court and High Courts		
Unit V	**Governance, Democracy and Contemporary Issues Concept of democracy and good governance Local self-government**	**03 Hours**
Panchayati Raj and Urban Local Bodies Constitutional amendments and landmark judgments Ethical governance and citizen participation Current issues related to Indian Constitution and governance.		
	Total Hours	**15**

Course activities for term work evaluation:

1. Group Discussion on Fundamental Rights and Duties
2. Debate on Constitutional and Contemporary Governance Issues
3. Case Study Analysis on Indian Judiciary and Landmark Judgments
4. Seminar / Presentation on Indian Constitution and Democratic Values
5. Poster Making on Fundamental Rights, Duties, and Good Governance
6. Essay Writing on Role of Citizens in Democracy and Nation Building
7. Mock Parliament / Mock Election Activity
8. Assignment on Constitutional Bodies and Their Functions
9. Field Visit / Report on Local Self-Government Institutions
10. Quiz / Awareness Activity on Indian Constitution and Governance Systems

Text Books

1. M. V. Pylee, An Introduction to the Constitution of India, Vikas Publishing
2. D. D. Basu, Introduction to the Constitution of India, LexisNexis

Reference Books

1. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press
2. Subhash Kashyap, Our Constitution: An Introduction to India's Constitution and Constitutional Law, National Book Trust

Online References

- **MOOC / NPTEL Courses**

1. https://onlinecourses.nptel.ac.in/noc22_hs79/preview
   (NPTEL1, Introduction to Indian Constitution, Prof. Sudhir Krishnaswamy, National Law School of India University)
2. https://onlinecourses.nptel.ac.in/noc23_hs118/preview
   (NPTEL2, Indian Constitution: Rights and Governance, Prof. Sudhir Krishnaswamy, National Law School of India University)
3. https://onlinecourses.nptel.ac.in/noc22_hs67/preview
   NPTEL3, Constitutional Studies, Prof. Alok Prasanna Kumar, National Law School of India University)
4. https://onlinecourses.nptel.ac.in/noc23_hs89/preview
   (NPTEL4, Public Policy and Governance, Prof. Anamika Barua, IIT Guwahati)
5. https://onlinecourses.nptel.ac.in/noc24_hs90/preview
   (NPTEL5, Governance and Public Administration in India, Prof. Anamika Barua, IIT Guwahati)

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC): Machine Learning									**Course Code: 25COHNR201**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Knowledge of linear and logistic regression

Course Objectives:

1. To explore various data pre-processing methods.
2. To study and understand regression and classification methods
3. To understand the need for multi-class classifiers.
4. To learn the working of clustering algorithms
5. To learn fundamental neural network algorithms.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand machine learning algorithms and algorithms.

CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.

CO3: Select and apply appropriately supervised machine learning algorithms for real time applications.

CO4: Compare and contrast different clustering algorithms.

CO5: Design an artificial neural network for solving engineering problems

Course Contents

Unit I	**Introduction to Machine Learning**	**08 Hours**

Introduction to Machine Learning, Comparison of Algorithms and Machine Learning Algorithms, ML vs AI vs Data Science. Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques, Models of Machine learning: Geometric model, Probabilistic Models, Logical Models, Grouping and grading models, Parametric and non-parametric models. Important Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches

Unit II	**Data pre-processing**	**08 Hours**

Concept of Feature, Pre-processing of data: Normalization and Scaling, Managing missing values, Introduction to Dimensionality Reduction, Principal Component Analysis (PCA), Local Binary Pattern. Introduction to various Feature Selection Techniques, sampling theorem.

Statistical feature engineering: count-based, Length, Mean, Median, Mode etc. based feature vector creation. Multidimensional Scaling, Matrix Factorization Techniques.

Unit III	**Supervised Learning: Regression and classification**	**08 Hours**

Linear and logistic regression, Bias, Variance, Generalization, Under fitting, Regression: Lasso regression, Ridge regression, Gradient descent algorithm. Evaluation Metrics. Evaluation Metrics and Score: Accuracy, Precision, Recall, F-score, Cross-validation, Micro-Average Precision and Recall, Micro-Average F-score, Macro-Average Precision and Recall, Macro-Average F-score. Classification: K-nearest neighbor, Support vector machine. Ensemble Learning: Bagging, Boosting, Random Forest, AdaBoost. Binary-Vs-Multiclass Classification.

