KARPAGAM
COLLEGE OF ENGINEERING
Rediscover | Refine | Redefine
Coimbatore - 641 032

Autonomous | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A' Grade | NBA (ECE, EEE, CSE, MECH & IT)

INFORMATION AND TECHNOLOGY

AMENDMENT – 2021

Regulations- 2018

KARPAGAM COLLEGE OF ENGINEERING

Coimbatore – 641 032

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GROUPING OF COURSES

1. Humanities and Social Sciences (HS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OA01	Principles of Management and Engineering Ethics	HS	3	3	0	0	3
2	21OA03	Professional Practice, Law and Ethics	HS	3	3	0	0	3
3	21OA04	Organizational Behaviour	HS	3	3	0	0	3
4	21OA05	Finance and Accounting	HS	3	3	0	0	3
5	21OA11	Technical English – I	HS	4	3	1	0	4
6	21OA12	Technical English – II	HS	5	3	0	2	4
7	21OA13	Business English – I	HS	5	3	0	2	4
8	21OA14	Business English – II	HS	5	3	0	2	4
9	21OA21	Basics of French	HS	4	3	1	0	4
10	21OA22	Functional French	HS	4	3	1	0	4
11	21OA31	Basics of German	HS	4	3	1	0	4
12	21OA32	Functional German	HS	4	3	1	0	4
13	21OA41	Basics of Japanese	HS	4	3	1	0	4
14	21OA42	Functional Japanese	HS	4	3	1	0	4

2. Basic Sciences (BS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OB01	Matrices and Calculus	BS	5	4	1	0	5
2	21OB02	Vector Calculus and Integral Transforms	BS	5	4	1	0	5
3	21OB03	Computational Differential Equations and Mathematical Statistics	BS	5	4	1	0	5
4	21OB04	Partial Differential Equations, Scientific Computing and Complex Variables	BS	5	4	1	0	5
5	21OB05	Z-Transform, Differential Equations and Complex Variables	BS	5	4	1	0	5
6	21OB06	Mathematical Foundations of Computing Sciences	BS	5	4	1	0	5
7	21OB07	Probability Theory and Mathematical Statistics	BS	5	4	1	0	5
8	21OB08	Probability and Random Processes	BS	5	4	1	0	5
9	21OB09	Optimization Techniques	BS	5	4	1	0	5
10	21OB10	Foundations of Computing Sciences	BS	5	4	1	0	5
11	21OB11	Discrete Mathematical Structures	BS	5	4	1	0	5
12	21OB12	Probability and Statistics	BS	5	4	1	0	5

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
13	21OB13	Mathematical Optimization Techniques	BS	5	4	1	0	5
14	21OB14	Operations Research	BS	3	3	0	0	3
15	21OB15	Numerical Linear Algebra	BS	5	4	1	0	5
16	21OB21	Engineering Physics	BS	6	3	1	2	5
17	21OB22	Physics for Electrical Sciences	BS	4	4	0	0	4
21	21OB23	Physics for Mechanical Sciences	BS	4	4	0	0	4
19	21OB24	Material Science for Civil Engineers	BS	4	4	0	0	4
20	21OB31	Chemistry for Electrical Sciences	BS	5	3	0	2	4
21	21OB32	Applied Chemistry	BS	3	3	0	0	3

3. Engineering Sciences (ES)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21FC01	Programming Logic and Design	ES	7	3	0	4	5
2	21FC02	C Programming – I	ES	7	3	0	4	5
3	21FC03	C Programming – II	ES	7	3	0	4	5
4	21FC04	Advanced C Programming	ES	7	3	0	4	5
5	21FC05	Basics of Civil and Mechanical Engineering	ES	4	4	0	0	4
6	21FC06	Basics of Electrical Engineering	ES	5	3	0	2	4
7	21FC07	Engineering Practices for Computer Sciences	ES	4	0	0	4	2
8	21FC08	Engineering Graphics	ES	4	0	0	4	2
9	21FC09	Digital Electronics and Microprocessors	ES	6	4	0	2	5
10	21FC10	Fundamentals of Digital Communication	ES	3	3	0	0	3
11	21FC11	PHP Programming	ES	5	3	0	2	4
12	21FC12	Fundamentals of Web Scripting	ES	5	3	0	2	4
13	21FC13	Fundamentals of Information Technology	ES	3	3	0	0	3
14	21FC14	Electronic Devices and Circuits	ES	5	3	0	2	4
15	21FC15	Progressive C Programming	ES	7	3	0	4	5
16	21FC16	Essentials of IT Infrastructure	ES	3	3	0	0	3
17	21FC17	Fundamentals of Computers	ES	3	3	0	0	3
21	21FC21	Fundamentals of Computer Communication	ES	3	3	0	0	3

4. Professional Core (PC)

S. No.	Course Code	Course Title	Category	Contact hours	Instruction Hours/Week			C
					L	T	P	
1	21FD01	Python Programming	PC	7	3	0	4	5
2	21FD02	Data Structures	PC	7	3	0	4	5
3	21FD03	Operating Systems	PC	5	3	0	2	4
4	21FD04	Software Testing	PC	3	3	0	0	3
5	21FD05	Database Management Systems	PC	7	3	0	4	5
6	21FD06	Object Oriented Programming	PC	5	3	0	2	4
7	21FD07	System Software	PC	5	3	0	2	4
8	21FD08	High Speed Networks	PC	3	3	0	0	3
9	21FD09	Software Engineering	PC	4	3	1	0	4
10	21FD10	Data Warehousing and Data mining	PC	4	4	0	0	4
11	21FD11	Object Oriented Analysis and Design	PC	5	3	0	2	4
12	21FD12	Unix and Shell Programming	PC	5	3	0	2	4
13	21FD13	Java programming	PC	7	3	0	4	5
14	21FD14	Computer Graphics and Multimedia	PC	5	3	0	2	4
15	21FD15	Mobile Computing and communication	PC	3	3	0	0	3
16	21FD16	XML and Web Services	PC	3	3	0	0	3
17	21FD17	Information Security	PC	3	3	0	0	3
21	21FD21	System Software and Operating Systems	PC	5	3	0	2	4
19	21FD19	Big data Analytics	PC	5	3	0	2	4
20	21FD20	Automata Theory and Compiler Design	PC	3	3	0	0	3
21	21FD21	Streaming Analytics	PC	5	3	0	2	4
22	21FD22	Statistics and Data Science	PC	4	4	0	0	4
23	21FD23	Data Analytics with R Programming	PC	5	3	0	2	4

5. Professional Electives (PE)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21FE01	Advanced Data Structures	PE	7	3	0	4	5
2	21FE02	Backup Recovery Systems and Architecture	PE	3	3	0	0	3
3	21FE03	Advanced Operating Systems	PE	5	3	0	2	4
4	21FE04	Advanced Java Programming	PE	7	3	0	4	5
5	21FE05	Design and Analysis of Algorithms	PE	7	3	0	4	5

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
6	21FE06	Information Storage and Management	PE	4	3	1	0	4
7	21FE07	Information Retrieval Management	PE	3	3	0	0	3
8	21FE08	Mobile Application Development	PE	5	3	0	2	4
9	21FE09	Business Intelligence	PE	3	3	0	0	3
10	21FE10	Internet of Things	PE	5	3	0	2	4
11	21FE11	Enterprise Application	PE	3	3	0	0	3
12	21FE12	Service Oriented Architecture	PE	3	3	0	0	3
13	21FE13	Open Source Technologies	PE	5	3	0	2	4
14	21FE14	Cyber Forensics	PE	3	3	0	0	3
15	21FE15	Human Computer Interaction	PE	3	3	0	0	3
16	21FE16	Agile Methodologies	PE	3	3	0	0	3
17	21FE17	Software Project Management	PE	3	3	0	0	3
21	21FE21	Web Application Development Using Java	PE	7	3	0	4	5
19	21FE19	Web Application Development Using Python	PE	7	3	0	4	5
20	21FE20	DevOps in Java	PE	7	3	0	4	5
21	21FE21	DevOps in Python	PE	7	3	0	4	5
22	21FE22	Advanced Algorithms	PE	7	3	0	4	5
23	21FE23	Advanced Python Programming	PE	7	3	0	4	5
24	21FE24	Advanced Database Management Systems	PE	7	3	0	4	5
25	21FE25	Code Optimization Techniques	PE	5	3	0	2	4
26	21FE26	Ethical Hacking	PE	3	3	0	0	3
27	21FE27	Artificial Intelligence	PE	4	3	1	0	4
28	21FE28	Mainframe Computing	PE	3	3	0	0	3
29	21FE29	User Interface Design	PE	2	2	0	0	2
30	21FE30	Data Science and Big Data Analytics	PE	5	3	0	2	4
31	21FE31	Business Intelligence Reporting Tools	PE	2	2	0	0	2
32	21FE32	Virtualization	PE	3	3	0	0	3
33	21FE33	Software Requirement Engineering	PE	3	3	0	0	3
34	21FE34	Cloud Infrastructure and Services	PE	3	3	0	0	3
35	21FE35	Virtual Reality and Augmented reality	PE	5	3	0	2	4
36	21FE36	Blockchain Technologies	PE	3	3	0	0	3
37	21FE37	3D Modeling and Rendering	PE	5	3	0	2	4
38	21FE38	Design Pattern and Design Thinking	PE	3	3	0	0	3

6. Employability Enhancement Courses (EEC)

S. No.	Course Code	Course Title	Category	Contact hours	Instruction Hours/Week			C
					L	T	P	
1	21FF01	Soft Skills	EEC	3	-	-	3	-
2	21FF02	Mini Project – I	EEC	2	0	0	2	1
3	21FF03	Mini Project – II	EEC	2	0	0	2	1
4	21FF04	Comprehension	EEC	-	-	-	-	-
5	21FF05	Internship – I	EEC	2	0	0	2	1
6	21FF06	Internship – II	EEC	2	0	0	2	1
7	21FF25	Project Work – Phase I	EEC	4	0	0	4	2
8	21FF50	Project Work – Phase II	EEC	20	0	0	20	10

7. Mandatory Courses (MC)

S. No.	Course Code	Course Title	Category	Contact hours	Instruction Hours/Week			C
					L	T	P	
1	21OG01	Environmental Science for Engineers	MC	5	3	0	2	-
2	21OG02	Indian Constitution	MC	3	3	0	0	-
3	21OG03	Essence of Indian Traditional Knowledge	MC	3	3	0	0	-

* The URLs mentioned in the syllabi were available at the time of framing the syllabi.

MODEL CURRICULUM

Minimum Credits to be earned: 160

Semester I								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	210A11	Technical English - I	HS	4	3	1	0	4
2	21OB01	Matrices and Calculus	BS	5	4	1	0	5
3	21OB21	Engineering Physics	BS	6	3	1	2	5
4	21FC13	Fundamentals of Information Technology	ES	3	3	0	0	3
5	21FC07	Engineering Practices for Computer Sciences	ES	4	0	0	4	2
6	21FC01	Programming Logic and Design	ES	7	3	0	4	5
Total				**29**	**16**	**3**	**10**	**24**

Semester II								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OA12	Technical English – II	HS	5	3	0	2	4
2	21OB02	Vector Calculus and Integral Transforms	BS	5	4	1	0	5
3	21PC04	Advanced C Programming	BS	7	3	0	4	5
4	21PC14	Electronic Devices and Circuits	ES	5	3	0	2	4
5	21OG01	Environmental Science for Engineers	ES	5	3	0	2	-
Total				**27**	**16**	**1**	**10**	**21**

Semester III								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OB11	Discrete Mathematical Structures	BS	5	4	1	0	5
2	21FC09	Digital Electronics and Microprocessors	ES	6	4	0	2	5
3	21FD02	Data Structures	PC	7	3	0	4	5
4	21FD05	Database Management Systems	PC	7	3	0	4	5
5	21FD13	Java Programming	PC	7	3	0	4	5
6	21OG02	Indian Constitution	MC	3	3	0	0	-
7	21FF05	Internship – I	EEC	2	-	-	2	1
Total				**35**	**20**	**1**	**14**	**26**

Semester IV								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OB12	Probability and Statistics	BS	5	4	1	0	5
2	21FD03	Operating Systems	PC	5	3	0	2	4
3	21FE01	Advanced Data Structures	PE	7	3	0	4	5
4	21FE04	Advanced Java Programming	PE	7	3	0	4	5
5	21XXXX	Open Elective - I	OE	4	4	0	0	4
6	21OG03	Essence of Indian Traditional Knowledge	MC	3	3	0	0	-
Total				**31**	**20**	**1**	**10**	**23**

Semester V								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21FD09	Software Engineering	PC	4	3	1	0	4
2	21XXXX	Open Elective - II	OE	5	3	0	2	4
3	21XXXX	Professional Elective - I	PE	7	3	0	4	5
4	21XXXX	Professional Elective - II	PE	7	3	0	4	5
5	21FF01	Soft Skills	EEC	3	-	-	3	-
6	21FF06	Internship – II	EEC	2	-	-	2	1
7	21FF02	Mini Project – I	EEC	2	-	-	2	1
Total				**30**	**12**	**1**	**17**	**20**

Semester VI								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21FD14	Computer Graphics and Multimedia	PC	5	3	0	2	4
2	21FD15	Mobile Computing and Communication	PC	3	3	0	0	3
3	21FD10	Data warehousing and Data mining	PC	4	4	0	0	4
4	21XXXX	Professional Elective - III	PE	4	3	1	0	4
5	21XXXX	Open Elective - III	OE	3	3	0	0	3
Total				**19**	**16**	**1**	**2**	**21**

Semester VII								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21FD08	High Speed Networks	PC	3	3	0	0	3
2	21XXXX	Professional Elective - IV	PE	3	3	0	0	3
3	21FD20	Automata Theory and Compiler Design	PC	3	3	0	0	3
4	21XXXX	Professional Elective - V	PE	5	3	0	2	4
5	21XXXX	Open Elective - IV	OE	3	3	0	0	3
6	21PF25	Project Work – Phase I	EEC	4	0	0	4	2
Total				**21**	**15**	**0**	**21**	**21**

Semester VIII								
S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21OA01	Principles of Management and Engineering Ethics	HS	3	3	0	0	3
2	21PF50	Project Work – Phase II	EEC	20	0	0	20	10
Total				**23**	**3**	**0**	**20**	**13**

* The URLs mentioned in the syllabi were available at the time of framing the syllabi.

HUMANITIES AND SOCIAL SCIENCES (HS)

21OA01 PRINCIPLES OF MANAGEMENT AND ENGINEERING ETHICS
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To have an insight in to the foundations of business and management.
- To understand the roles and responsibilities of a manager.
- To acquire knowledge in various verticals of management.
- To obtain knowledge in ethical engineering behaviour.
- To understand the importance of ethical code of conduct for sustainable development.

OUTCOMES:

Learners should be able to

CO1 :	differentiate managerial roles, skills, and styles in diverse organizational contexts to address evolving trends in management	**K2**
CO2 :	illustrate the planning and decision-making processes to formulate effective organizational strategies	**K2**
CO3 :	describe organizational structures and control mechanisms to optimize human resource and operational efficiency.	**K2**
CO4 :	explain the significance of professional ethics and sustainable practices in engineering with reference to global ethical standards	**K2**
CO5 :	summarize engineering ethics to be adopted for addressing ethical dilemmas and interpreting professional responsibilities through case studies.	**K2**

MODULE I **9**

Management – Science or art – Manager Vs entrepreneur – Managerial roles, skills and styles – Evolution of management thought – Types of business organization – Current trends and issues in management.

MODULE II **21**

Planning – Nature and purpose of planning – Planning process – Types of planning – Strategic management – MBO – Decision making process – Organizing – Nature and purpose of organizing – Formal and informal organization – Organization chart – Organization structure – Line and staff Authority – Centralization and decentralization – HRM – Career planning. Directing – Nature and purpose of directing – Motivation – Motivation theories – Job satisfaction – Job enrichment – leadership – Communication – Process and barrier of communication – Controlling – System and process of controlling – Budgetary and non-budgetary control techniques – Control performance – Direct and preventive control – Reporting

MODULE III **21**

Engineering ethics – Why engineering ethics – Personal Vs professional ethics – Code of ethics – Analysis of issues in ethical problems – Ethical problem solving techniques – Risk – Safety – Accidents – Professional responsibilities of engineers – Professional rights and whistle – Blowing. Ethical issues in engineering practices – Environmental ethics – Sustainable development – Environmental leadership – Global issues – Code of ethics of professional engineering societies – IEEE, NSPE, ASME, ASCE, AICHE, Japan society of civil engineers.

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Harold Koontz and Heinz Welhrich	Essentials of Management An International, Innovation and Leadership Perspective	McGraw Hill, Tenth Edition	2015
2	Charles B Fleddermann	Engineering Ethics	Prentice Hall	2008

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen P Robbins and Mary A Coulter	Management	Pearson Education, Thirteenth Edition	2016
2.	Tripathi P C and Reddy P N	Principles of Management	Tata Mcgraw Hill, Fifth Edition	2012
3.	Christopher P Neck, Jeffery D Houghton, Emma Murray and Charles L Lattimer	Management	Wiley, Second Edition	2016

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
4.	Ibo van de Poel and Lamber Royakkers	Ethics, Technology, and Engineering: An Introduction	Wiley-Blackwell First Edition	2011

WEB URLs:

1. www.open.lib.umn.edu/principlesmanagement/
2. www.learn.saylor.org/course/view.php?id=88&sectionid=858#section-1
3. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-805-ethics-and-the-law-on-the-electronic-frontier-fall-2005/
4. www.nptel.ac.in/courses/122108038/
5. www.nptel.ac.in/courses/110105079/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	1	1	-	1	1	-	-
CO2	-	-	-	-	-	2	-	1	1	-	1	1	-	-
CO3	-	-	-	-	-	-	-	1	1	-	1	-	-	-
CO4	-	-	-	-	-	2	-	3	1	-	1	1	-	-
CO5	-	-	-	-	-	-	-	3	1	-	1	1	-	-
CO	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**3**	**1**	**-**	**1.6**	**3**	**-**	**-**

21OA03 PROFESSIONAL PRACTICE, LAW AND ETHICS
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To understand the basic human values essential for an individual
- To impart the professional expectations from an engineer
- To understand the professional ethics to be followed by the engineer
- To comprehend the basic law of contract and labour law.
- To understand the right to information act and the Intellectual property rights applied for the engineering profession.

OUTCOMES:

Learners should be able to

CO1 :	be an engineer with human values.	**K1**
CO2 :	act as a professional	**K1**
CO3 :	follow the professional ethics needed for an engineer.	**K2**
CO4 :	handle the contract and labour related issues in their profession.	**K2**
CO5 :	apply the intellectual property rights and right to information acts in profession	**K3**

MODULE I **9**

Morals, values and ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for Others – Living peacefully – caring – Sharing – Honesty – Truthfulness and Trustworthiness – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

MODULE II **21**

Professionalism– Engineering as social experimentation – Engineering as experimentation, Engineers as Responsible experimenters – Professional accountability for work – Workplace issues – Job responsibilities and standards of practice – Team work – Relations with other professionals and non-professionals – business practices – Respective roles of various stakeholders – Confidentiality and Conflict of interest – Duties to inform – Whistle-Blowing – Statutory and non-statutory standards and codes of practice – Commitment to Safety – Safety and risk – Assessing and Reducing Risk – Insurance, risk management, and quality management – Due diligence – Environmental responsibilities and sustainable development – Use of software, computers and internet-based tools – Liability for software errors – Documentation authentication and control.

Ethics – Micro and macro Issues – Dimensions of engineering – Engineering ethics, Corporate responsibility – Moral reasoning and Codes of ethics – Moral choices and Ethical dilemmas – Code of conduct – Moral frameworks – Right ethics – Duty ethics – Virtue ethics – Self-realization ethics – Human centered ethics – Scientific centered ethics – Environmental ethics, Biocentric ethics –Ecocentric ethics – Global issues – Technology transfer – Sample codes of ethics – NSPE – ABET – IEEE – AICHE – ASCE – ASME.

MODULE III **21**

General principles of contract under Indian Contract Act, 2172 – General principles of contract – Sec. 1 to 75 of Indian Contract Act and including Government as contracting party – Kinds of government contracts and dispute settlement, Standard form contracts – nature, advantages, unilateral character – Principles of protection against possibility of exploitation, judicial approach to such contracts – exemption clauses – Clash between two standard form contracts.

Labour Laws – Industrial Disputes Act, 1947 – Collective bargaining; Industrial Employment (Standing Orders) Act, 1946 – Workmen's Compensation Act, 1923.

Right to Information Act, 2005 covering – Evolution and concept – Practice and procedures – Official Secret Act, 1923 – Indian Evidence Act, 2172 – Information technology – legislation and procedures –Cyber crimes – issues and investigations;

Law relating to Intellectual property covering introduction – Meaning of intellectual property, main forms of IP – Copyright, trademarks, patents and Designs, secrets – Other new forms such as plant varieties and geographical indications – International instruments on IP – Berne convention, rome convention, TRIPS, Paris convention and international organizations relating IPRs, WIPO, WTO et –Law relating to copyright in India including historical evolution of Copy Rights Act, 1957– Meaning of copyright – literary, dramatics and musical works, sound records and cinematographic films, computer programs – Ownership of copyrights and assignment – Criteria of infringement, piracy in Internet – Remedies and procedures in India – Law relating to trademarks under Trademark Act, 1999 including rationale of protection of trademarks as commercial aspect and Consumer rights –Trademarks – registration, procedures – Distinction between trademark and property mark – Doctrine of deceptive similarity – Passing off an infringement and remedies – Law relating to patents under Patents Act, 1970 including Concept and historical perspective of patents law in India – Patentable inventions with special reference to biotechnology products – Patent protection for computer programs – Process of obtaining patent – Application, examination, opposition and sealing of patents – Patent cooperation treaty and grounds for opposition – Rights and obligations of patentee – Duration of patents – Law and policy considerations – Infringement and related remedies.

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mike W Martin and Ronald Schinzinger	Ethics in Engineering	McGraw Hill	2014
2.	Natarajan S Senthilkumar V S and Govindarajan M	Professional Ethics and Human Values	PHI Learning Pvt Ltd	2013

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles D Fleddermann	Engineering Ethics	Pearson Education Fourth Edition	2014
2.	Charles E Harris Jr, Michael S Pritchard, Michael J Rabins Ray W James and P E Elaine E Englehardt	Engineering Ethics-Concepts and cases	Cengage Sixth Edition	2021
3.	Alavudeen A and Kalil Rahman R	Professional Ethics and Human Values	USP/Laxmi Publications (P) Ltd	2015
4.	Naagarazan R S	A Textbook on Professional Ethics and Human Values	New Age International	2016

WEB URLs:

1. www.nptel.ac.in/courses/109104068/38
2. www.nptel.ac.in/courses/109104068/
3. www.openculture.com/professional-ethics-a-free-online-course
4. www.nptel.ac.in/courses/110106081/
5. www.nptel.ac.in/courses/109104068/30

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	-	2	-	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	-	1	-	-	-	-	-	-
CO3	-	-	1	-	-	-	-	1	-	2	-	-	-	-
CO4	-	-	1	-	-	1	-	1	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO	-	-	**1**	-	-	**1.3**	-	**1**	-	**2**	-	-	-	**-**

21OA04 ORGANIZATIONAL BEHAVIOUR
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To understand the concept of organization behaviour and the framework for OB Model.
- To understand individual's attitude and emotions and its impact in workplace.
- Recognize the individual's personality, values, perception and motivation and its importance in behaviour.
- To understand the group behavior in organizations, including communication, leadership, power and politics.
- To understand the organizational system, including organizational structures, culture and change.

OUTCOMES:

Learners should be able to

CO1 :	visualize about manager's roles and the need of organizational behaviour	**K1**
CO2 :	develop good attitude and balance the emotions for effective performance at workplace.	**K1**
CO3 :	use interpersonal interactions to communicate purpose and vision, inspire commitment, and motivate others.	**K2**
CO4 :	demonstrate leadership, teamwork, and communication skills.	**K2**
CO5 :	effectively manage change.	**K2**

MODULE I **9**

Definition – Management functions – Managers roles – Management skills – Challenges and Opportunities of organizational behaviour (OB) – Discipline contributing to the OB field–Organizational behaviour models.

MODULE II **21**

Attitudes – Components – Attitude and Behaviour – Job attitudes – Values – Importance – Terminal and Instrumental values – Generational Values – Personality and values.

Emotions – Moods – Emotional labour – Emotional intelligence – OB applications of emotions and Moods.

Personality – Types – Factors influencing personality – Theories – Perceptions – Importance – Factors influencing perception – Judging others, perception and individual decision making – Motivation – Importance – Theories – Application.

MODULE III **21**

Groups – Stages of group development – Group decision making – Teams – types of teams – Creating effective teams. Communication – Process – Interpersonal communication – Organizational communication – Communication channels – Persuasive communication – Barriers to effective communication. Leadership – Theories – Trait and contingency theories – Power and politics – Bases of power – Causes and consequences of political behaviour- Organisation structure – Organisation designs – Organisation culture – Organisation change.

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stephen P Robbins, Timothy A Judge and Neharika Vohra	Organizational Behavior	Pearson Education Sixteenth Edition	2016
2.	Steven McShane and Mary Ann Von Glinow	Organizational Behavior	McGraw Hill Sixth Edition	2015

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	UdaiPareek	Understanding Organizational Behaviour	Oxford Publication, Fourth Edition	2016
2.	Aswathappa K	Organisational Behaviour Text Cases and Games	Himalaya Publishing House, Twelth Edition	2016
3.	Fred Luthans	Organizational Behaviour - An Evidence - Based Approach	McGraw Hill, Twelth Edition	2013
4.	Angelo Kinicki and Robert Kreitner	Organizational Behavior: Key Concepts, Skills and Best Practices	McGraw Hill, Fourth Edition	2012

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2. www.nptel.ac.in/downloads/110105034/
3. www.studocu.com › University of Melbourne › Organisational Behaviour
4. www.vutube.edu.pk/management-mgt/organizational-behavior-mgt502-vu-lectures-handouts-ppt-slides-assignments-quizzes-papers-books
5. www.freevideolectures.com/course/3502/organizational-behaviour-i

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	-	2	-	1	2	-	1	1	-	-
CO2	-	-	2	-	-	1	-	2	-	-	-	1	-	-
CO3	-	-	-	-	-	-	-	2	-	2	1	-	-	-
CO4	-	-	1	-	-	2	-	1	2	-	1	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO	-	-	**1.6**	-	-	**1.6**	-	**1.5**	**2**	**2**	**1**	**1**	-	-

21OA05 FINANCE AND ACCOUNTING
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To understand the concepts and acquire the skills to assess the financial performance.
- To understand the concept of time value of money and its applications.
- To determine the enterprise costs of raising capital through debt and equity offerings
- To apply the costing concepts for decision making
- To understand the concept of budgeting

OUTCOMES:

Learners should be able to

CO1:	interpret the financial performance of the company using ratios and cash flow statements.	**K2**
CO2:	acquire the skills to apply the concept of time value of money in corporate and personal finance.	**K2**
CO3:	obtain the skills to select the optimal capital structure based on cost of capital and ebit-eps analysis.	**K2**
CO4:	attain the skills for making the best make or buy decision.	**K2**
CO5:	apply the concept of budgeting control	**K3**

MODULE I **9**

Accounting concepts – Conventions – Rules – Double entry system – Journal – Ledger – Trial Balance – Final A/cs (simple problems only) – Depreciation and reserves – Meaning – Need for depreciation – Causes – Methods – Straight line method – Written down value method – Annuity method (Simple Problems)

Financial statement analysis – Ratio analysis – Profitability turnover ratios, Liquidity ratios, leverage ratios, and Financial ratios (Simple Problems)

Interpreting the cash flow statement – Cash flow from operations, cash flow from financing and cash flow from investment. (Theory)

MODULE II **21**

Time Value of Money – Future value of a single cash flow, annuity – Present value of a single cash flow, annuity, present value of an uneven cash flow, multi - period compounding – Capital Budgeting – Concept and Importance, capital budgeting decision – NPV, PI, IRR, Payback period (60% Problems) – Sources of Finance – Equity, debenture, preference share, private equity – Venture capital and Angel investor, cost of capital – Cost of debt, cost of preference share, cost of equity – Leverage – Financial leverage, operating leverage, combined leverage, EBIT-EPS analysis (50% Problems).

MODULE III **21**

Costing – Elements of cost, cost classification –Variable and Fixed Costs, direct and indirect costs, traceable and common costs, product costs and period costs, controllable and non-controllable Cost, standard and actual costs – Process costing, job costing, batch costing – Activity- based costing – Cost control Vs. cost reduction, (Theory) – Cost sheet preparation. Standard costing – Meaning, concepts and objectives – Merits and demerits of standard costing – Prerequisite for establishment of standard costing – Efficiency and activity ratios – Variance analysis and control marginal costing – Definition – Assumptions and Uses – Marginal costing Vs. Absorption costing – CVP /BEP analysis – Key factors and safety margin – Managerial decision making areas – Product mix – Make or Buy – Pricing decisions.

Budgetary control – Concepts and Objectives – Merits and demerits of budgetary control – Fixed and Flexible budget, cash budget and master budget, zero based budgeting.

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Khan M Y and Jain P K	Management Accounting : Text, Problems and Cases	Mcgraw Hill Education, Seventh Edition	2017
2.	M Y Khan and P K Jain	Financial Management : Texts, Problems and Cases	Mcgraw Hill Education, Seventh Edition	2014

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mohamed Hanif and Amitabha Mukherjee	Financial Accounting	Mcgraw Hill Education, Second Edition	2015
2.	Gupta R L and Radhaswamy M	Financial Accounting	Sultan Chand and Sons, First Edition	2014
3.	Maheshwari S N	Financial Management : Principles and Practice	Sultan Chand and Sons, Fourteenth Edition	2014
4.	Pandey I M	Financial Management	Vikas Publishing House Pvt. Ltd., Eleventh Edition	2015

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2. www.nptel.ac.in/courses/110101003/
3. www.vutube.edu.pk/vu-lectures/viewcategory/19/cost-management-accounting-mgt402
4. www.vutube.edu.pk/vu-lectures/viewcategory/13/financial-accounting-mgt101
5. www.wiley.com//college/managerialvideos/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	2	-	-	-	-	-	-	-	2	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	-	3	-	-	2	-	-	-	-	-	2	-	-	-
CO	**2**	**3**	**2**	-	**2**	-	-	-	-	-	**2**	-	-	-

21OA11 TECHNICAL ENGLISH – I
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: None

OBJECTIVES:

- To recall the usage of grammar and understand the basic reading and writing skills.
- To emphasize on listening and develop speaking skills
- To engage in formal writing.
- To enrich the receptive and productive skills.
- To develop fluency in language.

OUTCOMES:

Learners should be able to

CO1:	relate the usage of grammar and implement in reading and writing skills.	**K2**
CO2:	classify precise transition between paragraphs and write formally.	**K2**
CO3:	apply the linguistic parameters in everyday speaking and listening tasks effectively.	**K3**
CO4:	interpret the paragraphs, compose and compile documents for various purposes.	**K2**
CO5:	construct ideas and make effective presentation and participate in discussion.	**K3**

MODULE I **9**

Grammar: Parts of Speech – Gerunds and infinitives
Reading: Reading comprehension : (vocabulary, referents, and inferences/conclusions).
Writing: Letter Writing (Formal and Informal) – Email Writing

MODULE II **21**

Grammar: Tenses – Simple Present and Present continuous – Types of Sentences – Direct and Indirect – Connectives.
Reading: Identifying main and secondary information, transferring and interpreting information.
Writing: Resume writing with cover letter – Check lists – Building Itineraries – Paragraph writing.
Speaking: Describing people, places, jobs and things – Self Introduction – Asking questions.
Listening: Listening comprehension – Telephone conversation – Job description

MODULE III **21**

Grammar: Tenses: Perfect and Perfect continuous tenses – Reported speech – Active Passive - Identifying common errors.
Listening: Critical listening – Listening and Interpretation of ideas.
Reading: Reading comprehension: Cause and effect identification, reconstruction, rewording.
Writing: Business letters – Creative writing – Memo – Notice – Agenda.
Speaking: Oral presentations – Group discussions.

TOTAL: 45+15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jack C Richards with Jonathan Hull and Susan Proctor I	Interchange Student's Book 1	Cambridge University Press, Fourth Edition	2016
2.	Barun K Mitra	Effective Technical Communication	Oxford University Press, First Edition	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jack C Richards	Interchange Student's Book 1	Cambridge University Press, Fourth Edition	2015
2.	Raymond Murphy	Essential English Grammar	Cambridge University Press, Second Edition	2016
3.	Ashraf Rizvi M	Effective Technical Communication	McGraw Hill Education, First Edition	2013
4.	University of Cambridge	BEC Preliminary 1 (Exam Papers with answers)	Cambridge University Press	2010

WEB URLs:

1. www.onestopenglish.com
2. www.britishcouncil.org
3. www.learnenglishtoday.com
4. www.talkenglish.com
5. www.bogglesworldesl.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	3	3	2	-	3	-	-
CO2	-	-	-	-	3	-	-	3	3	2	-	3	-	-
CO3	-	-	-	-	3	-	-	2	3	2	-	3	-	-
CO4	-	-	-	-	3	-	-	3	3	2	-	2	-	-
CO5	-	-	-	-	3	-	-	3	3	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**3**	-	**-**	**2.8**	**3**	**2**	**-**	**2.6**	**-**	**-**

21OA12 TECHNICAL ENGLISH – II
(Common to all Branches)

3 0 2 4

PRE-REQUISITES: Technical English – I

OBJECTIVES:

- To make students realize the importance of writing reading and Listening.
- To understand the contexts of grammar and listening accompanied by fine reading skills in Speaking.
- To emphasize speaking in English through activities.
- To develop reading and writing skills through analysis of the facts between paragraphs.
- To enhance students' ability to listen and speak effectively in formal and informal contexts..

OUTCOMES:

Learners should be able to

CO1: infer the aspects of writing, reading and Listening with present scenario. **K2**

CO2: extend the given contents and reproduce the essence of it. **K2**

CO3: apply the English speaking and listening skills in the social milieu. **K3**

CO4: utilize the rules of grammar in reading contexts. **K3**

CO5: make use of the rules of writing and Speaking in formal and informal assignments. **K3**

MODULE I **9**

Grammar: Prepositions – Adjectives – Adverbs
Reading: Skimming – Scanning.
Writing: Paragraph writing: Compare and Contrast – Cause and Effect
Listening: Types of Listening – Barriers to listening

MODULE II **21**

Grammar: Tenses – Use of sequence words – Modal Verbs
Reading: Note making – Mind map – Cohesion and Coherence in reading
Writing: Paragraph writing – Jumbled sentences – Interpreting visual materials
Speaking: Role-play – Group interaction – Speaking in formal Situations
Listening: Listening and responding to video lectures – Listening to specific tasks – Focused Listening – Note taking

MODULE III **21**

Grammar: Concord – Use of Imperatives **–** WH Questions – Identifying common errors
Reading: Reading and Making inference – Reading and interpreting visual materials – Critical Reading – Shifting facts from opinions
Writing: Essay writing - Report **–** Proposals – Free writing
Speaking: Impromptu Speeches – Making presentations on given topics –Responding to questions – Mock interviews
Listening: Watching videos or documentaries and answering – Listening to different accents – Listening to Speeches

TOTAL: 45

LIST OF EXPERIMENTS:

1. Skimming and Scanning
2. Listening and Responding
3. Listening to different Accents
4. Movie review
5. Group discussion
6. Listening and paraphrasing.
7. Mock interview
8. Listening and note making
9. Presentation
10. Report Writing.

TEXT BOOKS:

SI.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jack C Richards with Jonathan Hull and Susan Proctor	Interchange Student's Book 2	Cambridge University Press, Fourth Edition	2016
2.	Rajesh K Lidiya	Communication Skills	Oxford University Press, Second Edition	2017

REFERENCE BOOKS:

SI.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Meenakshi Raman and Sangeeta Sharma	Fundamentals of Technical Communication	Oxford University Press, First Edition	2015

SI.No.	Author(s)	Title of the Book	Publisher	Year of Publication
2.	Ashraf Rizvi M	Effective Technical Communicatioṅn	McGraw Hill Education, First Edition	2013
3.	Russel Whitehead and Micheal Black	Pass Cambridge BEC Vantage (Self Study Practice tests with key)	Summertowm Publishing, Second Edition	2014
4.	University of Cambridge	BEC Vantage 4 (Exam Papers with answers)	Cambridge University Press, Second Edition	2010

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3. www.eslflow.com.
4. www.myenglishpages.com.
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COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	-	-	3	2	2	-	2	-	-
CO2	-	-	-	-	3	-	-	2	2	2	-	2	-	-
CO3	-	-	-	-	3	-	-	3	2	2	-	2	-	-
CO4	-	-	-	-	3	-	-	3	3	2	-	2	-	-
CO5	-	-	-	-	3	-	-	3	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**3**	-	**-**	**2.8**	**2.2**	**2**	**-**	**2**	-	**-**

21OA13 BUSINESS ENGLISH – I

(Common to all Branches)

3 0 2 4

PRE-REQUISITES: None

OBJECTIVES:

- To familiarise the learners on Everyday English in formal and informal contexts. .
- To build vocabulary and develop critical reading skill.
- To help students avoid waffling and write effectively by using a wide range of vocabularies.
- To improve their listening skill.
- To make students excellent in speaking skill, improve pronunciation; develop their fluency and analytical skills through activities.

OUTCOMES:

Learners should be able to

CO1:	recall and assimilate Everyday English and enhance accuracy in grammar.	**K1**
CO2:	understand and analyse the text critically.	**K2**
CO3:	apply the rules and write any formal and informal assignments effectively.	**K3**
CO4:	analyse the conversation and answer the questions with appropriate pronunciation.	**K2**
CO5:	enhance speaking in English in a professional forum.	**K2**

MODULE I **9**

Grammar: Tenses – Simple Present – Present Continuous tenses – Relative clauses – Compound Nouns – Adverbs
Reading: Reading and filling in the missing information – Reading and matching
Writing: E-mail – Memo – Formal Letters
Listening: Listening and filling the missing information
Vocabulary: Words describing actions – Formal and Informal Greeting/Questioning

MODULE II **21**

Grammar: Phrasal Verbs – Tense: Present Perfect, Simple Future and Future continuous tenses –Voices
Reading: Reading and Paraphrasing / summarizing.
Writing: Graphical Interpretation – Analytical reports – Sales reports
Listening: Listening to a conversation and understanding the main ideas
Speaking: Telephoning – Making an appointment – Booking a venue.
Vocabulary: Technology- Education – Environment - Personality

MODULE III **21**

Grammar: Conditional – Modal verbs – Articles – Gerunds and Infinitives - Clauses
Reading: Reading and Interpreting – Reading and Predicting
Writing: Proposals – Project reports – Note Making
Listening: Listening and Responding – Listening and Note taking – Listen and repeat words/sentences and paragraphs
Speaking: Business presentation – Group discussion
Vocabulary: Health – Business Vocabulary – Common Phenomena and Occurrences.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Listening for Specific Information - Cloze.
2. Listening to a conversation.
3. Listening to a Discussion or a Debate (Understanding and answering the questions).
4. Listening and fill in the missing information.
5. Reading and Reviewing
6. Reading and Matching
7. Planning a business trip/vacation in foreign countries.
8. Panel discussion
9. Mock Interview (job interview, interviewing famous personalities).
10. A mini presentation on a business theme.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barun K Mitra	Effective Technical Communication	Oxford University Press, First Edition	2017
2.	Norman Whitby	Business Benchmark	Cambridge University Press, Second Edition	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sanjay Kumar and Pushp Lata	Communication Skills a workbook	Oxford University Press, Second Edition	2021
2.	Meenakshi Raman and Sangeeta Sharma	Fundamentals of Technical Communication	Oxford University Press, First Edition	2014
3.	Norman Lewis	Word Power Made Easy	Goyal Publishers, First Edition	2014
4.	Guy Brook Hart	Business Benchmark	Cambridge University Press, First Edition	2006

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COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	2	2	3	-	2	-	-
CO2	-	-	-	-	2	-	-	2	2	3	-	2	-	-
CO3	-	-	-	-	2	-	-	2	2	3	-	2	-	-
CO4	-	-	-	-	2	-	-	2	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	2	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**2.6**	**-**	**2**	-	**-**

21OA14 BUSINESS ENGLISH – II
(Common to all Branches)

3 0 2 4

PRE-REQUISITES: Business English – I

OBJECTIVES:

- To comprehend grammar and sentence formation to develop writing skills.
- To share ideas orally with fluency and accuracy.
- To understand a range of real-world listening and reading materials.
- To produce and compose clear detailed essays and presentation on wide range of subjects.
- To develop their Vocabulary Comprehensively.

OUTCOMES:

Learners should be able to

CO1:	engage in writing as a process including drafting, editing, revising and proof reading.	**K1**
CO2:	expand vocabulary and fluently share their ideas orally.	**K2**
CO3:	demonstrate the ability to respond to a text/speaker through making critical connections and analysis.	**K2**
CO4:	speak and listen to explore, clarify and reflect on their thoughts and ideas.	**K2**
CO5:	comprehend and analyse verbal components effectively	**K3**

MODULE I **9**

Grammar: Concord – Relative Clauses – **Vocabulary**: Homophones, Homonyms – **Writing**: Paragraph Writing, Expository Essays.

MODULE II **21**

Grammar: Tenses – Vocabulary: Prefix, Suffix and Root words **– Reading –** Reading Comprehension, Inferential Reading and Reading aloud – **Writing** – Report Writing, Compare and contrast essays – **Listening** – Listening for specific and general information – Listening and Responding – **Speaking** – Pronunciation – Stress and Intonation – Group Discussion, Making Requests, Asking For and Giving Information.

MODULE III **21**

Grammar – Error Spotting – Infinitives – **Reading:** Reading Comprehension – Vocabulary – Sequential words – Verbal Analogy – **Writing -** Writing Articles for Newspapers and Journals, Paraphrasing – Reviews – **Listening** – Listening for Responding and Interpretation – **Speaking:** Describing people, places and things - Oral Presentations.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Self introduction
2. Cloze Listening
3. Listening for General and Specific information
4. Reading Comprehension
5. Movie review
6. Role play
7. Oral presentation
8. Resume
9. Panel discussion
10. Group discussion

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Guy Brook Hart	Business Benchmark upper-Intermediate Students's Book	Cambridge university Press, Fourth Edition	2013
2.	Russel Whitehead and Micheal Black	Pass Cambridge BEC Higher (Self Study Practice Tests with key)	Summertown Publishing, Second Edition	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Norman Lewis	Word Power Made Easy	Goyal Publishers, First Edition	2014
2.	Raymond Murphy	Essential English Grammar	Cambridge university Press, Second Edition	2016
3.	Meenakshi Raman and Sangeeta Sharma	Fundamentals of Technical Communication	Oxford University Press, First Edition	2015
4.	Barun K Mitra	Effective Technical Communication	Oxford University Press, First Edition	2017

WEB URLs:

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COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	2	2	3	-	2	-	-
CO2	-	-	-	-	2	-	-	2	2	3	-	2	-	-
CO3	-	-	-	-	2	-	-	2	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	2	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	2	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**2.4**	**-**	**2**	-	**-**

21OA21 BASICS OF FRENCH
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: None

OBJECTIVES:

- To have basic knowledge of grammar in French.
- To enrich the vocabulary and employ it.
- To develop fluency in language.
- To emphasize on developing speaking skills.
- To engage in formal writing assignments.

OUTCOMES:

Learners should be able to

CO1:	speak in social interactions, day to day life, work and leisure activities, interpersonal relations in the family, community and city life	**K1**
CO2:	write simple communications	**K2**
CO3:	read and speak simple sentences	**K2**
CO4:	listen and comprehend excerpts and infer the spoken and implied meanings	**K2**
CO5:	mingle with French people and to work in France or in French speaking countries	**K2**

MODULE I **9**

Saluer – se présenter – demander et dire le prénom et le nom – identifier une personne – demander des nouvelles d'une personne – demander l'age, l'adresse, le numéro de téléphone – Formes de politesse - parler de ses gouts
Grammaire : les verbes être et s'appeler – masculin et féminin – l'interrogation avec qui – les articles définis – masculin et féminin des noms et des adjectifs –en/au + pays, à+ville – les verbes aller, avoir – les adjectifs possessifs – l'adjectif interrogatif

MODULE II **21**

Nommer des objets – montrer et situer des objets – exprimer la possession – indiquer les couleurs – caractériser un objet – demander et indiquer le prix – montrer et situer des personnes– Grammaire : le pluriel des articles et des noms – le verbe être au pluriel du présent – les prépositions de lieu – les pronoms moi, toi, lui, elle, vous – le verbe avoir – la négation – l'interrogation qu'estce que l'accord des adjectifs – l'interrogation avec comment, combien – les démonstratifs ce cet cette ces – Situer un lieu sur un plan – s'informer sur un lieu – demander son chemin – indiquer la direction – indiquer le moyen de transport – situer un lieu sur une carte – donner un conseil – week-end à la mer – Grammaire : Les pronoms forts au pluriel nous, vous, eux, elles – les prépositions – l'interrogation avec où – l'impératif – l'adverbe y – le verbe prendre – on - c'est+lieu, c'est+article+nom, c'est+adjectif – les prépositions de lieu

MODULE III **21**

Demander et donner l'heure – indiquer une date – faire une demande polie – demander la profession de quelqu'un – demander des informations – Grammaire : l'interrogation avec quandet quelle heure estil – le verbe partir au présent – le verbe faire au présent – S'informer sur une activité actuelle – s'informer sur une activité habituelle – dire quel sport on fait – une journée avec – Grammaire : L'interrogation avec est-ce que, qu'est-ce que, où est-ce que, quand est-ce que – le genre des noms – les verbes lire et écrire au présent – les verbes pronominaux au singulier – le dimanche, le dimanche prochain.

TOTAL:45+15

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Guy Capelle and Robert Menand	Méthode de français	Hachette Livre	2003
2.	Guy Capelle and Robert Menand	Le cahier d'exercices	Hachette Livre	2003

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Régine Mérieux and Yves Loiseau	Méthode de français	Les Éditions, Didier	2004
2.	Régine Mérieux and Yves Loiseau	Le cahier d'exercices	Les Éditions, Didier	2004
3.	Annie Berthet, Catherine Hugo, Véronique M Kizirian, Béatrix Sampsonis and Monique Waendendries	Méthode de français	Hachette livre	2006
4.	Annie Berthet, Catherine Hugo, Béatrix Sampsonis and Monique Waendendries	Le cahier d'activités	Hachette livre	2006

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**

21OA22 FUNCTIONAL FRENCH
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: Basics of French

OBJECTIVES:

- To have good knowledge of grammar in French.
- To enrich the vocabulary and employ it.
- To develop fluency in French.
- To develop speaking skills in French.
- To engage in formal writing assignments.

OUTCOMES:

Learners should be able to

CO1:	speak in social interactions, day to day life, interpersonal relations in the family and community	**K1**
CO2:	write simple communications	**K2**
CO3:	read and speak simple sentences	**K2**
CO4:	listen and comprehend excerpts and infer the spoken and implied meanings	**K2**
CO5:	mingle with French people and to work in France or in French speaking countries	**K2**

MODULE I **9**

Se presenter, dire si on comprend. Presenter une personne, nommer les choses, savoir vivre, comprendre la grammaire.

MODULE II **21**

Donner des information sur une personne, demander, exprimer ses preferences, parler de son travail, parler de ses activites, parler de son pays, de sa ville – Dire la date, dire I'heure, donner des informations sur un employ du temps, proposer, accepter, situer, interroger, repondre, faire un programme d' activites.

MODULE III **21**

S'orienter, situer, se loger, exprimer la possession, connaitre les rythemes de vie, fixer des regles – Dire ce qu'on a fait, s'informer sur un employ du temps passé, expliquer, exprimer le doute ou la certitude, decouvrir les relations entre les mots, savoir s' informer.

TOTAL: 45+15

TEXT BOOK:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jacques pecheur and Jacky Girdet	Methode de Francais	CLE International	2002

REFERENCE BOOKS:

S.NO	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nelly Mauchamp	La France de toujours	CLE International	2005
2.	Jean Michel Cartier and Pierre Lederlion	Declic 1	CLE International	2004
3.	Annie Monnerie-Goarin and Evelyne Sirejols	Champion 1	CLE International	2001
4.	Jacques Pecheur	Chmpus 1	CLE International	2006

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	**-**	**-**

21OA31 BASICS OF GERMAN
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: None

OBJECTIVES:

- To have basic knowledge of grammar in German.
- To enrich the vocabulary and employ it.
- To engage in formal writing assignments.
- To develop fluency in language.
- To emphasize on developing speaking skills.

OUTCOMES:

Learners should be able to

CO1:	read and speak simple sentences	**K1**
CO2:	write simple communications	**K2**
CO3:	speak in social interactions– day to day life– work and leisure activities– interpersonal relations in the family– community and city life	**K2**
CO4:	listen and comprehend excerpts and infer the spoken and implied meanings	**K2**
CO5:	mingle with Dutch people and to work in Germany or in German speaking countries	**K2**

MODULE I **9**

Die Einleitung – Grüßen – Personalpronomen – Konjugation von Verben

MODULE II **21**

Possessivpronomen – Verb – Sein – Singular – Plural– Wortbildung– Ja/ Nein Frage und Fragewoerter– Tempus- Praesens– Dialoge - Negation– Zahlen– Maskulin– Feminin und Neutrum. Kasus– Das Essen und Leben in Deutschland.

MODULE III **21**

Die Zeit– Starke Verben– Praepositionen– Bestimmter und Unbestimmter Artikel - Modal Verben– Dialoge mit Kontext: Freizeit und Arbeit.

TOTAL:45+15

TEXT BOOKS:

SI. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hartmut Aufderstraße, Heiko Bock and Jutta Müller	Aktuell-1	Deutsch Als Fremdsprache	2007

REFERENCE BOOKS:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gick– Cornelia and Momentmal	Grundstufenlehrwerk	Deutsch als Fremdsprache M	2005
2.	Maria Dallapiazza and Eduard von Jan	Til Schonherr Tangram	Deutsch als Fremdsprache Berlin	2005

WEB URLs:

1. www.goethe.de
2. www.dw.de
3. www.mein-deutschbuch.de
4. www.grammatiktraining.de
5. www.learn-german-easily.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	-	**-**

21OA32 FUNCTIONAL GERMAN
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: Basics of German

OBJECTIVES:

- To develop the ability to communicate effectively using the German language
- To offer insights into the culture and society of countries where German is spoken
- To develop awareness of the nature of language and language learning
- To provide enjoyment and intellectual stimulation
- To form a sound base of the skills, language and attitudes required for progression to work or further study in the German speaking countries.

OUTCOMES:

Learner should be able to

CO1:	comprehend and respond to spoken language	**K1**
CO2:	realize and respond to written language	**K2**
CO3:	communicate in speech, showing knowledge of a range and variety of vocabulary, and applying the grammar and structures of German language	**K2**
CO4:	communicate in writing, showing knowledge of a range and variety of vocabulary, and applying the grammar and structures of German language	**K2**
CO5:	mingle with Dutch people and to work in Germany	**K2**

MODULE I **9**

Candidates understand gist and identify main points and detail in texts drawn from a variety of contexts and topic areas. They recognise points of view, attitudes and emotions and are able to draw conclusions. They show an ability to extract meaning from more complex language.

MODULE II **21**

Candidates understand gist and identify main points and detail in texts drawn from a variety of contexts and topic areas. They recognise points of view, attitudes and emotions and are able to draw conclusions. They show an ability to understand unfamiliar language and to extract meaning from more complex language - Candidates develop conversations and discussions and narrate events. They express and justify ideas and opinions, and produce longer sequences of speech using a variety of vocabulary, structures and verb tenses. They speak confidently with good pronunciation and intonation. The message is clear although there may still be some errors, especially when using more complex structures

MODULE III **21**

Candidates give information and narrate events. They express and justify ideas and opinions. They use a range of vocabulary, structures and verbs/tenses. Their spelling and grammar are generally accurate and their style is appropriate to purpose - Usage of language, advanced content of Grammar , Accent and fluency in German, Problems of consecutive and simultaneous interpretation-. Lexico-grammatical problems- Cultural analyses for better understanding of dialects and High German.

TOTAL: 45+15

TEXT BOOK:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hartmut Aufderstraße, Heiko Bock and Jutta Müller	Aktuell-1	Deutsch als Fremdsprache	2007

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gick Cornelia and Momentmal	Grundstufenlehrwerk	Deutsch als Fremdsprache M	2005
S.No.	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
2.	Maria Dallapiazza and Eduard von Jan	Til Schonherr Tangram	Deutsch als Fremdsprache Berlin	2005

WEB URLs:

1. www.goethe.de
2. www.dw.de
3. www.mein-deutschbuch.de
4. www.grammatiktraining.de
5. www.learn-german-easily.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	-	**2**	**2**	**-**	**2**	-	**-**

21OA41 BASICS OF JAPANESE
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: None

OBJECTIVES:

- To have basic knowledge of scripts in Japanese.
- To enrich the vocabulary and employ it.
- To engage in formal writing assignments.
- To emphasize on developing speaking skills
- To develop fluency in Japanese language.

OUTCOMES:

Learners will be able to

CO1:	read and speak simple sentences	**K1**
CO2:	write simple communications	**K2**
CO3:	speak in social interactions, day to day life, work and leisure activities, interpersonal relations in the family, community and city life	**K2**
CO4:	listen and comprehend excerpts and infer the spoken and implied meanings	**K2**
CO5:	mingle with French people and to work in Japan or in Japanese speaking countries	**K2**

MODULE I **9**

Introduction to Japanese syllables – Vowels and Consonants – Hiragana, Katakana – Pronunciation – Writing practice – Japanese Numerals – Demonstrative pronoun – Kore, Sore, Are and Dore (This, That, Over there, which) – Kono, sono, Ano and Dono (this, that, over there, which), Kochira, Sochira, Achira and Dochiora (this way....), Koko, Soko, Asoko and Doko (Here, There. location) – Greetings – Classification of verbs (be verb desu Present tense) – Part of body (look and learn) – Particle –Wa – Particle-Ne

MODULE II **21**

Basic structure of sentence (Subject+ Object+ Verb) – Classification of verbs a) Be verb desu Present and Present negative Past and Past negative b) 'Ga imasu' and 'Ga arimasu' for Existence of living things and non living things c) Masu form (Present and Present negative) – Particle- Ka, Ni, Ga, – Conjunction-Ya...nado – Grammar- ~ Go, ~Jin, San – Days/ Months /Year/Week (Current, Previous, Next, Next to Next) – Nation, People and Language – Classification of Adjectives 'I' and 'na'-ending – Vocabulary and its Meaning – Audio tape listening – Class tests – Classification of Particle (Ga, Ka, Wa, O, E, De,Ni, No, Kara, Made) – Classification of Adjectives I and Na – Classification of verbs – Go-dan verb, Ichi-dan verbs and Irregular verbs (Present, Present negative and past negative) – Aru And Iru verbs for living things and non-living things – Classification of question words (Doko, Dore, Dono, Dochira) – Time expressions (Jikan) – Number of hours – Vocabulary and its Meaning – Number of months, calendar of a month – Audio tape listening – Class tests

MODULE III **21**

Classification of Question words (Dare, Nani, , Itsu, Doyatte, Doo, dooshite, Ikutsu, Ikura) – Classification of Te forms – At the departmental store – At the Railway /Bus station – Polite form of verbs – At the hospital (Byoki) – Vocabulary and its Meaning – Audio tape listening – Class tests – Words of degree (Gurai and Kurai) – Adverb (Mazu,Sore kara,Saigo ni) –Name of the things you carry (look and learn) – Relationship of family (look and learn) – Visit a office and University – Positions and Direction – Vocabulary and its Meaning –Audio tape listening – Revision Test.

TOTAL: 45+15

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shokyuu Nihongo	Japanese Language Center for International Students	Tokyo University of foreign Studies	1998
2.	Mikio Kawarazaki	Nihongo Kananyuumon	Japan foundation	1978

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Timothy G Stout	Japanese Hiragana and Katakana for Beginners	Tuttle	2011
2.	Yasuo Yoshida, Naoomi Kuratani and Shunsuke Okunishi	Japanese for Beginners	Gakken	1984
3.	Shivo Suzuki and Iluolkawase	Nihongo Shoho test book with audio tapes	The Japan foundation	1981
4.	Nagoya Daigaku, Nihongo Kyōiku and Kenkyū Gurūpu	A course in modern Japanese	The University of Nagoya press	2002

WEB URLs:

1. www.japanesepod101.com
2. www.nihongo-pro.com
3. www.tanos.co.uk/jlpt
4. www.japanese-lesson.com
5. www.coscom.co.jp

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	-	**-**

21OA42 FUNCTIONAL JAPANESE
(Common to all Branches)

3 1 0 4

PRE-REQUISITES: Basics of Japanese

OUTCOMES:
Learners will be able to

CO1:	comprehend and respond to spoken language	**K1**
CO2:	realize and respond to written language	**K2**
CO3:	communicate in speech, showing knowledge of a range and variety of vocabulary, and applying the grammar and structures of the target language accurately	**K2**
CO4:	communicate in writing, showing knowledge of a range and variety of vocabulary, and applying the grammar and structures of the target language accurately	**K2**
CO5:	higher education, training and employment in Japan or in Japanese speaking countries	**K2**

MODULE I **9**
The language of the classroom – Home life –School routine – Eating and drinking – Health and fitness.

MODULE II **21**
Self –Family –pets –personal relationships – House and home – Leisure – Entertainments– Invitations – Eating out Festivals and special occasions – Holidays; getting around – Accommodation – Home town and geographical surroundings – Shopping – Public services – Natural environment – Weather – Finding the way – Meeting people – Places and customs–Travel and transport

MODULE III **21**
Further education and training – Future career plans – Employment – Communication – Language at work – Holiday travel and transport – Geographical surroundings – Weather – Places and customs Food and drink – Meeting people – Issues according to available resources and individual interest.

TOTAL: 45+15

TEXT BOOKS:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shokyuu Nihongo	Japanese Language Center for Inter national Students	Tokyo University of foreign Studies	1998
2.	Mikio Kawarazaki	Nihongo Kana nyuu mon	Japan foundation	1978

REFERENCE BOOKS:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Timothy G Stout	Japanese Hiragana and Katakana for Beginners	Tuttle	2011

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
2.	Yasuo Yoshida, Naoomi Kuratani and Shunsuke Okunishi	Japanese for Beginners	Gakken	1984
3.	Shinobu Suzuki and Iluolkawase	Nihongo Shoho test book with audio tapes	The Japan foundation	1981
4.	Nagoya Daigaku, Nihongo Kyōiku and Kenkyū Gurūpu	A course in modern Japanese	The University of Nagoya press	2002

WEB URLs:

1. www.japanesepod101.com
2. www.tofugu.com/learn-japanese
3. www.rocketlanguages.com
4. www.japanese-online.com
5. www.learn-japanese-adventure.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO2	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO3	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO4	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO5	-	-	-	-	2	-	-	-	2	2	-	2	-	-
CO	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**2**	-	**-**

BASIC SCIENCES (HS)

21OB01 MATRICES AND CALCULUS
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Mathematics at 10+2 level or equivalent level

OBJECTIVES:

- To compute eigenvalues and eigenvectors of real symmetric matrix.
- To acquaint the students with the concepts of functions of several variables and optimizing multivariate function.
- To make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- To impart knowledge in definite integrals and Beta, Gamma integrals.
- To develop the knowledge in multiple integrals and its applications.

OUTCOMES:

Learners should be able to

CO1:	illustrate the real symmetric matrix and diagonalize it by orthogonal transformation.	**K2**
CO2:	solve extreme value problems with or without constraints.	**K2**
CO3:	apply the concepts of differential equations in engineering problems.	**K3**
CO4:	make use of definite integrals, Beta and Gamma functions in complex engineering problems.	**K3**
CO5:	apply the concept of multiple integrals to find area and volume of any definite shape	**K3**

MODULE I **12**

Matrices: Eigenvalues and eigenvectors of a real matrix – Properties of eigenvalues – Statement and applications of Cayley-Hamilton theorem – Diagonalization by orthogonal reduction – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

MODULE II **24**

Functions of several variables: Partial derivatives – Total differential coefficients – Implicit functions – Jacobian – Properties – Maxima and minima of functions of two variables – Lagrange's method of constrained maxima and minima – Ordinary linear differential equations : Linear differential equation of second and higher order with constant coefficients – Euler-Cauchy linear differential equation – Method of variation of parameters.

MODULE III **24**

Definite integrals: Properties of definite integrals – Applications – Bernoulli's extension formula – Beta and Gamma integrals – Properties – Applications – Multiple integrals: Evaluation of double integrals – Sketch the region of integration – Change of order of integration – Change of variables – Area using double integrals – Evaluation of triple integrals – Volume of solids.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley and Sons, Tenth Edition	2017

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kandasamy P, Thilagavathy K and Gunavathy K	Higher Engineering Mathematics	S Chand and Co., First Edition	2016
2.	Grewal B S	Higher Engineering Mathematics	Khanna Publishers, Forty Forth Edition	2017
3.	Veerarajan T	Engineering Mathematics (For Semesters I and II)	McGraw Hill Education, First Edition	2017

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
4.	George Brinton Thomas and Ross L Finney	Calculus and Analytic Geometry	Pearson Publishers, Ninth edition	2002

WEB URLs:

1. www.nptel.ac.in/courses/122104021/
2. www.nptel.ac.in/courses/122101003/31
3. www.nptel.ac.in/courses/111107098/11
4. www.nptel.ac.in/courses/122101003/16
5. www.nptel.ac.in/courses/122104017/28

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO	**3**	**2**	**1**	-	-	-	-	-	-	-	-	**1**	-	-

21OB02 VECTOR CALCULUS AND INTEGRAL TRANSFORMS
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Matrices and Calculus

OBJECTIVES:

- To familiarize the concept of vector differential operator and its applications.
- To make the students to understand the concept of periodic function and represent them in Fourier series.
- To introduce the concept of Fourier transform techniques.
- To provide knowledge about the Laplace transform and their properties.
- To afford different techniques of finding inverse Laplace transform, which are useful in solving problems in basic engineering sciences.

OUTCOMES:

Learners should be able to

CO1: utilize the concepts of vector calculus in engineering fields. **K2**

CO2: illustrate the Fourier series in appropriate context of engineering problems. **K2**

CO3: solve the differential equations related to engineering fields with the help of Fourier transforms. **K3**

CO4: make use of the Laplace transform of standard functions in an appropriate context. . **K3**

CO5: apply inverse Laplace transform techniques to solve linear differential equations. **K3**

MODULE I **12**

Vector calculus: Vector differential operator – Gradient, divergence and curl – Identities (Statement only) – Directional derivative – Irrotational and solenoidal vector fields –Conservative vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Simple applications involving square, rectangle, cubes and rectangular parallelepipeds.

MODULE II **24**

Fourier series: Dirichlet's conditions – Odd and even functions – Half range sine and cosine series – Parseval's identity – Harmonic analysis – Fourier transforms: Statement of Fourier integral theorem – Complex Fourier transform – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity of Fourier transform.

MODULE III **24**

Laplace transform: Transforms of standard functions – Transform of unit step function – Dirac-Delta function – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions – Inverse Laplace transform : Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions – Convolution theorem– Solution of ordinary differential equations with constant coefficients using Laplace transforms.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Grewal B S	Higher Engineering Mathematics	Khanna Publishers, Forty Forth Edition	2017

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kandasamy P Thilagavathy K and Gunavathy K	Higher Engineering Mathematics	S Chand and Co., First Edition	2016
2.	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley and Sons, Tenth Edition	2017
3.	Veerarajan T	Transforms and Partial Differential Equation	McGraw Hill Education, Third Edition	2016
4.	Manish Goyal and Bali N P	A textbook of Engineering mathematics	Laxmi publications, Eighth edition	2011

WEB URLs:

1. www.nptel.ac.in/courses/122104017/29
2. www.nptel.ac.in/courses/122107037/24
3. www.nptel.ac.in/courses/122107037/28
4. www.nptel.ac.in/courses/111105035/22
5. www.nptel.ac.in/courses//111105035/24

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	-	**-**

21OB03 COMPUTATIONAL DIFFERENTIAL EQUATIONS AND MATHEMATICAL STATISTICS
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Vector Calculus and Integral Transforms

OBJECTIVES:

- To provide knowledge about the concepts of partial differential equation with constant coefficients.
- To afford various methods of solving algebraic and transcendental equations numerically.
- To provide the knowledge of solving linear ordinary and partial differential equations numerically.
- To impart the knowledge of testing various hypothesis using small and large sampling tests.
- To inculcate various techniques of analyzing design of experiments, which are widely used in social related problems.

OUTCOMES:

Learners should be able to

CO1:	solve second and higher order partial differential equations with constant coefficients.	**K2**
CO2:	solve the algebraic and transcendental equations numerically which are frequently appear in many engineering fields.	**K2**
CO3:	develop a numerical solution of linear ordinary and partial differential equations in appropriate context of engineering problems.	**K3**
CO4:	make use of various statistical methods to test the given hypothesis in an appropriate context of engineering problems.	**K3**
CO5:	analyze design of experiments using one, two and three way classifications.	**K3**

MODULE I **12**

Partial Differential Equations: Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations – Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

MODULE II **24**

Numerical solution of algebraic and transcendental equations: Newton-Raphson method – Direct methods – Gauss elimination method – Gauss Jordan method – Inverse of a matrix by Gauss Jordan method – Iterative methods – Gauss Jacobi and Gauss Seidel – Numerical solution of first order ordinary differential equation: Single step method – Euler's and Modified Euler's method – Taylor series method – Runge-Kutta method of fourth order – Numerical solution of parabolic equation – Bender-Schmidt method – Numerical solution of hyperbolic equation.

MODULE III **24**

Sampling theory: Distributions – Large sample – Testing of hypothesis for single mean and differences of two sample means – Testing of hypothesis for single variance and equality of variance – Testing of hypothesis for proportions – Small sample tests: student t-test – F-test – Chi-square test for independence of attributes and goodness of fit –Design of experiments – Analysis of Variance(ANOVA) – Completely randomized design – Randomized block design – Latin square design.

TOTAL: 60+15

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kandasamy P Thilagavathy K and Gunavathy K	Numerical Methods	S Chand and Co., First Edition	2016
2.	Gupta S P	Statistical Methods	Sultan Chand and Sons, Forty First Revised Edition	2014

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Steven C Chapra and Raymond P Canale	Numerical Methods for Engineers	McGraw Hill Education, Seventh Edition	2016
3.	Grewal B S	Higher Engineering Mathematics	Khanna Publishers, Forty Forth Edition	2017
4.	Veerarajan T	Probability, Statistics and Random Process	McGraw Hill Education, Forth Edition	2014

WEB URLs:

1. www.nptel.ac.in/courses/111107063/24
2. www.nptel.ac.in/courses/122102009/11
3. www.nptel.ac.in/courses/111107063/1
4. www.nptel.ac.in/courses/111105041/23
5. www.nptel.ac.in/courses/111105041/33

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2.8**	-	-	-	-	-	-	-	-	-	-	-	-

21OB04 PARTIAL DIFFERENTIAL EQUATIONS, SCIENTIFIC COMPUTING AND COMPLEX VARIABLES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Vector Calculus and Integral Transforms

OBJECTIVES:

- To provide knowledge about the concepts of partial differential equation with constant coefficients.
- To afford various methods of solving algebraic and transcendental equations numerically.
- To provide the knowledge of solving linear ordinary and partial differential equations numerically.
- To inculcate the knowledge of complex variables and bilinear transformation which are useful in real time applications.
- To make the student to understand the basics of complex integrals and their applications.

OUTCOMES:

Learners should be able to

CO1:	solve second and higher order partial differential equations with constant coefficients.	**K3**
CO2:	solve the algebraic and transcendental equations numerically which are frequently appear in many engineering fields.	**K3**
CO3:	develop a numerical solution of linear ordinary and partial differential equations in appropriate context of engineering problems.	**K3**
CO4:	make use of the concept of analytic function in appropriate context.	**K3**
CO5:	evaluate the complex integrals.	**K3**

MODULE I **12**

Partial Differential Equations: Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations – Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

MODULE II **24**

Numerical solution of algebraic and transcendental equations: Newton-Raphson method – Direct methods – Gauss elimination method – Gauss Jordan method – Inverse of a matrix by Gauss Jordan method – Iterative methods – Gauss Jacobi and Gauss Seidel – Numerical solution of first order ordinary differential equation: Single step method – Euler's and Modified Euler's method – Taylor series method – Runge-Kutta method of fourth order – Numerical solution of parabolic equation – Bender-Schmidt method – Numerical solution of hyperbolic equation.

MODULE III **24**

Analytic functions: Necessary and sufficient conditions – Cauchy-Riemann equations(statement only) – Properties of analytic functions – Construction of analytic function (Milne-Thompson method) – Conformal mapping –Discussion of transformation w = az, z+a, 1/z, exp z, sin z, cos z – Bilinear transformation – Complex integration : Statement and application of Cauchy's integral theorem and integral formula – Taylor's and Laurent's series(Excluding proof) – Singularities – Calculus of residues – Cauchy's residue theorem – Contour integration over unit circle and semi circular contours (Excluding poles on boundaries).

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Kandasamy P Thilagavathy K and Gunavathy K	Numerical Methods	McGraw Hill Education, First Edition	2016

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Grewal B S	Higher Engineering Mathematics	Khanna Publishers, Forty Forth Edition	2017
2.	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley and Sons, Tenth Edition	2017
3.	Veerarajan T	Transforms and Partial Differential Equation	McGraw Hill Education, Third Edition	2016
4.	Manish Goyal and Bali N P	A textbook of Engineering mathematics	Laxmi publications, Eighth Edition	2011

WEB URLs:

1. www.nptel.ac.in/courses/111107063/24
2. www.nptel.ac.in/courses/122102009/11
3. www.nptel.ac.in/courses/111107063/1
4. www.nptel.ac.in/courses/111107056/7
5. www.nptel.ac.in/courses/111103070/15

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	**-**

21OB05 Z-TRANSFORM, DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Vector Calculus and Integral Transforms

OBJECTIVES:

- To impart knowledge in Z-Transform and their properties with suitable applications.
- To provide the knowledge of solving linear ordinary differential equations, numerically.
- To afford knowledge about the concepts of partial differential equation of second and higher order with constant coefficients and methods of solving wave equations.
- To inculcate the knowledge of complex variables and bilinear transformation which are useful in real time applications.
- To make the student to understand the basics of complex integrals and their applications.

OUTCOMES:

Learners should be able to

CO1:	model the mathematical problems related to signal processing and solve by Z-transforms.	**K3**
CO2:	develop a numerical solution of linear ordinary differential equations in appropriate context of engineering problems.	**K3**
CO3:	solve second and higher order partial differential equations with constant coefficients and use techniques of solving wave equations in appropriate context.	**K2**
CO4:	make use of the concept of analytic function in appropriate context.	**K2**
CO5:	evaluate the complex integrals.	**K2**

MODULE I **12**

Z-Transform: Region of convergence – Transforms of standard functions – Properties of Z-Transform – Inverse Z-Transform using Partial fraction method and Residue method – Convolution Theorem – Solution of difference equations using Z-Transform (Boundary value problem).

MODULE II **24**

Numerical solution of first order ordinary differential equation: Single step method – Euler's and Modified Euler's method – Taylor series method – Runge-Kutta method of fourth order – Milne's predictor and corrector method – Partial Differential Equations : Formation of Partial Differential Equations – Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of Partial Differential Equations – Method of separation of variables – Fourier series solution of one dimensional wave equation – Numerical solution of hyperbolic equation.

MODULE III **24**

Analytic functions: Necessary and sufficient conditions – Cauchy-Riemann equations(statement only) – Properties of analytic functions – Construction of analytic function (Milne-Thompson method) – Conformal mapping – Discussion of transformation w = az, z+a, 1/z, exp z, sin z, cos z – Bilinear transformation – Complex integration: Statement and application of Cauchy's integral theorem and integral formula – Taylor's and Laurent's series(Excluding proof) – Singularities – Calculus of residues – Cauchy's residue theorem – Contour integration over unit circle and semi circular contours (Excluding poles on boundaries).

TOTAL: 60+15

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Grewal B S	Higher Engineering Mathematics	Khanna Publishers, Forty Fourth Edition	2017

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kandasamy P Thilagavathy K and Gunavathy K	Numerical Methods	S Chand and Co., First Edition	2016
2.	Steven C Chapra and Raymond P Canale	Numerical Methods for Engineers	McGraw Hill Education, Seventh Edition	2016
3.	Erwin Kreyszig	Advanced Engineering Mathematics	John Wiley and Sons, Tenth Edition	2017
4.	Veerarajan T	Transforms and Partial Differential Equation	McGraw Hill Education, Third Edition	2016

WEB URLs:

1. www.nptel.ac.in/courses/106106097/pdf/Lecture10_Z TransForm.pdf
2. www.nptel.ac.in/courses/111107063/1
3. www.nptel.ac.in/courses/111107063/24
4. www.nptel.ac.in/courses/111107056/7
5. www.nptel.ac.in/courses/111103070/15

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	-

21OB06 MATHEMATICAL FOUNDATIONS OF COMPUTING SCIENCES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Vector Calculus and Integral Transforms

OBJECTIVES:

- To afford the basics of mathematical logic operators and its applications.
- To impart the basic concepts of set theory and to apply them for various applications.
- To inculcate the fundamentals of relations and functions and its applications.
- To make the learners to understand the importance of Group codes.
- To provide basic knowledge in Trees and shortest route problems.

OUTCOMES:

Learners should be able to

CO1:	apply logical operators and propositional calculus in data structures and algorithms.	**K3**
CO2:	make use of concepts of set theory for various fields of engineering.	**K2**
CO3:	model various engineering problems with the help of relations and functions.	**K3**
CO4:	develop coding in appropriate context of engineering fields by the concept of Group codes.	**K2**
CO5:	apply the concept of Graph theory in real time problems.	**K3**

MODULE I **12**

Mathematical Logic: Propositions – Logical connectives – Compound propositions – Conditional and Biconditional propositions – Truth tables – Tautologies and contradictions – Logical equivalences and implications – De Morgan's laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II **24**

Basic concepts of set theory: Notations – Subset – Algebra of sets – The power set – Ordered pairs and cartesian product – Relations – Representation of a relation – Operations on relations – Reflexive, Symmetry and Transitive relations – Equivalence relation – Equivalence classes – Partition – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sub lattices – Functions – Definitions of functions – Classification of functions – Types of functions – Examples – Composition of functions – Inverse functions – Binary and n-ary operations – Characteristic function of a set – Hashing functions –Recursive functions – Permutation functions.

MODULE III **24**

Algebraic Structures: Binary operations – Semi groups – Monoids – Group – Abelian group – Properties – Examples – Codes and group codes – Basic notions of single error correction – Error recovery in group codes – Graph theory : Introduction – Basic terminology – Representation of graphs – Connectivity – Eulerian and hamiltonian graphs – Planar graphs – Directed graphs – Applications of graphs – Trees – Binary tree – Traversals of a binary tree – Expansion trees.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Trembly J P and Manohar R	Discrete Mathematical Structures with Applications to Computer Science	McGraw Hill Education, First Edition	2004
2.	Narsingh Deo	Graph Theory with applications to Engineering and computer science	Courier Dover publications, first Edition - reprint	2016

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman, Robert C Busby and Sharon Ross	Discrete Mathematical Structures	Pearson Education, Sixth Edition	2015
2.	Kenneth H Rosen	Discrete Mathematics and its Applications with Combinatorics and Graph Theory	McGraw Hill Education, Seventh Revised Edition	2012
3.	Veerarajan T	Discrete Mathematics with Graph Theory and Combinatorics	McGraw Hill Education, First Edition	2012
4.	Ralph P Grimaldi	Discrete and Combinatorial Mathematics: An Applied Introduction	Pearson Education, Fifth Edition	2004

WEB URLs:

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2. www.nptel.ac.in/courses/111107058/26
3. www.nptel.ac.in/courses/111107056/23
4. www.spms.ntu.edu.sg/~frederique/chap1.pdf
5. www.nptel.ac.in/courses//111106050/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	1	1	-	-	-	-	-	-	-	-	-	-	1	1
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	**2**	**1.4**

21OB07 PROBABILITY THEORY AND MATHEMATICAL STATISTICS
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Partial Differential Equations, Scientific Computing and Complex Variables / Z-Transform, Differential Equations and Complex Variables

OBJECTIVES:

- To provide the required fundamental concepts of probability theory in engineering applications.
- To introduce the concepts of discrete and continuous distributions.
- To make the learners to understand the concept of correlation and regression analysis and its applications.
- To impart the knowledge of testing of hypothesis using small and large sampling tests.
- To inculcate various techniques of analyzing design of experiments, which are widely used in social related problems.

OUTCOMES:

Learners should be able to

CO1:	make use of the fundamental concepts of probability theory to real time applications.	**K2**
CO2:	utilize various discrete and continuous distributions in appropriate context of engineering problems.	**K2**
CO3:	apply the concept of correlation and regression analysis.	**K3**
CO4:	make use of various statistical methods to test the given hypothesis in an appropriate context in engineering problems.	**K2**
CO5:	analyze design of experiments using anova table.	**K3**

MODULE I **12**

Probability theory: Axioms of probability – Conditional probability – Total probability – Baye's theorem – Random variables – Probability mass function – Probability density function – Properties – Moments – Moment generating functions.

MODULE II **24**

Standard distributions: Binomial – Poisson – Geometric – Uniform – Exponential and normal distributions and their properties – Mean, variance and standard deviation – Two dimensional random variables – Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.

MODULE III **24**

Sampling Theory: Distributions – Large sample – Testing of hypothesis for single mean and differences of two sample means – Testing of hypothesis for single variance and equality of variance – Testing of hypothesis for proportions – Small sample – t - test – F- test – Chi-square test for independence of attributes and goodness of fit – Design of experiments: Analysis of variance (ANOVA) – One way classification – Completely randomized design – Two way classification – Randomized block design – Latin square design.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta S P	Statistical Methods	Sultan Chand and sons, Forty first revised Edition	2014
2.	Peebles P Z	Probability, random variables and random signal principles	McGraw Hill Education, Fourth Edition	2002

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth Reprint	2017
2.	Irwin Miller and Marylees Miller	John E Freund's Mathematical Statistics with Applications	Pearson, Eighth Edition	2014
3.	Sheldon M Ross	Introduction to Probability and statistics for Engineers and scientists	Elsevier, Fourth Edition	2014
4.	Veerarajan T	Probability, Statistics and Random Process	McGraw Hill Education, Fourth Edition	2014

WEB URLs:

1. www.nptel.ac.in/courses/111104079/
2. www.nptel.ac.in/courses/105103027/22
3. www.nptel.ac.in/courses/105108079/8
4. www.nptel.ac.in/courses/111104073/3
5. www.onlinecourses.science.psu.edu/stat503/node/5

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	-

21OB08 PROBABILITY AND RANDOM PROCESSES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Mathematical Foundations of Computing Sciences / Z-Transform, Differential Equations and Complex Variables

OBJECTIVES:

- To provide the required fundamental concepts of probability theory in engineering applications.
- To impart the concepts of discrete and continuous distributions.
- To make the learner to understand the concept of correlation and regression analysis and its applications.
- To inculcate the terminologies of random processes and to give the knowledge to apply in various engineering applications.
- To make the students to understand the importance of correlation function and spectral studies.

OUTCOMES:

Learners should be able to

CO1:	make use of the fundamental concepts of probability theory to real time applications.	**K2**
CO2:	utilize various discrete and continuous distributions in appropriate context of engineering problems.	**K2**
CO3:	apply the concept of correlation and regression analysis.	**K3**
CO4:	exploit random processes for various applications.	**K2**
CO5:	apply the concept of auto correlation and spectral density in an appropriate context.	**K3**

MODULE I **12**

Probability theory: Axioms of probability – Conditional probability – Total probability – Baye's theorem – Random variables – Probability mass function – Probability density function – Properties – Moments – Moment generating functions.

MODULE II **24**

Standard distributions: Binomial – Poisson – Geometric – Uniform – Exponential and normal distributions and their properties – Functions of random variable – Joint distributions: Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables – Central limit theorem(statement only).

MODULE III **24**

Random Processes: Classification of random process – First and second order stationary – Strict sense stationary – Wide sense stationary and Ergodic processes – Markov process – Binomial, Poisson and Normal processes – Sine wave process – Auto correlation function : Cross correlation – Properties – Power spectral density – Cross spectral density – Properties – Weiner-Khinchine relationship between cross power spectrum and cross correlation function – Linear system with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roy D Yates and David J Goodman	Probability and Stochastic processes	Wiley India Pvt Ltd, Second Edition	2011

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
2.	Peebles P Z	Problems and solutions in probability, random variables and random signal principles (SIE)	McGraw Hill Education, First Edition	2012

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kishor S and Trivedi	Probability and Statistics with reliability, Queueing and Computer Science Applications	Prentice Hall of India, Second Edition	2016
2.	Henry Stark and John W Woods	Probability and Random Processes with application to signal processing	Pearson Education, Third Edition	2014
3.	Sheldon M Ross	Introduction to Probability and statistics for Engineers and scientists	Elsevier, Fourth Edition	2014
4.	Veerarajan T	Probability, Statistics and Random Process	McGraw Hill Education, Fourth Edition	2014

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4. www.nptel.ac.in/courses/117105085/10
5. www.nptel.ac.in/courses/117104127/41

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	**-**

21OB09 OPTIMIZATION TECHNIQUES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Probability and Random Processes

OBJECTIVES:

- To make the students to understand the importance of linear programming problem.
- To introduce the concept of Transportation and Assignment models.
- To inculcate various criteria, associated with decision making theory and Game theory.
- To afford the adequate knowledge on networking models.
- To pledge the basics of Queuing theory for real time applications.

OUTCOMES:

Learners should be able to

CO1:	model industrial related problems in the form of linear programming and solve it using suitable techniques.	**K2**
CO2:	develop an optimum solution for Transportation and Assignment models.	**K2**
CO3:	apply various game theory strategies in real time problems.	**K3**
CO4:	build a solution for problem in network models using suitable techniques.	**K2**
CO5:	identify various models in Queuing theory and construct optimum solution for the problems in reality.	**K3**

MODULE I **12**

Linear Programming Problem (LPP) – Standard form of LPP – Graphical method – Simplex method – Big M method – Principle of Duality – Dual and Primal problem – Dual Simplex method.

MODULE II **24**

– Transportation problem – Initial basic feasible solution by North west corner rule, Least cost method and Vogel's approximation method – Optimum solution by MODI algorithm – Assignment problem – Optimal solution by Hungarian algorithm – Travelling Salesman problem – Game Theory – Pay-Off matrix – Two person zero sum games – Maximin and Minimax principle – Pure strategies and mixed strategies – Saddle point – Value of the game – Concept of dominance – Graphical solution for 2 x n and m x 2 games.

MODULE III **24**

Network models: Network and basic components – Rules of network construction – Time calculation in networks – CPM – PERT – PERT calculations – Cost analysis – Crashing the network – Queuing theory: Markovian models – M/M/1 – M/M/C – Finite and infinite capacity – M/M/∞ queues – Finite source model – M/G/1 queue(steady state solutions only) – Little formula.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kanti Swarup, Gupta P K and Manmohan	Operations Research	Sultan Chand and Sons, Fifteenth edition	2010
2.	Hamdy A Taha	Operations Research: An Introduction	Pearson Education, Tenth Edition	2017

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kishor S and Trivedi	Probability and Statistics with reliability, Queueing and Computer Science Applications	Prentice Hall of India, Second Edition	2016
2.	Ronald L Rardin	Optimization in Operations Research	Pearson , Second Edition	2016
3.	Ravindran and Phillips Solberg	Operations Research Principles and Practice	Wiley, Second Edition	2007
4.	Billy E Gillett	Introduction to Operations Research- A Computer Oriented Algorithmic Approach	Tata McGraw-Hill Publishing Company Limited, Twenty Third Edition	2002

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- www.nptel.ac.in/courses/111102012/29
- www.nptel.ac.in/courses/112106131/33
- www.nptel.ac.in/courses/110105039/16
- www.nptel.ac.in/courses/112106131/30

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	-

21OB10 FOUNDATIONS OF COMPUTING SCIENCES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Mathematics at 10+2 level or equivalent level

OBJECTIVES:

- To make the students acquire knowledge in theory of Numbers and theory of equations.
- To provide the basics concepts of Set theory.
- To provide adequate knowledge in Relations and Functions.
- To impart knowledge in Combinatorics.
- To synthesize methods of solving problems in summation of series and recurrence relations.

OUTCOMES:

Learners should be able to

CO1:	use the fundamental properties of Numbers and solving techniques for algebraic equations in their relevant fields.	**K2**
CO2:	use the concept of set theory in an appropriate context.	**K2**
CO3:	apply the knowledge of Relations and Functions in real time problems.	**K3**
CO4:	use the principle of Mathematical induction and the concept of sequence/series.	**K2**
CO5:	solve recurrence relation.	**K2**

MODULE I **12**

Number Theory – Divisibility – Fundamental Properties – Euclidean algorithm – Euclid's lemma – Fundamental theorem of arithmetic – Congruence – Fermat's Little theorem – The Fermat-Euler theorem.

MODULE II **24**

Theory of equations – Formation of Equations having complex and irrational roots – Relation between roots and coefficients – Roots in AP, GP and HP – Reciprocal Equations – Relations – Representation of a relation – Operations on relations – Reflexive, Symmetry and Transitive relations – Equivalence relation – Equivalence classes – Partition – Partial ordering – Functions – Representation of function –Type of functions – Bijective function – Composition of functions – Inverse functions – Characteristic function of a set – Asymptotic function, modular function, monotonicity, floors and ceiling function, Primitive recursive function, Hashing function and Modular function (Concept Only).

MODULE III **24**

Combinatorics – Fundamental Principle of counting – Permutation and Combination – Pascal's triangle – Simple applications – Mathematical Induction –Pigeon hole principle – Principle of inclusion and exclusion – Infinite Series – Sequences – Convergence of series – General Properties – Test of convergence (Comparison test and D'Alembert's ratio test only) – Series of positive and negative terms – Binomial series – Arithmetic Series – Geometric Series – Fibonacci Series – Recurrence Relation – Formation of Recurrence relation – Solution of recurrence relation by Generating Functions.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Swapan Kumar Sarkar	A Text Book of Discrete Mathematics	S Chand and Co., Ninth Edition	2016
2.	Ralph P Grimaldi and Ramana B V	Discrete and Combinatorial Mathematics : An Applied Introduction	Pearson New International Edition, Fifth Edition	2016

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kenneth H Rosen	Discrete Mathematics and its Applications with ombinatorics and Graph Theory	Tata McGraw – Hill Pub Co Ltd, Seventh Revised Edition	2012
2.	Bernard Kolman Robert C Busby and Sharon Ross	Discrete Mathematical Structures	Prentice Hall, Sixth Edition	2009
3.	Trembly J P and Manohar R	Discrete Mathematical Structures with Applications to Computer Science	McGraw Hill Education, Indian Edition	2015
4.	Veerarajan T	Discrete Mathematics with Graph Theory and Combinatorics	McGraw Hill Education, First Edition	2012

WEB URLs:

1. www.nptel.ac.in/courses/109104040/17
2. www.nptel.ac.in/courses/111107058/26
3. www.nptel.ac.in/courses/111107056/23
4. www.spms.ntu.edu.sg/~frederique/chap1.pdf
5. www.nptel.ac.in/courses//111106050/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	-

21OB11 DISCRETE MATHEMATICAL STRUCTURES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Matrices and Calculus, Vector Calculus and Integral Transforms

OBJECTIVES:

- To make the students acquire knowledge in theory of Numbers.
- To provide the basic concepts of Theory of equations and principles of counting.
- To synthesize methods of solving problems in summation of series and recurrence relations.
- To provide various terminologies of Graphs.
- To make the students to understand various types of trees and its applications.

OUTCOMES:

Learners should be able to

CO1:	make use of fundamental concepts of Numbers theory in their relevant areas.	**K3**
CO2:	utilize the concepts of theory of equations and Combinatorics in engineering applications.	**K3**
CO3:	solve problems in infinite series and recurrence relation.	**K3**
CO4:	apply suitable graph and algorithms for a given situations.	**K3**
CO5:	choose the shortest path with the help of graph theory algorithms.	**K3**

MODULE I **12**

Number Theory – Divisibility – Fundamental Properties – Euclidean algorithm – Euclid's lemma – Fundamental theorem of arithmetic – Congruence – Fermat's Little theorem – The Chinese remainder theorem.

MODULE II **24**

Theory of Equations – Formation of Equations having complex and irrational roots – Relation between roots and coefficients – Roots in AP, GP and HP – Reciprocal Equations – Combinatorics – Fundamental Principle of counting – Permutation and Combination – Mathematical Induction – Principle of inclusion and exclusion – Sequence and Series – Binomial series – summation of infinite series - Arithmetic Series – Geometric Series – Fibonacci Series – Recurrence Relation – Formation of Recurrence relation – Solution of recurrence relation by Generating Functions**.**

MODULE III **24**

Graph Theory – Incidence and degree – Finite and Infinite graphs – Sub graphs – Isomorphism of graphs – Walks, Paths and Circuits – Eulerian and Hamiltonian graphs – Planar graph – Matrix representation of graphs – Incidence and Adjacency matrices – Coloring – Chromatic Partitioning – Covering – The four colour theorem (statement only) – Cut sets and Cut vertices – Connectivity and Separability – Trees – Properties – Rooted and Binary trees – Spanning trees – Kruskal's, Prim's and Dijkstra's Algorithms.

TOTAL: 60+15

TEXT BOOKS:

SI.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ralph P Grimaldi	Discrete and Combinatorial Mathematics: An Applied Introduction	Pearson Education First Indian reprint	2009
2	Narsingh Deo	Graph Theory with applications to Engineering and computer science	Courier Dover publications, First Edition - reprint	2016

REFERENCE BOOKS:

SI.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bernard Kolman, Robert C Busby and Sharon Ross	Discrete Mathematical Structures	Prentice Hall, Sixth Edition, Sixth Edition	2009
2	Kenneth H Rosen	Discrete Mathematics and its Applications with Combinatorics and Graph Theory	Tata McGraw – Hill Pub Co Ltd, Seventh Revised Edition	2012
3	Frank Harary	Graph theory	Addison-Wesley Publishing Company, revised 10th edition	2001
4.	Adria J Bondy and U S R Murthy	Graph Theory with Applications	Springer publisher- First corrected edition	2010

WEB URLs

1. www.mathportal.org
2. www.math.ethz.ch/education/bachelor/lectures/fs2015/math/graph_theory/
3. www.nptel.ac.in/courses/111106050/
4. www.tutorialspoint.com/discrete_mathematics/
5. www.mathworld.wolfram.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO	**3**	**2**	**2**	**1**	-	-	-	-	-	-	-	-	-	-

21OB12 PROBABILITY AND STATISTICS
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Matrices and Calculus, Vector Calculus and Integral Transforms, Discrete Mathematical Structures

OBJECTIVES:

- To provide the required fundamental concepts of probability theory.
- To introduce the concepts of Theoretical Distributions.
- To make the learners to understand the concept of correlation and regression analysis.
- To impart the knowledge of testing of hypothesis using small and large sampling tests.
- To inculcate various techniques of analyzing design of experiments.

OUTCOMES:

Learners should be able to

CO1:	make use of the fundamental concepts of probability theory to real time applications.	**K3**
CO2:	experiment with discrete and continuous distributions in suitable engineering problems.	**K3**
CO3:	apply the concept of correlation and regression.	**K3**
CO4:	utilize various statistical methods to test the given hypothesis in a relevant situation in engineering problems.	**K3**
CO5:	analyze the design of experiments using Randomized Block Design and Latin Square Design.	**K3**

MODULE I **12**

Concept of Probability – Addition and multiplication laws – Conditional probability – Total Probability – Baye's theorem and its applications – One dimensional Random Variables – Mathematical Expectation – Moments and Moment Generating Function.

MODULE II **24**

Theoretical Distributions – Discrete distributions – Binomial, Poisson, Geometric Distributions – Continuous distributions – Uniform , Exponential and Normal Distributions – Fitting Binomial and Poisson distributions – Statistics – Measures of Central Tendency – Mean, Median, Mode – Measures of Dispersion – Mean deviation – Standard deviation – Coefficient of variation – Correlation – Pearson's Correlation coefficient – Spearman's Rank correlation coefficient – Regression – Regression lines.

MODULE III **24**

Estimation Theory – Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation – Test of Hypothesis – Large sample tests based on normal distribution – Test for single mean – Difference between means – Proportion – Difference between proportion – Small sample test – Student-t test – Test for single mean – Difference between means – Snedecor's F test – Chi-square test for goodness of fit, independence of attributes – Design of experiments – Analysis of Variance – Completely Randomized Design – Randomized Block Design – Latin Square Design.

TOTAL: 60+15

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta S P	Statistical Methods	Sultan Chand and sons, Forty first revised Edition	2014
2.	Peebles P Z	Probability, random variables and random signal principles	McGraw Hill Education, Fourth Edition	2002

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramana B V	Higher Engineering Mathematics	McGraw Hill Education, Twenty Ninth - Reprint	2017
2.	Irwin Miller and Marylees Miller	John E Freund's Mathematical Statistics with Applications	Pearson, Eighth Edition	2014
3.	Sheldon M Ross	Introduction to Probability and statistics for Engineers and scientists	Elsevier, Fourth Edition	2014
4.	Veerarajan T	Probability, Statistics and Random process	McGraw Hill Education, Forth Edition	2013

WEB URLs:

1. www.mathworld.wolfram.com/Probability.html
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3. www.khanacademy.org/math/statistics-probability
4. www.nptel.ac.in/courses/111105041/33
5. www.stats.gla.ac.uk/steps/glossary/anova.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO	**3**	**2**	**2**	**1**	**-**	-	-	-	-	-	**-**	**1**	**-**	**-**

21OB13 MATHEMATICAL OPTIMIZATION TECHNIQUES
(Common to all Branches)

4 1 0 5

PRE-REQUISITES: Probability and Statistics/ Probability and Mathematical Statistics/ Probability and Random Process

OBJECTIVES:

- To provide the concept of Linear Programming Problem and its various solution procedures.
- To impart the knowledge of Transportation model.
- To introduce the concept of Assignment Problem.
- To afford the adequate knowledge on networking models.
- To inculcate various criteria, associated with decision making theory and Game theory.

OUTCOMES:

Learners should be able to

CO1: formulate and solve the linear programming problem on the basis of the known features of the problem. **K2**

CO2: develop an optimum solution for Transportation model. **K2**

CO3: construct an optimum solution for an Assignment Problem. **K3**

CO4: build a solution for problem in network models using suitable techniques. **K2**

CO5: apply various game theory strategies in real time problems. **K2**

MODULE I **12**

Linear Programming Problem – Formulation – Methods of solving an LPP – Graphical Method – The Simplex Algorithm – Big M Method – Principle of Duality – Dual and Primal problem – Dual Simplex method.

MODULE II **24**

Transportation Model – Methods for finding initial basic feasible solution – NWC Rule, LCM and Vogel's approximation – MODI method for finding optimum solution – Unbalanced Transportation Problem – Maximization in Transportation Problem. Assignment Model – Initial basic feasible solution – Hungarian algorithm to improve maximal assignment – Unbalanced AP – Impossible assignment – Maximization in AP.

MODULE III **24**

Network models – Critical Path method – Program Evaluation and Review Technique Determination of normal duration, optimal duration and minimum duration of the project – Network crash and cost analysis. Decision Analysis: Decision Making under Certainty – Decision Making under risk – Decision Tree – Decision Making under Uncertainty – Game Theory – Pay-Off matrix – Two person zero sum games – Maximin and Minimax principle – Pure strategies and mixed strategies – Saddle point – Value of the game – Concept of dominance – Graphical solution for 2 x n and m x 2 games.

TOTAL: 60+15

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hamdy A Taha	Operations Research –An Introduction	Pearson Education, Ninth Edition	2012
2.	Kanti Swarup, Gupta P K and Manmohan	Operations Research	Sultan Chand and Sons, Fifteenth Edition	2010

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Frederick S Hillier, Gerald J Lieberman, Bodhibrata Nag and Preetam Basu	Introduction to Operations Research	Tata McGraw-Hill Education Private Limited, Ninth Edition	2012
2.	Ronald L Rardin	Optimization in Operations Research	Pearson, Second Edition	2016
3.	Ravindran and Phillips Solberg	Operations Research – Principles and Practice	Wiley, Second Edition	2007
4.	Billy E Gillett	Introduction to Operations Research- A Computer Oriented Algorithmic Approach	Tata McGraw-Hill Publishing Company Limited, Twenty Third Edition	2002

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4. www.nptel.ac.in/courses/110105039/16
5. www.nptel.ac.in/courses/112106131/30

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

21OB14 OPERATIONS RESEARCH
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To understand the basic concepts of operations research and application of linear models.
- To comprehend the applications of transportation and assignment models.
- To provide the adequate knowledge networking models.
- To impart the knowledge on inventory and queuing models and its applications.
- To understand the concept of gaming theory in decision making.

OUTCOMES:

Learners should be able to

CO1:	use the linear model for business and industrial applications.	**K2**
CO2:	apply the principle and identify the feasible solutions using transportation and assignment problems.	**K2**
CO3:	apply the networking models for efficient project management.	**K3**
CO4:	utilize the inventory and queuing theory for effective inventory management	**K2**
CO5:	apply the game theory to select the best rational decisions	**K2**

MODULE I **9**

Concepts and scope of operations research (or) – Phases of or study – Models in OR – advantages and limitations of OR – Role of computers in OR – linear programming – Formulation of LPP – Methods and solutions – Graphical method – Simplex method – Big M method – Two phase method – Duality formulation – Optimisation with inequality constraints.

MODULE II **21**

Transportation problems (TP) – Initial basic feasible solution to transportation cost – Northwest corner rule, least cost method – Vogel's approximation method, optimal solution using modified distribution (MODI) method, degeneracy in TP, unbalanced TP, alternative optimal solutions, maximization in TP – Assignment problems – Hungarian method of solving assignment problem, multiple optimum solutions, maximisation in assignment problems, unbalanced assignment problems, restrictions in assignment problems.