Unit IV	**Unsupervised Learning**	**08 Hours**

K-Means, K-medoids, Hierarchical, and Density-based Clustering, Spectral Clustering. Outlier analysis: Evaluation metrics and score: elbow method, extrinsic and intrinsic methods. introduction of isolation factor, local outlier factor

Unit V	**Artificial Neural Networks**	**08 Hours**

Artificial Neural Networks: architecture of perceptron, Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Radial Basis Function Network, Activation functions, Introduction to Recurrent Neural Networks and Convolutional Neural Networks

	Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1 — **10 Marks**

Application Based Course Activities (any one)

1. Study of. Types of learning: Difference of Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques.
2. Write a Report on Geometric model, Probabilistic Models, Logical Models.
3. Write an algorithm Principal Component Analysis (PCA

CCA2 — **10 Marks**

List of Case Study:

Case Studies: Regression and classification: Lasso regression, Ridge regression, Gradient descent algorithm

Case study: Study of ensemble algorithms and difference between them.

CCA3 — **10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Bishop, Christopher M., and Nasser M. Nasrabadi, “Pattern recognition and machine learning”, Vol. 4. No. 4. New York: springer, 2006.
2. Ethem Alpaydin, “ Introduction to Machine Learning”, PHI 2nd Edition-2013

Reference Books

1. Tom Mitchell, “Machine learning”, McGraw-Hill series in Computer Science, 1997
2. Shalev-Shwartz, Shai, and Shai Ben-David, “Understanding machine learning: From theory to algorithms”, Cambridge university press, 2014.
3. Jiawei Han, Micheline Kamber, and Jian Pie, “Data Mining: Concepts and Techniques”, Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807

4. Hastie, Trevor, et al., “The elements of statistical learning: data mining, inference, and prediction”, Vol. 2. New York: springer, 2009.

Online References (MOOC / NPTEL Courses)

1. Machine Learning- Balaraman Ravindran, IIT Madras: https://www.youtube.com/watch?v=OTAR0kT1swg
2. Mathematical Foundations of Machine Learning, By Prof. Prathosh A P: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs02
3. Introduction to Machine Learning, By Prof. Balaraman Ravindran: IIT Madras: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs74

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name (PCC): Deep Learning									**Course Code: 25COHNR202**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Understanding of convolution

Course Objectives:

1. To understand the basics of neural networks.
2. Comparing different deep learning models.
3. To understand the Recurrent and Recursive nets in Deep Learning
4. To understand the basics of deep reinforcement Learning models.
5. To Describe Reinforcement Learning.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understand the basics of Deep Learning and apply the tools to implement deep learning applications

CO2: Evaluate the performance of deep learning models.

CO3: To apply deep learning using the technique of Convolution and Recurrent Neural Network (RNN.

CO5: Construct and apply on-policy reinforcement learning algorithms.

CO6:To Understand Reinforcement Learning Process

Course Contents

Unit I	**Introduction of Deep learning**	**08 Hours**

What is deep learning. History of deep learning, Advantage and challenges of deep learning. Learning representations from data, understanding convolution in deep learning. Common Architectural Principles of Deep Network, Architecture Design, Applications of Deep learning, Introduction and use of popular industry tools such as Tensor Flow,
Keras, PyTorch, Caffe, Shogun.

Unit II	**Deep Neural Networks**	**08 Hours**

Introduction to Deep Neural Networks :Multilayer Feed-Forward Networks , Training Neural Networks :Backpropagation and Forward propagation Activation Functions :Linear ,Sigmoid, Tannh, Hard Tanh, Softmax, Rectified Linear, Loss Functions :Loss Function Notation , Loss Functions for Regression , Loss Functions for Classification, Loss Functions for Reconstruction,

Parameters : Learning Rate, Regularization, Momentum, Sparsity, Deep Feedforward Networks – Example of Ex OR, Hidden Units, cost functions, error backpropagation, Gradient-Based Learning, Implementing Gradient Descent, vanishing and Exploding gradient Descent. Deep Learning with Pytorch, Jupyter, colab.

Unit III	**Convolution Neural Network**	**08 Hours**

Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network- Padding, Strides, Typical Settings, the ReLU layer, Pooling, Fully Connected Layers, The Interleaving between Layers, Local Response Normalization, Training a Convolutional Network

Unit IV	**Recurrent and Recursive Nets**	**08 Hours**

Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Challenge of Long-Term Dependencies, Echo State Networks, Leaky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Gated RNNs. Introduction to deep generative model, Boltzmann Machine, Deep Belief Networks, Generative adversarial network (GAN), discriminator network, generator network, types of GAN, Applications of GAN networks

Unit V	**Reinforcement Learning**	**6 Hours**

Introduction of deep reinforcement learning, Markov Decision Process, basic framework of reinforcement learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning Learning and Deep Q-Networks, Deep Q recurrent networks, Simple reinforcement learning for Tic-Tac-Toe.

	Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1	**10 Marks**

Application Based Course Activities (any one)

1. Draw and explain each part of CNN.
2. Draw and explain each component of RNN
3. Report on CNN and RNN applications

CCA2	**10 Marks**

List of Case Study:

1. **Case Studies:** Detail report on architecture of RNN with applications of RNN.
2. **Case Studies:** Detail report on reinforcement learning algorithm.

CCA3	**10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Goodfellow, I., Bengio, Y., Courville, A, “Deep Learning”, MIT Press, 2016.
2. Charu Agarwal, “Neural Networks and deep learning”, A textbook
3. Nikhil Buduma, “Fundamentals of Deep Learning”, SPD

Reference Books

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1. Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction”
2. by Seth Weidman, “Deep Learning from Scratch: Building with Python from First Principles” O’Reily
3. Francois Duval, “Deep Learning for Beginners, Practical Guide with Python and TensorFlow”

Online References (MOOC / NPTEL Courses)

1. Deep Learning,By Prof. Prabir Kumar Biswas, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_cs62
2. Machine Learning and Deep Learning - Fundamentals and Applications, By Prof. M. K. Bhuyan, IIT Guwahati: https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ee87 https://www.youtube.com/watch?v=KjDWcYHclOM
3. RNN, Tendulkar, IITM, https://www.youtube.com/watch?v=KjDWcYHclOM

Course: Machine Learning Laboratory			**Code:** 25COHNR201L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**
Practical	2	1	Oral / Marks: 25

- **Prerequisites:**
  Java language and preprocessing methods

- **Course Objectives:**
  - To implement various data pre-processing methods.
  - To study and implement regression and classification methods using coding.
  - To understand the need for multi-class classifiers.
  - To learn the working of clustering algorithms
  - To learn architecture of neural network algorithms.

- **Course Outcomes:** At the end of the course, students will be able to:

CCO1: Understand machine learning algorithms and algorithms.

CCO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.

CCO3: Select and apply appropriately supervised machine learning algorithms for real time applications.

CCO4: Compare and contrast different clustering algorithms.

CO5: Design an artificial neural network for solving engineering problems

List of Experiments (Any 10)

List of Experiments

1. Write a program in java to implement linear and logistic regression.
2. Write a program in java to implement a perceptron.
3. Write a program in java to implement a multilayer perceptron to face recognition.
4. Write a program in java to implement a K-mean algorithm for clustering.
5. Write a program in java to implement a K-NN algorithm for classification.
6. Apply backpropagation algorithm for ANN to learn A to Z

Course: Deep Learning Laboratory				Code: 25COHNR202L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Oral	Marks: 25

- **Prerequisites:**
  Java, Understanding of convolution

Course Objectives: To make the students understand

- Able to implement CNN.
- Implement RNN for sequential learning.
- To understand the Recurrent and Recursive nets in Deep Learning
- To understand the basics of deep reinforcement Learning models.

- **Course Outcomes:** At the end of the course, students will be able to:

CO1: Implement deep learning and CNN**.**
CO2: Evaluate the performance of deep learning models.
CO3: To apply algorithm of Recurrent Neural Network.
CO4: Construct and apply on-policy reinforcement learning algorithms.

List of Experiments (Any 10)

1. Write a program in java to implement CNN for image recognition.
2. Write a program in java to implement a RNN for sequential data.
3. Write a program in java to implement Q-earning algorithm.
4. Write a program in java to implement a LSTM using python libraries.
5. Write a program in java to implement CNN for 0bject detection.
6. Apply deep learning algorithm for image captioning.

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name: **Introduction to Cybersecurity**										**Course Code:** **25COMNR201**			
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Computer Networks, Mathematics

Course Objectives:

Objective of this course is to provide students with

1. Understand Foundational Security Principles
2. Identify Cyber Threats and Attack Vectors
3. Analyze Vulnerabilities in Systems and Networks
4. Understand Cyber Law and Ethics
5. Evaluate risk and determine appropriate mitigation strategies to protect against threats.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Define Core Security Principles

CO2: Understand Cryptographic Techniques

CO3: Identify Threats and Vulnerabilities

CO4: Understand Cryptographic Technique

CO5: Utilize Security Tools.