Network analysis – Construction of networks, Components and Precedence relationships – Event – activities – Rules of network construction, errors and dummies in network. PERT/CPM networks –project scheduling with uncertain activity times – Critical Path Analysis – Forward Pass method, Backward Pass method – Float (or slack) of an activity and event – Time – cost trade-offs – crashing activity times.

MODULE III **21**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice – Queueing models – Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life – Single / Multi variable search technique – Dynamic Programming.

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hamdy A Taha	Operations Research: An introduction	Pearson Education, Tenth Edition	2017
2.	Sharma J K	Operations Research: Theory And Applications	Laxmi Publications Sixth Edition	2017

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	KantiSwarup, Gupta P K and Man Mohan	Operations Research	S Chand and Company Pvt Ltd., Ninth Edition	2017
2.	Vasant Lakshman Mote and Madhavan T	Operations Research	Wiley India Pvt. Ltd., First Edition	2016
3.	Panneerselvam R	Operations Research	Prentice Hall India Pvt. Ltd., Second Edition	2015
4.	Prem Kumar Gupta and Hira D S	Operations Research	S Chand and Company Pvt Ltd., Seventh Edition	2014

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2. www.cosmolearning.org/courses/advanced-operations-research-527/video-lectures/
3. www.vuhelp.pk/group/mth601/forum/topics/operations-research-mth601-download-complete-lectures-1-45
4. www.vutube.edu.pk/mathematics-mth/operations-research-mth601-vu-lectures-handouts-ppt-slides-assignments-quizzes-papers-books
5. www.ocw.mit.edu/courses/mathematics/21-086-mathematical-methods-for-engineers-ii-spring-2006/video-lectures/lecture-28-linear-programming-and-duality/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

21OB15 NUMERICAL LINEAR ALGEBRA
(Common to All Branches)

4 1 0 5

PRE-REQUISITES: Matrices and Calculus

OBJECTIVES:

- To import the basic knowledge in Vector spaces and Subspaces including linear independenceand dependence vectors, Basis and its dimensions.
- To understand the linear maps between vector spaces, their matrix representations, null-spaceand Range spaces.
- To calculate Eigen values and eigenvectors, diagonalizability of a real symmetric matrix.
- To inculcate the concepts of Inner product spaces: Cauchy-Schwarz inequality, orthonormalbasis, the Gram-Schmidt procedure, orthogonal complement of a subspace.
- To learn the basic properties of orthogonal projections as linear transformations and as matrixtransformations.

OUTCOMES:

Learners should be able to

CO1:	solve the system of linear equations using direct and indirect methods.	**K2**
CO2:	identify the vector space and the subspaces, the linear transformation and its matrix representation.	**K2**
CO3:	apply diagonalization in Linear System of Equations.	**K3**
CO4:	recall the concept of orthogonal projection of a vector onto a subspace.	**K2**
CO5:	explain how orthogonal projections relate to least square approximations.	**K2**

MODULE I **12**

Linear System of Equations – Elementary Operations – Row Echelon form – Rank of a Matrix – Solving system of equations – Direct methods: Gauss Elimination and Gauss Jordan Methods — Inverses of Matrices by Gauss Jordan method – LU Factorizations – QR decomposition – Iterative methods: Gauss Jacobi and Gauss Seidel method – Power method for finding Eigen values.

MODULE II **24**

Vector Spaces – Subspaces – Linear Span – Linear Independence and dependence of vectors – Basis and Dimension – Linear Transformation – Properties of Linear Transformation — Null Space and Nullity of a matrix – Rank-Nullity theorem – Range Space – Dimension Theorem – Matrix Representation of Linear Transformation – Characteristic values – Diagonalization of Linear operators.

MODULE III **24**

Inner Products and Norms – Inner Product Spaces – Cauchy-Schwartz inequality – Orthogonal Vectors – Gram-Schmidt Orthogonalization Process – Orthogonal Complement – Orthogonal Projection – Projection Theorem – Least Square Approximations – Positive Definite Matrices – Minima, Maxima and Saddle points – Tests for positive definite, semi definite and indefinite matrices –Singular value Decomposition(SVD)

TOTAL: 60+15

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Friedberg S H, Insel AJ and Spence E	Linear Algebra	Pearson Education, Fifth Edition	2021
2.	Gilbert Strang	Linear Algebra and Learning from Data	Cambridge University Press, First Edition	2019

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Bernard Kolman and David R Hill	Introductory Linear Algebra	Pearson Education, First Reprint, New Delhi	2010
2.	Kumaresan S	Linear Algebra – A geometric approach	Prentice – Hall of India, Reprint, New Delhi.	2010
3.	Williams G	Linear Algebra with Applications	Jones and Bartlett Learning, First Indian Edition, New Delhi	2019
4.	Gene H Golub and Charles F Van Loan	Matrix Computations	The Johns Hopkins University Press, Fourth Edition	2013

WEB URLs:

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2. www.nptel.ac.in/courses/111/101/111101115/
3. www.nptel.ac.in/courses/111/107/111107106/
4. www.nptel.ac.in/courses/111/102/111102011/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

21OB21 ENGINEERING PHYSICS
(Common to all Branches)

3 1 2 5

PRE-REQUISITES: Physics at 10+2 level or equivalent level

OBJECTIVES:

- To inculcate the origin of quantum physics and schrodinger's equations.
- To impart the concepts and types of lasers.
- To introduce the theory of fiber optic principles.
- To introduce the wave optics phenomenon, Huygens' principle, Interference of light.
- To enhance the Elastic behavior of solids, thermal conduction and applications

OUTCOMES:

Learners should be able to

CO1:	relate the quantum equations effectiveness within the proper framework of contemporary physics.	**K2**
CO2:	explain the construction and working of He-Ne, Nd -YAG and semiconductor lasers	**K2**
CO3:	make use of fiber optics and its various categories.	**K3**
CO4:	discuss the waves and optics phenomena-applications	**K2**
CO5:	summarize the knowledge of properties of matter and thermal physics.	**K2**

MODULE I **9**

Limitations of classical Physics – Introduction to Quantum theory – Dual nature of matter and radiation- Properties of matter waves-de-Broglie wavelength in terms of voltage, energy, and temperature – Heisenberg's Uncertainty principle – verification – physical significance of a wave function- Schrödinger's Time independent and Time dependent wave equations – Particle in a one dimensional potential well – Electron microscope – Scanning Electron Microscope (SEM) –Transmission Electron Microscope (TEM).

MODULE II **21**

Lasers – Principle of Spontaneous emission and Stimulated emission – Einstein's A and B coefficients – Relation between Einstein's A and B coefficients – Population inversion – Pumping – Basic laser system – Types of lasers – He-Ne, Nd-YAG, Semiconductor lasers (homojunction) – Non destructive testing (NDT) – Applications of lasers in science, engineering and medicine – Optical fibers – Basic Principles involved in fiber optics – Total internal reflection – Structure of optical fiber – Propagation of light through optical fiber – Derivation for Numerical Aperture and acceptance angle - fractional index change - Classification of optical fiber based on materials, refractive index profile and Modes – Losses in optical fiber – Attenuation, dispersion, bending – Fiber optical communication links – Fiber optic sensors – Temperature and displacement– Endoscope.

MODULE III **21**

Huygens' Principle – Superposition of waves and interference of light – Interference produced in thin films due to reflected light – Air wedge– Theory – Applications – Testing of flat surfaces – Thickness of a thin sheet of paper – Michelson interferometer – Theory – Applications – Determination of wavelength of monochromatic light – Determination of difference in wavelengths – Determination of thickness of a thin transparent sheet – Elasticity – Hooke's law – stress-strain diagram – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young's modulus by uniform bending – I shaped girders– Thermal conductivity – heat conduction in solids – Rectilinear flow of heat through along a uniform bar – Forbe's and Lee's disc method: theory and experiment.

TOTAL: 45+15

LIST OF EXPERIMENTS:

1. Determination of Young's Modulus of the given material of the bar using uniform bending method.
2. To find the number of lines in the given grating and the wavelengths of the prominent lines in the mercury spectrum.
3. Determination of thickness of the given wire using air wedge method.
4. Determination of laser parameters, (i) Wavelength of the given laser source using grating (ii)Refractive index of the given liquid and (iii) Angle of divergence.
5. Determination of particle size of Lycopodium powder using diode laser.
6. Determination of band gap energy of semiconductor material.
7. Determination of acceptance angle of the given optical fiber.
8. Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic nterferometer.
9. Determination of Viscosity of liquid – Poiseuille's flow method.
10. Determination of Young's Modulus of the given material of the bar using non – uniform bending method.

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajendran V	Engineering Physics	McGraw Hill Education (India) Pvt. Ltd., Ninth Edition	2016
2.	Pandey B K and Chaturvedi S	Engineering Physics	Cengage Learning, Fifth Edition	2013

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jayakumar S	Engineering Physics	R K Publishers, First Edition	2007
2.	Jewett Serway	Physics for scientists and Engineers with modern physics	Cengage Learning, Ninth Edition	2014
3.	Ch Srinivas and Ch Seshu Babu	Engineering Physics	Cengage Learning, First Edition	2016
4.	Hitendra K Malik and Singh A K	Engineering physics	McGraw Hill Education (India) private Limited, Thirteenth edition	2016
5.	Senthil Kumar G	Engineering Physics I and II	VRB Publishers, Second Edition	2017

WEB URLs:

1. www.nptelvideos.com/physics/quantum_physics.php
2. www.laser.photoniction.com/tutorial/
3. www.newport.com/t/fiber-optic-basics
4. www. icecube.wisc.edu
5. www. physics.info/elasticity & www.askiitians.com/iit-jee-thermal-physics/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	1	1	-	1	-	-
CO2	3	2	-	-	-	-	-	-	1	1	-	1	-	-
CO3	3	2	-	-	-	-	-	-	2	1	-	2	-	-
CO4	3	2	-	-	-	-	-	-	2	1	-	2	-	-
CO5	3	2	-	-	-	-	-	-	2	1	-	2	-	-
CO	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1.6**	**1**	**-**	**1.6**	-	**-**

21OB22 PHYSICS FOR ELECTRICAL SCIENCES
(Common to all Branches)

4 0 0 4

PRE-REQUISITES: Physics at 10+2 level or equivalent level

OBJECTIVES:

- To impart the knowledge of conductors based on classical and quantum theory.
- To introduce the concept of semiconductors and its properties.
- To highlight the properties of dielectric materials.
- To comprehend the concept of shape memory alloys and its properties.
- To emphathise the knowledge of nano materials and its properties.

OUTCOMES:

Learners should be able to

CO1:	explain the properties of conductors.	**K2**
CO2:	differentiate various semiconductors based on their properties.	**K2**
CO3:	explain the properties and applications of modern engineering materials.	**K3**
CO4:	use shape memory alloys in appropriate context of engineering fields.	**K2**
CO5:	demonstrate various properties and methods of nano materials.	**K2**

MODULE I **12**

Conductors – Basic definitions – Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann-Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – Carrier concentration in metals.

MODULE II **24**

Semiconductors – Elemental semiconductors – Compound semiconductors – Intrinsic semiconductors – Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination (Experimental and Theoretical) – Extrinsic semiconductors – Carrier concentration in n-type semiconductor – Carrier concentration in p-type semiconductor – Hall effect – Determination of Hall coefficient (Numerics) – Applications – Solarcells – LED and Photo diode, Electric Dipole, Dipole Moment, Dielectric constant, Polarizability, Electric Susceptibility, Displacement Vector, Electronic, Ionic and Orientation Polarizations and calculation of Polarizabilities: Ionic and Electronic – Internal fields in solids, Clausius – Mossotti Equation, Piezoelectricity and Ferroelectricity.

MODULE III **24**

Shape memory alloys (SMA) – Characteristics, application, merits, demerits of SMA – Metallic glasses – Preparation, properties and applications – Superconductivity – BCS theory of superconductivity (qualitative treatment only) – Types of superconductors, properties – High TC superconductors – Applications – SQUIDS, cryotron, magnetic levitation – Bio materials – Nanomaterials – The significance of nanoscale – Nanophase materials – Properties – Fabrication methods – Top down process – Ball milling method, Lithography – Bottom-up process – Vapour phase deposition methods – PVD, CVD – Liquid phase methods – Colloidal and sol-gel methods – Carbon nanotubes – Structure, properties and applications – Organic FET– Organic LED.

TOTAL: 60

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajendran V	Engineering Physics	McGraw Hill Education (India) Pvt. Ltd., Ninth Edition	2016
2.	Pandey B K and Chaturvedi S	Engineering Physics	Cengage Learning, Second Edition	2013

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hitendra K Malik and Singh A K	Engineering physics	McGraw Hill Education (India) Pvt. Ltd., Thirteenth Edition	2016
2.	Senthilkumar G	Engineering physics I and II	VRB Publishers	2015
3.	James F and Shackelford S	Introduction to Material Science for Engineers	Macmillan Publishing Company, Eighth Edition	2014
4.	Jewett Serway	Physics for scientists and engineers with modern physics	Cengage Learning, Ninth Edition	2014

WEB URLs:

1. www.magcraft.com/conductors and insulators
2. www.eletronic-tutorials.ws/diode/diode_1html
3. www.electrical4u.com/orientational-polarization/
4. www.nptel.ac.in/courses/115101012(superconductor)
5. www.understandingnano.com/nanomaterials.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.4**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	**-**

21OB23 PHYSICS FOR MECHANICAL SCIENCES
(Common to all Branches)

4 0 0 4

PRE-REQUISITES: Physics at 10+2 level or equivalent level

OBJECTIVES:

- To impart the basic concept of thermal physics.
- To emphathise mechanical properties of solids.
- To inculcate the mechanical behavior of materials.
- To introduce the concepts magnetic and superconducting materials.
- To impart the basic concept of basics of vacuum science, production and measurement.

OUTCOMES:

Learners should be able to

CO1:	have adequate knowledge on the concepts of thermal properties of materials.	**K2**
CO2:	acquire the mechanical properties of solids.	**K2**
CO3:	use various behavior of materials in a relevant concept.	**K3**
CO4:	distinguish magnetic and superconducting materials.	**K2**
CO5:	Production and measurement of vacuum.	**K2**

MODULE I **12**

Transfer of heat energy – Thermal expansion of solids and liquids – Expansion joints – Bimetallic strips – Thermal conduction, convection and radiation – Heat conductions in solids – Thermal conductivity – Forbe's and Lee's disc method: theory and experiment – Conduction through compound media (series and parallel) – Thermal insulation – Applications - heat exchangers, refrigerators, ovens and solar water heaters.

MODULE II **24**

Mechanical properties of solids – Stress-strain relationship – Hooke's law – Torsional pendulum – Young's modulus by cantilever – Uniform and non-uniform bending – Stress-strain diagram for various engineering materials – Ductile and brittle materials – Mechanical properties of engineering materials (Tensile strength, Hardness, Fatigue, Impact strength, Creep) – Fracture – Types of fracture (Elementary ideas) – Strengthening mechanisms for the improvement of mechanical properties of materials – Solute hardening, Precipitation hardening, Dispersion hardening, Strain hardening – Factors affecting mechanical properties – grain, grain size and heat treatment.

MODULE III **24**

Permeability, Field Intensity, Magnetic Field Induction, Magnetization, Magnetic susceptibility – Origin of Magnetic Moment – Bohr magneton – Classification of Dia, Para and Ferromagnetic materials on the basis of magnetic moment – Domain Theory of Ferro magnetism on the basis of Hysteresis curve – Soft and Hard magnetic materials – Properties of anti-ferro and ferri magnetic materials and their applications – Superconductivity, Meissner effect, Effect of Magnetic field – Type-I and Type-II Superconductors – Applications of Superconductors - Importance of vacuum in industries - Pumping speed and throughput – Types of pumps-Rotary vane type Vacuum pump(oil sealed), Diffusion pump and Turbo molecular pump – Measurement of High Vacuum-McLeod Gauge-Pirani Gauge-Penning Gauge.

TOTAL: 60

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajendran V	Engineering Physics	McGraw Hill Education (India) Pvt. Ltd., Second Edition	2016
2.	Arumugam M	Physics -II	Anuradha agencies publishers	2010

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles Kittel	Introduction to Solid State Physics	John Wiley and sons Singapore, Eighth Edition	2012
2.	Gaur R K and Gupta S L	Engineering Physics	Dhanpat Rai Publishers, Eighth Edition	2012
Sl.No.	**Author(s)**	**Title of the Book**	**Publisher**	**Year of Publication**
3.	Pandey B K and Chaturvedi S	Engineering Physics	Cengage Learning India, Fifth Edition	2013
4.	William D and Callister Jr	Material Science and Engineering	John Wiley and sons, Nineth Edition	2013
5.	Raghavan V	Materials Science and Engineering	A First Course, Prentice Hall of India, Sixth Edition	2015

WEB URLs:

1. www.askiitians.com/iit-jee-thermal-physics/§
2. www.ncert.nic.in/ncerts/l/keph201.pdf
3. www.eng.sut.ac.th/metal/images/stories/pdf/06_Strengthening_mechanisms_1-30.pdf
4. www.nde-ed.org/EducationResources/CommunityCollege/MagParticle/ Physics/ElectromagneticFields.htm
5. www.belljar.net/basics.htm

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.2**	**1.2**	-	-	-	-	-	-	-	-	-	-	-	-

21OB24 MATERIAL SCIENCE FOR CIVIL ENGINEERS
(Common to all Branches)

4 0 0 4

PRE-REQUISITES: Physics at 10+2 level or equivalent level

OBJECTIVES:
- To study about the mechanical and thermal properties of the materials.
- To know about the Ceramics, Composites and polymeric materials.
- To get introduction about nano materials.
- To acquire the knowledge about ferrous and non-ferrous metals.
- To study about modern building materials.

OUTCOMES:
Learners should be able to

CO1:	acquire knowledge about mechanical properties of the materials.	**K2**
CO2:	have a sound knowledge about composite and polymer materials and its uses.	**K2**
CO3:	have a basic ideas about nano materials and its applications.	**K2**
CO4:	analyse the properties of ferrous and nonferrous building materials.	**K2**
CO5:	identify the modern building materials.	**K2**

MODULE I **12**

Mechanical properties of Materials – Concept of stress and strain of the materials – Elastic and plastic deformation, Hardness, Creep, Brittle fracture in ceramics and glasses – Toughening of ceramics and composites, Fatigue, Mechanical testing. Thermal and Optical properties of materials – Heat capacity – Thermal expansion – Thermal conductivity – Thermal stresses – Refraction – Transmission – Reflection – Absorption – Colour – Luminescence – Photoconductivity – Lasers – Optical fiber – Applications.

MODULE II **24**

Classification of Ceramics – Structure – Processing – Properties and applications of ceramics and composites – Polymer: Polymerization – Structure – Feature of polymers – Thermosetting and thermoplastic polymer – Additives and processing of polymer. Basic principles of nano material – Types of nano material – Synthesis: Top-Down and Bottom-up Process – Nanotechnology and environment – Properties and possible applications to nano-devices.

MODULE III **24**

Ferrous Metals – Pig iron – Cast iron – Mild steel – HYSD reinforcing rods – Stainless steel – Non-ferrous Metals – Aluminium, copper, lead etc., – Properties and applications – Glass : Type of glass – ingredients and manufacturing of glass – properties of glass for building purposes and structural uses – Paints – Varnishes and Distemper – Modern and Advanced Building Materials: - polymer materials – Fibre reinforced plastics – Ready to use building materials.

TOTAL: 60

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghavan V	Materials Science and Engineering	Prentice-Hall of India Private Limited, Sixth Edition	2015
2.	Singh I P	Materials Science and Engineering	Jain Brothers, Twelth Edition	2017

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Smith W F Javad Hashemi and Ravi Prakash	Material Science and Engineering	McGraw Hill Education, Fifth Edition	2017
2.	Van Vlack L H	Elements of Materials Science and Engineering	Pearson Education India, Sixth Edition	2002
3.	Shackelford J F and Muralidhara M K	Introduction to Materials Science for engineers	Pearson Education, Sixth Edition	2006

WEB URLs:

1. www.en.wikipedia.org/wiki/List_of_materials_properties
2. www.lehigh.edu/~amb4/wbi/kwardlow/basicsofmcp.htm
3. www.en.wikipedia.org/wiki/Nanomaterials
4. www.steelforge.com/raw-materials/ferrous-and-non-ferrous-material-overview/
5. www.slideshare.net/shonasrish/advanced-building-materials

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.4**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	**-**

21OB31 CHEMISTRY FOR ELECTRICAL SCIENCES
(Common to all Branches)

3 0 2 4

PRE-REQUISITES: Chemistry at 10+2 level or equivalent level

OBJECTIVES:

- To know the basics of water quality parameters and water technology.
- To be conversant with fundamentals of Electrochemistry.
- To develop a sound knowledge in principles of batteries.
- To gain the fundamental knowledge of polymeric materials.
- To acquire the knowledge in basics of nano materials.

OUTCOMES:

Learners should be able to

CO1:	develop a innovative methods for water quality and purification techniques.	**K2**
CO2:	have the clarity in the electrochemical terminologies.	**K2**
CO3:	analyze the dynamic process of batteries and nuclear energy concepts.	**K3**
CO4:	apply their knowledge for produce cheaper biodegradable polymers to reduce environmental pollution.	**K2**
CO5:	design economically and new methods of synthesis Nanomaterials.	**K2**

MODULE I **9**

Water quality parameters – Turbidity, acidity, alkalinity, DO, Nitrogen and fluoride contents of water – Hardness of water – types – Estimation of hardness of water by EDTA method – Boiler feed water - Requirements, Boiler water troubles – Scale and sludge formation, Boiler corrosion, Caustic embrittlement - Priming and Foaming – Softening of water – Internal treatment - (Carbonate, phosphate, Calgon and colloidal conditioning) – External treatment (Zeolite and Demineralization) – Desalination process – Reverse osmosis.

MODULE II **21**

Electrochemical cell – Redox reactions, reversible and irreversible cells – EMF measurement and applications – Single electrode potential, standard oxidation potential and reduction potential – Types of electrodes – Hydrogen and Calomel electrodes – Ion selective electrodes – Glass electrode and measurement of p^H – Electrochemical series and its significance – Nernst equation – Batteries – Definition, types – Dry cell, Alkaline batteries – Secondary battery – Lead acid battery, NICAD, Lithium and Lithium sulphur battery – Fuel cells – H_2 - O_2 Fuel Cell and Methyl alcohol Fuel Cell – Solar cell – photovoltaic cell – Nuclear reaction – fission and fusion reactions and Chain reaction – Light water nuclear reactor.

MODULE III **21**

Basic concepts of polymer – Classification and types of polymer – Addition polymerization (Free radical mechanism) and condensation polymerization – Coordination polymerization (Ziegler - Natta polymerization) – Individual polymers (PVC,PMMA,Teflon, Nylon 6 and Nylon 6,6, and backlite) – Engineering plastics – Thermoplastic and Thermosetting

– General characteristics of the plastics – Rubber – Natural Rubber – Drawback of natural rubber - Vulcanization of rubber – Synthetic Rubber (Buna - S and Butyl rubber) – Composites – FRP – Principle and applications – Nano chemistry – Basic concepts – distinction between molecules, nanoparticles and bulk materials – size - dependent properties – Nanoparticles, Nano cluster, Nano rod, Nanotube and Nanowire – CNT – synthesis, properties and applications – Synthesis of nano particles – Precipitation, Thermolysis (hydrothermal), Electrodeposition, Chemical vapour deposition and Laser ablation.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Determination of percentage of copper in brass by EDTA Method.
2. Determination of acidity of the given water sample.
3. Determination of Alkalinity of water sample by Double indicator method.
4. Estimation of available Chlorine in bleaching powder.
5. Estimation of chloride content in water sample by Argentometric method.
6. Estimation of strength of an acid by pH -Metry
7. Estimation of iron content in a water sample by Potentiometric method.
8. Conductometric titration of precipitation titration.
9. Estimation of acids in a mixture by conductometric method.
10. Determination of viscosity of sample by using Oswald'sViscometer.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dara S S and Umare S S	Engineering Chemistry	S.Chand and Company, First Edition.	2014
2.	Sivasankar B	Engineering Chemistry	Tata Mcgraw Hill Education, 2nd edition	2009

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shikha agarwal	Engineering Chemistry Fundamental and Applications	Cambridge Univeristy Press, Second Edition.	2016
2.	Jain P C and Monica Jain	A Textbook of Engineering Chemistry	Dhanpat rai and Co,16th edition.	2015
3	Sunita Rattan	Engineering Chemistry	SK Kataria and Sons, 3rd edition	2010
4	Palanna O G	Engineering Chemistry	Tata Mcgraw Hill Education, 1st edition	2009

WEB URLs:

1. www.readorrefer.in/article/Water-Technology_6794/
2. www.chemistryexplained.com/Ma-Na/Nanochemistry.html
3. www.chemistrylecturernotes.com/html/electrochemistry.html
4. www.nptel.ac.in/downloads/122101001/
5. www.askiitians.com/iit-jee-chemistry/inorganic-chemistry/polymers/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	CO1	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	CO2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	CO3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	CO4	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	CO5	3	2	-	-	-	-	-	-	-	-	-	-	-
CO	**CO**	**2.4**	**1.4**	-	-	-	-	-	-	-	-	-	-	**-**

21OB32 APPLIED CHEMISTRY
(Common to all Branches)

3 0 0 3

PRE-REQUISITES: Chemistry at 10+2 level or equivalent level

OBJECTIVES:

- To understand the basics of corrosion and its control.
- To know the important concepts of thermodynamic principles.
- To gain the knowledge of various engineering materials and their applications.
- To understand the fundamentals of fuels and their important concepts.
- To acquire the knowledge in analytical techniques.

OUTCOMES:

Learners should be able to

CO1:	apply their knowledge for protection of different metals from corrosion.	**K3**
CO2:	have a wide knowledge in thermodynamics concepts.	**K2**
CO3:	describe the advanced engineering materials and their industrial applications in various fields.	**K3**
CO4:	analyze the quality of fuels and combustion process.	**K2**
CO5:	be conversant with various analytical techniques and their applications.	**K2**

MODULE I **9**

Definition – Types of corrosion – Dry and wet corrosion (Mechanism) – Pilling bed-worth rule – Types of electrochemical corrosion – Differential aeration corrosion, galvanic corrosion, water line Corrosion, crevice corrosion, pitting corrosion – Factors influencing the corrosion – Control methods – Cathodic protection methods - Sacrificial anodic protection and Impressed current cathodic protection method – Protective coatings – Paints and Varnishes – Important constituents and their functions. Electroplating – principle and nickel electroplating.

MODULE II **21**

Basic concepts of thermodynamics – sypstem, surroundings, types of systems, boundary, state variables – Extensive and intensive properties – Internal energy and enthalpy – I and II law of thermodynamics – Entropy – Entropy change of ideal gas equation – Free energy and work function, Criteria of spontaneity – Gibbs-Helmholtz equations – Refractories – characteristics, classification, properties, Manufacture and some important refractories (alumina, and silicon carbide) – Abrasives – classification – natural and synthetic, applications – Lubricants – classification, properties, mechanism of lubricants – Grease and Graphite – Cement – classification – Manufacture of Portland cement – General properties – setting of cement – Alloy – properties of alloy, classification – ferrous and non-ferrous alloy – Heat treatment of alloys.

MODULE III **21**

Fuel – calorific value – higher, lower calorific values and theoretical calculation – Coal – Analysis of coal (proximate and ultimate) – Petroleum – Petrol – knocking petrol, octane number –Manufacture of synthetic petrol (Fischer Tropsch and Bergius Processes) – Diesel – characteristics, knocking, Cetane number – Gaseous fuel – Water and Producer gas – Combustion of fuels – Spontaneous Ignition temperature – Theoretical calculation of air for combustion (problems) – Electro analytical Methods – Conductometry and Potentiometry – Spectroscopy – Electromagnetic radiation spectrum – Absorption spectrum – UV spectra – Principle, Instrumentation and applications – Absorption laws – beers and Lamberts law – Colorimetric analysis – Estimation of Iron and Nickel by Colorimetry – Flame Photometry – principle and Instrumentation (block diagram only).

TOTAL: 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dara S S and Umare S S	Engineering Chemistry	S.Chand and Company, First Edition.	2014
2.	Sivasankar B	Engineering Chemistry	Tata Mcgraw Hill Education, Second Edition.	2009

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shikha agarwal	Engineering Chemistry Fundamental and Applications	Cambridge Univeristy Press, Second Edition.	2016
2.	Jain P C and Monica Jain	A Textbook of Engineering Chemistry	Dhanpat rai and Co, Sixteenth Edition.	2015
3	Sunita Rattan	Engineering Chemistry	SK Kataria and Sons, Third Edition.	2010
4	Palanna O G	Engineering Chemistry	Tata Mcgraw Hill Education, First Edition.	2009

WEB URLs

1. www.askiitians.com/iit-jee-chemistry/physical-chemistry/electrochemistry/corrosion/
2. www.ocw.mit.edu/courses/materials-science-and-engineering/3-00-thermodynamics/
3. www.nptel.ac.in/downloads/112108150/
4. www.nptel.ac.in/downloads/122101001/
5. www.readorrefer.in/article/Spectroscopy_6792/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.4**	**1.4**	-	-	-	-	-	-	-	-	-	-	-	**-**

ENGINEERING SCIENCES (ES)

21FC01 PROGRAMMING LOGIC AND DESIGN

3 0 4 5

PRE-REQUISITES: Mathematics 10th / +2 level or equivalent

OBJECTIVES:

- To understand the method of developing an algorithm and to understand the simple program design
- To analyse the loop structures
- To apply the concept of console I/O and arrays
- To learn the working of two-dimensional arrays
- To evaluate the modularization concepts and storage classes

OUTCOMES:

Learners should be able to

CO1	utilize the basic components of a C program, including data types, constants, variables, operators, and I/O statements, and selection structures for algorithm development.	**K3**
CO2	summarize the use of looping structures, control statements, and I/O functions in code development.	**K2**
CO3	make use of arrays, multi-dimensional arrays, and preprocessor directives in C programs, their applications in program development.	**K3**
CO4	implement user-defined functions, recursive functions, storage classes and function calls in C programming.	**K3**
CO5	develop C programs using control structures, arrays, functions, and recursion, ensuring proper use of syntax and functionality with appropriate debugging.	**K2**

MODULE I **9**

Logic and Scenarios – Steps in program development – An introduction to algorithm and pseudocode – Structure of C program – Basic data types and sizes – Constants – Variables – Operators – Input/output statements – Algorithms using selection – If and else statements – The CASE Structure – Switch statement – Goto statement.

MODULE II **21**

Loop -while-do while- for - break – continue – Types of I/O – Formatted I/O – Unformatted I/O functions – Header files – #include – Preprocessor directive – Macros – Conditional compilation statements – #line – #error – The minimum field width specifier – Scanset – Arrays – Declaration – Array operations – Declare array size using macro – Index range checking.

MODULE III **21**

Two dimensional – Multi-dimensional arrays – Application of arrays – Functions – Types – Reusability – User defined functions – Standard library functions – Function calls – Parameter passing – Call by value – Return statements – Arrays and functions – Recursive functions – Indirect – Direct – Tail – Recursion Vs iteration – Storage classes.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on ranges of data types
2. Programs on constants and variables
3. Programs on operators
4. Programs on selection control structure
5. Programs using looping statements
6. Programs on console I/O functions
7. Programs using pre-processor directive
8. Programs on array operation
9. Programs using two dimensional array
10. Programs using inbuilt Functions
11. Programs using User Defined function and recursive function
12. Programs using storage classes

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brian W Kernighan and Dennis M Ritchie	The C Programming Language	Prentice Hall, Second Edition	2015
2.	Jeri R Hanly Elliot B Koffman	Problem Solving and Program Design in C	Pearson Education , Eighth Edition	2015

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C: The Complete reference	McGraw Hill, Fourth Edition	2013
2.	David Griffiths and Dawn Griffiths	Head First C	O'Reilly Media , First Edition	2012
3.	Bryon S Gottfried	Programming with C	McGraw Hill, Second Edition	2010

WEB URLs:

1. www.hackerrank.com
2. www.codechef.com
3. www.learn-c.org
4. www.udemy.com
5. www.hackearth.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	-	1	-	2	2	-	1	2	1
CO2	2	1	-	-	2	-	-	-	2	2	-	1	2	2
CO3	3	2	1	1	2	-	-	-	2	2	-	1	-	-
CO4	3	2	1	1	2	-	-	-	2	2	-	1	1	2
CO5	3	2	-	-	2	-	1	-	2	2	-	1	1	2
CO	**2.6**	**1.6**	**1**	**1**	**2**	**-**	**1**	**-**	**2**	**2**	**-**	**1**	**1.5**	**1.8**

21FC02 C PROGRAMMING – I

3 0 4 5

OBJECTIVES:

- To understand the basic concept of C programming and develop programs using conditional, iterative and control structures.
- To apply the concept of console I/O and arrays.
- To evaluate the concepts of functions and storage classes.
- To analyze the programming constructs in structure and union.
- To study the working of preprocessor directives.

OUTCOMES:

Learners should be able to

CO1	Contrast C programming styles for solving engineering problems using control structures.	**K3**
CO2	Illustrate programs with console I/O and arrays, ensuring logical precision.	**K2**
CO3	Explain the concepts of functions and storage classes in practical, real-time applications.	**K2**
CO4	Outline computational solutions that effectively utilize structures and unions.	**K2**
CO5	Apply preprocessor directives to develop programs for enhanced code functionality.	**K3**

MODULE I **9**

Numbering system – Algorithm / Pseudo code – Flowchart – Program development steps – Structure of C program – A simple C program – Identifiers – Basic data types and sizes – Constants – Variables – Arithmetic – Relational and logical operators – Increment and decrement operators – Conditional operator – Bitwise operators – Assignment operator – Expressions – Precedence and order of evaluation – Input/output statements – Statements and blocks – if and switch statements – loops – while – do-while – for – break – continue – goto and labels.

MODULE II **21**

Types of I/O – Console I/O functions – Formatted I/O – Unformatted I/O functions – Header files – #include – #define – Arrays – Concepts – Declaration – Declare array size using macro – Definition – Accessing elements – Index Range Checking – Two Dimensional – Multi-Dimensional arrays – Application of arrays – Functions – Types – Reusability – User defined functions – Standard library functions – Function header – Function body – Function prototype – Function calls – Parameter passing – Call by value – Return Statements – Random number generation – Math functions – Truncate – Absolute – Float absolute – Arrays and functions – Recursive functions – Indirect – Direct – Tail – Recursion Vs Iteration – Storage classes.

MODULE III **21**

Derived types – Structures – Declaration – Definition and initialization of structures – Accessing structures – Nested structures – Arrays of structures – Structures and functions – typedef – Structure .Padding – #pragma pack(1) – Enumeration data type – Bit fields – Applications – Unions – Defining named constants – #undef – Predefined macros – Conditional compilation - Preprocessor operators – # – ## – #line – #error – #pragma – The minimum field width specifier – Scanset – The precision specifier – Suppressing input.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on ranges of data types
2. Programs on operators
3. Programs on control structures
4. Programs using looping statements
5. Programs on console I/O functions
6. Programs using array concept
7. Programs using inbuilt Functions
8. Programs using User Defined function and recursive function
9. Programs using storage classes
10. Programs on structure and unions
11. Programs on Enum, typedef and bit fields
12. Programs using preprocessor directives

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C: The Complete reference	McGraw Hill, Fourth Edition	2013
2.	Brian W Kernighan and Dennis M Ritchie	The C Programming Language	Prentice Hall, Second Edition	2015

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harry H Cheng	C for Engineers and Scientists: An Interpretive Approach	Tata McGraw-Hill First Edition	2010
2.	David Griffiths and Dawn Griffiths	Head First C	O'Reilly Media, First Edition	2012
3	Bryon S Gottfried	Programming with C	McGraw Hill, Second Edition	2010
4	Seymour Lipschutz	Schaum's Outlines, Data Structure with C	Tata McGraw-Hill Special Indian Edition	2011

WEB URLs:

1. www.hackerrank.com
2. www.learn-c.org
3. www.udemy.com
4. www.codechef.com
5. www.learnconline.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	1	-	1	1	-	1	2	2
CO2	2	1	-	-	1	-	1	-	1	1	-	1	2	1
CO3	2	1	-	-	1	-	1	-	1	1	-	1	2	1
CO4	2	1	-	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	1	2	2
CO	**2.4**	**1.4**	**2**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.4**

21FC03 C PROGRAMMING – II

3 0 4 5

OBJECTIVES

- To understand the basic concepts of pointer and array of pointers
- To evaluate the two dimensional array and string handling functions
- To apply the knowledge on dynamic memory allocation
- To learn the concept of structure pointer and function pointer
- To study the file operations and command line arguments

OUTCOMES

Learners should be able to

CO1	classify the concepts of pointers and their application in memory management.	**K2**
CO2	summarize the operations of two-dimensional arrays and string handling functions for effective problem-solving.	**K2**
CO3	implement dynamic memory allocation techniques for advanced computational problems.	**K3**
CO4	apply structure pointers and function pointers for modularity and functionality enhancement in programming.	**K3**
CO5	explain file operations and the use of command-line arguments to facilitate program execution.	**K2**

MODULE I **9**

Pointers – Pointer expressions – Pointer assignments – Pointer conversions – Pointers types – NULL pointer – Void pointer – Wild pointer – Pointer arithmetic – Pointer increment and decrement –Pointer comparisons – Pointers and arrays – Arrays of pointers – Multiple indirection initializing pointers – Restrict qualified pointers – Problems with pointers.

MODULE II **21**

Two dimensional array – Pointer to an array – Character manipulation functions – ctype.h – Strings – String I/O – String manipulation – Arithmetic operations on strings – String handling functions – Arrays and strings – Functions and strings – Pointers and strings – Using const in pointer declaration – Static and Dynamic Memory Allocation.

MODULE III **21**

Function pointers – Pointer and function – Call by reference – Function returning pointer – Pointer variables in structures – Pointers to structures. Standard C Vs Unix File – Streams and files – File system basics – The file pointer – Opening a file – Closing a file – Writing a character – Reading a character – Using fopen( ), fgetc( ), fputc( ), and fclose( ) – Using feof( ) – fputs( ) and fgets( ) – rewind() – ferror( ) – perror() – fprintf( ) and fscanf( ) – sprintf( ) and sscanf( ) – Command line arguments.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on pointers.
2. Program on type conversion using void pointer.
3. Programs on Array and pointers.
4. Programs using strings and pointers.
5. Programs using functions and strings.
6. Programs using advance use of pointers.
7. Programs insisting on different types of string functions and pointers.
8. Programs on malloc() function and calloc() function.
9. Programs using structure pointers.
10. Programs on file operations.
11. Programs on Encryption and Decryption of files.
12. Programs using random access file.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C: The Complete reference	McGraw Hill, Fourth Edition	2013
2.	Brian W Kernighan and Dennis M Ritchie	The C Programming Language	Prentice Hall, Second Edition	2015

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harry H Cheng	C for Engineers and Scientists: An Interpretive Approach	Tata McGraw-Hill First Edition	2010
2.	David Griffiths and Dawn Griffiths	Head First C	O'Reilly Media, First Edition	2012
3	Bryon S Gottfried	Programming with C	McGraw Hill, Second Edition	2010
4	Seymour Lipschutz	Schaum's Outlines, Data Structure with C	Tata McGraw-Hill Special Indian Edition	2011

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2. www.learn-c.org
3. www.udemy.com
4. www.codechef.com
5. www.learnconline.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	1	-	1	1	-	1	2	2
CO2	2	1	-	-	1	-	1	-	1	1	-	1	2	2
CO3	3	2	1	-	1	-	1	-	1	1	-	1	2	-
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	2	1	-	-	1	-	-	-	1	1	-	1	2	1
CO	**2.4**	**1.2**	**1**	**-**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.5**

21FC04 ADVANCED C PROGRAMMING

3 0 4 5

PRE-REQUISITES: Programming Logic and Design / C Programming I

OBJECTIVES:

- To use pointers to dynamically allocate, deallocate, and manage memory, complex data structures in programs.
- To apply the concept of string handling functions in real world applications
- To implement dynamic memory allocation and structure pointer effectively in real applications for efficient and scalable programming.
- To apply the function pointer and file operations in scenarios such as event handling, data storage/retrieval and creating plug-in architectures.
- To analyze the working of libraries and code optimization technique

OUTCOMES:

Learners should be able to

CO1	make use of the concepts of pointers, pointer arithmetic, and their applications with arrays and multi-level indirection in programming.	**K2**
CO2	illustrate the usage of strings, dynamic memory allocation techniques, and their integration with structures and unions for effective data manipulation.	**K3**
CO3	implement the concept of dynamic memory allocation for optimization and dynamic memory management.	**K3**
CO4	utilize code optimization techniques, including loop optimization and efficient function usage, to enhance program performance.	**K3**
CO5	develop code modules involving pointers, strings, dynamic memory allocation, file operations, and multi-file projects, emphasizing error-free coding standards.	**K4**

MODULE I **9**

Pointers – Pointer expressions – Pointer conversions – Pointer types – Restrict qualified pointers – Pointer arithmetic – Pointer increment and decrement – Multiple indirection initializing pointers – Pointer comparisons – Using const in pointer declaration – Problems with pointers – Pointers and arrays – Arrays of pointers.

MODULE II **21**

Pointer to an array – Variable length array (VLA) – Strings – String handling functions – Arrays and strings – Functions and strings – Pointers and strings – Static and dynamic memory allocation – Structures – Nested structures – Typedef – Structure padding – Enumeration data type – Pointer variables in structures – Pointers to structures – Bit fields – Union.

MODULE III **21**

Function pointers – Pointer and function – Function returning pointer – File system basics – The file pointer – File operations – fopen() – fgetc() – fputc() – fclose() – feof() – fputs( ) – fgets() – fprintf() – fscanf() – Erasing files – Random access file – Command line arguments – Multiple source files – Static and dynamic libraries – Code optimization – Optimization with loops – Fast mathematics in loops – Optimization by functions.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on pointers.
2. Programs on Array and pointers.
3. Programs using strings and pointers.
4. Programs using string handling functions.
5. Programs using functions and strings.
6. Programs on malloc() function and calloc() function.
7. Programs on structure pointers.
8. Programs using function pointers.
9. Programs on file operations.
10. Programs using random access file.
11. Programs using multiple source files.
12. Programs using code optimization techniques.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brian W Kernighan and Dennis M Ritchie	The C Programming Language	Prentice Hall, Second Edition.	2015
2.	Richard M Reese	Understanding and Using C pointers	O'Reilly, First edition	2013

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C: The Complete reference	McGraw Hill, Fourth Edition	2013
2.	Harry H Cheng	C for engineers and scientists: an interpretive approach	McGraw-Hill Higher Education	2010
3.	David Griffiths and Dawn Griffiths	Head First C	O'Reilly Media , First Edition	2012

WEB URLs:

1. www.thegeekstuff.com/category/c-programming/
2. www.learn-c.org
3. www.udemy.com
4. www.codechef.com
5. www.hackerrank.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	1	-	1	1	-	1	2	2
CO2	3	2	1	-	1	-	1	-	1	1	-	1	2	1
CO3	3	2	1	-	1	-	1	-	1	1	-	1	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	2
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	2
CO	**2.8**	**2**	**1.3**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.6**

21FC05 BASICS OF CIVIL AND MECHANICAL ENGINEERING

4 0 0 4

OBJECTIVE

- To understand the process involved in the manufacturing of cement and types of concrete.
- To know the types and properties of construction materials such as cement, concrete, steel sections.
- To learn the surveying and its applications.
- To understand the concepts of energy generation in power plants.
- To study about construction of IC engines and Boilers.

OUTCOMES:

Learners should be able to

CO1	identify knowledge on applications of different construction materials in various structures.	**K3**
CO2	select on different kinds of structures and its usage in different applications.	**K3**
CO3	explain on Surveying both theoretically and practically.	**K2**
CO4	interpret about the working of power plant.	**K2**
CO5	outline the working of IC engines and Boilers	**K2**

MODULE I **20**

Introduction to Civil Engineering – Materials – Bricks –Sand – Cement – Concrete – Steel sections – Site for foundations – Bearing capacity – Loads – Requirement of good foundations – Types – Introduction to Power Plants – Classification of Power Plants – Working principle of Steam, Gas, Diesel, Hydro – electric and Nuclear power plants – Merits and Demerits – Pumps and turbines – Classifications, working of centrifugal and reciprocating pump(single and double acting) – Applications.

MODULE II **20**

Superstructure – Brick Masonry – Stone masonry – Beams – Columns – Lintels – Roofing – Flooring– Plastering – Valuation. Mechanics – Internal and External forces – Strain – Elasticity – Types of Bridges and Dams – Basics of Interior design and Landscaping. Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Lubrication system – Ignition system – Magneto and Battery types – Cooling system – Boiler – Classification – Water tube boiler, Fire tube boiler – Boiler mounting and accessories.

MODULE III **20**

Surveying – Objects – Types – Classification – Principles – Measurements of Distances – Angles – Leveling – Determination of areas –Illustrative examples. Terminology of Refrigeration and Air conditioning – Refrigerant – Properties, types – Principle of Vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room air conditioner.

TOTAL: 60

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ramesh Babu V	Basic Civil and Mechanical Engineering	VRB Publishers, Revised Edition.	2013
2.	Venugopal K and Prabu Raja V	Basic Mechanical Engineering	Anuradha Publishers, Fourth Edition.	2010

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shanmugam G and Palanichamy M S	Basic Civil and Mechanical Engineering	Tata McGraw – Hill, Fourth Edition	2008
2.	Arora S C and Domkundwar S	A Course in Power plant Engineering	DhanpatRai and Co, Third Edition	2005
3.	Shanthakumar S R J	Basic Mechanical Engineering	Hi – Tech Publications, Second Edition	2005
4.	Basak N N	Surveying and Levelling	Tata McGraw – Hill, Second Edition	2014
5.	Seetharaman S	Basic Civil Engineering	Anuradha Agencies, First Edition	2005

WEB URLs:

1. www.surveying.com
2. www.levelling.org
3. www.constructionmaterials.com
4. www.web.iitd.ac.in/~ravimr/courses/mel345/classification.pdf
5. www.nptel.ac.in/courses/112105128

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO4	3	3	2	1	-	-	-	-	1	-	-	1	-	-
CO5	3	3	2	1	-	-	-	-	1	-	-	1	-	-
CO	**3.0**	**2.4**	**1.4**	**1.0**	-	-	-	-	**1.0**	-	-	**1.0**	-	-

21FC06 BASICS OF ELECTRICAL ENGINEERING

3 0 2 4

OBJECTIVES:

- To understand circuits and theorem.
- To learn different AC circuits.
- To learn different types of generators.
- To be familiarized with motor and generator types.
- To gain knowledge on measuring instruments.

OUTCOMES:

Learners should be able to

CO1	apply ohm's law and Kirchhoff's laws to the electric circuit to compute the electrical parameters	**K3**
CO2	develop the ability to apply circuit analysis to AC circuits	**K3**
CO3	make use of knowledge about constructional details of DC machines and single phase transformers	**K3**
CO4	examine the AC machines to draw the equivalent circuit	**K4**
CO5	inference construction, working principle of different measuring instruments and dynamometer type wattmeter for measurement of power	**K4**

MODULE I **9**

Circuits and theorems: Fundamentals of electrical engineering – Ohm's law – Kirchhoff's laws – Mesh and nodal analysis – Super position theorem – Thevenin's theorem – Norton's theorem – Reciprocity theorem – Maximum power transfer theorem – Star – Delta Transformations.

MODULE II **21**

AC circuits: Magnetic circuits – Electromagnetic induction – Faraday's law, Lenz's law – Self and mutual inductances – Production of alternating voltage – RMS value – Average value – Form factor – Peak factor – Phase difference – Phasor diagram – RL, RC, RLC circuits – DC machines and transformer: Fundamentals of DC machines – EMF equation – Types of generators – Load characteristics – DC Motors, types and characteristics – Torque equation – Starters – Speed control – Single phase transformer – EMF equation – OC and SC tests – Efficiency and regulation.

MODULE III **21**

AC machines: Introduction – Construction and principle of operation of AC machines – Alternators – Three phase and single phase induction motors – Types – Characteristics – Applications – Synchronous motor – Starting – Measuring instruments: Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Standards and calibration – Basic ammeter, Volt meter, Dynamometer type watt meter – Energy meter.

TOTAL : 45

LIST OF EXPERIMENTS:

1. Verification of Ohm's and Kirchhoff Law.
2. Verification of Circuit Theorem.
3. Load Test on Single Phase Transformer.
4. Load Test on DC shunt motor.
5. Load Test on DC series motor.
6. Speed Control of DC shunt motor.
7. Load Test on DC shunt generator.
8. Load Test on three phase induction motor.
9. Load Test onsingle phase induction Motor.
10. Measurement of single phase power and power factor.
11. Measurement of three phase power.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Smarajit Ghosh	Fundamentals of Electrical and Electronics Engineering	Prentice Hall, Second Edition	2011

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kothari D P and Nagrath I J	Basic Electrical Engineering	Tata McGraw Hill, Third Edition	2009
2.	Del Toro	Electrical Engineering Fundamentals	Prentice Hall, Second Edition	2011
3	Mehta V K and Rohit Mehta	Basic Electrical Engineering	S Chand and Company, Fourth Edition	2008
4	Sawhney A K and Puneet Sawhney	A Course in Electrical and Electronic Measurements and Instrumentation	Dhanpat Rai and Co, Eighteenth Edition	2010

WEB URLs:

1. www.ece.rice.edu/~dhj/courses/elec241/col10040.pdf
2. www.freevideolectures.com › Electrical Engineering › IISc Bangalore
3. www.uceou.edu/syllabus/BasicElectricalEngg_2105_2016.pdf
4. www.controlmanuals.com › Electronics › Electronics Systems
5. www.nptel.ac.in/courses/108108076/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	1	-	-	1	-	-
CO4	3	3	2	1	-	-	-	-	1	-	-	1	-	-
CO5	3	3	2	1	-	-	-	-	1	-	-	1	-	-
CO	**3.0**	**2.4**	**1.4**	**1.0**	-	-	-	-	**1.0**	-	-	**1.0**	-	-

21FC07 ENGINEERING PRACTICES FOR COMPUTER SCIENCES

0 0 4 2

OBJECTIVES:

- To check and measure Personal Computer's power supply voltage.
- To study the mother boards and various types of interface cards.
- To study and replaces hard disk.
- To study the different network cables and network devices.
- To assemble a Personal Computer.

OUTCOMES:

Learners should be able to

CO1	describe hardware components within a computer system.	**K2**
CO2	apply non-functioning computer systems and propose suitable repair solutions.	**K3**
CO3	disassemble and reassemble a fully functional computer system efficiently	**K3**
CO4	connect computers within a LAN environment to ensure seamless communication.	**K3**
CO5	summarize the roles of various network components in a LAN setup.	**K2**

LIST OF EXPERIMENTS

PC Hardware Servicing

1. Study of power supply requirement of Personal Computer.
2. Study of Mother Boards.
3. Study various cards used in a Computer System viz. Display Card, Ethernet Card etc
4. Study of I/O devices, interfacing and device driver installation.
5. Study of hard disk partition, defragmentation and installation.
6. Study of software an installation which includes OS, Software packages and programming development kits installation.
7. Study of Assembling a Personal Computer.
8. Study of Assembling a Laptop.
9. Study of Assembling a Mobile.

Networking and configuring Networks

1. Study of different types of network cables.
2. Study of network devices in detail.
3. Study of classes of network IP.
4. Connects the computer in Local Area Network.
5. Study of basic network commands and configuration commands.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	1	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	1	2	-
CO3	3	2	1	-	-	-	-	-	2	2	-	1	2	-
CO4	3	2	1	-	-	-	-	-	2	2	-	1	2	-
CO5	2	1	-	-	-	-	-	-	2	2	-	1	2	-
CO	**2.6**	**1.6**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**1**	**2**	**-**

21FC08 ENGINEERING GRAPHICS

0 0 4 2

OBJECTIVES:

- To provide knowledge on procedures to draw conics and involutes.
- To understand the basic principles of orthographic projection and its conventions.
- To impart the knowledge on projections of points, lines, plane surfaces and solids.
- To recognize the sectioning and development of surfaces.
- To know about 2D drafting and basic design software tools.

OUTCOMES:

Learners should be able to

CO1	illustrate various curves and involutes with exact dimensions	**K2**
CO2	choose visualization skills through free hand sketching of multiple views from pictorial views of objects	**K3**
CO3	build the projections of points, lines, plane surfaces and solids	**K3**
CO4	construct the sectioning and development of surfaces using different methods	**K3**
CO5	make use of 2D drafting and basic design software tools for engineering applications	**K3**

MODULE I **9**

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of involutes of triangle, square, pentagon, hexagon and circle – Drawing of tangents and normal to the above curves.

MODULE II **21**

Representation of three dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – Layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects – Projection of points in all quadrants – Projection of straight lines located in first quadrants – Projection of plane surfaces, Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

MODULE III **21**

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section – Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids perpendicular to the axis importance of 2D drafting – Sketching, mirroring, scaling, copying (simple and multiple) dimensioning – Wiring diagram and piping layout drawings – Practice of Computer Aided Drafting and dimensioning using appropriate software packages.

TOTAL : 45

TEXT BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natarajan K V	A Text book of Engineering Graphics	Dhanalakshmi Publishers, Fifth Edition	2010
2.	Morling K	Geometric and Engineering Drawing	Elsevier Publications, Second Edition	2010

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Venugopal K and Prabhu Raja V	Engineering Drawing and Graphics	New Age International, Fifth Edition	2010
2.	Dhananjay A Jolhe	Engineering Drawing with an introduction to AutoCAD	Tata McGraw Hill, First Edition	2008
3.	Bhatt N D	Engineering Drawing	Charotar Publishing House, Fifty Third Edition	2010
4.	Narayana K L and Kannaiah P	Engineering Graphics	Tata McGraw, First Edition	2008
5.	Basant Agarwal and Agarwal C M	Engineering Drawing	Tata McGraw Hill, Second Edition	2008

WEB URLs:

1. www.iitg.ernet.in/rkbc/me111.htm
2. www.cartercenter.org/resources/.../lecture notes/.../engineeringdrawing.pdf
3. www.engineeringdrawing.org
4. www.nptel.ac.in/courses.php?disciplineId=112
5. www.iitmweb.iitm.ac.in/phase2/courses/112104172/19.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO	**2.8**	**2.0**	-	-	-	-	-	-	-	-	-	-	-	-

21FC09 DIGITAL ELECTRONICS AND MICROPROCESSORS

3 0 2 4

OBJECTIVES:

- To study the logic gates and number systems.
- To understand combination logic.
- To provide in-depth theoretical base of the digital electronics.
- To understand flip flops, shift registers and counters operations.
- To understand state assignment and state reduction of asynchronous sequential logic.

OUTCOMES:

Learners should be able to

CO1	explain the principles of number systems, Boolean algebra, and basic logic gates for digital circuit design	**K2**
CO2	illustrate the design and operation of combinational and sequential circuits	**K2**
CO3	conduct experiments to implement digital circuits using simulation tools and integrated circuits (ICs)	**K3**
CO4	describe the architecture and other salient features of 8085 Microprocessor	**K2**
CO5	conduct experiments for interfacing and programming various peripherals with 8085 microprocessor	**K3**

MODULE I **9**

Boolean algebra and logic gates: Review of number systems – Binary arithmetic – Binary codes – Boolean algebra and theorems – CMOS transmission gate circuits– Simplifications of boolean functions using Karnaugh map and tabulation methods – Logic gates.

MODULE II **17**

Combinational logic: Combinational circuits – Analysis and design procedures – Circuits for arithmetic operations – Code conversion – Design with MSI devices: Decoders and encoders, Multiplexers and demultiplexers – Magnitude comparator – Memory and programmable logic: PLA, PAL, PROM.

MODULE III **19**

Synchronous sequential logic: Sequential circuits – Latches– Flip flops – Analysis and design procedures – State reduction and state assignment – Shift registers – Counters – Asynchronous sequential logic: Analysis and design of asynchronous sequential circuits – Reduction of state and flow tables – Race free state assignment – Hazards.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Verification of boolean theorems using digital logic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters (Binary to gray, BCD to excess 3).
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI device.
5. Design and implementation of magnitude comparator.

6. Design and implementation of multiplexers.
7. Design and implementation of shift (SISO and SIPO) registers.
8. Design and implementation of synchronous and asynchronous counters.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Morris R. Mano Michael D. Ciletti	Digital Design	Pearson Education, Fifth Edition	2013

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Donald D Givone	Digital Principles and Design	Tata McGraw-Hill, First Edition	2011
2.	Thomas C Bartee	Digital Computer Fundamentals	Tata McGraw-Hill, Sixth Edition	2012
3	Charles H Roth	Fundamentals of Logic Design	Jaico Publishing House, Seventh Edition	2013

WEB URLs:

1. www.rejinpaul.com/.../cs6201-digital-principles-and-system-design-notes
2. www.annauniverzity.com › CSE
3. www.iitg.ernet.in/asahu/cs221/Lects/
4. www.freevideolectures.com › Computer Science › IIT Kharagpur
5. www.csenote.weebly.com/digital-principles--system-design.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	-	1	-	-	-	1	1	-	1	1	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	2	1	-	1	-	-	-	1	1	-	1	1	-
CO	**2.4**	**1.4**	**1**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	**1**

21FC10 FUNDAMENTALS OF DIGITAL COMMUNICATION

3 0 0 3

OBJECTIVES:

- To familiarize with basics of communication system and analog modulation techniques.
- To gain knowledge about different types of digital modulation.
- To gain knowledge on pulse modulation techniques.
- To familiarize with source and Error control coding schemes.
- To study the spread spectrum modulation concepts and multiple access systems.

OUTCOMES:

Learners should be able to

CO1	explain analog modulation concepts and their applications.	**K2**
CO2	illustrate various digital signal modulation techniques used in communication systems.	**K2**
CO3	demonstrate pulse modulation techniques and their practical applications.	**K3**
CO4	analyze source and error control coding schemes in digital communication.	**K4**
CO5	identify and differentiate access methods for specific communication applications.	**K2**

MODULE I **9**

Basic representation of communication system – Transmitter – Channel noise and receiver – Baseband and band pass signal – Transmission media – Electromagnetic Spectrum – Modulation – Types – Need for Modulation – Theory of amplitude modulation – Evolution and description of SSB techniques – Theory of frequency and phase modulation – Comparison of Analog Modulation Techniques (AM – FM – PM).

MODULE II **21**

Introduction to digital communication – Shannon limit for information capacity – Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM). Pulse modulation – Pulse code Modulation (PCM) - Sampling, Quantization – sampling rate – Signal to quantization noise – Companding – Pulse Amplitude Modulation (PAM) – Pulse Width Modulation (PWM) – Pulse Position Modulation (PPM) – Pulse Time Modulation (PTM) – Comparison of Pulse Modulation techniques.

MODULE III **21**

Source and error control coding: Entropy – Source encoding theorem – Shannon fano coding – Huffman coding – Channel capacity – Channel coding theorem – Error control coding – Linear block codes – Cyclic codes – Convolution codes – Introduction to spread spectrum modulation – Pseudonoise sequences – Direct sequence spread spectrum – Frequency hop spread spectrum – Overview of Multiple Access Schemes – Global System for Mobile Communications (GSM) – Code division multiple access (CDMA).

TOTAL: 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon Haykin and Michael Moher	Communication Systems	John Wiley & Sons, Fifth Edition	2009
2.	John G Proakis and MasoudSalehi	Fundamentals of Communication Systems	Pearson Education, Third Edition	2008

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wayne Tomasi	Advanced Electronic Communication Systems	Pearson Education, Sixth Edition	2012
2.	Lathi B P and Zhi Ding	Modern Digital and Analog Communication System	Oxford University, Fourth Edition	2009
3	Roy Blake	Electronic Communication Systems	Thomson Delmar Publications, Second Edition	2012

WEB URLs:

1. www.ece.umd.edu/class/enee623.S2006/
2. www.ptgmedia.pearsoncmg.com/images/.../0132209101_01.pdf
3. www.home.iitj.ac.in/~ramana/digital_comm.pdf
4. www.nptel.ac.in/courses/117101051/
5. www.spie.org/samples/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO	**2.6**	**2.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.0**	**-**	**-**

21FC11 PHP PROGRAMMING

3 0 2 4

OBJECTIVES:

- To understand the concepts of PHP.
- To provide in-depth knowledge of strings, functions, arrays and objects in PHP.
- To understand handling HTML forms with PHP.
- To study the working of files and directories in PHP.
- To understand the PHP databases.

OUTCOMES:

Learners should be able to

CO1	develop scripts using PHP to build dynamic web applications.	**K3**
CO2	utilize string manipulation techniques and functions in PHP for application development.	**K3**
CO3	apply object-oriented programming concepts to create modular PHP code.	**K3**
CO4	implement query strings to handle dynamic data in web applications effectively.	**K3**
CO5	manipulate MySQL data using PHP to create database-driven websites.	**K3**

MODULE I **9**

The evolution of PHP – Installing PHP – Creating your first script – Variables in PHP – Data types – Operators and expressions – Making decisions – Doing repetitive tasks with looping.

MODULE II **21**

Creating and accessing strings – Searching strings – Replacing text within strings – Dealing with upper and lowercase formatting strings – Accessing array elements – Looping through arrays with for each – Working with multidimensional arrays – Writing your own functions – Writing recursive functions. OOP concepts – Classes and objects in PHP – Creating and using properties – Working with methods – Object overloading with – get() – set() and – call() – Using inheritance to extend the power of objects – Constructors and destructors – Handling HTML forms with PHP.

MODULE III **21**

Preserving state with query strings – Cookies and sessions – Working with files and directories – Introducing databases and SQL. Retrieving data from MySQL with PHP – Manipulating MySQL data with PHP – Working with HTTP – Generating images with PHP.

TOTAL: 45

LIST OF EXPERIMENTS

1. Introduction to basic HTML tags.
2. Program using operators.
3. Program using loops
4. Program using PHP functions.
5. Program using array.
6. Program using PHP forms and strings.
7. MySQL connection using PHP.
8. Insert the data into MYSQL database using web form.
9. Update the data present in MYSQL database using web form.
10. Delete the data from MYSQL database using web form

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matt Doyle	Beginning PHP 5.3	John Wiley & Sons, 2nd edition	2011
2.	Kevin Tatroe, PeterMacIntyre and Rasmus Lerdorf	Programming PHP	O'Reilly, Third Edition	2013

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Vikram Vaswani	PHP: A Beginner's Guide	Tata McGraw Hill, First Edition	2008
2.	Jason Gilmore	W Beginning PHP and MySQL	Apress, Fourth Edition	2010
3	Andi Gutmans, StigSaether Bakken and Derick Rethans	PHP 5 Power Programming	Prentice hall, Second Edition	2007

WEB URLs:

1. www.nptelvideos.com/php
2. www.w3schools.com/php/php_intro.asp
3. www.tutorialspoint.com/php/php_introduction.htm
4. www.ik.su.lt/PHP/McGraw.Hill.Osborne.Media.PHP.A.BEGINNERS.GUIDE.Oct.2008.eBoo k-DDU.pdf
5. www.infoap.utcluj.ro/multi/programming_PHP.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	1	-	-	-	1	1	-	-	-	-
CO3	3	2	1	-	1	-	-	-	2	2	-	-	-	-
CO4	3	2	1	-	1	-	-	-	2	2	-	-	-	-
CO5	3	2	1	-	2	-	-	-	2	2	-	-	-	-
CO	**2.8**	**1.8**	**1.0**	-	**1.2**	-	-	-	**1.7**	**1.7**	-	-	-	-

21FC12 FUNDAMENTALS OF WEB SCRIPTING

3 0 2 4

OBJECTIVES:

- To understand HTML tags, attributes, URL encoding.
- To know about CSS tags and text styles.
- To study the designed forms validation by java script.
- To understand the behavior of the web pages.
- To have the knowledge of workings of web server.

OUTCOMES:

Learners should be able to

CO1	create web pages with functional and aesthetic elements using scripting languages.	**K3**
CO2	describe presentation techniques for designing visually appealing web pages.	**K2**
CO3	apply operators and expressions effectively to perform computations in JavaScript.	**K3**
CO4	utilize arrays and functions for interactive JavaScript applications development	**K3**
CO5	interpret the process of working with server databases for dynamic web content.	**K2**

MODULE I **9**

Introduction: Internet – HTTP – http-server – HTML – HTML versions – Unicode Transformation Format (UTF) – HTML5 Resources – Doctype in html – html5 tags. Web Page: Design consideration – Tag structure – Tags(html, head, title, body, meta). Listing Values: Unordered – Ordered and definition list. Images: Web page background – resizing – alternate text. Hyperlink: Text link – Image link – Link with in document – Target – Email link – Tel link. Table: Table – Header – Footer – Body – Caption – Row – Cells and properties of table. iFrame: Insert iframe – Adjusting height and width. Form & input controls: About forms – Textbox – Password – Textarea – Radio button – Checkbox – Menu list – Submit – Reset – Changing tab order. Multimedia: Embed audio – Video.

MODULE II **21**

Cascading Style Sheets(CSS): Introduction – Syntax for creating style – Comments –Inline style – Internal and external style sheet. Text styling: Bold – Italic – Decoration – Font-family – Font-size – Letter space – Line-space – Text transformation – Alignment – Fore color – Sizing element and text wrapping. Backgrounds: Colors and images Element Control: Visibility – Display – Grouping – Positioning – Floating – Psuedo classes and elements. Box-model: Border – Margin – Padding – Outline – Grid system(960px, 1200px). Table styling: Border – Collapse border – Table width – Cell height, padding. Transformation, Transition and animation, Font-face, Responsive design javascript: Introduction – Need of javascript – Javascript vs Java – ECMAScript. Console: Log – Error – Warn. Grammer& types: Syntax & comment – Declaration – Scope of variable – Constant – Literals. Operators & expressions: Assignment – Comparisions – Arithmetic – Bitwise –Logical – Ternary and misc. Numbers, Date, String. Control flow & iteration: If..else – Switch – For – While – Do-while – For in – For of – Break/continue.

MODULE III **21**

Javascript arrays: Indexing – Types – Sorting – Slicing and other functions. Objects: Defining object & its properties – Defining methods – Prototype-based OOP – Creating object hierarchies and inheritance. Functions: Defining function – Invoking functions – Parameters (arguments object) – Call – Apply – Closures – IIFE. JSON: Raw JSON – Syntax – Parse – Stringify. BOM: Window – Screen – Location – History – Navigator – Popup alert – Timing – Clock cookie and local Storage. DOM: document selector – Changing HTML (html, text, attribute, style) – Adding & deleting elements – Form validation. DOM Events: Mouse – Key board – Form – Drag – Print and touch Events. AJAX: Introduction – Work flow – XML http request object (for cross browser) – XML http request properties & methods.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs using HTML formatting tags.
2. Programs using HTML Table and Form tags.
3. Programs using HTML iFrame and Multimedia tags.
4. Programs based on the different ways of stylesheet insertion.
5. Programs using CSS2. 6. Programs using CSS3.
7. Programs using Grid System.
8. Programs using JavaScript Arrays, Strings, Objects, and Functions.
9. Programs using OOPs and Prototype.
10. Programs using JavaScript Browser Object Model.
11. Programs using JavaScript Form Validation.
12. Programs using AJAX(XMLHttpRequest).

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas A Powell	HTML & CSS: The Complete Reference	Tata McGraw-Hill, Fifth Edition	2010
2.	Mike McGrath	JavaScript: Create functions for the web	Tata McGraw-Hill, Fifth Edition	2012

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeremy McPeak and Paul Wilton	Beginning JavaScript	Wiley-India, Fifth Edition	2015
2.	Larry Ullman	Modern JavaScript: Develop and Design	Pearson Education Inc., First Edition	2012
3	Zak Ruvalcaba and Anne Boehm	Murach's: HTML5 and CSS3	Training and Reference	2012

WEB URLs:

1. www.nptel.ac.in /courses/106105084/25.
2. www.w3.org/TR/2000.
3. www.tutorialspoint.com/Css.
4. www.build-your-website.co.uk/starting-scripting/
5. www.github.com/processing/p5.js.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	1	-	1	1	-	1	2	2
CO2	2	1	-	-	-	-	1	-	1	1	-	1	2	1
CO3	3	2	1	-	-	-	-	-	1	1	-	1	2	1
CO4	3	2	1	-	-	-	-	-	1	1	-	1	2	1
CO5	2	1	-	-	-	-	1	-	1	1	-	1	2	2
CO	**2.4**	**1.6**	**1**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.4**

21FC13 FUNDAMENTALS OF INFORMATION TECHNOLOGY

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To provide the basic concepts in information system and the benefits with these systems in modern society.
- To obtain knowledge in digital audio and video technologies.
- To impart knowledge in data communication.
- To get familiarized with the basics of computer networking.
- To understand the various technologies of Information Technology.

OUTCOMES:

Learners should be able to

CO1	describe computer software topics related to information technologies, systems, and processing concepts.	**K2**
CO2	analyze various technologies for audio and video processing in terms of functionality and limitations.	**K4**
CO3	explain fundamental communication techniques in information technology.	**K2**
CO4	determine appropriate networking architectures and technologies for specific applications.	**K3**
CO5	identify recent trends and developments in information technology.	**K2**

MODULE I **9**

Introduction to information technology – Understanding the digital domain – Representing numbers and text – Fundamentals of computers – Hardware – Storage technologies – Software – Software development process – Open source software.

MODULE II **21**

Digital and audio technology – Digitizing sound – Compression – Digital image and video – Formats – Display technology – Fundamentals of communication – Attenuation – Bandwidth – Multiplexing – A digital communication scenario – Fiber optics – Wireless communication.

MODULE III **21**

LANs – WAN background – Network management systems – Communication protocols – Internet architecture – Network security – Voice over IP – Bluetooth – Cellular technology – WiFi – WiMax – LTE – Basics of cloud computing – Introduction to big data analytics – Basics of internet of things.

TOTAL: 45

TEXT BOOK:

Sl.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Pelin Aksoy and Laura DeNardis	Introduction to Information Technology	Cengage Learning India Private Limited, First Edition	2012

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Ram B	Computer Fundamentals	New Age International Pvt. Ltd., Third Edition	2010
2.	Rajaram V	Fundamentals of Computers	Prentice Hall India, Fifth Edition	2010

WEB URLs:

1. www.idc-online.com/resource-categories/data-communications.
2. www.wiziq.com/tutorials/computer-fundamentals.
3. www.ece.mcmaster.ca/faculty/reilly/ee3tr4/prob_sol.html4.
4. www.indiabix.com/computer-science/networking/5.
5. www.tutorialpoints.com.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	2	2
CO2	2	1	-	-	-	-	-	-	1	1	-	1	2	2
CO3	2	1	-	-	-	-	-	-	1	1	-	1	2	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	2	1
CO5	3	3	2	1	-	-	-	-	1	1	-	1	2	1
CO	**2.4**	**1.6**	**1.5**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1.6**

21FC14 ELECTRONIC DEVICES AND CIRCUITS

3 0 2 4

OBJECTIVES:

- To understand the operation of basic electronic devices and power supplies.
- To understand the methods of biasing of BJT and FET devices.
- To analyze single-stage and multi-stage amplifiers.
- To analyze operation of different types of oscillators.
- To understand the functioning of operational amplifier and special devices.

OUTCOMES:

Learners should be able to

CO1	build circuit models for diodes, their applications in electronic circuits.	**K3**
CO2	explain the principles of biasing and functional aspects of biasing circuits for BJTs and FETs.	**K2**
CO3	analyze the gain characteristics of various amplifiers for different applications.	**K4**
CO4	construct sinusoidal oscillators for specified frequency ranges and applications.	**K3**
CO5	develop amplification circuits using operational amplifiers for signal processing tasks.	**K3**

MODULE I **9**

Diode: PN Junction diode, Zener diode, LED, LCD and its applications - Power Supplies: Rectifiers – Half wave Rectifier, Full wave Rectifier, Comparison: Average value of output voltage and load current, RMS value of the load voltage and load current, ripple factor, ripple frequency and efficiency. Regulated Power supplies: Voltage regulator and its types, Zener shunt voltage regulator, IC fixed and adjustable voltage regulators.

MODULE II **21**

Transistors: BJT – Construction, Operation, Configuration, Characteristics, DC load line, Stability factor, Biasing –Types of biasing (fixed bias – voltage divider) - Introduction to small signal amplifier - CE amplifier – Operation, Frequency response, FET: MOSFET – Construction, Operation, Configuration, Characteristics, Biasing – Types of biasing, Common Source amplifier – Operation, Frequency response, Multistage amplifiers – Overall gain, Frequency response – Types of coupling – RC coupled two stage amplifier.

MODULE III **21**

Oscillators: Criterion for oscillations – Classification – Sinusoidal oscillator: Hartley oscillator – Colpitts Oscillator – RC oscillator – Crystal Oscillator - Non-sinusoidal oscillator: Types of Multivibrator – Astablemultivibrator, Op-amp: Characteristics of op-amp, Inverting amplifier, Noninverting amplifier, Summing amplifier, Differential amplifier. Special devices: Thermistor, Photo diode, Optocoupler, SCR.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Characteristics of PN Junction Diode and Zener Diode.
2. Study of Half Wave and Full Wave rectifier circuits.
3. Characteristics of IC Voltage regulators.
4. Characteristics of BJT (common emitter configuration).
5. Implementation of Common Emitter amplifier configuration and study of its parameter.
6. Implementation of Common Source amplifier configuration and study of its parameter.
7. Implementation of Sinusoidal RC Oscillator and study of its parameter.
8. Implementation of Sinusoidal LC Oscillator and study of its parameter.
9. Characteristics of high frequency diode in rectifier circuit.
10. Analyze the switching behaviour of BJT with the help of LED.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sedha R S	A text book of applied Electronics	S Chand and Company Pvt. Ltd. Third Edition	2010
2.	Salivahanan S and Suresh Kumar N	Electronic Devices and circuits	Tata McGraw Hill, Third Edition	2012

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jacob Millman Christos C Halkiasand Satyabrata Jit	Electronic Devices and Circuits	Tata McGraw Hill, Fourth Edition	2010
2.	David A Bell	Electronic Devices and Circuits	Oxford University, Fifth Edition	2008

WEB URLs:

1. www.electronics-tutorials.ws/
2. www.allaboutcircuits.com/
3. www.tpub.com/neets/book7
4. www.circuitstoday.com/
5. www.nptel.ac.in/courses/117103063/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	-	2	1
CO2	2	1	-	-	-	-	-	-	1	1	-	-	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	1	-
CO4	3	2	1	-	-	-	-	-	1	1	-	-	1	-
CO5	3	2	1	-	-	-	-	-	1	1	-	-	1	-
CO	**2.8**	**2**	**1.3**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**1.4**	**1**

21FC15 PROGRESSIVE C PROGRAMMING

3 0 4 5

PRE-REQUISITES: C Programming- I / Programming Logic and Design

OBJECTIVES:

- To understand the basic concepts of pointer.
- To evaluate the string handling functions.
- To apply the knowledge about dynamic memory allocation and structure pointer.
- To study the file operations.
- To analyze the code optimization technique.

OUTCOMES:

Learners should be able to

CO1	describe the concept of pointers for solving complex programming problems.	**K2**
CO2	explain efficient programming using strings and string handling functions.	**K2**
CO3	solve problems using dynamic memory allocation and structure pointers.	**K3**
CO4	construct programs utilizing file management concepts effectively.	**K3**
CO5	apply code optimization techniques in C programming to improve performance	**K3**

MODULE I **9**

Pointers – Pointer Expressions – Pointer Assignments – Pointer Conversions - Pointers Types – NULL pointer – Void pointer – Wild pointer – Pointer Arithmetic – Pointer increment and decrement – Pointer Comparisons – Pointers and Arrays – Arrays of Pointers – Arrays with negative indexes –Two dimensional array – Pointer to an array – Multiple Indirection Initializing Pointers – Variable length array(VLA) – restrict Qualified Pointers – Problems with Pointers

MODULE II **21**

Strings – String I/O – String Manipulation – Arithmetic operations on strings – String handling functions – Arrays and strings – Functions and strings – Pointers and strings – Using const in pointer declaration - Static and Dynamic Memory Allocation – Function Pointers – Pointer and function – Call By Reference - function returning pointer - Structures &s Union - Pointer variables in structures – Pointers to structures.

MODULE III **21**

Standard C Vs Unix File – Streams and Files – File System Basics – The File Pointer – Opening a File – Closing a File – Writing a Character – Reading a Character – Using fopen( ), fgetc( ), fputc( ), and fclose( ) – Using feof( ) – Working with Strings: fputs( ) and fgets( ) – rewind( ) – ferror( ) –perror() Erasing Files – Flushing a Stream – fread( ) and fwrite( ) – fseek( ) and Random Access file – fprintf( ) and fscanf( ) – sprintf( ) and sscanf( ) – Command line arguments – Multiple Source Files – Static and Dynamic Libraries – Code Optimization –Optimization with loops– Fast Mathematics in loops – Optimization by functions.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on pointers
2. Programs on array and pointers
3. Programs using strings and pointers
4. Programs using functions and strings
5. Programs using advance use of pointers
6. Programs insisting on different types of string functions and pointers
7. Programs on malloc() function and calloc() function
8. Programs on file operations
9. Programs on encryption and decryption of files
10. Programs using random access file
11. Programs using multiple source files
12. Programs using code optimization techniques

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C: The Complete reference	McGraw Hill, Fourth Edition	2013
2.	Brian W Kernighan and Dennis M Ritchie	The C Programming Language	Prentice Hall, Second Edition	2015

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Harry H Cheng	C for Engineers and Scientists: An Interpretive Approach	Tata McGraw-Hill, First Edition	2010
2.	David Griffiths and Dawn Griffiths	Head First C	O'Reilly Media, First Edition	2012
3.	Richard M Reese	Understanding and Using C pointers	O'Reilly, First Edition	2013
4.	Seymour Lipschutz	Schaum's Outlines, Data Structure with C	Tata McGraw-Hill, Special Indian Edition	2011

WEB URLs:

1. www.hackerrank.com.
2. www.learn-c.org.
3. www.udemy.com.
4. www.codechef.com.
5. www.learnconline.com.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	1	-	1	2	2
CO2	2	1	-	-	1	-	-	-	1	1	-	1	2	2
CO3	2	1	-	-	1	-	-	-	1	1	-	1	-	-
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	2
CO5	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO	**2.4**	**1.4**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1.7**

21FC16 ESSENTIALS OF IT INFRASTRUCTURE

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To explain the main architectural building blocks, security concepts, data centres and storage as well.
- To be aware of the fundamentals of Internet and WWW.
- To acquire knowledge in HTML.
- To be familiar with the concepts of servers
- To know about the concept of scripting language.

OUTCOMES:

Learners should be able to

CO1	describe IT infrastructures and their components comprehensively.	**K2**
CO2	explain the working principles of websites and their underlying technologies.	**K2**
CO3	classify different types of servers and their functions in IT infrastructure.	**K2**
CO4	utilize scripting languages for IT infrastructure solutions development.	**K3**
CO5	design a simple web page using HTML and basic web design principles	**K4**

MODULE I **9**

Introduction to infrastructure: Definition – Infrastructure model – Trends in IT infrastructure – Green IT – Data centers: History – Building blocks – Availability – Performance and security – Virtualization: Introduction – Building blocks – Availability – Performance and security.

MODULE II **21**

Introduction to computers and internet: Evolution of the internet and world wide web – Web basics – Multitier application architecture – World Wide Web Consortium (W3C) – Web 2.0 – Operating system – Desktop and mobile operating system – Introduction to HTML5: Part I – Introduction to HTML5: Part II – Introduction to CSS: Part I – Introduction to XML.

MODULE III **21**

Servers: Types of servers – Application server – Web server – Database server – Social networks – Performance and security – Need for scripting languages – Types – Client side scripting – Server side scripting – Introduction to java script – Variables – Operators – Control statements I – Control statements II – Java script: Functions.

TOTAL: 45

TEXT BOOKS:

SI. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sjaak Laan	IT infrastructure Architecture – Infrastructure Building blocks and Concepts	Lulu Press Inc., Second Edition	2013
2.	Paul Deitel, Harvey Deitel and Abbey Dietel	Internet and World Wide Web- How to program	Prentice Hall, Fifth Edition	2011

REFERRENCE BOOKS:

SI. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Luke Welling and Laura Thomson	PHP and MySQL web development	Pearson Education, Fifth Edition	2016
2.	Shane Rebenschied	Macromedia Flash professional 8 beyond the Basics-Hand-on Training	Peachpit Press, First Edition	2006
3.	Gopalan N P and Akilandeswari J	Web Technology	Prentice Hall of India, Second Edition	2011
4.	Robin Nixon	Learning PHP, My SQL & Java script-with Query, CSS & HTML	O'reilly, Fourth Edition	2015

WEB URLs:

1. www.adobephotoshoptutorials.com.
2. www.coursestuff.co.uk/DESI1212/docs/Flash%20tutorials.pdf.
3. www.nptel.ac.in/course.php.
4. www.theinstitutes.org/course/essentials-information-technology.
5. www.onlinecourses.nptel.ac.in/noc17_cs02/preview.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	1	-	1	2	2
CO2	2	1	-	-	1	-	-	-	1	1	-	1	2	2
CO3	2	1	-	-	1	-	-	-	1	1	-	1	2	-
CO4	3	2	1	-	1	-	-	-	1	1	-	1	3	1
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	1
CO	**2.4**	**1.6**	**1.5**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2.2**	**1.5**

21FC17 FUNDAMENTALS OF COMPUTERS

3 0 0 3

PRE-REQUISITES: None

OBJECTIVES:

- To demonstrate the fundamental concepts of computer science and information technology.
- To enable students with a comprehensive understanding of computer hardware, software, and networking fundamentals.
- To know about the graphics primitives.
- To design, develop, and implement simple computer programs and applications using internet technologies.
- To demonstrate knowledge in HTML

OUTCOMES:

Learners should be able to

CO1	evolution of computers and identify the key features of different computer generations	**K2**
CO2	explain the basic components of a computer, including hardware, software, and networking fundamental	**K2**
CO3	construct simple computer programs using HTML, CSS, and other web programming languages	**K3**
CO4	develop an animation using Photoshop and Flash	**K3**
CO5	build a simple XML Document	**K3**

MODULE I **9**

Evolution of computers – Generations of computers – Classification of computers – Applications of computers – Computer components – Software booting – Types of softwares – Introduction to operating system – Concept of BIOS, Booting – Problem solving techniques – Algorithms – Flow chart – Program control structure – Language translator.

MODULE II **21**

Peripheral Devices: Input devices – Keyboard, mouse, scanner – Output devices – Monitor - VDU, LCD, CRT – Printers – Impact printers – Non-impact printers – Plotters, Storage devices - Primary memory – RAM, ROM, PROM, EPROM, cache memory – Secondary memory – Magnetic tape, hard disk, Compact disks. Computer Graphics: Graphics primitives – Line – Circle – Ellipse – Rectangle – Introduction to Flash – Introduction to Photoshop.

MODULE III **21**

Basics of Internet: Introduction – Internet – Basic internet terms – Getting connected to internet – The World Wide Web – HTML history – HTML documents – Elements of an HTML document – Header tags – Body tags – Formatting HTML documents – Managing images in html – Frames – Hypertext and link in HTML documents - Tables– Special effects in HTML documents – Cascading Style Sheets – Introduction to XML: Structuring data – XML namespaces – DTDs and schemas.

TOTAL: 45

TEXT BOOKS:

SI.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Balagurusamy E	Fundamentals of Computing and Programming	Tata McGraw Hill, First Edition	2010
2.	Paul Deitel, Harvey Deitel and Abbey Dietel	Internet and World Wide Web - How to Program	Prentice Hall, Fifth Edition	2011

REFERENCE BOOKS:

SI.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Steve Marschner and Peter Shirley	Fundamentals of Computer Graphics	CRC Press, Fourth Edition	2016
2.	Gopalan N P and Akilandeswari J	Web Technology	Prentice Hall, Second Edition	2014
3.	Shane Rebenschied	Macromedia Flash Professional 8 Beyond the Basics Hands-On Training	Peachpit Press, First Edition	2006

WEB URLs:

1. www.tutorialized.com
2. www.adobephotoshoptutorials.com
3. www.coursestuff.co.uk/DESI1212/docs/Flash%20tutorials.pdf.
4. www.ae.sharif.edu/~aerocad/Output%20primitives.ppt
5. www.cise.ufl.edu/~lok/teaching/csgss08/primitives.ppt

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	0	0	1	-	-	-	1	1	-	1	2	2
CO2	2	1	0	0	1	-	-	-	1	1	-	1	2	2
CO3	3	2	1	0	1	-	-	-	1	1	-	1	1	1
CO4	3	2	1	1	1	-	-	-	1	1	-	1	3	2
CO5	3	2	1	1	1	-	-	-	1	1	-	1	-	-
CO	**2.6**	**1.6**	**1**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1.7**

21FC21 FUNDAMENTALS OF COMPUTER COMMUNICATION

3 0 0 3

OBJECTIVES:

- To understand the basic transmission methodologies applied in data communications.
- To know the basic concepts of WAN technology.
- To be familiar with the types of LANs.
- To learn the Internet and transport protocols.
- To gain the knowledge about the operation of inter-networking.

OUTCOMES:

Learners should be able to

CO1	utilize the data transmission and signal encoding techniques	**K3**
CO2	apply knowledge of wireless transmission and propagation	**K3**
CO3	evaluate the principles and applications of circuit switching, packet switching, and cellular networks	**K3**
CO4	analyse the routing and internetwork protocols	**K4**
CO5	discover the advanced networking concepts, including multicasting, integrated service to optimize transport-layer performance.	**K4**

MODULE I **9**

Data Transmission: Concepts and Terminology – Analog and Digital Transmission – Channel Capacity Transmission Media: Guided Transmission Media – Wireless Transmission – Wireless Propagation – Line of Sight Transmission – Signal Encoding Techniques – Analog and Digital Data – Analog and Digital Signals.

MODULE II **21**

Circuit Switching and Packet Switching – Switched Communication Networks – Circuit Switching Networks – Circuit Switching Concepts – Packet Switching Principles – Cellular wireless networks – Principles of cellular networks – Local Area Network Overview – Topologies and transmission media – LAN protocol architecture – Emergence of High Speed LANs.

MODULE III **21**

Internetwork Protocols – Basic Protocol Functions – Principles of Internetworking – Internet Protocol Operation – Internetwork Operation – Multicasting – Routing Protocols – Integrated Services Architecture – Differentiated Services –Transport Protocols – Connection – Oriented Transport Protocol Mechanisms –TCP –TCP Congestion Control – UDP.

TOTAL: 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon H Haykins	Communication System	John Wiley Fourth Edition	2010
2.	William Stallings	Data and Computer Communications	Pearson Education Tenth Edition	2013

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James Kurose F Keith Ross W	Computer Networking: A Top-Down Approach	Pearson Education Sixth Edition	2013
2.	Larry Peterson L Peter Davie S	Computer Networks	Harcourt Asia Pvt. Ltd. Fifth Edition	2011
3.	Behrouz Forouzan A	Data Communications and Networking	Tata McGraw- Hill, Fifth Edition	2016

WEB URLs:

1. www.freeprogrammingresources.com/tcp.html
2. www.mcmcse.com/cisco/guides/osi.shtml
3. www.compnetworking.about.com/od/vpn/a/vpn_tunneling.htm
4. www.nptel.iitk.ac.in/courses/Webcoursecontents/IIT%20Kharagpur/Computer%20networks/New_index1.html
5. www.compnetworking.about.com/od/workingwithipaddresses/l/blip.htm

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	3	2
CO2	3	2	-	-	-	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	1	2	1
CO4	3	3	2	-	1	-	1	-	1	1	-	1	2	1
CO5	3	3	2	-	1	-	-	-	1	1	-	1	3	2
CO	**3**	**2.6**	**1.8**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2.4**	**1.7**

PROFESSIONAL CORE (PC)

21FD01 PYTHON PROGRAMMING

3 0 4 5

PRE-REQUISITES: Basics of Program

OBJECTIVES:

- To learn about basic python language syntax and semantics, control structures and data structures in python.
- To be comfortable using the built-in functions and creating user-defined functions in python.
- To understand the object oriented programming concepts in python.
- To gain knowledge in identifying relationships among classes in python.
- To learn how to handle exception in python.

OUTCOMES:

Learner should be able to

CO1	Explain the fundamental concepts of Python programming.	**K2**
CO2	Apply Python programming concepts for developing basic applications.	**K3**
CO3	Analyze Python programming techniques to reach appropriate conclusions.	**K4**
CO4	Design Python programs to meet specified requirements.	**K3**
CO5	Conduct experiments using object-oriented concepts in Python to build console-based applications	**K3**

MODULE I **9**

Python Fundamentals: Introduction to Python – Values and types – Keywords – Expressions – Comments – Operators – Command line arguments. Control Structures – Pass statement. Data Structures: String – Mutable vs immutable types – indexing and slicing – String functions. Tuple: Tuple operations – List – List operations – List as array – List comprehension. Set – Set operations – Dictionary – Dictionary operations.

MODULE II **21**

Functions: Python built in functions – User defined functions – Creating function – Invoking functions – Types of function arguments – Recursion and lambda or anonymous functions. Packages: Defining,Creating and Accessing a Package, importing packages and user defined modules. OOPS: OO terminologies (class, object, method, inheritance, abstraction, encapsulation, polymorphism) – UML Class diagram – access specifiers – Creating classes – Creating object – Accessing members – init() method – instance, static and class methods - Importance of self – Implementing encapsulation.

MODULE III **21**

Inheritance: Implementing inheritance – Types of inheritance. Polymorphism: Implementing polymorphism – Method overloading – Method overriding – Operator overloading. Abstraction: Abstract classes – Association and aggregation – Exception handling: Errors vs exceptions – Handling exceptions – Raising exception – Creating user defined exception.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs using operators and control structures.
2. Programs using string functions.
3. Programs using tuple and list.
4. Programs using set and dictionary.
5. Programs using built-in functions.
6. Implementing user defined functions with various parameter options
7. Implementation of class & objects.
8. Implementation of inheritance and association.
9. Implementation of overloading and overriding.
10. Implementation of exception handling.

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Allen B Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly, Second Edition	2016
2	Guido van Rossum and Fred L Drake Jr	An Introduction to Python Revised and updated for Python 3.2	Network Theory Ltd., First Edition	2011
3	Dusty Phillips	Python 3 Object-oriented Programming	Packt Publishing, Third Edition	2021

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mark Lutz	Learning Python	O'Reilly Media, Fifth Edition	2013
2	Mark Summerfield	Programming in Python 3	Dorling Kindersley, India Pvt. Ltd. First Edition	2009

WEB URLs:

1. www.docs.python.org/3.5/
2. www.programiz.com/python-programming
3. www.pythonspot.com/
4. www.learnpython.org/
5. www.developers.google.com/edu/python/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	1	-	-	-	-	-	2	-	-	-
CO2	3	2	1	-	-	-	-	-	-	1	2	-	1	2
CO3	2	2	1	-	1	-	-	-	-	-	-	-	1	2
CO4	2	2	2	1	1	-	-	-	-	1	2	2	1	2
CO5	3	3	3	1	1	-	-	-	3	1	1	2	1	2
CO	**2.4**	**2.2**	**1.6**	**1.0**	**1.0**	-	-	-	**3.0**	**1.0**	**1.8**	**2.0**	**1.0**	**2.0**

21FD02 DATA STRUCTURES

3 0 4 5

PRE-REQUISITES: Programming Logic and Design

OBJECTIVES:

- To understand and explain the concepts of data structures and its operations.
- To solve problems using linear and non-linear data structures.
- To design and implement various data structure algorithms
- To understand the importance of various algorithms with their time complexity.
- To develop application using data structure algorithms.

OUTCOMES:

Learners should be able to

CO1	summarize the concepts of linear and non-linear data structures.	**K2**
CO2	apply data structure concepts for real-time applications development.	**K3**
CO3	analyze sorting, searching, and hashing techniques for data management.	**K4**
CO4	identify the solutions using linear and non-linear data structures.	**K3**
CO5	develop mini-projects involving data structures, sorting, and hashing techniques.	**K4**

MODULE I **9**

Abstract Data Types (ADT) – Elementary data types – Basic concepts of data structures – Data types Vs Data structures. Arrays: Operations – Memory representation – Implementation of one, two, three and multi dimensioned arrays – Sparse and dense matrices – String operations using arrays. Stack: Introduction to stack – LIFO/FILO structure – Implementation of stack using arrays – Applications of stack – Parenthesis matching, Evaluation of expression, Infix to postfix conversion, recursion.

MODULE II **21**

Queue: Introduction to queue – LILO/FIFO structure – Types of queue – Circular queue, Priority queues, DEQUE – Implementation of queue using arrays – Applications of queue. Linked list: List ADT – Singly linked list – Doubly linked list – Circularly linked list – Applications – Polynomial all operations (insertion, deletion, merge, and traversal), Linked stack, Linked queue – Dynamic memory management. Trees: Introduction – Binary trees – Search tree ADT : Binary search trees, AVL trees – Tree traversals. Graphs: Introduction – Trees Vs Graphs – Topological sort – Breath first search algorithm – Depth first search algorithm – Applications of breath first and depth first search.

MODULE II **21**

Sorting: Introduction – Need for sorting – Applications of sorting – Bubble sort – Insertion sort – Shell sort – Heap sort – Merge sort – Quick sort – Radix sort – External sorting techniques. Analysis of sorting techniques – Average, best and worst case, Time complexity and space complexity. Searching: Linear search – Binary search. Hashing: General idea – Hash function – Collision resolution – Separate chaining, open addressing, Linear probing, Double hashing, Bucket hashing.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on arrays, sparse matrix and dense matrix.
2. Programs on Recursion and its applications.
3. Array implementation of stack operations and its applications.
4. Implement the queue ADT in different ways and use it for different applications.
5. Implementation of singly linked list operations.
6. Implementation of doubly linked list, circular linked list with all elementary operations.
7. Linked list implementation of stack and queue.
8. Programs on trees.
9. Programs on DFS and BFS.
10. Programs on sorting.
11. Programs on Hashing.
12. Programs on Searching.

TEXT BOOKS:

Sl.No	Authors (s)	Title of the Book	Publisher	Year of Publication
1	Mark Allen Weiss	Data Structures and Algorithm Analysis in C	Pearson Education, Second Edition	2007
2	Gilberg R F and Forouzan B A	Data Structures: A Pseudocode Approach with C	Thomson Learning, Second Edition	2005

REFERENCE BOOKS:

Sl.No	Authors (s)	Title of the Book	Publisher	Year of Publication
1	Aho J E Hopcroft and Ullman J D	Data Structures and Algorithms	Pearson Education, First Edition	2009
2	Seymour Lipschutz	Data Structures	Tata McGraw – Hill, First Edition	2014
3	Aaron M Tenenbaum, Yedidyah Langsman and Moshe J Augenstein	Data Structures using C	Pearson Education, Second Edition	2009

WEB URLs:

1. www.ocw.mit.edu/courses/
2. www.visualgo.net/en
3. www.nptel.ac.in/course.php
4. www.cs.usfca.edu/~galles/visualization/Algorithms.html
5. www.lcm.csa.iisc.ernet.in/dsa/dsa.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	1	-	2	2		1	2	1
CO2	3	2	1	-	2	1	1	-	2	2		1	2	1
CO3	3	3	2	1	2	-	1	-	2	2		1	2	1
CO4	3	2	1	-	2	-	1	-	2	2		1	2	1
CO5	3	3	2	1	2	1	1	-	2	2	1	1	2	1
CO	**2.8**	**2.2**	**1.5**	**1**	**2**	**1**	**1**	**-**	**2**	**2**	**1**	**1**	**2**	**1**

21FD03 OPERATING SYSTEMS

3 0 2 4

PRE-REQUISITES: Programming Logic and Design

OBJECTIVES:

- To understand technical aspects of Operating Systems.
- To become aware of the issues in the management of resources like processor, memory and input-output.
- To obtain some insight into the design of an operating system.
- To comprehend paging, segmentation and deadlocks.
- To be aware of file management and Real Time systems.

OUTCOMES:

Learners should be able to

CO1	describe the concepts, structure, and design of operating systems.	**K2**
CO2	apply deadlock-related concepts to solve resource allocation problems.	**K3**
CO3	analyze processes, resource control, scheduling, I/O files, and memory management.	**K4**
CO4	implement a computer-based system or program to meet specified needs.	**K3**
CO5	conduct experiments with shell scripting, inter-process communication, scheduling, and memory management.	**K3**

MODULE I **9**

Introduction – Operating systems objectives and functions – Evolution of operating systems batch, Multiprogramming. Multitasking, Multiuser, Parallel, Distributed, Real-Time systems and Hand held systems. Kernel: Kernel (monolithic, microkernel, layered, Exo-kernel and Hybrid kernel structures) –, System components – System calls – System programs. Process management: Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter-process communication. Case studies: System: EMV.LIB level 2 kernel for embedded systems. Mobile: Adapting linux kernel for mobile platform.

MODULE II **21**

Threads: Thread – Types of thread – Multicore and multithreading – Threading issues, CPU scheduling: Basic concepts – Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling. Concurrency: Principles of concurrency – The critical section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors. Case studies: System:- Landing CG on EARTH: A case study of fine-grained multithreading on an evolutionary path, mobile: Power efficiency study of multi-threading applications for multi-core mobile systems. Dead lock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlocks. Storage management: Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Device drivers: Device drivers – Block and character devices – Streams,character and block device switch tables. Case studies: System: Device driver Support for NUMA I/O devices in windows and Linux kernel. Mobile: Android device driver development services for handhelds and industrial applications.

MODULE III **21**

Virtual memory: Introduction – Demand paging – Process creation – Page replacement – Allocation of frames –Thrashing. File system implementation: File concept – Access methods – Directory structure – File system mounting – File sharing – Protection-file system structure – File system-implementation – Directory implementation – Allocation methods – Free space management. Virtualization: Introduction – Virtualization – Virtual data center operating system – Storage virtualization – Virtual networking – Virtual security. Case studies: System: Vware vsphere. Mobile: Mobile telesystems OJSC. I/O Management: Kernel I/O subsystems – Disk structure – Disk scheduling– Disk management – Swap-space management. Real time systems: Characteristics of real-time operating systems – Classification of real-time systems – Architectures of real-time systems – Scheduling in RTOS – Rate monotonic scheduling – Priority inversion – RTOS for hand-held devices. Case studies: Controlling an injection molding process, Flight simulator, digital call center handler, codec.