Course Contents

Unit I	**Cybersecurity Concepts**	**08 Hours**

Understanding cyber security, the CIA Triad (Confidentiality, Integrity, Availability), and the need for security. types of cybercriminals, hacking concepts, and motivation behind attacks. Authentication mechanisms (passwords, biometrics) and authorization technique.

Unit II	**Cyber Threats and Vulnerabilities**	**08 Hours**

viruses, worms, Trojans, ransomware, and spyware, Phishing, spear-phishing, pretexting, and social media attacks. Denial of Service (DoS), Distributed DoS (DDoS), Man-in-the-Middle (MitM), and password cracking.

Unit III	**Network and System Security**	**08 Hours**

types of firewalls (packet filtering, stateful inspection) and configuration. network-based vs. Host-based IDS. Wi-Fi vulnerabilities, WPA2/WPA3 protocols, and IoT security. Securing software and web applications

Unit IV	**Cryptography**	**08 Hours**

Symmetric and asymmetric encryption, hashing algorithms. VPNs, SSL/TLS, and database security.

Unit V	**Cyber Law, Standards, and Compliance.**	**6 Hours**

overview of the IT Act (2000), intellectual property rights, and copyright laws. Risk management, incident handling, and business continuity planning. Ethical issues, professional code of conduct, and security audits.

	Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1	**10 Marks**

Application Based Course Activities (any one)

1. Study of confidentiality, authentication and privacy with examples.
2. List of measure attacks in network and discuss in short.
3. Write an algorithm on to maintain privacy in document

CCA2	**10 Marks**

List of Case Study:

1. **Case Studies:** Report on WPA2/WPA3.
2. **Case Studies:** Study of any Virtual private network.
3. **Case Studies:** Detail discussion on SSL/TLS,

CCA3	**10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. Security in Computing" by Charles P. Pfleeger, Shari Lawrence Pfleeger, and Jonathan Margulies.
2. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives" by Nina Godbole and Sunit Belapure.

Reference Books

1. Introduction to Cyber Security" - Compiled by Uttrakhand Open University.
2. Cyber Security" - Dr. S.B. Kishore, et al. (Reference for Units 1-5).
3. Security in Computing" - Charles P. Pfleeger, Pearson Education.

Online References (MOOC / NPTEL Courses)

1. Cyber Security and Privacy, By Prof. Saji K Mathew,IIT Madras: https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_cs127
2. INTRODUCTION TO CYBER SECURITY, By Dr. Jeetendra Pande: https://onlinecourses.swayam2.ac.in/e-learning/preview/nou19_cs08
3. Cryptography and Network Security, IIT Kharagpur, Prof. Sourav Mukhopadhyay: https://nptel.ac.in/courses/106105162

S.Y.B. Tech. Computer Engineering													
Semester- III													
Course Name: **Cryptography and Network Security**									**Course Code:** **25COMNR202**				
Teaching Scheme (Hours/Week)			**Examination Scheme**							**Credits**			
L	**P**	**T**	**CCA**	**ISE**	**ESE**	**TW**	**OR**	**PR**	**TOTAL**	**L**	**P**	**T**	**TOTAL**
3	-	-	20	30	50	-	-	-	100	3	-	-	3

Prerequisite:

Computer Networks, Mathematics

Course Objectives:

Objective of this course is to provide students with

1. Understand Foundational Security Concepts
2. Master Cryptographic Techniques
3. Analyze Network Security Protocol
4. Apply Security Mechanisms
5. Identify Security Threats and Vulnerabilities

Course Outcomes:

At the end of the course, students will be able to:

CO1: Understanding Security Fundamentals

CO2: Applying Cryptographic Techniques

CO3: Data Integrity and Authentication

CO4: Network Security Protocols

CO5: System Security Application.

Course Contents

Unit I	**Introduction and Classical Cryptography**	**08 Hours**

OSI Security Architecture, security attacks, services, and mechanisms. Substitution ciphers (Caesar, Play fair, Hill), transposition ciphers, steganography, and cryptanalysis, Modular arithmetic, Euclid’s Algorithm, Euler's and Fermat's Theorems.

Unit II	**Symmetric Key Cryptography**	**08 Hours**

Structure, Shannon's theory of confusion and diffusion, Feistel network structure, Data Encryption Standard (DES), Strength of DES, Triple DES. advanced Encryption Standard (AES), block cipher modes of operation.