TOTAL : 45

LIST OF EXPERIMENTS:

1. Shell programming
    a. Command syntax
    b. Write simple functions
    c. Basic tests
2. Shell programming

a. Conditions
b. Loops
c. Patterns

3. Write programs using the following system calls of Unix Operating System.
   a. fork, exec, getpid, exit, wait, close, mkfifo.
4. Write programs using the I/O system calls of Unix Operating System (open, read, write etc.,).
5. Write C Programs to simulate thread functions like create, join, detach, exit.
6. Given the list of processes their CPU burst times and arrival times, display average turnaround time, average waiting time for FCFS, SJF, PRIORITY and ROUND ROBIN.
7. Implement the classical problems of synchronisation using semaphore.
8. Implement the resource management scheme – Banker's algorithm.
9. Implement the memory schemes – I.
10. Implement the memory schemes – II.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	Operating Systems Concepts	John Wiley, Ninth Edition	2012
2.	William Stallings	Operating Systems- Internals and Design Principles	Prentice Hall, Eight Edition	2014

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Krishna C M and Kang G Shin	RTS: Real-Time Systems	Tata McGraw-Hill, Third Edition	2010
2.	William Stallings	Modern Operating Systems	Pearson Education, Fourth Edition	2014
3.	Pramod Chandra and Bhatt P	An Introduction to Operating Systems Concepts and Practice	Prentice Hall India, Fourth Edition	2014
4.	William J Lowe	VMware Infrastructure 3 for dummies	John Wiley and Sons, Fourth Edition	2010

WEB URLs:

1. www.os-book.com/
2. www.williamstallings.com/OperatingSystems/
3. www.cs.hmc.edu/~keller/courses/cs156/s98/
4. www.nptel.ac.in/courses/106108101/2
5. www.vmware.com/pdf/ws6_manual.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	2	1
CO2	3	2	1	1	1	-	-	-	2	2	-	1	3	1
CO3	3	3	2	1	1	-	-	-	2	2	-	1	2	1
CO4	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO5	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1.5**	**-**	**-**	**-**	**1.8**	**21**	**-**	**1**	**2**	**1**

21FD04 SOFTWARE TESTING

3 0 0 3

PRE-REQUISITES: Knowledge on Software Engineering

OBJECTIVES:

- To learn about the basics of Software testing.
- To understand the concepts of various test case designs.
- To explore various levels of testing.
- To know how to manage test cases.
- To build a frame work that controls, monitors and automate test cases.

OUTCOMES:

Learners should be able to

CO1	explain various software testing methods in the context of software development.	**K2**
CO2	apply appropriate test cases for software development in different domains.	**K3**
CO3	analyze software test automation techniques to improve testing efficiency.	**K4**
CO4	develop test plans and test cases for specific software problems.	**K3**
CO5	evaluate the effectiveness of test strategies to ensure software quality.	**K4**

MODULE I **9**

Testing process: Testing as an engineering activity – Role of process in software quality – Testing as a process – Basic definitions – Software testing principles – The tester's role in a software development organization – Origins of defects – Defect classes – The defect repository and test design – Defect examples – Developer/tester support for developing a defect repository.

MODULE II **21**

Testing strategies: Introduction to testing design strategies – The smarter tester – Test case design strategies – Using black box approach to test case design random testing – Requirements based testing – Positive and negative testing – Boundary value analysis – Decision tables – Equivalence class partitioning state-based testing – Cause-effect graphing – Error guessing – Compatibility testing – User documentation testing – Domain testing using white–box approach to test design – Test adequacy criteria – Static testing vs. structural testing – Code functional testing – Coverage and control flow graphs – Covering code logic – Paths – Their role in white–box based test design – Code complexity testing – Evaluating test adequacy criteria. The need for levels of testing – Unit test – Unit test planning – Designing the unit tests. The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – Scenario testing – Defect bash elimination – System testing – Types of system testing – Acceptance testing – Performance testing – Regression testing – Internationalization testing – Ad-hoc testing – Alpha – Beta tests – Testing OO systems – Usability and accessibility testing.

MODULE II **21**

Test plan and review: People and organizational issues in testing – Organization structures for testing teams – Testing services – Test planning – Test plan components – Test plan attachments – Locating test items – Test management – Test process – Reporting test results – The role of three groups in test planning and policy development – Introducing the test specialist – Skills needed by a test specialist – Building a testing group. Software test automation – Skills needed for automation – Scope of automation – Design and architecture for automation – Requirements for a test tool – Challenges in automation – Test metrics and measurements – Project, progress and productivity metrics – Status Meetings – Reports and control issues – Criteria for test completion – SCM – Types of reviews – Developing a review program – Components of review plans – Reporting review results. – Evaluating software quality – Defect prevention – Testing maturity model.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Srinivasan Desikan and Gopalaswamy Ramesh	Software Testing – Principles and Practices	Pearson Education, First Edition	2021

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Glenford J.Myers, Tom Badgett and	The art of software testing	Wiley, Third Edition	2011
2.	Corey Sandler, Aditya P Mathur	Foundations of Software Testing	Pearson Education, First Edition	2008

WEB URLs:

1. www.coursera.org/course/sdn1
2. www.ecee.colorado.edu/~ekeller/classes/fall2012_sdn
3. www-bcf.usc.edu/~minlanyu/teach/csci694b-spring14
4. www.cs.princeton.edu/courses/archive/fall13/cos597E/
5. www.kth.se/student/kurser/kurs/IK2220?l=en

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	-	-	-	-	-	-	1	-	1	1	-
CO3	3	-	-	-	2	-	-	-	-	-	-	1	-	-
CO4	2	2	2	1	-	-	-	2	2	2	2	1	1	1
CO5	-	-	-	1	-	-	-	-	-	-	-	1	1	-
CO	**2.5**	**2.0**	**2.0**	**1.0**	**2.0**	**-**	**-**	**2.0**	**2.0**	**1.5**	**2.0**	**1.0**	**1.0**	**-**

21FD05 DATABASE MANAGEMENT SYSTEMS

3 0 4 5

PRE-REQUISITES: Knowledge on Set Theory and any Programming Languages

OBJECTIVES:

- To understand the basic concepts of Database Management Systems.
- To learn about the Structured Query Language (SQL).
- To familiar with subqueries.
- To gain knowledge about control transaction.
- To enhance knowledge in normalization and system privileges.

OUTCOMES:

Learners should be able to

CO1	illustrate the foundational concepts of database management systems, including data models, keys, and the entity-relationship model.	**K2**
CO2	construct SQL queries for retrieving, sorting, and manipulating data using advanced features that includes pattern matching, joins, and subqueries.	**K3**
CO3	construct SQL queries for retrieving, sorting, and manipulating data using advanced features that includes pattern matching, joins, and subqueries.	**K4**
CO4	utilize normalization forms, concurrency control and recovery techniques to address transaction-related challenges.	**K3**
CO5	implement database applications using SQL to address real-world scenarios in domains such as railway reservations, library management, and online shopping.	**K3**

MODULE I **9**

Introduction of DBMS orientation – Data – Information – Database - File system – DBMS - Entity relationship model – File system vs DBMS – Keys and its importance – Data models – Limit the rows that are retrieved by a query – Sort the rows that are retrieved by a query – Use substitution variables – Use the SQL row limiting clause – Use pattern matching to recognize patterns across multiple rows in a table.

MODULE I **21**

Describe various types of functions that are available in SQL – Use character, number, and date – Use conversion functions – Identify the available group functions – Use group functions – Group data by using the GROUP BY clause – Include or exclude grouped rows by using the HAVING clause – Use equijoins and non-equijoins – Use a self-join – Use outer joins – Generate a cartesian product of all rows from two or more tables – Use the cross_outer_apply_clause – Use subqueries – List the types of subqueries – Use single-row and multiple-row subqueries – Create a lateral inline view in a query – Explain set operators – Use a set operator to combine multiple queries into a single query – Control the order of rows returned.

MODULE III **21**

Describe the DML statements – Insert rows into a table – Update rows in a table – Delete rows from a table – Control transactions – Categorize the main database objects – Review the table structure – Describe the data types that are available for columns – Create tables – Create constraints for tables – Describe how schema objects work – Truncate tables – Create simple and complex views with visible/invisible columns – Retrieve data from views – Create, maintain and use sequences – Create private and public synonyms – Query various data dictionary views – Differentiate system privileges from object privileges – Grant privileges on tables and on a user – View privileges in the data dictionary – Grant roles – Distinguish between privileges and roles – Normalization: Need for Normalization – Functional Dependency – 1NF, 2 NF, 3 NF, BOYCE CODD, 4 NF, 5 NF.

TOTAL: 45+15

LIST OF EXPERIMENTS:

1. Data Definition Language Commands in RDBMS
2. Data Manipulation Language and Data Control
3. High Level Language Extension with Sequence and View
4. Design and Implementation of Employee database System using Subquery
5. Design and Implementation of Student database System
6. Embedded SQL
7. Data Design Using ER Model and Normalization Processing
8. Design and Implementation of Payroll System
9. Design and Implementation of Banking Information System
10. Design and Implementation of Library Management System

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abraham Silberschatz, Henry F Korth and Sudarshan S	Database System Concepts	Tata McGraw-Hill, Sixth Edition	2016
2.	Ramez Elmasri and Shamkant B Navathe	Fundamental Database Systems	Boston Addison-Wesley, Seventh Edition	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raghu Ramakrishnan	Database Management System	Tata McGraw-Hill, Third Edition	2005
2.	Date C J	An Introduction to Database Systems	Pearson Education, Eighth Edition	2004
3.	Peter Rob and Corlos Coronel	Database System, Design, Implementation and Management	Thompson Learning, Eleventh Edition	2016

WEB URLs:

1. www.oracle.com
2. www.microsoft.com/sql
3. www.tutorialspoint.com
4. www.w3schools.com
5. www.nptel.ac.in/courses/106106093/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	1	-	1	-	-
CO2	3	2	1	-	2	-	-	-	2	2	-	1	2	-
CO3	3	3	2	1	1	-	-	-	2	2	-	1	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	1	-	-
CO5	3	2	1	-	2	-	-	-	2	2	-	1	2	2
CO	**2.8**	**2**	**1.3**	**1**	**1.6**	**-**	**-**	**-**	**1.8**	**1.8**	**-**	**1**	**2**	**2**

21FD06 OBJECT ORIENTED PROGRAMMING

3 0 2 4

PRE-REQUISITES: Fundamental of Computers and C Programming Language

OBJECTIVES:

- To understand the relationship between system software and machine architecture.
- To gain knowledge about the basic assembler function concepts.
- To understand the concepts of basic loader functions.
- To know the design and implementation of macro processor.
- To familiar text editors.

OUTCOMES:

Learners should be able to

CO1	explain the fundamental object-oriented programming (OOP) concepts, including encapsulation, inheritance, polymerphism, and abstraction	**K2**
CO2	apply OOP priciples to develop optimized and efficient C++ programs for solving basics computational problems	**K3**
CO3	examine OOP based solutions using C++ by applying deugging, error-handling, and performance analysis techniques	**K4**
CO4	design object-oriented models based on given problem specifications	**K4**
CO5	conduct experiments using C++ OOP concepts and develop a functional console-based applications	**K4**

MODULE I **9**

Introduction : Programming paradigms – Procedural programming – Modular programming – Object oriented programming – Basic concepts of OOPS – Procedure versus object oriented programming – Applications of C+ + – Tokens – Keywords – Identifiers – Variables – Constants – Data types – Operators – Control structures – Basic I/O operations.

MODULE II **21**

Classes and Objects: Classes – Access specifiers – Objects – Scope resolution operator – Data and member functions – Objects and instances – Static class members – Default arguments – Constant objects – Array of objects – Constant member functions – Constructors and Destructors: Constructors – Types of constructors – Overloaded Constructors – Destructors – Overloading: Functions – Call by value – Call by reference – Call by address – Inline functions – Friend functions – Friend classes – Overloading – Function overloading – Operator overloading – Operator overriding.

MODULE II **21**

Inheritance: Introduction – Base and Derived classes – Accessibility modes and inheritances –Types of inheritance – Single – Multiple – Multilevel – Hybrid – Hierarchical inheritances – Threading –Constructors in Base and Derived classes – Abstract class – Wrapper classes. Pointers and Exception handling: Pointers – Dynamic memory allocation – Array of pointer to base class objects – Polymorphism – Compile time and runtime – Static and dynamic binding – Virtual functions – Need for Virtual functions – Exception handling – Try-catch – Throw – Multiple catch statements – Uncaught exceptions – Templates – File concepts – Threading.

TOTAL: 45

LIST OF EXPERIMENTS:
(Using C or C++)

1. Programs on control structures.
2. Programs on arrays.
3. Programs on functions.
4. Programs on inline functions.
5. Programs on classes and objects.
6. Programs on function overloading.
7. Programs on operator overloading.
8. Programs on constructors and destructors.
9. Program on friend class.
10. Programs on friend functions.
11. Programs on inheritances.
12. Programs on virtual base classes.
13. Program on virtual functions.
14. Programs on exception handling.
15. Programs on templates.
16. Programs on file concepts

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Balagurusamy E	Object Oriented Programming with C++	Tata McGraw Hill, Sixth Edition	2013
2.	Yashavant Kanetkar	Let us C++	BPB publications, Second Edition	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Herbert Schildt	C++ - The Complete Reference	Tata McGraw Hill Fourth Edition	2017
2.	Ashok N Kamthane	Programming in C++	Pearson Education Second Edition	2013
3.	John R Hubbard	Programming with C++	Tata McGraw Hill Third Edition	2009

WEB URLs:

1. www.cplusplus.com.
2. www.desy.de/gna/html/cc/Tutorial/node3.htm
3. www.askville.amazon.com/Compare-Contrast-Structured-programming-Object-
4. www.stanford.edu
5. www.cs.uwlax.edu/~jjhursey/teaching/2012

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	2	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	2	-	-	1	-
CO4	3	2	2	2	-	-	-	-	-	2	-	-	1	-
CO5	3	3	2	2	-	-	-	-	-	2	-	-	1	-
CO	**3**	**2.2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**

21FD07 SYSTEM SOFTWARE

3 0 2 4

PRE-REQUISITES: Fundamental of Computers and C Programming Language

OBJECTIVES:

- To understand the relationship between system software and machine architecture.
- To gain knowledge about the basic assembler function concepts.
- To understand the concepts of basic loader functions.
- To know the design and implementation of macro processor.
- To familiar text editors.

OUTCOMES:

Learners should be able to

CO1	define the fundamental concepts of assemblers, loaders, and macro processors.	**K2**
CO2	apply macro processor concepts to design user interfaces.	**K3**
CO3	analyze different types of assemblers and loaders to optimize software functionality.	**K4**
CO4	evaluate macro processors and text editors for their efficiency in code generation.	**K4**
CO5	implement assemblers and loaders for generating target codes in software applications.	**K3**

MODULE I **9**

System software and machine architecture – Evolution and components of the programming System – The simplified instructional computer (SIC) – Machine architecture – Data and instruction formats – Addressing modes – Instruction sets – I/O and programming.

MODULE II **21**

Basic assembler functions – A simple SIC assembler – Assembler algorithm and data structures – Machine dependent assembler features – Instruction formats and addressing modes – Program relocation – Machine independent assembler features – Literals – Symbol – Defining statements – Expressions – One pass assemblers and multi pass assemblers – Basic loader functions – Design of an absolute loader – A simple bootstrap loader – Machine dependent loader features – Relocation – Program linking – Algorithm and data Structures for linking loader – Machine – Independent loader features – Automatic library search – Loader options – Loader design options – Linkage editors – Dynamic linking – Bootstrap loaders.

MODULE II **21**

Basic macro processor functions – Macro definition and expansion – Macro processor algorithm and data structures – Machine independent macro processor features – Concatenation of macro parameters generation of unique labels – Conditional macro expansion – Keyword macro parameters – Macro within macro. Text editors – Overview of the editing Process – User interface – Editor structure – Interactive debugging systems – Debugging functions and capabilities – Relationship with other parts of the system – User interface criteria.

TOTAL: 45

LIST OF EXPERIMENTS:

(Using C or C++)

1. Implement a symbol table with functions to create, insert, modify, search, and display.
2. Implement pass one of a two pass assembler.
3. Implement pass two of a two pass assembler.
4. Implement a single pass assembler.
5. Implement an absolute loader.
6. Implement a relocating loader.
7. Implement a single pass macro processor.
8. Implement a simple text editor with features like insertion / deletion of a character, word, and sentence.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Leland L Beck	System Software – An Introduction to Systems Progrmming	Pearson Education, Third Edition	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dhamdhere D M	Systems Programming and Operating Systems	Tata McGraw-Hill, Second Edition	2011
2.	John J Donovan	Systems Programming	Tata McGraw-Hill, First Edition	2005

WEB URLs:

1. www.ocw.mit.edu/courses
2. www.docsity.com/en/system-software
3. www.nptel.ac.in/course.php
4. www.computerhope.com/jargon/s/systsoft.htm
5. www.techterms.com/definition/systemsoftware

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	2	1	-	-	-	-	-	-	-	-	1	1	-
CO4	1	1	1	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO	**2.0**	**1.8**	**1.3**	-	-	-	-	-	-	-	-	**1.0**	**1.0**	**-**

21FD08 HIGH SPEED NETWORKS

3 0 0 3

OBJECTIVES:

- To learn the fundamentals of networking and protocols.
- To know the concepts of ATM.
- To know the techniques involved to support network modeling and queuing analysis.
- To understand the real time traffic, congestion and flow control techniques.
- To know the concept about quality of service of different applications.

OUTCOMES:

Learners should be able to

CO1	explain the fundamentals of networking and protocols in high-speed networks.	**K2**
CO2	illustrate concepts related to atm networks and their operations.	**K2**
CO3	analyze techniques for network modeling and queuing analysis to optimize network performance.	**K4**
CO4	design real-time traffic management and flow control techniques.	**K3**
CO5	evaluate the quality of service (qos) for different network applications.	**K4**

MODULE I **9**

Network history – Speed and quality of service – Advanced TCP/IP and ATM networks – TCP/IP protocol architecture – OSI model – Internetworking – TCP –UDP – IP – Ipv6 – Packet switching networks – Frame relay network.

MODULE II **21**

ATM protocol architecture – ATM logical connection – ATM cells – ATM service categories – AAL – High speed LANs and wireless LAN – Introduction to probability – Random variable – Stochastic process – Introduction to queues – Queuing analysis for computer network – Queuing models – Single and multiple server queues – Queues with priorities – Network of queues.

MODULE III **21**

Effects of congestion – Congestion and control – Traffic management – Congestion control in packet switching network – Frame relay congestion control – Need of flow control – Link control mechanism – ARQ performance – TCP flow control – TCP congestion control – Performance of TCP over ATM – Traffic and congestion control in ATM network – Integrated service architecture (ISA) – Queuing discipline – Random early detection – Differentiated service – RSVP – MPLS – RTP.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William Stallings	High Speed networks and Internets Performance and QoS	Pearson Education, Second Edition	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Warland and Pravin Varaiya	High Performance Communication Networks	Jean Harcourt Asia Pvt. Ltd, Second Edition	2012
2.	Irvan Pepelnjk Jim, Guichard Jeff Apcar	MPLS and VPN architecture	Cisco Press volume 2, First Edition	2007

WEB URLs:

1. www.networktutorials.info/index.html.
2. www.vidyarthiplus.com/vp/thread-20051.html#.WvqMU2Wgfcc
3. www.slideshare.net/ayyakathir/unit1-29753217.
4. www.ecomputernotes.com/computernetworkingnotes/network-technologies/asynchronous-transfer-mode.
5. www.noction.com/blog/tcp-transmission-control-protocol-congestion-control

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO5	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO	**2.6**	**2**	**1.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.6**	**1**

21FD09 SOFTWARE ENGINEERING

3 1 0 4

PRE-REQUISITES: None

OBJECTIVES:

- To understand software engineering process models and software requirements.
- To learn software engineering design process.
- To employ a selection of concepts and techniques to complete a small-scale analysis and design in mini projects.
- To impart knowledge on the importance of testing and various testing methods / techniques.
- To provide basic knowledge about software project management.

OUTCOMES:

Learners should be able to

CO1	explain the fundamental concepts of software engineering, including lifecycle models and methodologies.	**K2**
CO2	apply specifications into a design by identifying components and constructing architectural solutions.	**K3**
CO3	analyze the principles at different phases of software development to ensure system consistency.	**K4**
CO4	estimate resources, effort, and scheduling for software project management.	**K3**
CO5	evaluate the effectiveness of software engineering techniques in solving real-world problems.	**K4**

MODULE I **9**

Software engineering: Software process models – Process activities – Coping with change – Agile software development: Plan driven and agile development – Extreme programming – Agile project management – Requirement engineering: User requirement – System requirement – Functional and non functional requirement – Requirement engineering process: Feasibility studies – Requirements – Elicitation – Validation and management – Software prototyping: Prototyping in the software process – Rapid prototyping techniques – User interface prototyping.

MODULE II **21**

Design process and concepts – Modular design – Design heuristic – Design model and document – Architectural design – Software architecture – Data design – Architectural design – Transform and transaction mapping – User interface design – User interface design principles – Real time systems – Real time software design – System design – Real time executives – Data acquisition system – Monitoring and control system – SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items.

MODULE III **21**

Taxonomy of software testing – Levels – Test activities – Types of software testing – Black box testing – Testing boundary conditions – Structural testing – Test coverage criteria based on data flow mechanisms – Regression testing – Testing in the large – Software testing strategies – Strategic approach and issues – Unit testing – Integration testing – Validation testing – System testing and debugging – Measures and measurements – S/W complexity metrics – Size measure – Data and logic structure measure – Information flow measure – Software cost estimation – Function point models – COCOMO model – Delphi method – Defining a task network – Scheduling – Earned value analysis – Error tracking – Software changes – Program evolution dynamics – Software maintenance – Architectural evolution –Taxonomy of CASE tools.

TOTAL: 45+15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Roger S Pressman	Software Engineering – A practitioner's Approach	Tata McGraw Hill, Seventh Edition	2015
2.	Ian Sommerville	Software Engineering	Pearson Education, Ninth Edition	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richard Fairley	Software Engineering Concept	Tata MaGraw Hill, International Edition	2017
2.	James F Peters and Witold Pedryez	Software Engineering - An Engineering Approach	John Wiley and Sons, Third Edition	2000

WEB URLs:

1. www.project– management– podcast.com/
2. www.codebetter.com/darrellnorton/2005/02/02/lean– software– development– overview/
3. www.sei.cmu.edu/productlines/frame_report/req_eng.htm
4. www.careervarsity.com/careertools/softwaretesting.ppt
5. www.scribd.com/doc/16103271/Software-Testing.ppt

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	2	2
CO3	3	3	2	1	-	-	-	1	-	-	-	1	1	1
CO4	3	2	1	-	-	-	-	1	1	1	2	1	2	-
CO5	3	3	2	1	1	-	-	1	1	1	1	1	1	1
CO	**2.8**	**2.2**	**1.5**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1.5**	**1**	**1.5**	**1.3**

21FD10 DATA WAREHOUSING AND DATA MINING

4 0 0 4

PRE-REQUISITES: Database Management Systems

OBJECTIVES:

- To understand the basic concepts of data warehouse.
- To learn the primary task of data mining processes.
- To know in detail about the association rule mining and classification methods.
- To understand the clustering algorithms.
- To study data mining applications.

OUTCOMES:

Learners should be able to

CO1	explain the fundamental concepts of data warehousing and data mining.	**K2**
CO2	apply preprocessing techniques to clean and prepare datasets for analysis.	**K3**
CO3	analyze the performance of clustering algorithms on given datasets	**K4**
CO4	develop data mining solutions using appropriate strategies to meet specified requirements.	**K3**
CO5	evaluate the integration of data mining results into decision-support systems.	**K4**

MODULE I **9**

Need for data warehousing – Data warehouse architecture – Multi dimensional data model – OLAP technology – Categorization of OLAP servers – Data cube computation.

MODULE II **21**

Motivation – Data mining functionalities – Steps in data mining process – Architecture of typical data mining systems – Classification of data mining Systems – Data preprocessing: Data cleaning – Integration – Transformation – Reduction – Discretization – Concept hierarchies – Frequent item set mining: Apriori algorithm using candidate generation – Mining various kinds of association rules – Classification: Issues – Decision tree induction – Bayesian classification.

MODULE III **21**

Types of data in cluster analysis – Clustering methods: Partitioning methods – Hierarchical methods – Density based method – Outlier analysis – Spatial data mining – Multimedia data mining – Text mining – Time series mining – Mining the world wide web.

TOTAL: 60

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jiawen Han, Micheline Kamber and Jian pei	Data Mining Concepts and Techniques	Morgan Kaufmann Publisher, Third Edition	2012
2.	Alex Berson and Stephen J Smith	Data Warehousing, Data Mining and OLAP	Tata McGraw-Hill, First Edition	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Margaret Dunham	Data Mining: Introductory and Advanced Topics	Pearson Education, First Edition	2008
2.	Rajan Chattamvelli	Data Mining Methods	Alpha Science Intl. Ltd., Second Edition	2015

WEB URLs:

1. www.cs.gsu.edu/~cscyqz/courses/dm
2. www-db.standford.edu/`ullman/mining/mining.html
3. www.kdnuggets.com
4. www.eecs.wsu.edu/~cook/dm
5. www.ocw.mit.edu/courses/sloan- school- of- management/15- 062- data- mining-spring2003/lecture-notes

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	1	-	-	2	-	-	-	-	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO	**2.4**	**1.8**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1.8**	**1.8**

21FD11 OBJECT ORIENTED ANALYSIS AND DESIGN

3 0 2 4

PRE-REQUISITES: Software Engineering

OBJECTIVES:

- To understand the unified process in software development.
- To interpret the importance of use cases.
- To study standard design patterns.
- To study object based systems.
- To understand the system using standard design patterns.

OUTCOMES:

Learners should be able to

CO1	understand the fundamental principles of object-oriented programming and design methodologies.	**K2**
CO2	model uml diagrams to represent various system components effectively.	**K3**
CO3	analyze domain models to derive solutions for complex software systems.	**K4**
CO4	develop use case diagrams and domain models for subsystems.	**K3**
CO5	implement basic software systems using object-oriented design principles.	**K3**

MODULE I **9**

Introduction – Object oriented analysis and design – Iterative development and unified process - Inception – Understanding requirements. Use-case model: Writing requirements in context – Use-cases – From inception to elaboration.

MODULE II **21**

Use-case model: Drawing system sequence diagrams – Domain model: Visualizing concepts – Adding associations – Adding attributes – Use-case model: Adding detail with Operation contracts interaction diagram notation. Grasp: Designing objects with responsibilities – Design Model: Use-case realizations with grasp patterns – Determining visibility – Creating design class diagrams – Mapping designs to code – Introduction to iterative planning and project issues.

MODULE III **21**

GRASP: More patterns for assigning responsibilities – Designing use-case realizations with GoF design patterns – Relating use-cases – Refining the domain model – Adding new SSDs and contracts – Modeling behavior in state chart diagrams – Designing the logical architecture with patterns – Organizing the design and implementation model packages – Introduction to architectural analysis and the SAD – Designing more use-case realizations with objects and patterns – Designing a persistence framework with patterns.

TOTAL: 45

LIST OF EXPERIMENTS:

1. To develop a problem statement.
2. Identify Use Cases and develop the Use Case model.
3. Identify the conceptual classes and develop a domain model with UML Class diagram.
4. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagrams.
5. Draw relevant state charts and activity diagrams.
6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.
7. Develop and test the Technical services layer.
8. Develop and test the Domain objects layer.
9. Develop and test the User interface layer.

SUGGESTED APPLICATIONS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System

13. BPO Management System
14. Library Management System
15. Student Information System

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Craig Larman	Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development	Pearson Education, Tjird Edition	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides	Design patterns: Elements of Reusable Object-Oriented Software	Tata McGraw Hill, Second Edition	2010
2.	Martin Fowler	UML Distilled	Pearson Education, Third Edition	2021
3.	James Rumbaugh, Ivar Jacobson and Grady Booch	The Unified Modeling Language Reference Manual	Addison Wesley, Second Edition	2010

WEB URLs:

1. www.omg.org
2. www.ibm.rational.com
3. www.ebookbrowse.com/unit-ii-ooad-notes-doc-d140021629
4. www.utdallas.edu/~chung/OOAD/presentation
5. www.docsity.com/en/study-notes/computer-science/object-oriented-analysis-and-design

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	3	2	2	-	-	-	-	-	-	3	2	-
CO3	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO4	3	3	3	3	2	2	-	-	-	-	-	3	2	-
CO5	3	3	3	3	3	2	2	-	-	-	-	3	2	-
CO	**3**	**2.8**	**2.8**	**2.75**	**2.25**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**2**	**-**

21FD12 UNIX AND SHELL PROGRAMMING

3 0 2 4

PRE-REQUISITES: Operating Systems

OBJECTIVES:

- To familiarize the Unix/Linux environment.
- To learn the Unix processes and regular expressions.
- To understand the fundamentals of shell scripting.
- To gain knowledge about Unix internals.
- To learn about secure storage and system recovery techniques.

OUTCOMES:

Learners should be able to

CO1	define and understand the interactive features of unix/linux environments.	**K2**
CO2	apply unix processes and shell programming concepts in system tasks.	**K3**
CO3	analyze secure storage techniques and recovery mechanisms in unix systems.	**K4**
CO4	develop applications using unix system calls, library routines, and error handling.	**K3**
CO5	experiment with unix commands and shell scripts to solve real-time problems.	**K3**

MODULE I **9**

History of Unix – GUI – The Unix architecture – The shell – The Unix file system – Executing commands and command options – Interactive features: Job control, history – File utilities (cp, mv, rm, etc.) – comm, cmp, diff – Tree walking – find, xargs.

MODULE II **21**

Unix processes – Pipes – Signals – Process utilities (ps, kill, wait, sleep) – Filters: cat, head, tail, sort, uniq. Regular expressions: grep, fgrep, egrep. SED – Awk – Shell commands – Shell operations – Scripting – Variables – Loops – Functions – Arrays – Here documents – Arithmetic expressions – Parsing – Command history – Command execution – Restricted shells – Built in commands.

MODULE III **21**

System calls and Library routines – Error handling – Regular file management – Unix internals – Kernel basics – Kernel processes and user processes – Input/ Output – Interprocess communication – Unix system administration – Maintaining the file system – Maintaining user accounts – Installing software – Peripheral devices – Network interface – Configure local services– Manage physical storage with Logical Volume Manager (LVM) – Centralized and secure storage (ISCSI) – Establish network connectivity – Secure network services – Manage virtual machines – Deploy file sharing services – System recovery techniques**.**

TOTAL: 45

LIST OF EXPERIMENTS:

1. Execution of Linux commands.
2. Simple shell script for basic arithmetic and logical calculations.
3. Write awk script that uses all of its features.
4. Use SED instruction to process /etc/ passwd file.
5. Shell scripts to check various attributes of files and directories.
6. Shell scripts to perform various operations on given strings.
7. Shell scripts to explore system variables such as PATH, HOME etc.
8. Shell scripts to check and list attributes of processes.
9. Execution of various system administrative commands.
10. Shell script to display list of users currently logged in.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sumitabha Das	Unix concepts and Applications	Tata McGraw-Hill, Fourth Edition	2008
2.	Graham Glass and King Ables	Unix For Programmers and Users	Pearson Education Third Edition	2009

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arnold Robins	UNIX in a nutshell	OR`IELLY, Fourth Edition	2005
2.	Sivaselvan B and Gopalan N P	A Beginners Guide To Unix	PHI Learning, First Edition	2009

WEB URLs:

1. www.ee.surrey.ac.uk/Teaching/Unix
2. www.cs.bu.edu/teaching
3. www.elearning.vtu.ac.in/CS36.html
4. www.grymoire.com/Unix/Awk.html
5. www.unix.org/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	1	1	-
CO	**3**	**2**	**1.4**	**1.5**	-	-	-	-	-	-	-	**1.0**	**1.0**	**-**

21FD13 JAVA PROGRAMMING

3 0 4 5

PRE-REQUISITES: Fundamental of Computers

OBJECTIVES:

- To learn the basic fundamental concepts of java programming.
- To gain knowledge of object-oriented programming in Java
- To understand the concepts of interface and packages in Java.
- To handle Exceptions in Java.
- To gain knowledge of Java Collection API.

OUTCOMES:

Learner should be able to

CO1	explain the fundamental concepts of object-oriented programming and Java program structures	**K2**
CO2	illustrate the use of operators, decision-making statements, and looping constructs in the context of Java programs.	**K3**
CO3	illustrate the use of operators, decision-making statements, and looping constructs in the context of Java programs.	**K4**
CO4	construct multithreaded and file-handling applications by leveraging Java's packages, interfaces, and exception-handling mechanisms.	**K4**
CO5	construct multithreaded and file-handling applications by leveraging Java's packages, interfaces, and exception-handling mechanisms.	**K4**

MODULE I **9**

Java fundamentals: Java architecture – Language Basics – Features of java – Comments – Data types – Variables – Operators – Type conversion and casting – Flow control statements – Arrays – OOPS – Classes and objects: Concepts of classes and objects – UML class diagram – Creating classes – Methods – Constructors – Static variables and methods – This Keyword – Encapsulation – Implementing encapsulation.

MODULE II **21**

Inheritance: Inheritance hierarchies – Super and sub classes – Access control – Super keyword – Final classes and methods – The object class. Polymorphism: Dynamic binding – Method overriding – Garbage collection – String: StringBuffer – Abstraction: Abstract classes and methods. Packages – Defining, creating and accessing a package – importing packages. Interfaces: Interfaces vs. Abstract classes – Defining an interface – Implementing interfaces – Extending interfaces.

MODULE III **21**

Exception handling – Errors vs exceptions – Exception hierarchy – Usage of try, catch, throw, throws and finally, re throwing exceptions – Built-in exceptions – User defined exceptions. Wrapper classes – Byte, Short, Integer, Float, Double, Boolean, Character. Java Collections API – Introduction to collection – Generics – List implementations – Set implementations – Map implementations.

TOTAL: 45

LIST OF EXPERIMENTS

1. Programs using Control structures and Arrays
2. Programs using Classes and Objects
3. Programs using Inheritance.
4. Programs using polymorphs and String class.
5. Programs using Interface and package.
6. Programs using Exception handling mechanism
7. Programs using Wrapper classes
8. Programs using List Collection.
9. Programs using Map Collection
10. Programs using Set Collection

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cay S Horstmann and Gary Cornell	Core Java: Volume I – Fundamentals	Prentice Hall, Eleventh Edition	2021
2.	Herbert Schildt	Java2: The Complete Reference	Tata McGraw-Hill,Tenth Edition	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Paul J Deitel	Java for Programmers	Pearson Education, Second Edition	2012
2.	Deitel and Deitel	Java How to Program, Early Objects	Prentice Hall, Eleventh Edition	2021
3.	Herbert Schildt and Dale Skrien	JAVA Fundamentals	McGraw-Hill, First Edition	2012

WEB URLs:

1. www.docs.oracle.com/javase/tutorial/java/nutsandbolts
2. www.javabeginner.com/learn-java
3. www.tutorialspoint.com/java/java_abstraction.htm
4. www.docs.oracle.com/javase/tutorial/collections/intro/
5. www.tutorialspoint.com/java/java_exceptions.htm

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	2	2	2
CO2	3	2	1	1	2	-	-	-	2	2	-	2	3	2
CO3	3	3	2	1	2	-	-	-	2	2	-	2	3	2
CO4	3	3	2	1	2	-	-	-	2	2	-	2	3	2
CO5	3	3	2	1	2	-	-	-	2	2	-	2	2	2
CO	**2.8**	**2.4**	**1.7**	**1**	**2**	**-**	**-**	**-**	**1.8**	**1.8**	**-**	**2**	**2.6**	**2**

21FD14 COMPUTER GRAPHICS AND MULTIMEDIA

3 0 2 4

PRE-REQUISITES: Fundamental of Computes and C Programing Language

OBJECTIVES:

- To understand basic computational model for line, circle, 2D concepts.
- To provide in-depth knowledge about shape modeling of 3D application.
- To understand basic concepts related to multimedia including interface standards, database and software.
- To study different file formats and Multimedia I/O technologies.
- To understand the hypermedia applications.

OUTCOMES:

Learners should be able to

CO1	define the basic concepts and algorithms of computer graphics.	**K2**
CO2	apply graphic computing techniques to develop multimedia systems with enhanced interactivity.	**K3**
CO3	analyze the integration of multimedia technologies for practical applications.	**K4**
CO4	implement basic drawing algorithms and perform 2d/3d transformations.	**K3**
CO5	create multimedia applications using animation techniques to meet user specifications.	**K3**

MODULE I **9**

Introduction to graphics – Display devices – Data representation techniques – Line drawing algorithms – Circle drawing algorithms – Attributes – Two-dimensional geometric transformations – Two-dimensional clipping and viewing.

MODULE II **21**

Three-dimensional object representations – Three-dimensional geometric and modeling transformations – Three-dimensional viewing – Color models – Animation – Introduction to visualization – Multimedia applications – Multimedia system architecture – Evolving technologies for multimedia – Defining objects for multimedia systems – Multimedia data interface standards – Multimedia databases.

MODULE III **21**

Multimedia data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Storage and retrieval technologies. User interface – Hypermedia messaging – Mobile messaging – Hypermedia message component – Creating hypermedia message – Integrated multimedia message standards – Integrated document management – Distributed multimedia systems applications.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Implement the exercises using C / openGL/ Java
2. Implementation of algorithms for drawing
   - 2D Primitives
   - Line (DDA, Bresenhams) all slopes
   - Circle (Midpoint)
3. Implementation of 2D geometric transformations
   - Translation
   - Rotation
   - Scaling
   - Reflection
   - Shear
4. Implementation of composite 2D Transformations
5. Implementation of 3D transformations - Translation, Rotation, Scaling
6. Composite 3D transformation.
7. Creating 3D objects and scenes.
8. Image editing and manipulation – Basic operations on image using any image editing software, creating gif animated images, image optimization
9. 2D Animation – To create interactive animation using any authoring tool.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Donald Hearn and Pauline Baker M	Computer Graphics C Version	Pearson Education, Second Edition	2011
2.	Prabat K Andleigh and Kiran Thakrar	Multimedia Systems and Design	Prentice Hall, Fourth Edition	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James D Foley, Andries van Dam, Steven K Feiner and John F Hughes	Computer Graphics: Principles and Practice	Pearson Education, Second Edition	2013
2.	Judith Jeffcoate	Multimedia in practice Technology and Applications	Pearson Education, Second Edition	2011

WEB URLs:

1. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-837-computer-graphics-fall-2012/lecture-notes/
2. www.courses.psu.edu/art/art201_jxm22/tutorials.html
3. www.graphics.cornell.edu/online/tutorial
4. www.student.kuleuven.be/~m0216922/CG
5. www.geocities.com/SiliconValley/Park/9784/tut.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	-
CO2	3	2	1	-	2	-	-	-	2	2	-	-	-	-
CO3	3	3	2	1	2	1	-	-	2	2	-	-	-	-
CO4	3	2	1	-	2	1	-	-	2	2	-	-	-	-
CO5	3	2	1	-	2	1	-	-	2	2	-	-	-	-
CO	**2.8**	**2**	**1.2**	**1**	**2**	**1**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**

21FD15 MOBILE COMPUTING AND COMMUNICATION

3 0 0 3

OBJECTIVES:

- To understand the basic concepts of mobile communication and computing.
- To be familiar with mobile IP and mobile transport layer.
- To learn the basics of Wireless LAN.
- To be exposed to adhoc networks.
- To gain knowledge about the concepts of WSN.

OUTCOMES:

Learners should be able to

CO1	understand the fundamental principles of mobile communication technologies and networks.	**K2**
CO2	compute the functionalities of mobile internet protocols and transport layers.	**K3**
CO3	analyze the performance of routing techniques in mobile networks.	**K4**
CO4	develop network configurations using simulation tools and routing methods	**K3**
CO5	design and simulate ad-hoc networks for optimized packet transmission.	**K3**

MODULE I **9**

Basics of communication technologies – Introduction to mobile computing: Mobile computing vs wireless networking – Mobile computing applications – Characteristics of mobile computing – Structure of mobile computing application – Global system for mobile communication (GSM) – General packet radio service (GPRS) – Universal mobile telecommunication system (UMTS) – MAC protocols: Wireless MAC issues – Fixed assignment schemes – Random assignment schemes – Reservation based schemes.

MODULE II **21**

Mobile internet protocol: Mobile IP – Packet delivery – Overview of mobile IP – Features of mobile IP – Key mechanism in mobile IP – Route optimization – DHCP – Mobile transport layer: Overview of TCP/IP – Terminology – Architecture of TCP/IP – Operation of TCP – Adaptation of TCP window – Improvement in TCP performance – Wireless LAN: Infrared vs radio transmission – Infrastructure – IEEE 802.11 – HIPERLAN – Bluetooth.

MODULE III **21**

Mobile Ad-Hoc Networks: Ad-Hoc basic concepts – Characteristics – Applications – Design issues – Routing – Essential of traditional routing protocols – Popular routing protocols – Vehicular ad hoc networks (VANET) – MANET vs VANET – Security issues and counter measures – Wireless sensor networks: WSN vs MANET –Applications – Architecture of the sensor node – Challenges in the design of an effective WSN –Characteristics of sensor networks – WSN routing protocols – Target coverage – Clustered WSN.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Prasant Kumar Pattanaik and Rajib Mall	Fundamentals of Mobile Computing	PHI, Second Edition	2016
2.	Jochen Schiller	Mobile Communications	Pearson, Second Edition	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stojmenovic and Cacute	Handbook of Wireless Networks and Mobile Computing	Wiley, First Edition	2002
2.	Dharma Prakash Agarval, Qing and An Zeng	Introduction to Wireless and Mobile systems	Thomson Asia Pvt Ltd, First Edition	2005
3.	Uwe Hansmann, Lothar Merk, Martin Nicklons.S and Thomas Stober	Principles of Mobile Computing	Springer, Second Edition	2003
4.	William.C.Y.Lee	Telecommunications - Analog and Digital Systems	Tata Mc Graw Hill, Second Edition	2006
5.	Toh C H	AdHoc Mobile Wireless Networks	Pearson Education, First Edition	2002

WEB URLs:

1. www3.nd.edu/~cpoellab/teaching/cse40814_fall08/Lesson1.pdf
2. www.courses.csail.mit.edu/6.885/spring06/notes.html.
3. www.tutorialspoint.com/mobile_computing/index.htm
4. www.searchmobilecomputing.techtarget.com/tutorial/Mobile-computing-tutorials
5. www.cse.iitk.ac.in/users/rkg/Talks/mobile_main.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO	**2.8**	**2**	**1.2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

21FD16 XML AND WEB SERVICES

3 0 0 3

PRE-REQUISITES: Basics of Java Programming

OBJECTIVES:

- To understand the fundamental concepts of XML framework.
- To understand the XML security.
- To provide knowledge about web service architecture.
- To understand the fundamental concepts of web services and implementations.
- To study the building blocks of web services.

OUTCOMES:

Learners should be able to

CO1	understand the fundamental requirements and concepts of xml.	**K2**
CO2	apply xml schemas to validate and manage document structures.	**K3**
CO3	analyze the architecture and technologies of web services for application integration.	**K4**
CO4	develop soap-based services to achieve interoperability across platforms.	**K3**
CO5	evaluate the role of restful web services in modern software applications.	**K4**

MODULE I **9**

Introduction to XML – XML and the web – XML requirements, applications and advantages – Basic XML programs – DTD – Attributes – XML schema – XML schema advantages.

MODULE II **21**

XML Namespace – XSLT – DOM –Xpath – Xquery – Xpointer – Canonicalization – The XML security framework – XML encryption – Encryption XML data – XML digital signature – Digital signature elements – Steps in signature generation XKMS – XKMS structure – Guidelines for signing XML documents. Architecting web services: Motivations for web services – Technical motivations for web services – SOA – Architecting web services.

MODULE III **21**

Web Services – Types – SOAP: Introduction – The SOAP model – SOAP messages – SOAP Encoding – SOAP RPC – WSDL: WSDL structure – Interface – Definitions – Bindings – Services – Using SOAP and WSDL. UDDI: Introduction – Basics – UDDI API – Future of UDDI.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ron Schmelzer, Taravis Vandersypen and Diane Kennedy	XML and Web Services Unleashed	Pearson Education, First Edition	2009
2.	Frank P Coyle	XML, Web Services and the Data Revolution	Pearson Education, First Edition	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anders Moller and Michael I Schwartzbach	An Introduction to XML and Web Technologies	Pearson Education First Edition	2009
2.	Priscilla Walmsley	Definitive XML Schema	Pearson Education, Second Edition	2013

WEB URLs:

1. www.web3.apl.jhu.edu/605.481/notes/WebServicesOverview.pdf
2. www.web3.apl.jhu.edu/605.481/notes/Java-XML.pdf
3. www.web3.apl.jhu.edu/605.481/notes/XML.pdf
4. www.genomeutwin.org/events/SENGER_060504_.webservices.ppt
5. www.fdi.ucm.es/profesor/jjruz/websi/bibliografia/ws1.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	1	-	-	2	-	-	-	-	-	-	1	-
CO3	2	2	1	-	-	-	-	-	-	-	-	-	1	1
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	2	1	-	-	-	-	-	-	-	-	-	1	1
CO	**2.4**	**1.8**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

21FD17 INFORMATION SECURITY

3 0 0 3

PRE-REQUISITES: Computer Networks

OBJECTIVES:

- To understand the basic concepts of information security.
- To gain knowledge in risk management.
- To be aware of policy standards and practices.
- To understand different security technologies and security tools.
- To learn about intellectual property rights and patents.

OUTCOMES:

Learners should be able to

CO1	define the principles of information security, including legal, ethical, and technological aspects.	**K2**
CO2	apply copyright and intellectual property rights in information security systems.	**K3**
CO3	illustrate legal and professional issues relevant to securing information systems.	**K3**
CO4	classify security components and analyze their effectiveness in mitigating threats.	**K4**
CO5	evaluate cryptographic techniques for securing sensitive data and communications.	**K4**

MODULE I **9**

Introduction to information security: History – Security model – Components of an information system – Balancing information security access – Approaches – The system development life cycle – The security systems development life cycle – Security professionals and the organization – Communities of internet – The need for security.

MODULE II **21**

Risk management: Introduction – Risk identification – Assessment – Control strategies – Selecting a risk control strategy – Management – Planning for security: Information security planning and governance – Policy, standards and practices – blueprint – Education, training and awareness – Continuity strategies – Security Technology: Firewalls and VPNs – Intrusion detection, prevention systems and other security tools: Introduction – IDPS – Honeypots – Honeynets and padded cell systems – Scanning and analysis tools – Biometric access controls.

MODULE III **21**

Implementing information security: Project management – Technical and non technical aspects of implementation – Legal, Ethical and Professional issues in information security: Law and ethics – International laws and legal bodies – Ethics and information security – Ethics for IT professional organizations – Intellectual Property Rights: Invention and creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (Movable property – Immovable property – Intellectual property) – IP patents – Copyrights and related rights – Trademarks and rights arising from trademark registration.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Michael E Whitman and Herbert J Mattord	Principles of Information Security	Vikas Publishing House, New Delhi, Fourth Edition	2011
2.	Ganguli	Intellectual Property Rights: Unleasing the Knowledge Economy	Tata McGraw-Hill, First Edition	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles P Pfleeger and Shari Lawrence Pfleeger	Security in Computing	Pearson Education, Fourth Edition	2007
2.	Micki Krause and Harold F Tipton	Handbook of Information Security Management	CRC Press, Fourth Edition	2007
3.	Subbaram N R	Handbook of Indian Patent Law and Practice	Viswanathan Pvt. Ltd, First Edition	2007
4.	Stuart McClure, Joel Scrambray and George Kurtz	Hacking Exposed	Tata McGraw-Hill, Seventh Edition	2012

WEB URLs:

1. www.garykessler.net/library/crypto.html
2. www.itscolumn.com/2012/03/28-types-of-computer-security-threats-and-risks/
3. www.wipo.int/edocs/mdocs/sme/en/wipo_ip_bak_03/wipo_ip_bak_03_www_34147.pdf
4. www.shareyouressays.com/116688/8-most-important-differences-between-movable property-and-immovable-property
5. www.lawmart.com/forms/difference.htm

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO5	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO	**2.8**	**2.2**	**1.5**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

21FD21 SYSTEM SOFTWARE AND OPERATING SYSTEMS

3 0 2 4

OBJECTIVES:

- To know about the function of linkers, loaders and assemblers.
- To understand different types of operating system.
- To learn the process management.
- To understand memory management.
- To be aware of file management.

OUTCOMES:

Learners should be able to

CO1	define the core concepts of system software and operating systems.	**K2**
CO2	apply scheduling, process, and memory management techniques for problem-solving.	**K3**
CO3	analyze and evaluate processes, memory allocation, and file management system.	**K4**
CO4	develop and implement solutions using system software principles.	**K3**
CO5	simulate operating system functionalities for improved resource utilization.	**K3**

MODULE I **9**

Overview of language processors – Assemblers: Design of two pass assemblers – Single pass assemblers. MACRO: Macro definition – Macro call – Macro expansion. Loaders – Absolute loaders – Relocating loaders – Relocation and linking concepts – Design of linker – Self relocating programs.

MODULE II **21**

Introduction – Operating systems objectives and functions – Evolution of operating systems – Batch – Multiprogramming – Multitasking – Multiuser – Parallel – Distributed – Real-time systems and hand held systems – System components – System calls – System programs. Process management – Process concepts – Scheduling – Operations – Interprocess communications – Threads – Multicore programming – Multithread models – Libraries – Issues – CPU scheduling – Concepts – Criteria – algorithms – Multiprocessor scheduling – Deadlocks – Deadlocks characterization – Methods – Prevention – Avoidance – Detection.

MODULE III **21**

Memory management – Swapping – Contiguous memory allocation – Segmentation – Paging – Demand paging – Page replacement – File system interface – Concepts – Access methods – Directory and disk structures – File systems mounting – File system structures – File system implementation – Directory implementation – I/O systems.

LIST OF EXPERIMENTS:

(Using C or C++)

1. Implement a single pass assembler.
2. Implement a relocating loader.
3. Implement a single pass macro processor.
4. Shell Programming
   - Basic commands.
   - Write simple functions.
5. Given the list of processes, their CPU burst times and arrival times, display/ print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for priority and Round Robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
7. Implement the memory management scheme.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Leland L Beck	System Software – An Introduction to Systems Progrmming	Pearson Education, Third Edition	2012
2.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	Operating Systems Concepts	John Wiley, Ninth Edition	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dhamdhere D M	Systems Programming and Operating Systems	Tata McGraw-Hill, Second Edition	2011
2.	William Stallings	Operating Systems - Internals and Design Principles	Prentice Hall, Eight Edition	2014

WEB URLs:

1. www.docsity.com/en/system-software
2. www.williamstallings.com/OperatingSystems
3. www.os-book.com/
4. www.techterms.com/definition/systemsoftware
5. www.nptel.ac.in/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	2	1
CO2	3	2	1	1	1	-	-	-	2	2	-	1	2	1
CO3	3	3	2	1	1	-	-	-	2	2	-	1	2	1
CO4	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO5	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1.5**	**-**	**-**	**-**	**1.8**	**1.8**	**-**	**1**	**2**	**1**

21FD19 BIG DATA ANALYTICS

3 0 2 4

PRE-REQUISITES: Data Structures and Database Management Systems

OBJECTIVES:

- To learn about fundamentals of big data.
- To understand basic concepts of NoSQL.
- To be familiar with mongoDB streams.
- To learn map reduce environment for data analysis.
- To understand basic R-Language techniques.

OUTCOMES:

Learners should be able to

CO1	define the terminologies of big data, including hadoop, mongodb, and mapreduce.	**K2**
CO2	apply problem-solving strategies to address challenges in real-time applications.	**K3**
CO3	analyze datasets to extract meaningful insights using mapper and reducer techniques.	**K4**
CO4	design solutions for real-world problems using big data tools and frameworks.	**K3**
CO5	evaluate the performance of data processing systems using hdfs and mapreduce integration with R.	**K4**

MODULE I **9**

Introduction to Big Data – Challenges with Big Data – Volume – Velocity – Varity – Why Big Data – Big data analytics: Big data analytics – Classification of analytics – Top challenges facing big data – Important – Data science – Terminologies used in big data – Open source tools

MODULE II **21**

NoSQL: NoSQL – Why NoSQL – SQL vsNoSQL –Hadoop: Hadoop – History – Overview – Features of Hadoop – Versions – Hadoop versus SQL – RDBMS versus HADOOP – Distributed computing challenges – HDFS – Processing data with Hadoop: MapReduce Daemons – YARN – Interacting with Hadoop Ecosystem. Introduction to MongoDB – Why MongoDB – Terms used in RDBMS and MongoDB – Data types in MongoDB – MongoDB Query Language: (Create, Read, Update, Delete, Insert, Save (), Count, Limit, Sort, Skip) – MapReduce function – Aggregate function

MODULE III **21**

Introduction to MAPREDUCE Programming: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression – Hive: Hive – Hive Architecture – Hive Datatypes, Pig: Feature of PIG – PIG on Hadoop – PIG Philosophy – R Language Introduction: Assignment to objects – Creating simple objects – Function – Concatenation and arrays – Listing and deleting objects – Conditional and Iterative execution – Reading in external data – Outputting data.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Perform setting up and installing Hadoop in its two operating modes: Pseudo distributed and fully distributed.
2. To implement the following file management tasks in HDFS: Adding files and directories, Retrieving files, Deleting files
3. To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, To view the output file, and To calculate execution time.
4. To perform NoSQL database using mongodb to create, update and insert.
5. Install and run Pig then write Pig Latin scripts to write, run, join, project and filter your data.
6. Install and run Hive then use Hive to create, alter and drop databases tables, views, functions and indexes.
7. To study and implement basic functions and commands in R Programming.
8. To build WordCount, a text mining method using R for easy to understand and visualization than a table data.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Seema Acharya and Subhashini Chellappan	Big Data and Analytics	John Wiley,First Edition	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Murray S J	Learn R in a day	SJ Murray, Second Edition	2013
2.	Michael J Crawley	The R Book	John Wiley, Second Edition	2012
3.	Venkat Ankam	Big Data Analytics	Packt Publishing, First Edition	2016

WEB URLs:

1. www.exterro.com/resources/
2. www.ibmbigdatahub.com/
3. www.tutorialspoint.com/hadoop/
4. www.impetus.com/
5. www.guru99.com/bigdata-tutorials.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	2	2	-	1	2	1
CO2	3	2	1	-	2	-	-	-	2	2	-	2	2	1
CO3	3	3	2	1	2	-	-	-	1	1	-	1	2	1
CO4	3	2	1	-	2	-	-	-	1	1	-	2	2	1
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	1
CO	**2.8**	**2.2**	**1.5**	**1**	**1.6**	**-**	**-**	**-**	**1.4**	**1.4**	**-**	**1.4**	**2**	**1**

21FD20 AUTOMATA THEORY AND COMPILER DESIGN

3 0 0 3

PRE-REQUISITES: Data Structures, Discrete Mathematics Structures

OBJECTIVES:

- To know the fundamentals of finite automata.
- To learn and understand the function of lexical analysis.
- To learn and understand the function of syntax analysis.
- To understand process of intermediate code generator and gain knowledge on runtime environments.
- To perform code optimization and code generation.

OUTCOMES:

Learners should be able to

CO1	explain the principles of automata, lexical analysis, syntax analysis, and code generation.	**K2**
CO2	construct automata and parsers for compiler design.	**K3**
CO3	analyze code optimization techniques to enhance compiler efficiency.	**K4**
CO4	design error-detection mechanisms for compiler development.	**K3**
CO5	evaluate runtime systems for memory allocation and instruction scheduling in compilers.	**K4**

MODULE I **9**

Finite automata – Deterministic finite automata – Non-deterministic finite automata – Equivalence of deterministic and non deterministic finite automata – NFA to DFA – Finite automata with epsilon transitions – Epsilon-NFA to DFA – Minimization of automata – Applications – Regular expressions – Finite automata and regular expressions – Applications of regular expressions.

MODULE II **21**

Introduction – The structure of compiler – Building a compiler – Application of compiler technology – Lexical analysis – Role of lexical analyzer – Specification and recognition of tokens – Lexical analyzer generators – LEX tools – Syntax analysis – Context free grammar – Top down parsing – Recursive descent parsing – Predictive parsing – Non-recursive predictive parsing – Error recovery – Bottom up parsing – LR parsers – Construction of SLR (1) parsing table, Canonical LR (1) parsing table and LALR (1) parsing table – Parser generators - YACC.

MODULE III **21**

Syntax directed definitions – Evaluation orders for syntax directed definitions – Applications of syntax directed translation – Intermediate code generation – Three address code – Types and declarations – Expression translation – Type checking – Back patching - Run time environments – Storage organization – Code generation - Issues in the design of code generator – Addresses in the target code – Basic blocks in flow graph – Simple code generator – Code optimization techniques – Parallelizing compilers.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John Hopcroft, Rajeev Motwani and Jeffrey Ullman	Introduction to Automata Theory Languages and Computation	Pearson Education, Third Edition.	2009
2.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman	Compilers: Principles, Techniques and Tools	Pearson Education, Second Edition	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Torbengidius Mogensen,	Basics of Compiler Design	Springer Second Edition	2011
2.	Charles N, Ron K Cytron, Richard J LeBlanc Jr	Crafting a Complier	Pearson Education, Third Edition	2010
3.	K. D. Cooper, L. Torczon	Engineering a Compiler	Morgan-Kaufmann, Second Edition	2011
4.	Micheal Sipser	Introduction to the Theory of Computation	Cengage Learning, Third Edition	2014

WEB URLs:

1. www.gate cse.in/category/compiler-design/
2. www.tutorialspoint.com/compiler_design
3. www.swayam.gov.in/nd1_noc20_cs13/preview
4. www.geeksforgeeks.org/compiler-design-tutorials/
5. www..geeksforgeeks.org/theory-of-computation-automata-tutorials/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	1	1
CO	**2.8**	**2.2**	**1.5**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

21FD21 STREAMING ANALYTICS

3 0 2 4

PRE-REQUISITES: Database Management Systems and Data Structures

OBJECTIVES:

- To be familiar with big data batch and real time processing.
- To understand the basic object oriented and functional programming concepts in scala using interactive shell.
- To be aware of operations and functions of transformation and actions used in Resilient Distributed Dataset (RDDs).
- To explore and analyze the spark streaming data.
- To enhance knowledge in MLLibrary and GraphX library in spark.

OUTCOMES:

Learners should be able to

CO1	explain the limitations of mapreduce and the architecture of apache spark.	**K2**
CO2	apply transformation and action functions on rdds to develop solutions.	**K3**
CO3	analyze real-time data using spark sql for visualization and insights.	**K4**
CO4	experiment with scala to implement object-oriented and functional programming solutions.	**K3**
CO5	evaluate advanced analytics libraries for efficient stream data visualization.	**K4**

MODULE I **8**

Introduction to big data and apache spark: Understanding big data – Batch processing – Real time processing – Hadoop architecture – Data processing hadoop – Spark architecture – Spark in hadoop ecosystems – Spark web UI.

MODULE II **19**

Introduction: Scala for spark – Scala in other frameworks – Scala REPL – Variable types – Type inference – Lazy values – Control structures – Loop – Functions – Procedures. Collections: Array – Array buffer – Maps – Tuples – Lists. Oops and functional programming in scala: Classes in scala – Getters and setters – Constructor – Singletons – Companion objects – Inheritance in Scala – Traits – Layered traits – Functional style programming in scala. Spark common operations: Invoke spark shell, PySpark and SparkR – Basic spark operation – Analyze sparkcontext and spark properties – Build spark projects – Spark modes – Persistence in spark. Playing with RDD: RDD operation – Load and save data from RDD – RDD function – Transformation – Action – Analyze RDD functions – Advanced RDD operations - Integrating spark with hadoop.

MODULE III **21**

Spark steaming and MLLib: Spark streaming architecture – Run a spark steaming program – Transformation in spark steaming – Window operation in spark streaming – Checkpointing for fault tolerance – Machine Learning algorithms in spark – Concepts in ML – Steps in ML pipeline. SQL context and hive context in spark SQL – Dataframe in spark SQL – Data visualization in spark – Accumulators and broadcast variables – GraphX library in spark – Graph algorithms.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Analysis of document using Map Reduce.
2. Analysis of various dataset using jars.
3. Classes and objects in scala.
4. Implementation, Overriding and traits using scala.
5. Implement Server login analysis in using spark.
6. File Handling in Spark.
7. Manipulating RDD functions in Scala.
8. Spark Streaming data
9. Create the property graph from array of vertex and edges.
10. Analyze Real-Time flight data using Spark GraphX.

TEXT BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Muhammad Asif Abbasi	Learning Apache Spark 2	Packt Publishing, First Edition	2017
2	Rezaul Karim Md and Sridhar Alla	Scala and Spark for Big Data Analytics: Explore the concepts of functional	Packt Publishing, First Edition	2017

REFERENCE BOOKS:

Sl.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Romeo Kienzlerand Shuen Mei	Apache Spark 2: Data Processing and Real-Time Analytics	Packt Publishing, First Edition	2021
2	Pascal Bugnion	Scala for Data Science	Packt Publishing, First Edition	2016

WEB URLs:

1. www.scala-exercises.org/scala_tutorial
2. www.databricks.com/spark
3. www.nptel.ac.in/courses/106/105/106105216/
4. www.spark.apache.org/graphx/
5. www.udemy.com/course/apache-spark-with-scala-hands-on-with-big-data/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	2	2	-	1	2	1
CO2	3	2	1	-	2	-	-	-	2	2	-	2	2	1
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CO4	3	2	1	-	2	-	-	-	1	1	-	2	2	1
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	1
CO	**2.8**	**2.2**	**1.5**	**1**	**1.6**	**-**	**-**	**-**	**1.4**	**1.4**	**-**	**1.4**	**2**	**1**

21FD22 STATISTICS AND DATA SCIENCE

4 0 0 4

PRE-REQUISITES: Database Management System and Data Structures

OBJECTIVES:

- To familiarize the data distribution in R.
- To impart knowledge on supervised learning techniques using mathematical modelling.
- To learn and implement the advanced machine learning techniques.
- To understand the concepts of integrating Deep Learning environment.
- To enhance the knowledge to write Neural Network in R and executing in R.

OUTCOMES:

Learners should be able to

CO1	generalize various tools used in data science, including data processing, machine learning, and statistics.	**K2**
CO2	solve problems using algorithms for statistical analysis, machine learning, and data extraction.	**K3**
CO3	select appropriate methods to address issues in big data, machine learning, and deep learning using statistical techniques.	**K4**
CO4	integrate knowledge of statistical data analysis techniques in decision-making.	**K3**
CO5	outline user interface applications for real-world problems and present results using data visualization techniques.	**K3**

MODULE I **12**

Data science: Data science involves – Era of data science – Business intelligence vs Data science – Life cycle of data science – Tools of data science. Introduction to big data and hadoop – Introduction to R – Introduction to spark – Introduction to machine learning – Statistical inference – Terminologies of statistics – Centers – Spread – Probability – Normal distribution binary distribution – Data analysis pipeline – Data extraction – Types of data – Raw and processed data – Data wrangling – Exploratory data analysis – Visualization of data.

MODULE II **24**

Machine learning use cases – Process flow – Categories supervised learning algorithm: Linear regression and logistic regression – Classification and its use cases – Decision tree – Confusion matrix – Random forest – Navies bayes – Support vector machine – Classification – Clustering use cases – K-means clustering – C-means clustering – Canopy clustering – Hierarchical clustering – Association rules – Recommendation engine – User based recommendation – Item based recommendation difference: User based and item based recommendation – Recommendation use cases.

MODULE III **24**

Text mining use cases – Mining algorithms – Quantifying text – TF-IDF – Time Series data – Variables – Components of time series data – Visualize the data to identify time series components – ARIMA model – Exponential smoothing models – ETS model – Reinforced learning – Deep learning – Biological neural networks – Understand Artificial Neural Networks – Building an Artificial Neural Network – Terminologies of ANN's.

TOTAL: 60

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Hadley Wickham and Garrett Grolemund	R for Data Science: Import, Tidy, Transform, Visualize, and Model Data	O'Reilly Publisher, First Edition	2016
2.	Thomas Mailund	Beginning Data Science in R: Data Analysis, Visualization, and Modelling for Data Scientist	Apress Publisher, First Edition	2017

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	W Holmes Finch, Jocelyn E Bolin and Ken Kelley	Multilevel Modelling using R	CRC Press, First Edition	2014
2.	Jaynal Abedin and Kishor Kumar Das	Data Manipulation with R	Packt Publisher, Second Edition	2015

WEB URLs:

1. www.mosaic-web.org/go/Master-Modeling.pdf
2. www.cran.r-project.org/doc/
3. www.nptel.ac.in/course.php
4. www.r4ds.had.co.nz/
5. www.statslab.cam.ac.uk/~pat/redwsheets.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	-	2	-
CO2	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	-	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

21FD23 DATA ANALYTICS WITH R PROGRAMMING

3 0 2 4

PRE-REQUISITES: Database Management System and Data Structures

OBJECTIVES:

- To study the basic concepts of R-Programming and important role in solving complex analytical problems.
- To learn about the versatility and robustness of R to extract data from various format includes csv, data scraped from website.
- To obtain knowledge in visualization and the concepts of creating simple as well as complex visualizations in R.
- To understand the various Machine Learning algorithms.
- To explore algorithm for classification and clustering methods.

OUTCOMES:

Learners should be able to

CO1	define and explain the basics of R Programming in terms of data structures, importing various file formats and machine learning concepts.	**K2**
CO2	apply R programming for text processing and analysis the data.	**K3**
CO3	analyze the mathematical formulation of machine learning and statistical models to visualize the data in various graphs.	**K4**
CO4	conduct experiments on supervised and unsupervised machine learning techniques to derive business insights.	**K3**
CO5	develop a mini-project using machine learning algorithm and calculate the accuracy.	**K3**

MODULE I **9**

Business analytics – Knowledge on the R – R in the industry – R verses other analytics tools – Install R and R Packages – Basic operations – R studio and various GUI – Help feature in R – R community – R sessions and function – Basic math – Variables – Datatypes – Vectors – Advanced Data structures in R – Built-in functions in R – Apply functions.

MODULE II **17**

Import data: Excel – CSV – TSV – Text – SAS, SPSS format – Packages installation for database import – Detecting outliers – Basics of Web Scraping – Exploratory Data Analysis (EDA) – Implementation of EDA on various datasets - Data transformation using dplyr - Tidy data: gather – Separate – unite – spread. Boxplots – Multiple packages in R for data analysis –The fancy plots like segment plot, HC plot in R – R Data visualization – Graphical functions – R Plot – 3D plots - Sentiment analysis.

MODULE III **19**

Introduction to Data Mining – Understanding Machine Learning – Supervised and unsupervised machine learning algorithms – Simple Linear regression – Multiple Linear Regression - Polynomial regression –Decision trees – Algorithm for creating decision trees – Greedy approach: Entropy and information gain Creating a perfect decision tree – Classification rules for decision trees – Survival Analysis - Concepts of random forest – Working of random forest – Features of random forest – Logistic regression – K-means clustering – Association rule mining – Probability distribution – Normal distribution – Binomial distribution – Poisson distribution – Correlation and covariance – **Anova.**

TOTAL: 60

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Hadley Wickham and Garrett Grolemund	R for Data Science: Import, Tidy, Transform, Visualize, and Model Data	O'Reilly Publisher, First Edition	2016
2.	Thomas Mailund	Beginning Data Science in R: Data Analysis, Visualization, and Modelling for Data Scientist	Apress Publisher, First Edition	2017

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	W Holmes Finch, Jocelyn E Bolin and Ken Kelley	Multilevel Modelling using R	CRC Press, First Edition	2014
2.	Jaynal Abedin and Kishor Kumar Das	Data Manipulation with R	Packt Publisher, Second Edition	2015

WEB URLs:

1. www.mosaic-web.org/go/Master-Modeling.pdf
2. www.cran.r-project.org/doc/
3. www.nptel.ac.in/course.php
4. www.r4ds.had.co.nz/
5. www.statslab.cam.ac.uk/~pat/redwsheets.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	-	2	-
CO2	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	-	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

PROFESSIONAL ELECTIVES

21FE01 ADVANCED DATA STRUCTURES

3 0 4 5

PRE-REQUISITES: Data Structures

OBJECTIVES:

- To know the basics of algorithm analysis and notations.
- To understand the concept of tree data structure along with its elementary operations.
- To learn about the advanced tree data structures like threaded trees, tournament trees, B-trees, splay trees, red black trees and tries.
- To understand the basic concept of the graph data structures and many algorithms associated with it.
- To know the basics of advanced randomized algorithms, parallel algorithms and string pattern matching algorithms.

OUTCOMES:

Learners should be able to

CO1 :	illustrate problem-solving techniques in advanced data structures.	**K2**
CO2 :	determine the use of advanced hierarchical data structures in real-time applications.	**K3**
CO3 :	focus on algorithms for graph data structures and pattern matching.	**K4**
CO4 :	parse solutions for problems involving non-linear data structures and pattern matching.	**K3**
CO5 :	develop mini-projects using non-linear data structures and pattern matching algorithms.	**K3**

MODULE I **9**

Introduction to algorithm design techniques: Fundamentals of algorithmic problem solving – Important problem types – Problem solving techniques – Greedy algorithms – Divide and conquer – Dynamic programming – Backtracking – Branch and bound – Randomized algorithms – Introduction to algorithm analysis: Asymptotic notations, recurrences – Iterative and recursive algorithms.

MODULE II **21**

Trees: Introduction – Terminologies – Array and linked representation – Binary search tree Vs Threaded binary tree – Tournament trees – Balanced trees: Applications. Heaps: Array based heaps – Min, max heap – Binary heap – Operations – Binomial heap. Multi way trees: 2-3 trees – 2-4 trees – Operations – B-tree – Definition – B-Tree of order m – Operations – Insertion, Searching, B+ trees – Red Black Tree – Splay Tree – Elementary operations – Introduction to tries and compressed tries – Dictionaries – Suffix trees – Suffix arrays.

MODULE III **21**

Graphs: Introduction – Traversals - Applications of graphs: Articulation Point – Connectivity – Biconnected graph – Eulerian path and circuit – Strongly connected components – Spanning trees – Minimum spanning tree algorithms – Prim's algorithm – Kruskal's algorithm – Applications – Single source shortest path algorithms – Dijkstra's – Bellman ford – Floyd warshalls all pair shortest path. advanced algorithms: Network flow problem – Ford fulkerson algorithm – Introduction to parallel algorithms – Parallel sorting algorithms – Randomized algorithms – Randomness to hide worst cases – Optimization problems with a random structure – Pattern matching algorithms: Brute force string matching – KMP string matching algorithm – Boyer moore string matching.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs on recursive and iterative algorithms.
2. Programs on sorting and searching algorithms.
3. Implementation of binary search tree operations.
4. Program on Threaded binary tree and in-order traversal.
5. Implementation of tournament tree using array data structure.
6. Array implementation of binary heap.
7. Programs on balanced search tree.
8. Implementation of DFS and BFS.
9. Implementation of topological sorting.
10. Implementation of shortest path algorithm using adjacency matrix and list.
11. Implementation of ford Fulkerson algorithm.
12. Program on String matching algorithms.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Cormen T H, Leiserson C E, Rivest RL and Stein C	Introduction to Algorithms	MIT Press, Third Edition	2009
2.	Anany Levitin	Introduction to Design and Analysis of Algorithm	Pearson Education, Second Edition	2015

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jeff Edmonds	How to Think about Algorithms	Cambridge University Press	2008
2.	Aho A V, Hopcroft J E and Ullman J D	Data Structures and Algorithms	Pearson Education, Fourth Impression	2009
3.	Mark Allen Weiss	Data Structrures and Algorithm Analysis in C	Pearson Education, Second Edition	2007
4.	Seymour Lipschutz and Vijayalakshmi Pai	Data Structures	Tata McGraw-Hill First Edition	2011

WEB URLs:

1. www.nptel.ac.in/course.php
2. www.web.engr.illinois.edu/~jeffe/teaching/algorithms/
3. www.oseindia.net/tutorial/datastructure/index.html
4. www.web.stanford.edu/class/cs166/
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	2	2	-	1	-	-
CO2	3	2	1	1	2	1	-	-	2	2	-	1	2	-
CO3	3	3	2	1	2	-	1	-	2	2	-	1	2	-
CO4	3	2	1	-	2	-	1	-	2	2	-	1	2	2
CO5	3	2	1	-	2	1	1	-	2	2	1	1	2	2
CO	**2.8**	**2**	**1.2**	**1**	**2**	**1**	**1**	**-**	**2**	**2**	**1**	**1**	**2**	**2**

21FE02 BACKUP RECOVERY SYSTEMS AND ARCHITECTURE

3 0 0 3

PRE-REQUISITES: Data Structures

OBJECTIVES:

- To introduce backup recovery systems and architecture (BRSA).
- To understand the practical foundation level training.
- To establish a baseline of skills to enhance additional training.
- To impart knowledge on backup and recovery techniques for networking technologies and networking administration.
- To describe the different types of backup storage media, their advantages and disadvantages.

OUTCOMES:

Learners should be able to

CO1 : represent backup and recovery terminologies, operations, and applications. **K2**
CO2 : estimate the role of technologies in data deduplication for backup systems. **K3**
CO3 : discriminate between steps in planning backup and recovery processes. **K4**
CO4 : develop mail server include file systems, database for different strategies **K3**
CO5 : summarize cluod bsed backup solutions, remote office deployments monitoring and reporting **K3**

MODULE I **9**

Introduction to backup and recovery concepts – Backup software – Physical backup media – Virtual backup media – Virtual tape allocation models.

MODULE II **21**

New media technologies – Deduplication – Fixed block deduplication – Variable block deduplication – Data type limitations – Deduplication terms and types – Software architectures – Commvault – Netbackup.

MODULE III **21**

Application backup strategies – File systems – Databases – Mail server – Sample backup environments – Cloud backup as a service – Single backup servers – Remote office deployments – Long distance backups – Monitoring and reporting.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Steven Nelson	Pro Data Backup and Recovery	Apress, First Edition	2014

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jim Stephens	Data Recovery Guide: Backup, Recover, Restore Before you Lose Your Mind	CreateSpace Independent Publishing Platform, First Edition	2015
2.	Peter V Kay	Backup & Recovery Specialist, Data Backup & Disaster Recovery Engineer	BLGS LLC, First Edition	2014

WEB URLs:

1. www.cisco.com/c/en/us/td/docs/voice_ip_comm/cucm/drs/8_5_1/drsag851.html#wp42168
2. www.ictacademy.in/pages/Backup-Recovery-Systems-and-Architecture.aspx
3. www.msdn.microsoft.com/en-IN/library/dn435916.aspx#Support
4. www.oracle.com/technetwork/server-storage/hardware-solutions/oos- backup-recovery1973210.pdf
5. www.education.emc.com/academicalliance/documents/EAA_backup_recovery_one-pager.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	2	1
CO2	3	3	2	2	2	-	-	-	-	2	-	1	3	2
CO3	3	3	3	2	2	1	-	-	-	3	1	2	3	3
CO4	3	2	3	3	2	2	-	-	-	3	2	2	3	3
CO5	3	3	3	3	3	3	2	2	1	3	3	3	3	3
CO	**3**	**2.6**	**2.4**	**2.5**	**2.3**	**2**	**2**	**2**	**1**	**2.4**	**2**	**1.8**	**2.8**	**2.4**

21FE03 ADVANCED OPERATING SYSTEMS

3 0 2 4

PRE-REQUISITES: Data Structures

OBJECTIVES:

- To introduce backup recovery systems and architecture (BRSA).
- To understand the practical foundation level training.
- To establish a baseline of skills to enhance additional training.
- To impart knowledge on backup and recovery techniques for networking technologies and networking administration.
- To describe the different types of backup storage media, their advantages and disadvantages.

OUTCOMES:

Learners should be able to

CO1 : translate the concepts of distributed operating systems, file systems, multiprocessor operating systems, and security features. **K2**

CO2 : execute distributed scheduling and memory management to solve specific problems. **K3**

CO3 : modify code to implement advanced operating system concepts. **K3**

CO4 : organize case studies on open-source operating systems for mobile devices. **K3**

CO5 : translate the concepts of distributed operating systems, file systems, multiprocessor operating systems, and security features. **K3**

MODULE I **9**

Distributed operating systems – Architectures of distributed systems – Distributed mutual exclusion – Distributed deadlock detection – Agreement protocols.

MODULE II **21**

Distributed File Systems: Distributed resource management – Distributed file systems – Distributed shared memory – Distributed scheduling. Fault Tolerance: Failure recovery and fault tolerance – Case study – AMOEBA.

MODULE III **21**

Security: Protection and security – Resource security and protection – Access and flow control – Multiprocessor operating systems – Multiprocessor system architectures – Multiprocessor operating systems. Database Operating Systems: Introduction to database operating systems – Concurrency control – Theoretical aspects – Concurrency control algorithms.

TOTAL: 45

Case Study/ Mini-project can be designed for the following

1. Development of a reasonably sized dynamically loadable kernel module for Linux kernel.
2. Study educational operating systems such as Minix, Weenix and develop reasonably sized interesting modules for them.
3. Study the Android open source operating system for mobile devices and develop / modify few modules.
4. Study any embedded and real-time operating system such as eCos and develop/ modify few modules.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mukesh Singhal and Niranjan G Shivaratri	Advanced Concepts in Operating Systems - Distributed, Database and Multiprocessor Operating Systems	Tata McGraw Hill, First Edition	2012
2.	Andrew S Tanenbaum	Modern Operating Systems	Prentice Hall India, Fourth Edition	2014

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mary S Gorman and Todd Stubbs S	Introduction to Operating Systems A survey course	Tata McGraw Hill, First Edition	2012

WEB URLs:

1. www.cs.gsu.edu/~cscyqz/courses/aos/aoslectures.html
2. www.gost.isi.edu/555/fall2012/lectures/usc– csci555– f12– part1.pdf
3. www.slideshare.net/anirudhanchikku/advanced– operating– system– lecture– notes
4. www.gama.vtu.lt/biblioteka/Operating_systems/Operating_systems.pdf
5. www.ebookmaterials.blogspot.in/2011/07/advanced– operating– systems– lecturer.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	2	1
CO2	3	2	1	1	1	-	-	-	2	2	-	1	2	1
CO3	3	3	2	1	1	-	-	-	2	2	-	1	2	1
CO4	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO5	3	2	1	-	2	-	-	-	2	2	-	1	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1.5**	**-**	**-**	**-**	**1.8**	**1.8**	**-**	**1**	**2**	**1**

21FE04 ADVANCED JAVA PROGRAMMING

3 0 4 5

PRE-REQUISITES: Java Programming

OBJECTIVES:

- To learn the basic fundamental concepts of advanced java programming.
- To obtain an experience in implementing database connectivity in Java
- To learn about JUnit in Java
- To gain knowledge about JDBC CRUD operations.
- To understand Lambda expressions and Streams in Java

OUTCOMES:

Learners should be able to

CO1	implement I/O operations using byte and character streams, object serialization, and random access file handling in Java	**K3**
CO2	develop multithreaded applications by applying thread lifecycle management, synchronization, and inter-thread communication techniques.	**K3**
CO3	apply CRUD operations and transaction management using JDBC, and test Java applications using JUnit frameworks.	**K3**
CO4	illustrate functional programming concepts including lambda expressions, functional interfaces, and streams to process and transform data in Java applications.	**K2**
CO5	demonstrate the use of multithreading, JDBC operations, JUnit testing, and functional programming constructs like lambdas and streams.	**K3**

MODULE I **9**

I/O Streams: Introduction to I/O-I/O operations – Streams – Byte streams – Character streams – Text input/output – Binary input/output – Random access file operations – Object serialization. Multithreading: Introduction to Multithreading – Process Vs Thread – Thread life cycle – Thread class – Runnable interface – Thread creation – Thread control and Priorities – Inter thread communication – Thread synchronization.

MODULE II **21**

JDBC: Introduction to JDBC – Establishing connection – Executing query and processing results – Performing CRUD operations – PreparedStatement and MetaData objects – CallableStatement and Transactions. JUnit: Introduction to JUnit – JUnit with Eclipse – Assert method and Annotations – Parameterized tests – Test suite – Test runner.

MODULE III **21**

Functional Interfaces – Predicates – Functions – Suppliers – Consumers – Lambda expressions – Accessing local and class variables – Function argument in lambda expression – Sorting – Predicates and lambda expressions. Streams: Filter – Sorted – Map – Reduce – Count – Parallel Streams.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs using threads
2. Programs using multithreading
3. Programs using JDBC CRUD operations.
4. Programs using prepared statement in JDBC.
5. Programs using callable statement in JDBC.
6. Programs using JUnit.
7. Programs using functional interface.
8. Programs using lambda expressions.
9. Programs using streams.
10. Programs using filters.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Herbert Schildt	Java2:The Complete Reference	McGraw-Hill, Tenth Edition	2017
2.	Cay S Horstmann and Gary	Cornell Core Java: Volume I – Fundamentals	Prentice Hall, Eleventh Edition	2021
3.	Raoul-Gabriel Urma, Mario Fusco and Alan Mycroft	Java 8 in Action: Lambdas, streams, and functional-style programming	Manning Publications, First Edition	2015

REFERENCE BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Petar Tahchiev, Felipe Leme and Vincent Massol	JUnit in Action	Manning Publications, Second Edition	2011
2.	David Flanagan and Benjamin Evans	Java in a Nutshell	O'Reilly Media, Seventh Edition	2021

WEB URLs:

1. www.javatpoint.com/creating-thread
2. www.tutorialspoint.com/junit/index.htm
3. www.ntu.edu.sg/home/ehchua/programming/java/JDBC_Basic.html
4. www.docs.oracle.com/javase/tutorial/java/nutsandbolts
5. www.javatpoint.com/java-8-method-reference

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	2	2	2
CO2	3	2	1	1	2	-	-	-	2	2	-	2	3	2
CO3	3	3	2	1	2	-	-	-	2	2	-	2	3	2
CO4	3	3	2	1	2	-	-	-	2	2	-	2	3	2
CO5	3	3	2	1	2	-	-	-	2	2	-	2	2	2
CO	**2.8**	**2.4**	**1.7**	**1**	**2**	**-**	**-**	**-**	**1.8**	**1.8**	**-**	**2**	**2.6**	**2**

21FE05 DESIGN AND ANALYSIS OF ALGORITHMS

3 0 4 5

PRE-REQUISITES: Data Structures

OBJECTIVES:

- To understand basic concepts of algorithms and analyze the asymptotic performance.
- To be familiar with major algorithm design strategies and data structures.
- To apply important algorithmic design paradigms to engineering problems in various domains and methods of analyzing it.
- To learn and implement advanced algorithms efficiently using appropriate design techniques.
- To use the concept of approximation and randomization to find efficient algorithms for hard problems.

OUTCOMES:

Learners should be able to

CO1	construct solutions using problem-solving techniques and asymptotic notations.	**K2**
CO2	compute real-time applications with problem-solving strategies.	**K3**
CO3	differentiate between strategies for solving algorithmic problems.	**K4**
CO4	structure efficient algorithms using suitable paradigms for real-time applications.	**K3**
CO5	demonstrate mini-projects using various problem-solving techniques and assess their performance.	**K2**

MODULE I **9**

to curve-growth rate analysis – Asymptotic analysis – Asymptotic notations – Amortized analysis – Recurrence equations – Analysis of recursive and non-recursive algorithms – General method.

MODULE II **21**

Divide and conquer: Brute force – Selection sort – Bubble sort. Divide and conquer: General method – Binary search – Min-max problem – Median finding – Merge sort – Quick sort – Integer multiplication – Strassen's matrix multiplication – Convex hull problem. Greedy algorithms: General method – Fractional knapsack – Job sequencing with deadlines – Huffman coding – Minimum cost spanning trees – Single source shortest path problem. Transform and conquer: Binary tree – BST – AVL tree operations – Heaps – Heap sort – Horner's rule.

MOUDLE III **21**

Dynamic programming – General method – Principle of optimality – Making change problem – Assembly line scheduling – 0/1 Knapsack – Travelling salesman problem – Longest common subsequence – Optimal search tree – Matrix chain multiplication – A machine scheduling problem – Case-studies. Back tracking: General method – 8 Queens problem – Sum of subsets – Graph colouring – Hamiltonian problems. Randomization: **Introduction to randomized algorithms -** Random numbers, randomized quick sort, Min cut problem. NP-Completeness and approximation: The class P and NP – Polynomial time reduction – NP-completeness – NP-hard problems – Hamiltonian cycle – Travelling salesman problem – Approximation algorithms.

TOTAL: 45

LIST OF EXPERIEMENTS:

1. Programs on recursive and non-recursive functions.
2. Programs on sorting using various design strategies.
3. Implementations of strassen matrix multiplication algorithm using divide and conquer Technique.
4. Program to find the median of given two arrays using divide and conquer.
5. Program to implement fractional knapsack problem using greedy algorithm design technique.
6. Implementation of activity selection and job sequencing using greedy technique.
7. Implementation of minimum spanning tree using greedy method
8. Implementation of AVL tree and heap using transform and conquer method
9. Implementation of optimal BST using dynamic programming.
10. Program to implement LCS and LPS using dynamic programming.
11. Program to solve the N-Queens problem using backtracking.
12. Implementation of Hamiltonian cycle and travelling salesman problem.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Cormen T H, Leiserson C E and Stein C	Introduction to Algorithms	PHI Learning, Third Edition	2011
2.	Anany Levitin	Introduction to Design and Analysis of Algorithm	Pearson Education, Third Edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jeff Edmonds	How to Think about Algorithms	Cambridge University, First Edition	2014
2.	Dasgupta	Algorithms	Tata McGraw Hill, First Edition	2016
3.	Harsh Bhasin	Algorithms Design and Analysis	Oxford university, First Edition	2016

WEB URLs:

1. www.cs.usfca.edu/~galles/visualization/Algorithms.html
2. www.lcm.csa.iisc.ernet.in/dsa/dsa.html
3. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2012/lecture-notes/
4. www.openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
5. www.nptel.ac.in/course.php

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	-	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

21FE06 INFORMATION STORAGE AND MANAGEMENT

3 1 0 4

PRE-REQUISITES: Database Management Systems

OBJECTIVES:

- To evaluate storage architectures and datacentre elements.
- To describe storage networking technologies such as FC– SAN, IP– SAN, CAS.
- To learn the concepts of different virtualization technologies.
- To understand and articulate business continuity solutions and backup technologies.
- To understand key characteristics, services, deployment models, and infrastructure components.

OUTCOMES:

Learners should be able to

CO1	summarize the overview of data center concepts with storage arrays.	**K2**
CO2	implement various network storage architectures.	**K3**
CO3	analyze methodologies for backup and recovery.	**K4**
CO4	evaluate advanced security issues and technologies for storing and securing databases.	**K4**
CO5	illustrate the efficient strategies like replication, dedupliction with security threats	**K3**

MODULE I **9**

The value of information and data creation to a business – Overview of Data Center infrastructure elements and their requirements – Physical and logical components of host, connectivity and storages – Disk drive architecture and performance – RAID – Different RAID levels (RAID 0, 1, 3, 4, 5, 0+1/1+0 and 6) – Overview of Intelligent Storage System (ISS) – Components of ISS – Implementation of ISS as storage arrays.

MODULE II **21**

DAS Implementation – Overview of SCSI – Architecture, Components. Topologies: FC-SAN , IP – SAN, FCoE, – NAS Overview of Object based storage system – CAS. Application: Long term archiving solution – Unified storage – Block level and File level storage virtualization technologies– processes. Overview of emerging technologies: Cloud service models – Cloud deployment models – Cloud challenge.

MODULE III **21**

Information Availability – Measurement – Downtime: causes – consequences – RTO – RPO – Storage infrastructure: Single point of failure and solution – Backup/Recovery: Purpose, Architecture, Topologies – Local and remote replication: Technologies, Operation – Emerging Technologies: Duplication, Offsite Backup – Introduction to information security – Critical security attributes for information system – Elements of a shared storage model and security extensions – Storage security domains – Common threats in each domain.

TOTAL: 45+15

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Somasundaram G and Alok Shrivastava	Information Storage and Management	John Willey	2012
2.	Anany Levitin	Introduction to Design and Analysis of Algorithm	Pearson Education, Third Edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jeff Edmonds	How to Think about Algorithms	Cambridge University, First Edition	2014
2.	Dasgupta	Algorithms	Tata McGraw Hill, First Edition	2016
3.	Harsh Bhasin	Algorithms Design and Analysis	Oxford university, First Edition	2016

WEB URLs:

1. www.cs.usfca.edu/~galles/visualization/Algorithms.html
2. www.lcm.csa.iisc.ernet.in/dsa/dsa.html
3. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2012/lecture-notes/
4. www.openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
5. www.nptel.ac.in/course.php

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	2	-
CO2	3	3	2	2	2	-	-	-	-	2	-	1	1	-
CO3	3	3	3	2	2	1	-	-	-	3	1	2	1	1
CO4	3	2	3	3	2	2	-	-	-	3	2	2	1	1
CO5	3	3	3	3	3	3	2	2	1	3	3	3	3	2
CO	3	2.6	2.4	2.5	2.25	2	2	2	1	2.4	2	1.8	1.6	1.3

21FE07 INFORMATION RETRIEVAL MANAGEMENT

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To understand the basics of information storage.
- To learn the information retrieval strategies.
- To familiar with neural network concepts.
- To learn the integrating structured data and text.
- To study parallel information retrieval.

OUTCOMES:

Learners should be able to

CO1	illustrate the basic concepts of information storage, retrieval strategies, and structured search.	**K2**
CO2	apply genetic algorithms to solve dataset problems.	**K3**
CO3	examine structured data and text within a relational model.	**K4**
CO4	analyze parallel information retrieval techniques and web search architectures.	**K4**
CO5	**e**xplain the efficiency of query processing and optimization in information retrieval systems.	**K2**

MODULE I **9**

Introduction to Information Storage: Information Storage – Storage Architecture – Data Center Infrastructure – Data Center Environment: Application – DBMS – File system – Storage – Disk Drive Components

MODULE II **21**

Information Retrieval Strategies: Vector Space Model – Probabilistic Retrieval Strategies – Language Models – Inference Network – Extended Boolean Retrieval – Latent Semantic Indexing – Neural Networks – Genetic Algorithms – Fuzzy Set Retrieval. Retrieval Utilities: Relevance Feedback – Clustering – Passage-based Retrieval – N-grams – Regression Analysis – Thesauri – Semantic Networks. Efficiency: Inverted Index – Query Processing – Query Expansion - Signature Files – Duplicate Document Detection.

MODULE III **21**

Integrating Structured Data and Text: Review of Relational Model – A Historical Progression – IR as a Relational Application – Semi-Structured Search using a Relational Schema – Multi-dimensional Data Model – Mediators. Parallel Information Retrieval: Parallel Text Scanning – Parallel Indexing – Clustering and Classification – Searching the Web – Structure of the Web – IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Somasundaram, Gnanasundaram and Alok Shrivastava	1. Information Storage and Management	Wiley, Second Edition	2016
2.	David A Grossman and Ophir Frieder	1. Information Retrieval Algorithms Heuristics	Springer, Second Edition	2004

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Robert R Korfhage	Information Storage and	Wiley, First Edition	2009

WEB URLs:

1. www.nlp.stanford.edu/IR-book/html/htmledition/irbook.html
2. www.doc.ic.ac.uk/~nd/surprise_97/journal/vol4/hks/inf_ret.html
3. www.ncbi.nlm.nih.gov/pmc/articles/PMC3137130/
4. www.text-analytics101.rxnlp.com/2014/11/what-are-n-grams.html
5. www.nlp.stanford.edu/IR-book/pdf/20crawl.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	2	-
CO3	3	3	2	3	2	-	-	-	-	-	-	-	2	-
CO4	3	3	3	3	2	1	-	-	-	-	-	-	1	-
CO5	3	3	2	3	2	-	-	-	-	-	-	-	1	-
CO	3	2.8	2.4	2.4	2	1	**-**	**-**	**-**	**-**	**-**	**-**	**1.4**	**-**

21FE08 MOBILE APPLICATION DEVELOPMENT

3 0 2 4

PRE-REQUISITES: Java Programming

OBJECTIVES:

- To develop knowledge about mobile application development.
- To understand the building blocks of mobile apps.
- To gain knowledge about graphics and animations in mobile apps.
- To know about testing of mobile apps.
- To understand more about how to distribute apps on mobile market place.

OUTCOMES:

Learners should be able to

CO1	clarify the overview of Android, including its states and lifecycle.	**K2**
CO2	apply mobile applications for e-marketing in Android and iPhone environments.	**K3**
CO3	analyze mobile databases and various types of testing techniques.	**K4**
CO4	develop simple Android applications.	**K3**
CO5	implement Android applications in various fields using modern tools.	**K3**

MODULE I **9**

Mobility landscape – Mobile platforms – Mobile apps development – Overview of android platform – Setting up the mobile app development environment along with an emulator – A case study on mobile app development. App user interface designing – Mobile UI resources (Layout, UI elements, Draw-able, Menu) – Activity – States and life cycle – Interaction amongst activities – App functionality beyond user interface – Threads, async task, services – States and lifecycle, Notifications, Broadcast receivers.

MODULE II **21**

Telephony and SMS APIs – Native data handling – On-device file I/O – Shared preferences – Mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). Graphics and animation – Custom views – Canvas – Animation APIs – Multimedia – Audio/video playback and record – Location awareness and native hardware access (sensors such as accelerometer and gyroscope).

MODULE III **21**

Debugging mobile apps – White box testing – Black box testing and test automation of mobile apps –JUnit for android, robotium and monkey talk. Versioning – Signing and packaging mobile apps – Distributing apps on mobile market place. Introduction to objective C – iOS features – UI implementation – Touch frameworks – Location aware applications using core location and map kit –Integrating calendar and address book with social media application – Using WIFI – iPhone market place – Drawbacks on iOS over Android – Various stores available in online market – Configuration of mobile app – Online ecommerce transaction – E-booking transaction.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Develop an application that uses GUI components, font and colors.
2. Develop simple application on Android.
3. Develop a native calculator application.
4. Develop an application that makes use of database.
5. Writing multithread applications.
6. Write an application that draws basic graphical primitives on the screen.
7. Implement an application that writes data to the SD card.
8. Implement audio and graphics support in android.
9. Write a mobile application that creates alarm clock.
10. Develop location services and google maps in Android.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Anubhav Pradhan and Anil V Deshpande	Composing Mobile Apps	Wiley, First Edition	2014

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Barry Burd	Android Application Development All-in-one for Dummies	John Wiley, First Edition	2012

WEB URLs:

1. www.impetus.com/mobility
2. www.cise.ufl.edu/~helal/classes/f10/notes/intro_to_mobile.ppt
3. www.diva– portal.org/smash/get/diva2:626531/FULLTEXT01.pdf
4. www.law.fsu.edu/library/databases/ppt/Androidapps.ppt
5. www.infosys.com/flypp/resources/Documents/mobile-application-testing.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO	**2.8**	**2**	**1.2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**

21FE09 BUSINESS INTELLIGENCE

3 0 0 3

PRE-REQUISITES: Database Management System

OBJECTIVES:

- To learn the BI infrastructure components.
- To understand the need for data integration.
- To identify the goal and primary task of multidimensional modelling.
- To know in detail about the enterprise reporting.
- To study the metrics for business applications.

OUTCOMES:

Learners should be able to

CO1	generalize the components of BI, data integration, and enterprise reporting. (K2)	**K2**
CO2	implement data integration using SSIS and perform multidimensional modeling. (K3)	**K3**
CO3	distinguish between scorecards and dashboards for business insights. (K4)	**K4**
CO4	design enterprise reports using SSRS. (K3)	**K3**
CO5	develop dashboards and scorecards for business insights using real-time metrics	**K3**

MODULE I **9**

Introduction to OLTP and OLAP – BI definitions and concepts – Business applications of BI – BI framework – Role of data warehousing in BI – BI infrastructure components – BI Process – BI technology – BI roles and responsibilities.

MODULE II **21**

Concepts of data integration need and advantages of using data integration – Introduction to common data integration approaches – Introduction to ETL using SSIS – Introduction to data quality – Data profiling concepts and applications. Introduction to data and dimension modelling – Multidimensional data model – ER modelling versus multidimensional modelling – Concepts of dimensions – Facts – Cubes – Attribute – Hierarchies – Star and snowflake schema – Introduction to business metrics and KPIs – Creating cubes using SSAS.

MODULE III **21**

Introduction to enterprise reporting – Concepts of dashboards – Balanced scorecards – Creating dashboards – Scorecard vs. Dashboard – Introduction to SSRS Architecture – Enterprise reporting using SSRS – Case studies – Real time business scenarios – Identify the metrics – Indicators – Business goals.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Prasad P N and Seema Acharya	Fundamentals of Business Analytics	Wiley India, First Edition	2011
2.	David Loshin	Business Intelligence	Morgan Kaufmann Publishers, Second Edition	2012

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mike Biere	The New Era of Enterprise Business Intelligence: Using Analytics to Achieve	Prentice Hall, First Edition	2011
2.	Lynn Langit	Foundations of SQL Server 2005 Business Intelligence	Apress, First Edition	2007

WEB URLs:

1. www.learnbi.com
2. www.techrepublic.com
3. www.nepbusinessdirectory.com
4. www.cio.com / Applications /Business Intelligence (BI)/ Tutorial
5. www.assyst–international.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	2	-	-	-	-	-	-	-	1	-
CO4	3	3	3	3	2	1	-	-	-	-	-	-	1	-
CO5	3	3	3	3	2	-	-	-	-	-	-	-	1	-
CO	3	2.8	2.6	2.4	2	1	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

21FE10 INTERNET OF THINGS

3 0 2 4

PRE-REQUISITES: Database Management System

OBJECTIVES:

- To introduce various design aspects of IoT, its communication models and its general architecture.
- To study the fundamentals of various sensors and its applications.
- To study the various wireless communication technologies used in IoT.
- To know the need of Data analytics and Cloud computing for IoT.
- To familiarize with security requirements and different smart use cases of IoT.