Unit III	**Asymmetric Key Cryptography**	**08 Hours**

Principles of public-key cryptosystems, prime and relative prime numbers, RSA algorithm, Diffie-Hellman key exchange, Key Management and Distribution, Elliptic Curve Cryptography (ECC) and Knapsack algorithm

Unit IV	**Hash Functions and Message Authentication**	**08 Hours**

Message Authentication Codes (MAC), HMAC, CMAC, Secure Hash Algorithm (SHA-512), MD5, Digital Signatures, X.509 Authentication Service, Kerberos.

Unit V	**Network Security Applications**	**6 Hours**

Pretty Good Privacy (PGP), S/MIME, Overview, Authentication Header (AH), Encapsulating Security Payload (ESP), Transport and Tunnel modes, Secure Socket Layer (SSL/TLS), HTTPS, Firewalls, IEEE 802.11 Wireless LAN Security

Total Hours	**40**

Course Activities for Continuous Comprehensive Assessment (CCA):
Students are required to complete Any Two (CCA1 Compulsory)

CCA1 — **10 Marks**

Application Based Course Activities (any one)

1. Draw and explain Architecture of OSI model
2. Distinguishing crypto graphic algorithms.
3. Detail report on types cryptography algorithms.

CCA2 — **10 Marks**

List of Case Study:

1. **Case Studies:** List and Implementation asymmetric algorithm for any application.
2. **Case Studies:** Any application on Pretty Good Privacy (PGP), S/MIME.
3. **Case Studies**: Analysis of MAC, HMAC, CMAC.

CCA3 — **10 Marks**

Seminar: Any topic from unit 1 to 5

Text Books

1. William Stallings: Cryptography and Network Security: Principles and Practice (5th-7th editions).
2. Behrouz A. Forouzan: Cryptography & Network Security.

Reference Books

1. Douglas R. Stinson: Cryptography: Theory and Practice.
2. Alfred J. Menezes et al.: Handbook of Applied Cryptography

Online References (MOOC / NPTEL Courses)

1. Cryptography and Network Security, IIT Kharagpur,Prof. Sourav Mukhopadhyay: https://nptel.ac.in/courses/106105162
2. Foundations of Cryptography, By Prof. Ashish Choudhury: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_cs03

Course: Fundamental of Cybersecurity Lab.				Code: 25COMNR201L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Oral	Marks: 25

- **Prerequisites:** Computer Networks

- **Course Objectives:**
  1. Understand Foundational Security Principles
  2. Identify Cyber Threats and Attack Vectors
  3. Analyze Vulnerabilities in Systems and Networks
  4. Understand Cyber Law and Ethics
  5. Evaluate risk and determine appropriate mitigation strategies to protect against threats.

- **Course Outcomes:** At the end of the course, students will be able to:
  CO1: Define Core Security Principles
  CO2: Understand Cryptographic Techniques
  CO3: Identify Threats and Vulnerabilities
  CO4: Utilize Security Tools

List of Experiments

1. Study of Core Security Principles.
2. Implement of public key cryptography.
3. Implement of private key cryptography.
4. Details of threads and vulnerabilities.
5. Password Cracking (Dictionary/Brute Force)
6. Perform an audit on a Windows/Linux machine using CIS Benchmarks.
7. Password Complexity and Strength Analysis

Virtual Laboratories:

- Cryptography Lab**:** Focuses on mathematical foundations and RSA/digital signature simulations.
- Network Security Lab**:** Covers TCP communication, SYN Floods, and Firewalls.

Course: Cryptography and Network Security Lab.				Code: 25COMNR202L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical	02	1	Oral	Marks: 25

- **Prerequisites:** Computer Networks, Mathematics

- **Course Objectives:**

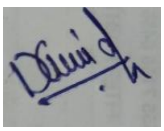
1. Understand the algorithm
2. Master Cryptographic Techniques
3. Analyze Network Security Protocol
4. Apply Security Mechanisms

Course Outcomes: On completion of the course, student will be able to–

CO1: Understanding Security Fundamentals
CO2: Applying Cryptographic Techniques
CO3: Data Integrity and Authentication
CO4: Network Security Protocols

List of Experiments

1. Write a Java program to implement the DES algorithm logic.
2. Write a JAVA program to implement the AES algorithm.
3. Write a Java program to implement RSA algorithm
4. Write a Java program to implement Diffie-Hellman key exchange.
5. Calculate the message digest of a text using the MD5 algorithm in JAVA.
6. Calculate the message digest of a text using the SHA-1 algorithm in JAVA
7. Calculate the message digest of a text using the MD5 algorithm in JAVA



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