OUTCOMES:

Learners should be able to

CO1	paraphrase the characteristics of IoT, layers of its architecture, communication models, sensor types, enabling technologies, and security features.	**K2**
CO2	make use of the functionalities of sensors, communication technologies, cloud computing, and data analytics in real-life applications.	**K3**
CO3	select appropriate sensors, communication technologies, and IoT platforms based on specifications.	**K4**
CO4	demonstrate interfacing of various sensors with Arduino microcontrollers.	**K3**
CO5	paraphrase the characteristics of IoT, layers of its architecture, communication models, sensor types, enabling technologies, and security features.	**K2**

MODULE I **9**

Definition of IoT – Characteristics of IoT – Physical design of IoT – Logical design of IoT – Communication models and APIs – IoT enabling technologies – General architecture of IoT – Difference between M2M and IoT – Business Scope.

MODULE II **21**

Sensing and Actuation – Sensor fundamentals – Sensor characteristics – Overview of various sensors: Temperature – Pressure – Humidity – Flow – Acceleration – Position – Motion – Vibration – Gas Sensors. Introduction to Smart Sensors – Actuators: Relay – Solenoid – DC motors – Stepper motors – Servo motors – IoT Communication: Device to Device – Device to Gateway and Gateway to Cloud – RFID – NFC – QR – WPAN – Wi-Fi – LPWA – Cellular – LTE-M – Sensor node and Introduction to WSN – Typical IoT network

MODULE III **21**

Enablement platform for IoT applications and analytics – Next generation Clouds for IoT applications and analytics – Emerging field of IoT Data Analytics – Expounding the Edge / Fog Computing paradigm – Security Management of an IoT Ecosystem – Smart use cases of IoT.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Led blink using Arduino UNO.
2. Distance measurement using ultrasonic sensor.
3. To measure temperature and humidity in air using humidity sensor.
4. To detect motion detection using PIR sensor.
5. To measure obstacle detection count using IR sensor.
6. Automatic irrigation using soil moisture sensor.
7. To control a servo motor using Bluetooth module.
8. Interfacing a GSM module for fire detection application.
9. Interfacing a GPS module for obtaining latitude and longitude.
10. Implementing MQTT protocol using Nodemcu-esp8266.
11. Controlling led using Google Assistant (IFTTT).
12. StoringAir temperature for every second in middleware like(Ubidot).

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Arshdeep Bahga and Vijay Madisetti	Internet of things	University Press, Second Edition.	2015
2.	Pethuru Raj and Anupama C Raman	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	CRC Press, First Edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Oliver Hersent, David Boswarthichk and OmarElloumi	The internet of things – Key applications and protocols	John Wiley, First Edition.	2012
2.	Lyla B Das	Embedded Systems	Pearson Education, First Edition.	2013
3.	Dieter Uckelmann, Mark Harrison and Florian Michahelles	Architecting the Internet of Things, Springer publications	Springer Publications, First Edition.	2011
4.	Marco Schwatrz	Internet of Things with Arduino Cookbook	Packt Publications, First Edition.	2016

WEB URLs:

1. www.onlinecourses.nptel.ac.in/noc17_cs22/preview.
2. www.csc2.ncsu.edu/faculty/mpsingh/tutorials/IoT/
3. www.codeproject.com/Learn/IoT/
4. www.tutorialspoint.com/internet_of_things/index.htm
5. www.favoriot.com/blog

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5		PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-		-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	2		-	-	-	-	-	-	-	3	2
CO3	3	3	2	3	2		-	-	-	-	-	-	-	2	2
CO4	3	3	3	3	2		1	-	-	-	-	-	-	2	2
CO5	3	2	2	1	-		-	-	-	-	-	-	-	2	2
CO	**3**	**2.6**	**2.4**	**2**	**2**		**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**	**2**

21FE11 ENTERPRISE APPLICATION

3 0 0 3

PRE-REQUISITES: Database Management System

OBJECTIVES:

- To describe the life cycle methodologies of enterprise application
- To study the business modeling and non-functional requirements
- To explore the enterprise architecture and data representations
- To learn the construction maps and code analysis concepts
- To evaluate the application using different testing methodologies

OUTCOMES:

Learners should be able to

CO1	explain the basic concepts of enterprise applications related to software engineering methodologies.	**K2**
CO2	analyze user requirements and design use case diagrams.	**K4**
CO3	evaluate the concept of code review with different categories of testing.	**K4**
CO4	implement testing methodologies for real-time applications.	**K3**
CO5	conduct experiments related to digital circuits using effective HDL.	**K3**

MODULE I **9**

Introduction to enterprise applications and its types – Software engineering methodologies – Life cycle of raising enterprise applications – Key determinant of successful enterprise applications – Measuring the success of enterprise applications.

MODULE II **21**

Incepting enterprise applications: Enterprise analysis – Business modeling – Requirements elicitation and analysis – Requirements validation – Planning and estimation. Architecting and designing enterprise applications: Views and view points – Enterprise architecture – Logical architecture – Technical architecture – Data architecture and design – Infrastructure architecture and design – Documentation of application architecture and design.

MODULE III **21**

Construction readiness of enterprise applications – Introduction to software construction maps – Construction of solution layers – Methodologies of code review – Static code analysis – Build and testing – Dynamic code analysis. Testing: Types and methods of testing an enterprise application – Testing levels and approaches – Testing environments – Integration testing – System testing – User acceptance testing – Rolling out enterprise applications.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Anubhav Pradhan Satheesh B Nanjappa Senthil K Nallasamy and Veerakumar Esakimuthu	Raising Enterprise Applications: A Software Engineering Perspective	John Wiley, First Edition	2010

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Soren Lauesen	Software Requirements: Styles & Techniques	Addison Wesley, First Edition	2002
2.	Brian Berenbac Daniel J Paulish Juergen Kazmeier and Arnold Rudorfer	Software Systems Requirements Engineering: In Practice	Tata McGraw Hill, First Edition	2009
3.	Vasudeva Varma	Software Architecture: A Case Based Approach	Pearson Education, First Edition	2009
4.	Naresh Chauhan	Software Testing Principles and Practices	Oxford University Press, First Edition	2010

WEB URLs:

1. www.java.sun.com/blueprints/guidelines/designing_enterprise_applications_2e/
2. www.brahms.st.informatik.tu-darmstadt.de/ead12
3. www.cis.ait.asia/course_offerings/49/lecture_notes
4. www.cs.colorado.edu/~kena/classes/7821/f06/lectures/05
5. www.softwaretestingmentor.com/types-of-testing/globalization-testing/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	2	-	-	-	-	-	-	-	1	-
CO4	3	3	3	3	2	1	-	-	-	-	-	-	1	-
CO5	3	3	3	3	2	-	-	-	-	-	-	-	1	-
CO	**3**	**2.8**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

21FE12 SERVICE ORIENTED ARCHITECTURE

3 0 0 3

PRE-REQUISITES: Computer Networks

OBJECTIVES:

- To understand of the basic principles of service orientation.
- To understand service oriented analysis techniques.
- To understand SOA approach and patterns for e-business.
- To learn the concepts service composition, orchestration and choreography.
- To understand various web services specification standards.

OUTCOMES:

Learners should be able to

CO1	illustrate the concepts of service orientation and its architecture.	**K2**
CO2	apply service orientation principles in business and web services.	**K3**
CO3	analyze business scenarios in e-business and various web services specification standards.	**K4**
CO4	design service-oriented applications based on given specifications.	**K3**
CO5	evaluate security, transactions, and orchestration in service-oriented applications	**K4**

MODULE I **9**

Principles of service orientation – Client-server architecture – Distributed internet architecture – SOA characteristics – Anatomy of SOA – Components – Interaction – Technical and business benefits – Multi-channel access – Business process management – Web services – Service descriptions – Messaging with SOAP – Message exchange patterns.

MODULE II **21**

Service oriented architecture – Overview of SOA architecture – Characteristics of SOA, Comparing SOA with client-server and distributed architectures – Benefits of SOA – Service layers – Web services architecture – Enterprise service bus – Service oriented architecture approach – SOA approach and patterns for e-business. Business scenario: Supply chain management – Steps of SOA approach – Technology options – Transport – Service communication protocol – Service description.

MODULE III **21**

Web services – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message exchange patterns – Orchestration – Choreography – WS transactions – Building SOA – Based applications – Service oriented analysis and design – Service modeling – Design standards and guidelines – Composition – WS-BPEL – WS-coordination – WS-policy – WS-security – SOA support in J2EE.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Thomas Erl	Service Oriented Architecture: Concepts, Technology and Design	Pearson Education, Second Edition	2008
2.	Mark Endrel, Jenny Ang and All Arsanjani	Patterns: Service-Oriented architecture and web services	IBM Corporation, First Edition	2004

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Frank P Coyle	XML, Web Services and the Data Revolution	Pearson Education, Second Edition	2002
2.	Ron Schmelzer	XML and Web Services	Pearson Education, First Edition	2008
3.	Eric Newcomer and Greg Lomow	Understanding SOA with Web Services	Pearson Education, Second Edition	2009
4.	Sandeep Chatterjee and James Webber	Developing Enterprise Web Services: An Architect's Guide	Prentice Hall, Second Edition	2004

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1. www.serviceorientation.com/serviceorientation/the_service_orientation_design_paradigm.
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3. www.service-architecture.com/articles/web-services/
4. www.guru99.com/wsdl-web-services-description-language.html
5. www.docs.jboss.org/savara/releases/2.0.x/gettingstartedguide/html/sid-3735782.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	2	3
CO3	3	3	2	3	2	-	-	-	-	-	-	-	2	3
CO4	3	3	3	3	2	1	-	-	-	-	-	-	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	-	2	2
CO	**3**	**2.8**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2.4**

21FE13 OPEN SOURCE TECHNOLOGIES

3 0 2 4

PRE-REQUISITES: Basics of Database and Operating Systems

OBJECTIVES:

- To introduce technological, social, and pragmatic aspects of developing open source software.
- To understand information about free and open source software projects from software releases.
- To understand how to use a version control system and to interface with version control systems used by development communities.
- To provide an exposure to open source Django.
- To understand the concepts of apache web server.

OUTCOMES:

Learners should be able to

CO1	summarize the basics of open sources, open source databases, PHP, and Django.	**K2**
CO2	apply tools, techniques, and strategies of open source technologies.	**K3**
CO3	analyze various open source hardware and open source web servers.	**K4**
CO4	develop an application using Django.	**K3**
CO5	implement open-source hardware-based applications using Raspberry Pi and Arduino.	**K3**

MODULE I **9**

Introduction to open sources – Need to open sources – Advantages of open sources – Application of open sources – LINUX: Introduction – General overview – Kernel mode and user mode – Process – Advanced concepts – Scheduling – Scheduling multiprocessor systems – Personalities – Cloning – Signals – Development with Linux.

MODULE II **21**

Introduction to open source database: Introduction to MySQL – Setting up account – Starting, stopping the MySQL server – Data and time – Sorting query – Database metadata – Creating and using database – Creating and selecting database. PHP: Introduction – Variables – Constants – Data types – Operators – Statements – Functions – Arrays – Object Oriented Concepts – PHP Classes and objects - String Manipulation and regular expression – File handling and data storage – Error handling – Secure e-mail – PHP and SQL database – PHP and LDAP – Connectivity. Sending and receiving e-mails – Debugging and Security – Templates.

MODULE III **21**

Django: Introduction to Django – Templates – Models – Forms – Deploying django – Caching – Integrating with legacy databases and applications – Security. Open Source Hardware: Raspberry pi – Arduino – Building embedded applications with raspberry pi and arduino – Open source 3-D printing. Web server: Apache Web server – Working with web server configuring and using MDA: Introduction to MDA – Meta object facility – UML and UML Profiles – MDA applications – Apache web services.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Text Processing with PERL.
2. Write PERL program to connect with MYSQL database.
3. Simple exercises in PHP.
4. Implementation of a login form using PHP and LAMP Stack
5. GUI PROGRAMMING: GAMBAS
6. Install a samba package to share files and printer (CUPS).
7. Implementation of building and maintaining a RPM Package and serve the package to client system via ftp
8. Install RCS, CVS, SVN version control system and update a package and print the version of it.
9. Set up the complete network interface using if config command – gateway, DNS, IP tables, etc.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Sampathkumar K S	Understanding FOSS	GNU Developers, Fourth Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Matt Welsh, Matthias Kalle Daileimer, Terry Dawson and Lar Kaufman	Running Linux	O'Reilly, Fourth Edition	2006
2.	Carla Schroder	Linux Cookbook	O'Reilly, First Edition	2004

WEB URLs:

1. www.oreilly.com/catalog/opensources/book/toc.html
2. www.dsl.org/cookbook/cookbook_toc.html
3. www.tldp.org/guides.html
4. www.network– theory.co.uk/docs/gcontrol
5. www.sources.redhat.com/autobook

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	2	1	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO	**3**	**2.8**	**2.6**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2.6**

21FE14 CYBER FORENSICS

3 0 0 3

PRE-REQUISITES: Computer Networks

OBJECTIVES:

- To understand about computer forensics and investigations.
- To know about digital evidence and crime.
- To analyze and validate forensics data.
- To know about e-mail investigation.
- To understand about Mobile device forensics.

OUTCOMES:

Learners should be able to

CO1	illustrate various investigation procedures and summarize the duplication of digital evidence.	**K2**
CO2	apply knowledge of digital evidence in forensic investigations.	**K3**
CO3	design and develop forensic tools and analyze network forensics.	**K3**
CO4	demonstrate systematic studies in high-tech forensic practices.	**K3**
CO5	evaluate forensic investigation reports and present expert testimony in high-tech investigations.	**K4**

MODULE I **9**

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach – Procedures for corporate high-tech investigations – Data recovery workstations and software – Conducting an investigation.

MODULE II **21**

Data acquisition – Storage formats for digital evidence – Validating data acquisitions – Processing crime and incident scenes – Identifying digital evidence – Collecting evidence in private-sector incident scenes – Preparing for a search-seizing digital evidence at the scene-storing digital evidence –Reviewing a case – Current computer forensics tools – Software tools – Hardware tools – The macintosh file structure and boot process – Computer forensics analysis and validation – Addressing data – Hiding techniques.

MODULE III **21**

Virtual machines, Network forensics – Developing standard procedures – Live acquisitions – e-mail investigations – Investigating e-mail crimes and violations – Understanding e-mail servers – Cell phone and mobile device forensics – Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Bill Nelson, Amelia Phillips and Christopher Steuart	Computer Forensics and Investigations	Cengage Learning, Fifth Edition	2016

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Eoghan Casey	Handbook of Digital Forensics and Investigation	Academic Press, First Edition	2010
2.	John RVacca	Computer Forensics	Cengage Learning, Second Edition	2005

WEB URLs:

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.phpwww.nptel.ac.in/courses/106101060
3. www.samsclass.info/121/ppt/ch11.ppt
4. www.garykessler.net/library/role_of_computer_forensics.html
5. www.ukessays.com/essays/information-technology/computer-forensics-and-crime-investigations-information-technology-essay.php

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	2	1	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO	**3**	**2.8**	**2.8**	**2.4**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2.6**

21FE15 HUMAN COMPUTER INTERACTION

3 0 0 3

PRE-REQUISITES: Fundamentals of Computers

OBJECTIVES:

- To understand the basic concepts of Human Computer Interaction.
- To understand HCI in software process.
- To be aware of implementation and evaluation techniques.
- To be familiar with HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- To understand the guidelines for user interface.

OUTCOMES:

Learners should be able to

CO1	explain the concepts of computer interaction, web interactions, and lifecycle models.	**K2**
CO2	apply HCI principles for designing multimedia, e-commerce, or e-learning websites.	**K3**
CO3	analyze stakeholder requirements and collaboration models for HCI projects.	**K4**
CO4	design web interfaces according to specified requirements.	**K3**
CO5	evaluate user experience and usability metrics for HCI-based system	**K4**

MODULE I **9**

The Human: I/O channels – Human memory – Reasoning and problem solving. The computer: Text entry devices – Positioning, pointing and drawing – Display devices – Memory – processing and networks; Interaction: Models of interactions – Frameworks – Ergonomics – Interaction styles – Elements of the WIMP interface – Interactivity – Paradigms.

MODULE II **21**

Interactive Design basics – Process of design – Scenarios – Navigation design – Screen design and layout – Iteration and prototyping. HCI in software process: Software life cycle – Usability engineering – Prototyping in practice – Design rationale. Design rules principles, standards, guidelines, golden rules and heuristics. Implementation support: Elements of windowing systems – Programming the application – Using Toolkits – User interface management systems – Evaluation Techniques – Universal Design.

MODULE III **21**

Cognitive models – Socio Organizational issues and stake holder requirements – Communication and collaboration models –Task analysis – Hypertext, Multimedia and WWW – Designing Web Interfaces – Drag and Drop – Direct Selection – Contextual Tools – Overlays – Inlays and Virtual Pages – Process flow. Case Studies.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Alan Dix, Janet Finlay Gregory Abowd and Russell Beale	Human Computer Interaction	Pearson Education, Third Edition	2009
2.	Bill Scott and Theresa Neil	Designing Web Interfaces	O'Reilly Media Inc. First Edition	2009

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Dan R Olsen	Human – Computer Interaction	Cengage Learning, First edition	2010
2.	Andrew Sears and Julie A Jacko	The Handbook of Formal Methods in Human-Computer Interaction	Lawrence Erlbaum Associates, Second Edition	2017

WEB URLs:

1. www.hcibook.com/e3/plain/resources/
2. www.ebook-dl.com/item/designing_web_interfaces_bill_scott_theresa_neil
3. www.uxbooth.com/articles/designing-for-mobile-part-1-information-architecture/
4. www.osmwp.github.io/introduction.html
5. www.fit.mta.edu.vn/files/DanhSach/__Human_computer_interaction.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	2
CO2	-	3	3	-	-	-	-	-	-	3	-	-	2	2
CO3	-	3	3	3	-	-	-	-	-	-	-	-	2	1
CO4	-	-	3	3	3	-	-	-	3	3	-	-	1	-
CO5	-	-	3	3	3	-	-	-	3	3	3	3	2	1
CO	**3**	**2.7**	**2.6**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.8**	**1.5**

21FE16 AGILE METHODOLOGIES

3 0 0 3

PRE-REQUISITES: Software Engineering

OBJECTIVES:

- To understand agile methods and roles.
- To understand the XP lifecycle processing.
- To learn different types of planning and development methodology.
- To be familiarized with development environment.
- To gain knowledge on delivery and cyclicality.

OUTCOMES:

Learners should be able to

CO1	illustrate the concepts of agile software development and Extreme Programming (XP).	**K2**
CO2	examine the releasing, planning, and development phases of XP.	**K4**
CO3	distinguish between globalization, reflection, change, and leadership phases in agile projects.	**K4**
CO4	develop solutions for real-time problems using XP phases and methods.	**K3**
CO5	measure agile software development processes and their impact on project success.	**K4**

MODULE I **9**

Agile development – Agile classification methods – Principles – Project Management – Modeling – Story – Evidence – Scrum: Lifecycle, Work products, roles and practices

MODULE II **21**

Understanding the XP – Life cycle – XP Team – XP concepts – Adopting XP – Theory of constraints – XP prerequisite and recommendation – The challenge of change – Applying XP to a brand new project, existing project, phase – Base organization – Planning – Vision – Release planning – Pair programming – Collaborating – Releasing: No bugs, Version control – Ten minute build, Collective code ownership, Documentation – Planning: Vision, Release Planning – Risk management – Estimating, Developing: Incremental requirements – Customer tests – Refactoring – Incremental design and architecture.

MODULE III **21**

Values and principles – Improve the process – Rely on people – Eliminate waste – Deliver value – Technical excellence – Globalization: Agile approach in global software development – Communication in distributed agile teams. Reflection: Reflection on learning in Agile software development. Change: Transition to an Agile software development environment – Organizational changes. Leadership: Styles – The Agile change leader. Delivery and cyclicality: Reflective session between releases.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Craig Larman	Agile and Iterative Development	Pearson Education, Third Edition	2016

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Orit Hazzan Yael Dubinsky	Agile Software Engineering	Springer International, Second Edition	2014
2.	James Shore and Shane Warden	The Art of Agile Development	O`REILLY, First Edition	2013

WEB URLs:

1. www.agilesoftwareproject– management– podcast.com
2. www.codebetter.com/darrellnorton/2005/02/02/lean– Agile software– development– overview
3. www.sei.cmu.edu/productlines/frame_report/agile_req_eng.htm
4. www.careervarsity.com/careertools/agilesoftwareengineering.ppt
5. www.scribd.com/doc/16103271/Software-Agile.ppt

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	2	2
CO3	-	3	3	3	-	-	-	-	3	-	-	-	1	1
CO4	-	-	3	3	3	-	-	-	-	3	-	-	2	-
CO5	-	-	3	3	3	-	-	-	3	3	3	3	1	1
CO	**3**	**2.7**	**3**	**2.8**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**1.5**	**1.33**

21FE17 SOFTWARE PROJECT MANAGEMENT

3 0 0 3

PRE-REQUISITES: Software Engineering

OBJECTIVES:

- To study the fundamentals of software project Management and various steps.
- To impart the steps involved in the evaluating of a project.
- To learn the concept of software project analysis and activity planning.
- To understand the concepts of change control and contract management.
- To know the concepts of organizational behaviors.

OUTCOMES:

Learners should be able to

CO1	define the basic concepts of software project management and its steps.	**K2**
CO2	calculate project schedules, resources, and evaluations using assessment techniques.	**K3**
CO3	illustrate the utilization of software resources and tools for project management.	**K2**
CO4	design software projects using efficient management tools and techniques.	**K3**
CO5	estimate project variables and synthesize plans for adjustment.	**K3**

MODULE I **9**

Project definition – Contract management – Activities covered by software project management – Plans, methods and Methodologies – Stakeholders – Management control – Traditional versus modern project management practices – Overview of project planning – Stepwise project planning.

MODULE II **21**

Project portfolio management – Evaluation of individual projects – Technical assessment – Cost benefit analysis – Cash flow forecasting – Cost benefit evaluation techniques – Risk evaluation – Project schedule – Sequencing and scheduling activities – Network planning models – Forward pass – Backward pass – Activity float – Shortening project duration – Activity on arrow networks – Categories of Risk – Risk identification – Risk assessment – Risk planning – Risk management – Applying the PERT techniques – CPM techniques.

MODULE III **21**

Creating framework – Collecting the data – Visualizing progress – Cost monitoring – Earned value – Prioritizing – Monitoring – Getting project back to target – Change control – Managing contracts – Introduction – Types of contract – Stages in contract placement – Typical terms of a contract – Contract management – Acceptance – Managing people and organizing teams – Introduction – Understanding behavior – Organizational behavior – Selecting the right person for the job – Instruction in the best methods – Motivation – The Oldham-Hackman job characteristics model – Becoming a team – Decision making – Leadership – Organizational structures – Performance management – Stress – Health and safety – Case studies.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Bob Hughes and Mike Cotterell	Software Project Management	Tata McGraw Hill, Fifth Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Gopalaswamy Ramesh	Managing Global Software Projects	Tata McGraw Hill First Edition	2009
2.	Walker Royce	Software Project Management	Pearson Education Tenth Edition	2013
3.	Kelkar S A	Software Project Management: A Concise Study	PHI Learning Third Edition	2013

WEB URLs:

1. www.at– web1.comp.glam.ac.uk/staff/dwfarthi/projman.htm
2. www.ccca-accje.org
3. www.cs.ox.ac.uk/people/michael.wooldridge/teaching/soft-eng/lect05.pdf
4. www.nptel.com
5. www.tutorialspoint.com

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	2	2
CO3	2	2	1	1	-	-	-	-	-	-	-	1	1	1
CO4	3	2	1	-	-	-	-	1	1	1	2	1	2	-
CO5	3	3	2	1	1	-	-	1	1	1	1	1	1	1
CO	**2.6**	**2**	**1.2**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1.5**	**1**	**1.5**	**1.3**

21FE21 WEB APPLICATION DEVELOPMENT USING JAVA

3 0 4 5

PRE-REQUISITES: Advanced Java Programming

OBJECTIVES:

- To learn the basic fundamental concepts of web application development using java.
- To understand the concepts of Bootstrap and XML.
- To gain knowledge on Servlets and JSP for creating application.
- To learn concepts of Object Relational Mapping for developing web application.
- To understand the concepts of Servlet and JSP with ORM in web applications.

OUTCOMES:

Learners should be able to

CO1	exemplify the principles of frontend web development using Java.	**K2**
CO2	implement Servlets, JSP, and Hibernate for dynamic web page creation.	**K3**
CO3	solve real-world problems by developing dynamic web applications with Java frameworks.	**K3**
CO4	organize backend and deployment techniques for efficient web application design.	**K3**
CO5	conduct experiments using Hibernate for collection and association mapping.	**K4**

MODULE I **9**

HTML – Introduction to HTML and its elements – Layout tags – Semantic tags – Application tags – Logical tags. Introduction to HTML5. CSS: Introduction to CSS – Styles and stylesheets – Formatting with CSS – Links and lists – CSS box model – CSS3. Bootstrap: Introduction to bootstrap – Formatting and styling using bootstrap – Bootstrap grid system

MODULE II **21**

JavaScript: Introduction to javascript – Javascript functions and objects – Javascript validations – Regular expression. XML: Introduction to XML – XML DTD – XML schema. Servlets – Introduction to servlets – Get and post requests – Servlet API and lifecycle – Servlet request and response interfaces – Httpservlet – Requestdispatcher – Httpsession – Cookies and session management – Servlet database interaction.

MODULE III **21**

JSP: Introduction to JSP – JSP API – Scripting elements – Directive elements – Action elements – implicit objects – Java beans in JSP – Cookies and session management. Object/Relational mapping – Approaches to ORM – Introduction to hibernate – Hibernate API – Working with objects – Hibernate 3 with annotations – Querying in hibernate – Hibernate Query Language (HQL) – Criteria queries – Create queries with native SQL – Basic O/R mapping – Collection mapping – Association mappings – Inheritance mapping – Develop a web application using hibernate.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Developing static web pages using HTML.
2. Developing web site using HTML and CSS
3. Developing web site using bootstrap
4. Developing dynamic web pages using java script.
5. Validating web pages using java script
6. Creating XML page with DTD.
7. Developing web application using servlets.
8. Developing web application using JSP.
9. Developing application using ORM framework.
10. Integrating servlet and JSP with ORM.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Paul Deitel, Harvey Deitel and Abbey Deitel	Internet and World Wide Web – How to program	Pearson Education. Fifth Edition	2021
2.	Sharanam Shah and Vaishali Shah	Java EE 6 for Beginners	Shroff Publishers, First Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Santosh Kumar K	Spring and Hibernate	Tata McGraw-Hill, Second Edition	2013
2.	Joel Murach and Michael Urban	Java Servlets and JSP	Pearson Education, Third Edition	2014
3.	Budi Kurniawan	Servlet & JSP: A Tutorial	Brainy Software, Second Edition	2015

WEB URLs:

1. www.w3schools.com/html/html_css.asp
2. www.w3schools.com/xml/default.asp
3. www.tutorialspoint.com/servlets/
4. www.oracle.com/technetwork/java/javaee/jsp/index.html
5. www.javatpoint.com/hibernate-tutorial

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	1	2	2
CO2	3	2	1	1	2	-	-	-	1	1	-	1	2	2
CO3	3	2	1	1	2	-	-	1	1	1	-	1	2	2
CO4	3	2	1	1	2	-	1	1	1	1	1	1	2	2
CO5	3	3	2	1	2	-	-	-	1	1	-	1	2	2
CO	**2.8**	**2**	**1.2**	**1**	**2**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**

21FE19 WEB APPLICATION DEVELOPMENT USING PYTHON

3 0 4 5

PRE-REQUISITES: Advanced Python Programming

OBJECTIVES:

- To learn the basic fundamental concepts of web application development using python.
- To understand the concepts of Bootstrap and XML.
- To gain knowledge on Flask and Jinja2 template.
- To learn concepts of Object Relational Mapping using SQLAlchemy.
- To understand the concepts of Flask SQLAlchemy for developing web applications.

OUTCOMES:

Learners should be able to

CO1	paraphrase the core concepts of web application development using Python. (K2)	**K2**
CO2	implement Python for developing web applications using Flask and Jinja2 templates. (K3)	**K3**
CO3	extrapolate web application behavior and conclude design effectiveness. (K4)	**K4**
CO4	construct web applications with HTML, JavaScript, and XML as per given specifications. (K3)	**K3**
CO5	perform experiments to develop web applications using Flask SQL Alchemy. (K4)	**K4**

MODULE I **9**

HTML: Introduction to HTML and its elements – Layout tags – Semantic tags – Application tags – Logical tags – Introduction to HTML5. CSS: Introduction to CSS – Styles and stylesheets – Formatting with CSS – Links and lists – CSS box model – CSS3. Bootstrap: Introduction to bootstrap – Formatting and styling using bootstrap – Bootstrap grid system.

MODULE II **21**

JavaScript: Introduction to javascript – Javascript functions and objects – Javascript validations – Regular expression. XML: Introduction to XML – XML DTD – XML schema. Flask – Application configuration – HTTP methods – Status code – Routing – Form handling – Request handling – JSON response – Session – Cookie – Templates – Jinja2 – Variable – Filters – Macro – Comments – Escaping – Template inheritance – HTML escaping – Expressions and control structures – Error handling.

MODULE III **21**

SQLAlchemy: Introduction – Connection – Mapping – Declare mapping – Schema – Creating session – Adding and updating objects – Commit & rollback – Query API – Association mapping – Mapping inheritance. Flask SQLAlchemy: Introduction – Configuring flask application with SQLAlchemy – Mapping relationship – Mapping inheritance – CRUD operations.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Developing static web pages using HTML.
2. Developing web site using HTML and CSS
3. Developing web site using bootstrap
4. Developing dynamic web pages using javascript.
5. Validating web pages using javascript
6. Creating XML page with DTD.
7. Developing web application using flask.
8. Developing web application with flask and jinja2 templates.
9. Developing application using SQLAlchemy.
10. Developing web application using Flask SQLAlchemy.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Paul Deitel, Harvey Deitel and Abbey Deitel	Internet and World Wide Web – How to program	Pearson Education. Fifth Edition	2021
2.	Miguel Grinberg	Flask Web Development	O'Reilly Media, Second Edition	2021
3.	Rick Copeland	Essential Sqlalchemy: Mapping Python to Databases	O'Reilly, Second Edition	2016

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Dwyer Gareth	Flask By Example	Packt Publishing, First Edition	2016
2.	Ron DuPlain	Instant Flask Web Development	Packt Publishing, First Edition	2013

WEB URLs:

1. www.w3schools.com/html/html_css.asp
2. www.w3schools.com/xml/default.asp
3. www.docs.sqlalchemy.org/en/latest/orm/tutorial.html
4. www.flask.pocoo.org/docs/1.0/
5. www.flask-sqlalchemy.pocoo.org/2.3/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	1	2	2
CO2	3	2	1	1	2	-	-	-	1	1	-	1	2	2
CO3	3	2	1	1	2	-	-	1	1	1	-	1	2	2
CO4	3	2	1	1	2	-	-	-	1	1	-	1	2	2
CO5	3	3	2	1	2	-	-	-	1	1	-	1	2	2
CO	**2.8**	**2**	**1.2**	**1**	**2**	-	-	**1**	**1**	**1**	-	**1**	**2**	**2**

21FE20 DEVOPS IN JAVA

3 0 4 5

PRE-REQUISITES: Web Application Development Using Java

OBJECTIVES:

- To learn DevOps tools, technologies for MVC based web application.
- To understand the steps of Continuous Integration for web application.
- To learn about automated testing in Jenkins environment.
- To gain knowledge in configuration management for web applications.
- To introduce continuous deployment to test and deploy web applications.

OUTCOMES:

Learners should be able to

CO1	classify the stages in the DevOps lifecycle for Java web applications.	**K2**
CO2	compute deployment strategies using DevOps tools for Java applications.	**K3**
CO3	differentiate the benefits of DevOps in Java application development.	**K4**
CO4	design MVC applications using frameworks aligned with DevOps principles.	**K3**
CO5	structure experiments to deploy Java web applications through DevOps tools.	**K3**

MODULE I **9**

DevOps basics: Understanding DevOps movement – DevOps lifecycle – DevOps tools and technologies. Web application framework: Overview – Architecture – Components – Configuration – Model – View – Controller – Developing MVC applications – Integrating ORM.

MODULE II **21**

Git: Version Control – Repository – Git workflow – Git commands – init, push, pull, commit, clone and log. Continuous integration: Introduction – Installing jenkins – Configuring jenkins server – Setting up build jobs – Understanding projects in java and moving to Jenkins – Creating built-in delivery pipelines – Building pipeline plugin – Deploying a WAR file. Automated Testing: Automating unit tests – Configuring test reports – Code quality and reporting.

MODULE III **21**

Configuration management: Getting started with chef – Overview of hosted chef – Installing and configuring chef workstation – Converging chef node using chef workstation. Docker container, Understanding difference between virtual machines and containers – Installing and configuring docker – Creating a first docker container – Managing containers. Continuous deployment: Implementing automated and continuous deployment – Deploying a web application.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Developing static web site using MVC framework.
2. Developing dynamic web pages using MVC.
3. Developing application using MVC framework with database integration.
4. Continuous integration with jenkins.
5. Developing pipeline using jenkins.
6. Continuous deployment using jenkins.
7. Deploying a web application in docker.
8. Developing cookbooks using chef.
9. Configuration management using chef.
10. Deploying a web application.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mitesh Soni	DevOps for Web Development	Packt Publishing, First Edition	2016
2.	Randy Connolly and Ricardo Hoar	Fundamentals of Web Development	Pearson Edition, Second Edition	2021
3.	Santosh Kumar K	Spring and Hibernate	McGraw-Hill, Second Edition	2013
4.	John Fergusan Smart	Jenkins – The definitive guide: Continuous Integration for the Masses	O'Reilly, First Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Nikhil Pathania	Learning Continuous Integration with Jenkins	Packt Publishing, First Edition	2016
2.	Christophe Vanfleteren, Colin Yates, Marten Deinum, and Seth Ladd	Pro Spring MVC: With Web Flow	Apress, First Edition	2012

WEB URLs:

1. www.docs.spring.io/spring/docs/3.2.x/spring-framework-reference/html/mvc.html
2. www./jenkins.io/doc/
3. www.tutorialspoint.com/jenkins/jenkins_automated_testing.htm
4. www.docs.chef.io/chef_overview.html
5. www.devops.com/continuous-delivery-vs-continuous-deployment/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	-	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

121FE21 DEVOPS IN PYTHON

3 0 4 5

PRE-REQUISITES: Web Application Development Using Python

OBJECTIVES:

- To learn DevOps tools, technologies for MVC based web application.
- To understand the steps of continuous integration for web application.
- To learn about automated testing in Jenkins environment.
- To gain knowledge in configuration management for web applications.
- To introduce continuous deployment to test and deploy web applications.

OUTCOMES:

Learners should be able to

CO1	classify the phases of the DevOps lifecycle for Python-based web applications.	**K2**
CO2	calculate the impact of DevOps tools on Python web application deployment.	**K3**
CO3	focus on the usage of DevOps for Python application development.	**K4**
CO4	design Python-based MVC applications using DevOps tools.	**K3**
CO5	organize experiments to deploy Python web applications using DevOps.	**K3**

MODULE I **9**

DevOps basics: Understanding DevOps movement – DevOps lifecycle – DevOps tools and technologies. Web application framework: Overview – Architecture – Components – Configuration – Model – View – Controller – Developing MVC applications – Integrating ORM.

MODULE II **21**

Git: Version control – Repository – Git workflow – Git commands – init, push, pull, commit, clone and log. Continuous Integration: Introduction – Installing Jenkins – Configuring jenkins server – Setting up build jobs – Understanding projects in python and moving to jenkins. Creating built-in delivery pipelines – Building pipeline plugin – Deploying a WAR file. Automated testing: Automating unit tests – Configuring test reports – Code quality and reporting.

MODULE III **21**

Configuration management: Getting started with chef, Overview of hosted chef – Installing and configuring chef workstation – Converging chef node using chef workstation. Docker container – Understanding difference between virtual machines and containers – Installing and configuring docker. Creating a first docker container – Managing containers. Continuous Deployment: Implementing automated and continuous deployment – Deploying a web application.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Developing static web site using MVC framework.
2. Developing dynamic web pages using MVC.
3. Developing application using MVC framework with database integration.
4. Continuous integration with jenkins.
5. Developing pipeline using jenkins.
6. Continuous deployment using jenkins.
7. Deploying a web application in docker.
8. Developing cookbooks using chef.
9. Configuration management using chef.
10. Deploying a web application.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mitesh Soni	DevOps for Web Development	Packt Publishing, First Edition	2016
2.	Adrian Holovaty and Jacob K. Moss	The Definitive Guide to Django: Web Development Done Right	Apress, Second Edition	2013
3.	John Fergusan Smart	Jenkins – The definitive guide: Continuous Integration for the Masses	O'Reilly, First Edition	2011
4.	Mischa Taylor and Seth Vargo	Learning Chef	O'Reilly, First Edition	2014
5.	Adrian Mouat	Using Docker: Developing and Deploying Software with Containers	O'Reilly, First Edition	2014

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Nikhil Pathania	Learning Continuous Integration with Jenkins	Packt Publishing, First Edition	2016
2.	Arun Ravindran	Django Design Patterns and Best Practices	Packt Publishing, Second Edition	2021
3.	Matthias Marschall	Chef Infrastructure Automation Cookbook	Packt Publishing, Second Edition	2015

WEB URLs:

1. www.docs.djangoproject.com/en/2.1/
2. www.jenkins.io/doc/
3. www.tutorialspoint.com/jenkins/jenkins_automated_testing.htm
4. www.docs.chef.io/chef_overview.html
5. www.devops.com/continuous-delivery-vs-continuous-deployment/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	-	-	-
CO2	3	2	1	1	1	-	-	-	1	1	-	1	2	1
CO3	3	3	2	1	-	-	-	-	1	1	-	-	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	1	-	-	2	1
CO	**2.8**	**2**	**1.2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**2**	**1**

21FE22 ADVANCED ALGORITHMS

3 0 4 5

PRE-REQUISITES: Data Structures and Design Analysis of Algorithms

OBJECTIVES:

- To learn programming and mathematical backgrounds for design and analysis of algorithm.
- To study the concept of designing an algorithm.
- To have a complete understanding of the various advanced data structures.
- To learn and implement advanced algorithms using appropriate design techniques.
- To inculcate advanced graph algorithms and applications.

OUTCOMES:

Learners should be able to

CO1	classify advanced data structures and algorithm design techniques.	**K2**
CO2	calculate the efficiency of algorithmic approaches using advanced data structures.	**K3**
CO3	exemplify the application of algorithm paradigms to solve engineering problems.	**K3**
CO4	design efficient algorithms to address complex computational problems.	**K3**
CO5	outline and demonstrate advanced algorithm design techniques to assess performance.	**K4**

MODULE I **9**

Programming language backgrounds: STL in C++ – Data structures support in python. Mathematical backgrounds: Logarithmic exponentiation – Efficient prime factorization – Combinatorics – Sieve of eratosthenes – Geometry – Co-ordinate compression – Binomial coefficients – Euclid's extended algorithm – Line intersections – Probability – Modular multiplicative inverse – Matrix exponentiation –Miller rabin primality test – Heavy light decomposition – Convex hull – Hungarian algorithm –Sweepline algorithm – Gaussian algorithm – Pollard rho factorization – Euler's totient function – Burnside lemma.

MODULE II **21**

Recursion – Dynamic programming – Backtracking – Branch and bound – Suffix automata – Game theory – Meet in the middle – Arbitrary precision integer – Square root decomposition. Knapsack problem – Stable marriage problem – N-queen problems – Tug of wars – Sudoku problem. Advanced Trees: Binary indexed tree – Segment tree – Lowest common ancestors – Counting inversions – Suffix tree – Interval tree – Sparse table – K-D tree – Treap – Link/cut tree.

MODULE III **21**

Advanced Graph Algorithms: Union find/disjoint set – Cycle detection – Bellman ford – Maxflow –Ford-fulkerson – Edmonds karp algorithm – Min cut – min cost flow – Dinic's algorithm – Maximum bipartite matching – Topological sorting – Eulerian & hamiltonian paths – Graph coloring – Blossom's algorithm – Jarvis algorithm – Graham Scan – Johnson's algorithm. Searching and pattern matching: Rabin-karp algorithm – Z-algorithm – Aho-corasick string matching algorithm – Manacher's algorithm – Kasai's algorithm – Levenshtein distance. Sorting: Quick select.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Programs to solve problems using STL.
2. Programs to solve geometric problems.
3. Programs on convex-hull optimization.
4. Programs on dynamic programming.
5. Programs involves backtracking methods.
6. Programs involve segment tree.
7. Implementation of k-d Tree.
8. Implementation of finding lowest common ancestors.
9. Program on detecting cycle in a graph.
10. Programs involve topological sorting.
11. Implementation of graph coloring.
12. Implementation of pattern matching algorithms.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Cormen T H, Leiserson C E, Rivest RL and Stein C	Introduction to Algorithms	PHI Learning, Third Edition	2012
2.	Yonghui Wu and Jiande Wang	Data structure Practice for Collegiate Programming Contests and Education	CRC Press, First Edition	2016
3.	Steven Halim and Felix Halim	Competitive Programming, The New Lower Bound of Programming Contests	Lulu publication, Third Edition	2013

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jon Kleinberg and Eva Tardos	Algorithm design	Pearson Education, First Edition	2012
2.	Jeff Edmonds	How to Think about Algorithms	Cambridge University Press, First Edition	2014
3.	Anany Levitin	Introduction to Design and Analysis of Algorithm	Pearson Education, Third Edition	2017

WEB URLs:

1. www.cpbook.net/methodstosolve
2. www.codechef.com/certification/prepare#foundation
3. www.people.cs.clemson.edu/~bcdean/dp_practice/
4. www.infoarena.ro/blog/meet-in-the-middle
5. www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-854j-advanced-algorithms-fall-2005/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	1	1
CO2	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO3	3	2	1	-	2	-	-	-	2	1	-	1	1	1
CO4	3	3	2	1	2	-	-	-	2	2	-	1	2	2
CO5	3	3	2	1	2	-	-	-	2	2	-	1	2	2
CO	**2.8**	**2.2**	**1.5**	**1**	**1.7**	-	-	-	**1.6**	**1.4**	-	1	**1.6**	**1.4**

21FE223 ADVANCED PYTHON PROGRAMMING

3 0 4 5

PRE-REQUISITES: Python Programming

OBJECTIVES:

- To learn the basic fundamental concepts of advanced python programming.
- To be comfortable using the collections API and Decorators in Python.
- To learn about Unit Test module and creating test case in Python
- To gain knowledge about JDBC CRUD operations and database exception handling in Python.
- To apply how to handle modules concepts in Python

OUTCOMES:

Learners should be able to

CO1	paraphrase the advanced concepts in Python programming.	**K2**
CO2	implement advanced Python concepts to develop real-world applications.	**K3**
CO3	synthesize Python programming concepts to solve complex programming problems.	**K3**
CO4	construct applications using Python's file, thread, and database modules.	**K3**
CO5	perform experiments using PyUnit and collections for a given problem.	**K4**

MODULE I **9**

File I/O – Text files – File modes – Reading and writing files – Object serialization. Multithreading: Introduction to multithreading – Process Vs Thread – Thread life cycle – The threading module – Thread class – Thread creation – Thread control – Thread synchronization – Multithreaded priority queue.

MODULE II **21**

Python database connectivity: About cx_oracle package – Creating and closing database connection – Creating and closing cursor – Executing DDL and DML – Commit, rollback and savepoint – Data binding in query string – Calling functions and procedures – Handling database errors. PyUnit: Introduction to unittest module – Test fixtures – Test Case – Assert functions – Skipping and Ignoring test case – Test suite – Test runner.

MODULE III **21**

Python Collections API: OrderedDict – Defaultdict – Counter – Namedtuple – Deque. Decorators: Simple function decorators – Classes as Decorators – Chained Decorators – Decorator arguments. Python Modules: Random module – Math and time modules – re module – Using match and search functions – Working with match objects – Other re-module functions.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Implementation of file handling operations in python.
2. Implementation of object serialization in python.
3. Implementation of user define threading to handle more than one function.
4. Develop database applications using cx_Oracle module.
5. Implementation of pyunit in python.
6. Implementation of collection in python.
7. Develop a function and class decorators in python.
8. Create and import modules and packages.
9. Implementation of math and time modules.
10. Implementation of re module functions.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Allen B. Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly, Second Edition	2016
2.	Guido van Rossum and Fred L. Drake Jr	An Introduction to Python Revised and updated for Python 3.x	Network Theory, First Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mark Lutz	Learning Python	O'Reilly Media, Fifth Edition	2013
2.	Mark Summerfield	Programming in Python 3	Pearson Education Second Edition	2021
3.	Doug Hellmann	The Python 3 Standard Library by Example	Pearson Education, Second Edition	2021

WEB URLs:

1. www.docs.python.org/3.5/
2. www.programiz.com/python-programming
3. www.pythonspot.com/
4. www.tutorialedge.net/python/pyunit
5. www.pythonforbeginners.com/api/list-of-python-apis

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	1	-	1	1	-	1	2	2
CO2	3	2	1	-	1	-	1	-	1	1	-	1	2	1
CO3	3	2	1	-	1	-	1	-	1	1	-	1	2	1
CO4	3	2	1	-	1	-	-	-	1	1	-	1	2	2
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	2
CO	**2.8**	**2**	**1.3**	**1**	**1**	**-**	**1**	**-**	**1**	**1**	**-**	**1**	**2**	**1.6**

21FE24 ADVANCED DATABASE MANAGEMENT SYSTEMS

3 0 4 5

PRE-REQUISITES: Database Management System

OBJECTIVES:

- To understand the basics of storage and environment structure.
- To learn about the user security and concurrency control (SQL).
- To know about different backup and recovery techniques.
- To gain knowledge in PL/SQL programming.
- To provide knowledge in PL/SQL procedures, functions and packages.

OUTCOMES:

Learners should be able to

CO1	define the key components and role of a DBA in database management systems.	**K2**
CO2	illustrate storage structures and relationships used in databases.	**K2**
CO3	organize and optimize database management tools and processes.	**K4**
CO4	design and implement PL/SQL programs to manage database functions.	**K3**
CO5	structure solutions to integrate PL/SQL programs with Oracle cursors for database management.	**K3**

MODULE I **9**

Introduction: Tasks of a DBA – Oracle architectural components – DBA tools – DBA users – Basic sql* plus commands – Create a database using DBCA (Database Configuration Assistant) – Setting database initialization parameter files – Starting up a database (4 stages) – Alter database commands – Shutting down options – Monitoring an oracle instance using diagnostic files – Creating a database manually – Data dictionary and dynamic performance views – Maintaining the control file – Redo log files – Sizing of data files – Table spaces.

MODULE II **21**

Storage structure and relationships: Managing undo data – Managing users – Managing privileges, roles, tables-table partitioning – Managing password security and constraints – Managing profiles – Bitmap indexes – Locking mechanism – To lock and unlock user accounts. Overview of listener process – LSNRCTL commands – Oracle net services client-side configuration – Identify the importance of checkpoints – Backup and recovery concepts – Hot backup – Cold backup – Performing flashback – Recovering from non-critical loses – RMAN backups – Portioning a disk – Transporting data between databases (import and export) – SQL Tuning and full-table scans.

MODULE III **21**

PL/SQL overview – Environment – Basic syntax – Data types – Variables and scope – Constant declaration comment – Server output ON-records – Operators – Conditional control – loop statements – Sequential control case statement – Transaction – Strings – Arrays – Functions – Data and time – Object oriented-parameters. PL/SQL cursors: Implicit cursors – Explicit cursors – For loop cursors – Parameterized cursors – Exceptions: User defined exception – User named exception – Procedures – Packages – Triggers – Types of triggers – Oracle forms: Create a form using a form builder – Oracle reports – Creating reports using a report builder.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Create a database manually in oracle 10g.
2. Creating and manipulating users, Profiles, roles and security credentials.
3. Managing Control files, Redo log Files, Data files, Alert log files.
4. Managing Table spaces.
5. Managing Table Partitions.
6. Recovery techniques
    a. Flashback Technology
    b. HOT and COLD backup
    c. RMAN backup
    d. EXPORT/IMPORT tables, databases, schemas, table spaces
7. PL/SQL
    a. (a)Looping Statement
    b. (b)Arrays
    c. (c)Records
    d. (d)Cursors
8. PL/SQL Procedures and Functions.
9. PL/SQL Triggers, Collections and Packages.
10. Design and Implementation of Employee Information System using Oracle Forms and Reports.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Sam R Alapati	Expert Oracle Database 11g Administration	Apress, First Edition	2009
2.	Scott Urman	Oracle Database 10G Pl/Sql Programming	Tata McGraw-Hill, First Edition	2008

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Bob Bryla	Oracle Database 12c DBA Handbook	Tata McGraw Hill, First Edition	2015
2.	Ian Abramson, Michael Abbey and Michael J	Oracle Database 11g, A Beginner"s Guide	Oracle Press, First Edition	2008
3.	Steven Euerstein and Bill Pribyl	Oracle PL/SQL Programming	O'Reilly Media, Sixth Edition	2014

WEB URLs:

1. www.oracle-dba-online.com
2. www.dba-oracle.com/concepts
3. www.pluralsight.com/courses/oracle-database-12c-fundamentals
4. www.plsqlchallenge.com
5. www.techonthenet.com/oracle/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	1	-	1	-	-
CO2	1	1	1	-	1	-	-	-	1	1	-	1	1	-
CO3	3	3	2	1	1	-	-	-	2	2	-	1	2	-
CO4	3	2	1	-	2	-	-	-	2	2	-	1	-	-
CO5	3	2	1	-	2	-	-	-	2	2	-	1	2	2
CO	**2.4**	**1.8**	**1.2**	**1**	**1.4**	-	-	-	**1.6**	**1.6**	-	**1**	**1.6**	**2**

21FE25 CODE OPTIMIZATION TECHNIQUES

3 0 2 4

PRE-REQUISITES: Nil

OBJECTIVES:

- To understand the concepts of translation languages.
- To introduce the concept and techniques of various optimization techniques.
- To understand operations of code optimization methods and operations.
- To understand the concept of code generation.
- To understand the concept of inter-procedural analysis.

OUTCOMES:

Learners should be able to

CO1	paraphrase the basic concepts of code optimization and language processors.	**K2**
CO2	implement code optimization techniques to enhance performance in coding problems.	**K3**
CO3	modify existing code using optimization techniques for improved efficiency.	**K3**
CO4	design and generate optimized code for various computational problems.	**K3**
CO5	focus on the application of code generation techniques to solve complex problems.	**K4**

MODULE I **9**

Language processors – The structure of a compiler – The evolution of programming languages – The science of building a compiler – Applications of compiler technology programming language basics – The lexical analyzer generator – Parser generator – Overview of basic blocks and flow graphs – Aggregated data structures – Control flows – Procedures – Objects – Optimization of basic blocks – Principle sources of optimization – Importance of individual optimizations – Order and repetition of optimizations – Code optimization and tuning techniques.

MODULE II **21**

Optimization in design level and source code level – Code size reduction – De-optimization – De-optimization to reduction code – Continuous program optimization – Optimization for power consumption – Profit driven optimization – Early optimizations: Constant – Expression evaluation – Scalar replacement of aggregates – Algebraic simplifications and re-association – Value numbering – Copy propagation –Sparse conditional constant propagation – Redundancy elimination – Loop optimizations – Procedure optimizations – Register allocation – Code scheduling – Control flow and low – Level optimizations.

MODULE III **21**

Code Generation: Introduction – Issues in the design of a code generator – The target machine – Run time storage management – Basic blocks and flow graphs – A simple code generator – Register allocation and assignment – The DAG representation of basic blocks – Peephole optimization – Generating code from DAGs – Dynamic programming code generation algorithm – Code generator generators – Inter procedural analysis: Basic concepts – Need for Interprocedural analysis – A logical representation of data flow – A simple pointer – Analysis algorithm – Context insensitive interprocedural analysis – Context – Sensitive pointer analysis – Data log implementation by binary decision diagrams.

TOTAL: 45

LIST OF EXPERIMENTS:

2. Programs to optimize the code using basic blocks.
3. Implementation of codes using different optimization and tuning techniques.
4. Optimize the code using different programming languages using optimization techniques.
5. Programs on common sub expression elimination technique.
6. Programs on constant expression evaluation technique.
7. Programs on loop optimization techniques.
8. Programs on peephole optimization techniques.
9. Implementation of code using value numbering locally and globally.
10. Programs on algebraic simplification and reassociation.
11. Programs on deoptimization techniques.
12. Programs on alias analysis optimization technique.
13. Implementation of programs using DAGs.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D and Ullman	Compilers: Principles Techniques and Tools	Pearson Education, Second Edition	2008
2.	Steven S and Muchnick Morgan Kaufmann	Advanced Compiler Design and Implementation	Elsevier, First Edition	2003

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Randy Allen and Ken Kennedy	Optimizing Compilers for Modern Architectures: A Dependence– based Approach	Morgan Kaufmann Publishers, First Edition	2015
2.	David Galles	Modern Compiler Design	Pearson Education, Fourth Edition	2009

WEB URLs:

1. wwwx.cs.unc.edu/~pozefsky/Fall08/CodeOptimizationTechniques.html.
2. www.viva64.com/en/t/0084/.
3. www.tutorialspoint.com/compiler_design/compiler_design_code_optimization.htm
4. www.nptel.ac.in/courses/106108052/.
5. www.javacodegeeks.com/2011/07/java-tools-source-code-optimization-and.html.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	1	1
CO	**2.6**	**2**	**1.5**	**1**	-	-	-	-	-	-	-	-	**1**	**1**

21FE26 ETHICAL HACKING

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To learn various hacking techniques and attacks.
- To know how to protect data assets against attacks from the internet and assess also measure threats to information assets.
- To understand the benefits of strategic planning process.
- To perform penetration tests into secure networks for evaluation purposes.
- To enable students to understand issues associated with the nature of forensics.

OUTCOMES:

Learners should be able to

CO1	illustrate the basic concepts of ethical hacking, networking, and cyber forensics.	**K2**
CO2	exploit vulnerabilities in computer systems and networks using advanced tools and technologies.	**K3**
CO3	discriminate various attacks to protect data and secure computer networks.	**K4**
CO4	apply security mechanisms to defend against cyber threats and network attacks.	**K3**
CO5	evaluate cybersecurity frameworks, intrusion detection systems, and forensic methodologies.	**K4**

MODULE I **9**

Single hacking windows – Network hacking – Web hacking – Password hacking – A study on various attacks – Input validation attacks – SQL injection attacks – Buffer overflow attacks – Privacy attacks.

MODULE II **21**

Single TCP/IP – Checksums – IP spoofing port scanning – DNS spoofing – DoS attacks – SYN attacks – Smurf attacks – UDP flooding – DDOS – Models – Firewalls – Packet filter firewalls – Packet inspection firewalls – Application proxy firewalls – Batch file programming – Fundamentals of computer fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic planning process.

MODULE III **21**

Architecture strategies for computer fraud prevention – Protection of web sites – Intrusion detection system – NIDS – HIDS – Penetrating testing process – Web services – Reducing transaction risks – Forensics – Computer forensics – Journaling and it requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and novelty detection.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Ankit Fadia	Ethical Hacking	Macmillan India Ltd, Second Edition	2010
2.	Kenneth C Brancik	Insider Computer Fraud	Auerbach Publications, Taylor & Francis, First Edition	2008

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Ec-Council	Ethical Hacking and Countermeasures: Attack Phases	Delmar Cengage Learning, First Edition	2009
2.	Patrick Engebretson	The Basics of Hacking and Penetration Ethical Hacking and Penetration Easy	Syngress Media, Second Revised Edition	2013

WEB URLs:

1. www.tutorialspoint.com/ethical_hacking/index.htm
2. www.guru99.com/ethical-hacking-tutorials.html
3. www.hacking-tutorial.com/#sthash.3UsKiALy.dpbs
4. www.go4expert.com/articles/ethical-hacking-basics-class-part-1-t11925/
5. www.udemy.com/penetration-testing/.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	-	3	3	3	-	-	-	-	3	-	-	-	-	-
CO4	-	-	3	3	3	-	-	-	-	3	-	-	-	-
CO5	-	-	3	3	3	-	-	-	3	3	3	3	-	-
CO	**3**	**2.7**	**3**	**2.8**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**-**	**-**

21FE27 ARTIFICIAL INTELLIGENCE

3 1 0 4

PRE-REQUISITES: Knowledge on Statistics, Calculus and Matrix Algebra

OBJECTIVES:

- To understand the role of intelligent agents.
- To learn uninformed and informed search strategies.
- To learn to represent knowledge effectively using first order logic.
- To understand planning problems.
- To familiar the application of AI in the real world.

OUTCOMES:

Learners should be able to

CO1	represent intelligent agent systems and demonstrate problem-solving strategies.	**K2**
CO2	describe adversarial search and solve constraint satisfaction problems.	**K3**
CO3	develop inferences using propositional logic and first-order logic.	**K4**
CO4	explain various knowledge representation methods used in ai applications.	**K4**
CO5	organize knowledge of machine learning methods to explore real-world ai solutions.	**K4**

MODULE I **9**

Introduction – Definition – Future of artificial intelligence. Intelligent agents: Agents and environments – The concept of rationality – Nature of environments – Structure of agents.

MODULE II **21**

Problem solving agents – Example problems – Searching for solutions – Uninformed search strategies – Searching with partial observations – Informed (heuristics) search strategies – Heuristics functions – Local search algorithms and optimization Problems – Online search agents and unknown environments – Game playing – Optimal decisions in games – Alpha-beta pruning – Stochastic games – Constraint satisfaction problems – Constraint propagation – Backtracking search – Local search – Syntax and semantics of first order logic – Using first order logic – Knowledge engineering in first order logic – Unification and lifting – Forward chaining – Backward chaining – Resolution.

MODULE III **21**

Planning problem – Algorithms for planning as state space search – Planning graphs – Classical planning approaches – Analysis of planning approaches – Planning time, Schedules and resources – Hierarchical planning – Planning and acting in nondeterministic domain – Multiagent planning. AI applications – Forms of learning – Supervised learning – Learning decision trees – Regression and classification with linear models.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Russell and Norvig P	Artificial Intelligence: A Modern Approach	Prentice Hall, Third Edition	2015

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Tim Jones M	Artificial Intelligence: A Systems Approach (Computer Science)	Jones and Bartlett Publishers, Inc First Edition	2008
2.	Ethem Alpaydin	Introduction to Machine Lerning (Adptive Computation and Machine Learning Series)	The MIT Press, Second Edition	2009
3.	David L Poole and Alan K Mackworth	Artificial Intelligence: Foundations of Computational Agents	Cambridge University Press, Second Edition	2017
4.	Deepak Khemani	Artificial Intelligence	Tata McGraw Hill, First Edition	2013

WEB URLs:

1. www.stpk.cs.rtu.lv/sites/all/files/stpk/materiali/MI/Artificial%20Intelligence%20A%20Modernn%20Approach.pdf
2. www.philosophy.wisc.edu/lang/AIEthics/
3. www.anzaq.com/2013/11/download-artificial-intelligence-modern.html
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5. www.drive.google.com/file/d/0B2wQvc_jNVbceEpMNGg4R3NrSDg/edit?pref=2andpli=1

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	-
CO3	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO4	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO	**2.8**	**2.4**	**1.75**	**1**	-	-	-	-	**2**	**2**	-	-	-	-

21FE28 MAINFRAME COMPUTING

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To understand the basics and operating mechanisms of mainframe systems.
- To learn the system capacity and several servers.
- To learn the various features of z/OS.
- To understand the application programming and system programming on z/OS.
- To understand the system management and autonomic computing.

OUTCOMES:

Learners should be able to

CO1	define mainframe computing concepts and methods for accessing large data.	**K2**
CO2	apply scalability concepts to solve problems in mainframe computing.	**K3**
CO3	focus on system management and autonomic computing principles.	**K4**
CO4	design solutions for mainframe data handling using best practices.	**K3**
CO5	organize mainframe system components for optimal management and performance.	**K4**

MODULE I **9**

MainFrame: Mainframe concepts – An evolving architecture mainframe computer users factors – Contributing to mainframe use – Mainframe workloads.

MODULE II **21**

Capacity : Capacity – Elements of a system required for capacity – Few server vs many server – Service level agreement – Managing the system to the SLA – Architecture, running work and capacity – Several servers on one physical machine – Parallel sysplex and its measurements – Scalability, integrity and security – Introduction to scalability – Scalability concepts – Scalability implementation on IBM system – Integrity – Security – Introduction to availability – Inhibitors to availability – Redundancy – z/OS elements for availability – Disaster recovery.

MODULE III **21**

Accessing large amount of data : Introduction – Channel subsystem – Control unit – DASD CKD architecture and DASD subsystem – Multiple allegiance/parallel access volumes – Database and data sharing – Data placement and management – System management and autonomic computing – Introduction – System data – Configuration management – Operating management – Performance management – Problem management – Introduction to autonomic computing – Self healing – Self protecting – Self optimizing.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mike Ebbers,Frank Byrne, Pilar Gonzalez Adrados,Rodney Martin and Jon Veilleux	Redbook – Introduction to Mainframe - Large Scale Commercial Computing	IBM Corp., First Edition	2006
2.	Lydia Parziale, Edi Lopes Alves, Klaus Egeler, Clive Jordan	Introduction to the New Mainframe : z/VM Basics	IBM Redbooks, First Edition	2007

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Gary Deward Brown	JCL Programming Bible (with z/OS)	Wiley India dream tech, Fifth Edition	2002
2.	John Kettner, Mike Ebbers, Wayne O'Brien, Bill Ogden	Introduction to the New Mainframe: z/OS Basics	IBM Redbooks, Third Edition	2011

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1. www.ibm.com/support/docview.wss?uid=pub1sa22759706
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4. www.princeton.edu/~achaney/tmve/.../Mainframe_computer.html
5. www.mainframegurukul.com/ibm/what– is/mainframe– computer.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	1	-	-	2	-	-	-	-	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	1	-	-	-	-	-	-	-	-	-	2	2
CO	**2.4**	**1.8**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1.8**	**1.8**

21FE29 USER INTERFACE DESIGN

2 0 0 2

PRE-REQUISITES: Nil

OBJECTIVES:

- To learn the principles and fundamentals of user interface design.
- To analyze principles related to collaborative or social software.
- To establish target users, functional requirements, and interface requirements for a given computer application.
- To understand user interface design principles, and apply them to designing an interface.
- To learn user interface designs through usability inspection and user models.

OUTCOMES:

Learners should be able to

CO1	paraphrase the principles of user interface design and the design process.	**K2**
CO2	construct user interfaces using design process techniques to meet functional requirements.	**K3**
CO3	classify testing methods to evaluate the effectiveness of user interface designs.	**K4**
CO4	design user interfaces based on usability principles and target user needs.	**K3**
CO5	perform user testing and analyze feedback to refine user interfaces.	**K4**

MODULE I **6**

The importance of user interface design – Defining the user interface – Importance of good design – The graphical user interface – The web user interface: Popularity – Characteristics – Principles of user interface design.

MODULE II **12**

The user interface design process: Usability – Important human characteristics in design – Human considerations in design – Human interaction speed – Business definition and requirements analysis – Determining basic business functions – Human considerations in screen design – Technological considerations in interface design – Structures of menus – Functions of menus – Content of menus – Formatting of menus – Phrasing the menu – Navigating menus – Kinds of graphical menus – Window characteristics – Components – Window presentation styles type – Window management – Operations.

MODULE III **12**

Characteristics of device based controls – Selecting the proper device – Based controls – Selection controls – Presentation controls – Text for web pages – Providing the proper feedback – Guidance and assistance – International considerations – Accessibility – Icons – Multimedia – Colors – Organizing and laying out screens – The purpose of usability testing – Importance – Prototypes – Kinds of tests – Developing and conducting the test – Analyze , Modify and Retest – Evaluate the working system.

TOTAL: 30

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Wilbent. O. Galitz	The Essential Guide To User Interface Design	John Wiley& Sons ,Third Edition	2007

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Wilbent. O. Galitz	The Essential Guide To User Interface Design	John Wiley & Sons, Second Edition	2001
2.	John Kettner, Mike Ebbers, Wayne O'Brien, Bill Ogden	Introduction to the New Mainframe: z/OS Basics	IBM Redbooks, Third Edition	2011

WEB URLs:

1. www.awwwards.com/web-ui-design-best-practices-free-ebook.html
2. www.wps.aw.com/wps/media/objects/524/536701/ch15.ppt
3. www.slideshare.net/vicci4041/user-interface-design-ppt
4. www.webdesign.tutsplus.com/categories/ui-design
5. www.ics.uci.edu/~taylor/ics52_fq01/UISlides.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	2	2	-	1	2	1
CO2	3	2	1	-	2	-	-	-	2	2	-	2	2	1
CO3	3	3	2	1	2	-	-	-	1	1	-	1	2	1
CO4	3	2	1	-	2	-	-	-	1	1	-	2	2	1
CO5	3	3	2	1	1	-	-	-	1	1	-	1	2	1
CO	**2.8**	**2.2**	**1.5**	**1**	**1.6**	**-**	**-**	**-**	**1.4**	**1.4**	**-**	**1.4**	**2**	**1**

21FE30 DATA SCIENCE AND BIG DATA ANALYTICS

3 0 2 4

PRE-REQUISITES: Nil

OBJECTIVES:

- To learn about fundamentals of big data.
- To understand basic concepts of NoSQL.
- To be familiar with mongoDB streams.
- To learn map reduce environment for data analysis.
- To understand basic R-Language techniques.

OUTCOMES:

Learners should be able to

CO1	define the fundamentals of big data, nosql, and r language techniques.	**K2**
CO2	compute solutions to big data problems using map-reduce concepts and r-language techniques.	**K3**
CO3	compare queries in rdbms and mongodb to determine the most efficient solution.	**K4**
CO4	design solutions using nosql databases and mongodb for data analysis tasks.	**K3**
CO5	implement and manage big data analytics tools to solve complex problems.	**K3**

MODULE I **9**

Introduction to Big Data – Challenges with Big Data – Volume – Velocity – Varity – Why Big Data – Big data analytics: Big data analytics – Classification of analytics – Top challenges facing big data – Important – Data science – Terminologies used in big data – Open source tools

MODULE II **21**

NoSQL: NoSQL – Why NoSQL – SQL vsNoSQL –Hadoop: Hadoop – History – Overview – Features of Hadoop – Versions – Hadoop versus SQL – RDBMS versus HADOOP – Distributed computing challenges – HDFS – Processing data with Hadoop: MapReduce Daemons – YARN – Interacting with Hadoop Ecosystem. Introduction to MongoDB – Why MongoDB – Terms used in RDBMS and MongoDB – Data types in MongoDB – MongoDB Query Language: (Create, Read, Update, Delete, Insert, Save (), Count, Limit, Sort, Skip) – MapReduce function – Aggregate function

MODULE III **21**

Introduction to MAPREDUCE Programming: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression – Hive: Hive – Hive Architecture – Hive Datatypes, Pig: Feature of PIG – PIG on Hadoop – PIG Philosophy – R Language Introduction: Assignment to objects – Creating simple objects – Function – Concatenation and arrays – Listing and deleting objects – Conditional and Iterative execution – Reading in external data – Outputting data.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Perform setting up and installing Hadoop in its two operating modes: Pseudo distributed and fully distributed.
2. To implement the following file management tasks in HDFS: Adding files and directories, Retrieving files, Deleting files
3. To run a basic Word Count MapReduce program to understand MapReduce Paradigm: To count words in a given file, To view the output file, and To calculate execution time.
4. To perform NoSQL database using mongodb to create, update and insert.
5. Install and run Pig then write Pig Latin scripts to write, run, join, project and filter your data.
6. Install and run Hive then use Hive to create, alter and drop databases tables, views, functions and indexes.
7. To study and implement basic functions and commands in R Programming.
8. To build WordCount, a text mining method using R for easy to understand and visualization than a table data.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Seema Acharya and Subhashini Chellappan	Big Data and Analytics	John Wiley, First Edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Murray SJ	Learn R in a day	SJ Murray, Second Edition	2013
2.	Michael J Crawley	The R Book	John Wiley, Second Edition	2012
3.	Venkat Ankam	Big Data Analyics	Packt Publishing, First Edition	2016

WEB URLs:

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2. www.ibmbigdatahub.com/
3. www.tutorialspoint.com/hadoop/
4. www.impetus.com/
5. www.guru99.com/bigdata-tutorials.html

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	2	2	-	1	2	1
CO2	3	2	1	-	2	-	-	-	2	2	-	2	2	1
CO3	3	3	2	1	2	-	-	-	-	1	-	1	2	1
CO4	3	2	1	-	2	-	-	-	1	1	-	2	2	1
CO5	2	2	1	1	1	-	-	-	1	1	-	1	2	1
CO	**2.6**	**2**	**1.25**	**1**	**1.6**	-	-	-	**1.5**	**1.4**	-	**1.4**	**2**	**1**

21FE31 BUSINESS INTELLIGENCE REPORTING TOOLS

2 0 0 2

PRE-REQUISITES: Nil

OBJECTIVES:

- To learn the fundamentals of business intelligence reporting tools (BIRT).
- To learn the fundamentals of scripting in reporting tools and event handler.
- To understand the fundamentals of debugging event handlers.
- To understand the BIRT APIs.
- To understand the working with the extension framework.

OUTCOMES:

Learners should be able to

CO1	paraphrase the basic concepts of business intelligence reporting tools (birt).	**K2**
CO2	implement birt scripting techniques to create custom reports in applications.	**K3**
CO3	classify reporting tool technologies and apply them to solve data visualization problems.	**K3**
CO4	design business intelligence projects using birt and reporting tool technologies.	**K3**
CO5	organize reporting systems with event handlers and apis to integrate birt into applications.	**K4**

MODULE I **6**

Installing and deploying BIRT: Introducing BIRT report designers – Installing a BIRT report designer – Deploying a BIRT report to an application server – Understanding the BIRT architecture – About the BIRT engines and services – Types of BIRT report items – About the ROM specification.

MODULE II **12**

Scripting in a report design : Using scripting in a report design – Event order sequence – Using java script to write an event handler : Using BIRT report designer to enter a java script event – Using the report context object – Determining script execution sequence – Calling java from java script – Using java to write an event handler : Writing a java event handler – Understanding the BIRT interfaces – Working with chart event handlers – Understanding when chart events fire – Java script chart event handler – Using scripting to access data – Using a java object to access a data source – Debugging event handlers.

MODULE III **12**

Integrating BIRT into applications : Understanding the BIRT APIs – BIRT report engine API – Design engine API – Engine class hierarchy – BIRT chart engine API – Programming using the BIRT reporting APIs: Generating reports from an application – Programming the structure of a report design – Programming using the BIRT charting API : Modifying chart properties – Using a chart item in a report design – Working with the extension framework : Building the BIRT project – Extending BIRT – Developing a report item extension – Developing a report rendering extension – Developing an ODA extension.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Janson Weatherby, Tom Bondur and Lana Chanta basheva	Integrating and Extending BIRT	Addision Wesley,The Eclipse Series, Second Series	2012

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Diana Peh , Alethea Hannemann , Nola Hague	BIRT A field Guide for Reporting	Addision Wesley, The Eclipse Series, First Edition	2006
2.	John Ward	Practical Data Analysis and Reporting with BIRT	Packt Publishing Ltd, First Edition	2008

WEB URLs:

1. www.eclipse.org/birt
2. www.eclipse.org/birt/presos/Eclipse%20BIRT%20Project%20IntroductionEclipseWorld.pdf
3. www.fico-forum.com/?p=451
4. www.ibm.com/support/knowledgecenter/en/SSPLFC_7.2.0/UserGuide/c_cop_analytics_BIRTreporting.html.
5. www.fme.aegean.gr/sites/default/files/computerappsenterprise_lectures10111213.pptx

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	-	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	-	-	-
CO3	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO4	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO5	3	3	2	1	-	-	-	-	2	2	-	-	-	-
CO	**2.8**	**2.4**	**1.75**	**1**	-	-	-	-	**2**	**2**	-	-	-	-

21FE32 VIRTUALIZATION

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To develop a focused technology view targeted at virtualization.
- To focus virtualization on computing and Networking virtualization.
- To apply the concept of virtualization to an entire machine.
- To be aware of the knowledge on server consolidation.
- To be the aware of the concept of virtualization storage.

OUTCOMES:

Learners should be able to

CO1	define the concepts of computing, server, and network virtualization.	**K2**
CO2	apply virtualization technologies to enhance scalability in computing environments.	**K3**
CO3	design private cloud platforms using virtualization tools for cloud services.	**K3**
CO4	implement server and storage virtualization technologies to optimize resource management.	**K3**
CO5	perform case studies on virtual machine products and evaluate their application.	**K4**

MODULE I **10**

Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level or Operating Virtualization – Application Virtualization- Virtualization Advantages – Virtual Machine Basics – Taxonomy of Virtual machines - Process Virtual Machines – System Virtual Machines – Hypervisor - Key Concepts

MODULE II **21**

Server Consolidation : Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization –Uses of Virtual server Consolidation – Planning for Development – Selecting server Virtualization Platform. **Network Virtualization :** Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization - Data- Path Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation – Ipsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi- Topology Routing.

MODULE III **17**

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries. **Vitual Machine Products:** Xen Virtual machine monitors- Xen API – VMware – VMware products – Vmware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	William von Hagen	Professional Xen Virtualization	Wrox Publications	2008
2.	Chris Wolf, Erick M. Halter	Virtualization: From the Desktop to the Enterprise	A Press	2005

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Kumar Reddy, Victor Moreno	Network virtualization	Cisco Press	2006
2.	James E. Smith, Ravi Nair	Virtual Machines: Versatile Platforms for Systems and Processes	Elsevier/Morgan Kaufmann	2005
3.	David Marshall, Wade A. Reynolds	Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center	Auerbach Publications	2006

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1. www.lecturer.eepis-its.edu/~isbat/materikuliah/.../Virtualization.ppt
2. www.cs.nju.edu.cn/distribute-systems/lecture-notes/c11.ppt
3. www.edux.fit.cvut.cz/oppa/MI-POA/prednasky/MI-POA10.pdf
4. www.cs.otago.ac.nz/cosc440/lectures/lecture%2010.ppt

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	1	2	2
CO2	3	2	1	1	2	-	-	-	1	1	-	-	1	1
CO3	3	2	1	1	2	-	-	1	1	1	-	1	2	2
CO4	3	2	1	1	1	-	1	1	1	1	1	1	1	1
CO5	3	3	2	1	2	-	-	-	1	1	-	1	2	2
CO	**2.8**	**2**	**1.2**	**1**	**1.8**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**1.6**	**1.6**

21FE33 SOFTWARE REQUIREMENT ENGINEERING

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To understand the basics of requirements engineering
- To learn different techniques used for requirements elicitation
- To know the role played by requirements analysis in requirement integration
- To understand the use of various methodologies for requirements development
- To recognize the current trends in requirements prioritization and validation.

OUTCOMES:

Learners should be able to

CO1	define software requirement concepts and system integration techniques.	**K2**
CO2	use requirement analysis tools to solve problems in software engineering.	**K3**
CO3	classify requirements using uml and other languages for efficient system modeling.	**K4**
CO4	design solutions for requirements validation and development based on industry standards.	**K3**
CO5	analyze software requirements and their integration into practical systems.	**K4**

MODULE I **9**

Software requirement overview – Software development roles – Software development process kernels – Commercial life cycle model – Vision development – Stakeholders needs & analysis – Stakeholder needs –Stakeholder activities.

MODULE II **21**

The process of requirements elicitation – Requirements elicitation problems – Problems of scope – Problems of understanding – Problems of volatility – Current elicitation techniques – Information gathering – Requirements expression and analysis – Validation – An elicitation methodology framework – A Requirements elicitation process model – Methodology over method – Integration of techniques – Fact-finding – Requirements gathering – Evaluation and rationalization – Prioritization – Integration and validation. **Requirements analysis** : Identification of functional and non functional requirements – Identification of performance requirements – Identification of safety requirements – Analysis – Feasibility and internal compatibility of system requirements – Definition of human requirements baseline.

MODULE III **21**

Requirements analysis – Requirements Documentation – Requirements development workflow – Fundamentals of requirements development – Requirements attributes guidelines document – Supplementary specification document – Use case specification document – Methods for software Prototyping – Evolutionary prototyping –Throwaway prototyping. **Requirements validation** Validation objectives – Analysis of requirements validation – Activities – Properties – Requirement reviews – Requirements testing – Case tools for requirements engineering.

TOTAL: 30

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Dean Leffingwe and Don Widrig	Managing Software Requirements A Use Case Approach	Addison Wesley, Second Edition	2008

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Ian Sommerville, Pete Sawyer	Requirements Engineering: A Good Practice Guide	Pearson Education, Sixth Edition	2004
2.	Wiegers, Karl, Joy Beatty	Software requirements	Pearson Education, Third Edition	2013

WEB URLs:

1. www.engineersgarage.com/tutorials.
2. www.vssut.ac.in/lecture_notes/lecture1428551142.pdf.
3. www.aminotes.com/2017/09/software-engineering-notes.html.
4. www.velhightech.com/wp-content/uploads/2021/12/CS6403-Software-Engineering.pdf.
5. www.btechguru.com/prepare--anna-university--computer-science-and-engineering--software-engineering.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	1	2	2
CO3	3	3	2	1	-	-	-	1	-	-	-	1	1	1
CO4	3	2	1	-	-	-	-	1	1	1	2	1	2	-
CO5	3	3	2	1	1	-	-	1	1	1	1	1	1	1
CO	**2.8**	**2.2**	**1.5**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1.5**	**1**	**1.5**	**1.3**

21FE34 CLOUD INFRASTRUCTURE AND SERVICES

3 0 0 3

PRE-REQUISITES: Nil

OBJECTIVES:

- To understand the phases of transition from classic data center to virtual data center.
- To study the virtualization technology at computer, storage, network, desktop.
- To describe the business continuity solutions in a VDC environment.
- To know the Cloud infrastructure components and service management processes.
- To introduce the Cloud security concerns and the key considerations for migration to the Cloud.

OUTCOMES:

Learners should be able to

CO1	define the phases of transition from classic data centers to virtual data centers.	**K2**
CO2	apply cloud technologies to solve storage and computation challenges in cloud infrastructure.	**K3**
CO3	design solutions for network, access, and data protection in cloud services.	**K4**
CO4	implement cloud infrastructure components, including service management processes.	**K3**
CO5	organize solutions to address security concerns and key considerations for cloud migration.	**K4**

MODULE I **9**

Introduction to cloud – Phases of journey to the cloud – Business drivers for cloud computing – Definition of cloud computing – Characteristics of cloud computing as per NIST – Steps involved in transitioning from classic data center to cloud computing environment – Cloud applications – Cloud services.

MODULE II **21**

Key elements of CDC – Compute, storage, and network on business continuity – Data center management – Application – DBMS – Compute – Storage and Networking – Object based and unified storage technologies – Business continuity overview and backup – Replication technologies – CDC Management – Virtualized Data Center (VDC) – Compute, Storage, Network virtualization techniques – Block and file level storage virtualization – Virtual provisioning and automated storage tiering – Virtual LAN (VLAN) and Virtual SAN (VSAN) and their benefits – Key network traffic management techniques in VDC – Backup and recovery of virtual machines (VMs) – VM replication and migration technologies – Recovery options from total site failure due to a disaster.

MODULE III **21**

Cloud infrastructure – Characteristics of cloud computing – Cloud services models – Cloud deployment models – Economics of cloud – Cloud infrastructure components – Cloud service creation processes – Cloud service management processes – Key security concerns and threats in cloud – Security concerns and counter measures in a VDC and cloud environment – Governance – Risk – Compliance aspects in cloud – Cloud security best practices – Cloud models suitable for different categories of users – Considerations for choosing applications suitable for Cloud – Different phases to adopt the cloud – Migration to cloud.

TOTAL: 30

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Velte T	Cloud Computing: A Practical Appraoch	Tata McGraw Hill, First Edition	2010

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Halper Fern Kaufman Marcia Bloor Robin and Hurwit Judith	Cloud Computing For Dummies	Wiley India, Ninth Edition	2009
2.	Kris Jamsa	Cloud Computing: SaaS, PaaS,IaaS, Virtualization, Business Models, Mobile, Security	Jones and Bartlett, First Edition	2013
3.	Rajkumar Buyya James Broberg and Andrzej Goscinski	Cloud Computing: Principles and Paradigms	Wiley India Pvt. Ltd., Second Edition	2013
4.	Thomas Erl Ricardo Puttini and Zaigham Mahmood	Cloud Computing: Concepts, Technology & Architecture	Prentice Hall, First Edition	2013

WEB URLs:

1. www.vmware.com/in/techpapers/2012/cloud-infrastructure-architecture-case-study-10255.html
2. www.adeptechno.com/ass et/pdf/Course_Guide_EXIN_Cloud.pdf
3. www.guru99.com/cloud-computing-for-beginners.html
4. www.oracle.com/technetwork/topics/entarch/oracle-wp-cloud-ref-arch-2183533.pdf
5. www.koenig-solutions.com/cloud-infrastructure-services-training-course.aspx

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	-	2	1	-	2	1	2
CO2	3	2	1	1	2	-	-	-	2	1	-	3	1	1
CO3	3	3	3	2	3	-	-	-	3	2	-	3	1	2
CO4	2	1	2	2	3	-	-	-	2	3	-	3	1	2
CO5	3	3	3	3	3	-	-	-	3	3	-	3	1	2
CO	**2.8**	**2.2**	**2.2**	**2.2**	**2.8**	-	-	-	**2.4**	**2**	-	**2.8**	**1**	**1.8**

21FE35 VIRTUAL REALITY AND AUGMENTED REALITY

3 0 2 4

PRE-REQUISITES: Baiscs of Program

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues.
- To understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- To know the intricacies of these platform to develop PDA applications with better optimality

OUTCOMES:

Learners should be able to

CO1	analyze system or process requirements for virtual and augmented reality applications.	**K2**
CO2	identify design problems and collaborate as a member of an engineering team.	**K3**
CO3	utilize technical resources to enhance virtual and augmented reality systems.	**K4**
CO4	develop technical documentation and present design results to stakeholders.	**K3**
CO5	perform in a team to create a fully functional web-based virtual/augmented reality application.	**K3**

MODULE I **9**

Introduction: The three I‘s of virtual reality-commercial VR technology and the five classic components of a VR system - Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation-interfaces and gesture interfaces - Output Devices: Graphics displays - Sound displays & haptic feedback.

MODULE II **21**

Software Technologies: Database - World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occludes, Lights and Cameras, Scripts, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, 3D Interaction Techniques: 3D Manipulation tasks, Manipulation Techniques and Input Devices, Interaction Techniques for 3D Manipulation, Design Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations of Wayfinding, User Centered Wayfinding Support, Environment Centered Wayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestural Commands, Tools, Multimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, symbolic Input Techniques, Design Guidelines, Beyond Text and Number entry.

MODULE III **21**

Advances In 3D User Interfaces: 3D User Interfaces for the Real World, AR Interfaces as 3D Data Browsers, 3D Augmented Reality Interfaces, Augmented Surfaces and Tangible Interfaces, Agents in AR, Transitional AR-VR Interfaces - The future of 3D User Interfaces, Questions of 3D UI Technology, 3D Interaction Techniques, 3D UI Design and Development, 3D UI Evaluation and Other Issues.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Study of tools like unity, maya,3DS Max, AR toolkit, Vuforia, and Blender.
2. Use the primitive object and apply various projection methods by handling camera.
3. Download object from asset store and apply various lighting and shading effects.
4. Model three-dimensional object using various modelling techniques and apply texture over them.
5. Create three-dimensional realistic scene and develop simple virtual reality enabled mobile application which have limited interactivity.
6. Add audio and text special effect to the developed application.
7. Develop VR enabled application using motion trackers and sensors incorporating full haptic interactivity.
8. Develop VR enabled application with interactivity like E learning environment, virtual walkthroughs and visualization of historic places.
9. Develop VR enabled simple application like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple VR enabled gaming applications.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Jung, Timothy, tom Dieck, M. Claudia (Eds.)	Augmented Reality and Virtual Reality	Springer	2021
2.	C. Burdea & Philippe Coiffet, Gregory, John Wiley & Sons.	Virtual Reality Technology	Second Edition	2007
3.	Alan B Craig, William R Sherman and Jeffrey D Will	Developing Virtual Reality Applications: Foundations of Effective Design.	Second Edition	2008

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Robert Scoble and Shel Israel	The Fourth Transformation: How Augmented Reality and Artificial Intelligence Will Change Everything	Patrick Brewster Press	2016
2.	Jason Jerald	The VR Book: Human-Centred Design for Virtual Reality	New York	2015
3.	Jos Dirksen	The JavaScript 3D Library for WebGL	Packt Publishing	2015

WEB URLs:

1. www.augmented-reality-in-education.wikispaces.com
2. www.msl.cs.uiuc.edu/vr/ www.w3schools.com/angular
3. www.docs.unity3d.com/Manual/UnityOverview.html
4. www.photonengine.com/en-us/Photon
5. www.learningenglish.voanews.com/a/augmented-reality-versus-virtual-reality

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	-	2	1	-	2	1	1
CO2	3	3	2	2	1	-	-	-	2	1	-	3	-	1
CO3	2	3	1	2	1	-	-	-	-	2	-	3	1	-
CO4	1	2	1	1	3	-	-	-	3	3	-	3	-	2
CO5	3	3	3	3	3	-	-	-	3	3	-	3	1	2
CO	**2.4**	**2.6**	**1.8**	**2.2**	**2.2**	**-**	**-**	**-**	**2.5**	**2**	**-**	**2.8**	1	**1.5**

21FE36 BLOCKCHAIN TECHNOLOGIES

3 0 0 3

PRE-REQUISITES: Cryptography

OBJECTIVES:

- To understand Blockchain's fundamental components, and examine decentralization using Blockchain.
- To explain how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To know about alternative Blockchains and Blockchain projects in different domains.
- To study the basic protocols of Blockchain.

OUTCOMES:

Learners should be able to

CO1	define the components and functionality of blockchain technology.	**K2**
CO2	apply cryptographic techniques to develop decentralized blockchain applications.	**K3**
CO3	illustrate the ethereum model and analyze its solutions for various use cases.	**K4**
CO4	design applications utilizing blockchain technology for industry-specific problems.	**K3**
CO5	evaluate alternative blockchain solutions and assess their practical applications.	**K4**

MODULE I **9**

Introduction – basic ideas behind block chain - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Decentralization using Blockchain.

MODULE II **16**

Cryptographic basics for cryptocurrency - a short overview of Hashing, signature schemes, encryption schemes and elliptic curve cryptography - Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.

MODULE III **20**

Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart contracts - Attacks on smart contracts - Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Bitcoin and cryptocurrency technologies: a comprehensive introduction	Princeton University Press	2016
2.	Imran Bashir,	Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained	Packt Publishing, Second Edition,	2021.

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Arshdeep Bahga, Vijay Madisetti	Blockchain Applications: A Hands On Approach	VPT	2017
2.	Andreas Antonopoulos, Satoshi Nakamoto,	Mastering Bitcoin	O'Reilly	2014
3.	Alex Leverington	Ethereum Programming	Packt Publishing	2017

WEB URLs:

1. www.upgrad.com/blockchain-certification-pgd-iiitb/?utm_source
2. www.blockgeeks.com/guides/what-is-blockchain-technology
3. www.nvlpubs.nist.gov/nistpubs/ir/2021/NIST.IR.8202.pdf
4. www.fivebooks.com/best-books/blockchain-kevin-werbach
5. www.blockchain.ieee.org/images/files/pdf/20210917-blockchain-architecture-and-reference-frameworks c-lima.pdf

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	-	1	1	-	1	2	1
CO2	3	2	1	-	2	1	-	-	1	1	-	1	-	-
CO3	3	3	2	1	2	-	1	-	1	1	-	1	1	-
CO4	2	2	1	-	2	-	1	-	1	1	-	1	-	1
CO5	3	3	2	1	2	1	1	-	1	1	-	1	2	1
CO	**2.6**	**2.2**	**1.5**	**1**	**2**	**1**	**1**	-	**1**	**1**	-	**1**	**1.6**	**1**

21FE37 3D MODELING AND RENDERING

3 0 2 4

PRE-REQUISITES: Computer Graphics and Multimedia

OBJECTIVES:

- To understand the basic concepts and understanding of tools related to 3D production.
- To be comfortable with basics of modeling, lighting, texturing and rendering.
- To gain the basic knowledge of strong 3D design.

OUTCOMES:

Learners should be able to

CO1	define 3d primitives and texture mapping techniques for modeling and rendering.	**K2**
CO2	implement object manipulation techniques to design and render 3d models.	**K3**
CO3	analyze and compare modeling techniques to optimize rendering quality.	**K4**
CO4	design interactive 3d models and scenes using various rendering technologies.	**K3**
CO5	perform experiments to apply animation techniques and develop a 3d mini project.	**K4**

MODULE I **9**

3D rendering pipeline – 3D Geometric primitives – Bezier – B-Splines – NURBS – Fractals – Particle systems – 3D transforms – Deform modifiers – Solid modeling – Poly modelling – Surface modeling – Tessellation – Extruded shapes – Mesh approximations to smooth objects – Sphere – Cylinder – Hierarchical modelling – Physically based modeling.

MODULE II **21**

Procedural and Bitmap textures – Texture mapping an image – Bump mapping – Environment mapping – Interpolation – Magnification and Minification – Mipmapped textures – Adding textures on to curved surfaces – Animated textures – Tiling rendering textures – Camera Basics – Camera Movement – Directing the Camera.

MODULE III **21**

Shading models – Diffuse and secular reflections – Ambient light – Combining light contributions – Adding color – Flat Shading – Smooth Shading – Phong – Gouraud – Wire frame – Hidden surface removal – Ray tracing methods – Volume Rendering – Radiosity methods – Kinematics – Rigid body animation – Collision detection.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Implement a program that determines the point of intersection between two lines and line with a plane.
2. Using vertex and color arrays, set up the description for a scene containing at least six two dimensional objects.
3. Implement a program that removes the hidden surface of the objects in a scene of five objects that overlaps. Music and audio editing
4. Creation of interactive presentation and portfolio using 2D animation (tweening, masking, audio effect) Video editing.
5. Implement the Object to modifying, gravity and applying movements to particles.
6. Implement the Object of human, birds, animal characters.
7. Develop a simple Game using Unity as a mini project
8. Study with lights, applying different light for the scene.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	F. S. Hill Jr. and Stephen Kelly	Computer Graphics Using OpenGL	Pearson Education/PHI Learning, Third Edition	2007
2.	Mark Giambrun	3D Graphics and Animation	New Riders Press, Second Edition	2002

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Donald Hearn M and Pauline Baker	Computer Graphics – C Version	Pearson Education/ PHI Learning , First Edition	2004
2.	Chen, Jim X., Chen and Chunyang	Foundations of 3D Graphics Programming using JOGL and Java 3D	Springer, Second Edition	2008

WEB URLs:

1. www.lynda.com/Maya-tutorials/Learn-core-concepts-3D-modeling-rendering/2811345/2930172-4.html.
2. www.designblendz.com/blog/3d-modeling-vs-rendering.
3. www.realspace3d.com/resources/what-is-3d-rendering/.
4. www.sculpteo.com/blog/2021/08/14/top-of-the-best-online-3d-modeling-classes/.
5. www.resources.turbosquid.com/training/composition-lighting-rendering/3d-photography-2/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	2	-	-	1	-	-
CO2	3	1	1	-	-	1	-	-	2	-	-	1	-	-
CO3	3	2	2	1	1	-	1	-	2	-	-	1	-	-
CO4	3	1	1	-	-	-	1	-	2	-	-	1	-	-
CO5	3	2	2	1	2	1	1	-	2	-	-	1	-	-
CO	**2.8**	**1.5**	**1.5**	**1**	**1.6**	**1**	**1**	-	**2**	-	-	**1**	-	-

21FE38 DESIGN PATTERN AND DESIGN THIKING

3 0 0 3

PRE-REQUISITES: Software Enginereing

OBJECTIVES:

- To remember and understand the importance of design patterns.
- To demonstrate and analyse the different aspects of how the objects interact with each other and with physical components of the design solutions.
- To provide an insight into design thinking with graphical interfaces to provide dynamism in transformations of a design product or a solution.

OUTCOMES:

Learners should be able to

CO1	illustrate the purpose of various design patterns.	**K2**
CO2	apply behavioral aspects of design patterns to solve specific problems.	**K3**
CO3	distinguish interactions between physical components and users, managing design solutions through visual representations and simulation models.	**K4**
CO4	implement design thinking methodologies to develop innovative solutions.	**K3**
CO5	evaluate the effectiveness of design patterns and prototypes in real-world applications.	**K4**

MODULE I **9**

Introduction to Design patterns: Describing design pattern – Design problems – Design problems solved by design patterns – Selection of a design pattern – Usage of design patterns.

MODULE II **21**

The catalog of design pattern: Creational pattern – Structural pattern – Behavioural pattern – Class and object communication – Case Study: Designing a document editor – Design Thinking: Defining design thinking – Needs – Requirements.

MODULE III **21**

Stages in design thinking: Immersion – Preliminary immersion – In-depth immersion – Analysis and Synthesis: Insight – Affinity diagram – Conceptual Map – Guiding criteria – Empathy map – Ideation: Brainstorming – Co-creation workshop – Idea menu – Decision matrix – Prototyping: Paper prototyping – Volumetric model – Staging – Storyboard – Service prototyping – Case Study: Andorinha project.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Enrich Gamma,Richard Helm,Ralp Johnson and John Vissides	Design Patterns: Elements of reusable object oriented software	Pearson Education/PHI Learning, Second Edition	2009

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Alan Shalloway and James R.Trott	Design Pattern Explained :A new perspective on object oriented design	Addison Wesley publication, Second Edition	2004
2.	Tim Brown	Change by Design: Design Thinking Transforms organizations and inspires innovations	Herper Collins publication, First Edition.	2009

WEB URLs:

1. www.interaction-design.org/literature/article/using-design-patterns-doing-it-again-without-the-hard-work.
2. www.netobjectives.com/Courses/Design-Patterns-Thinking.
3. www.ideou.com/pages/design-thinking.
4. www.disciplinedagileconsortium.org/DA-Technical-Design-Patterns-Thinking.
5. www.careerfoundry.com/en/blog/ux-design/what-is-design-thinking-everything-you-need-to-know-to-get-started/.

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	2	1
CO3	-	3	3	3	-	-	-	-	3	-	-	-	2	1
CO4	-	-	3	3	3	-	-	-	-	3	-	-	2	1
CO5	-	-	3	3	3	-	-	-	3	3	3	3	2	1
CO	**3**	**2.7**	**3**	**2.8**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**2.2**	**1**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

21AF01/21MF01/21CF01/21LF01/21TF01/21EF01/21NF01/21PF01/21FF01
SOFT SKILLS
(Common to all Branches)

0 0 3 0

PRE-REQUISITES: None

OBJECTIVES:

- To provide an opportunity to acquire knowledge of grammar to speak and write appropriately.
- To train communicate effectively and develop the interpersonal skills.
- To develop team building and presentation skills.
- To provide an understanding and develop etiquette necessary to present himself.

OUTCOMES:

Learner should be able to

CO1	make use of basic rules of grammar, including sentence construction, tenses, and vocabulary, to enhance oral communication and report drafting	**K3**
CO2	utilize the principles of active listening, body language, and paraphrasing, to foster productive interactions	**K3**
CO3	demonstrate emotional intelligence and assertive skills to improve decision-making, self-enrichment	**K3**
CO4	execute interview preparation techniques, incorporating mock interviews, group discussions, and time management strategies effectively.	**K3**
CO5	apply professional etiquettes in various contexts (telephone, e-mail, dining) and demonstrate ethical decision-making skills in professional scenario.	**K3**

MODULE I

Basic rules of grammar – Parts of speech – Tense – Concord – Vocabulary – Sentence Construction – Idioms and phrases.

MODULE II

Verbal communication – Non-verbal communication – Body language – Pose-expression – Active listening – Paraphrasing – Peer review – Effective communication. Importance of team work – Team Vs group – Attributes of a successful team – Self enhancement – Assertive skills – Self-confidence – Emotional intelligence – Decision making.

MODULE III

Interview skills – Facing interview – Preparation and checklist – Mock interview – Feedback – Group discussion – Team work – Discussion on news headlines – Mock GD and feedback – Presentation skills – Effective presentation – Selection of topic – Time management – Mock presentation and comments.
ETIQUETTES: Telephone and E-mail etiquette – Dining etiquette – Role model.
ETHICS: Importance of ethics – Choices and dilemmas – Negotiation skills.

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Alex K	Soft Skills	Chant Publication	2014
2.	Peter Francis S J	Soft Skills and Professional Communication	Tata McGraw-Hill Education	2011

WEB URLs:

1.www.eslflow.com
2.www.onestopenglish.com
3.www.citehr.com
4.www.scribd.com
5.www.nptel.ac.in/syllabus/109104031

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	1	-	-	-	2	3	-	1	1	1
CO2	-	-	-	-	-	-	-	-	2	3	-	1	1	1
CO3	-	-	-	-	-	-	-	-	2	3	-	1	1	1
CO4	-	-	-	-	1	-	-	-	2	3	-	1	1	1
CO5	-	-	-	-	1	-	-	-	2	3	-	1	1	1
CO	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**1**	**1**	**1**

21AF02/21MF02/21CF02/21LF02/21TF02/21EF02/21NF02/21PF02/21FF02

MINI PROJECT – I

(Common to all Branches)

0 0 2 1

PRE-REQUISITES: None

OBJECTIVES:

- To provide an opportunity to transform theoretical knowledge acquired into practice.
- Sufficient confidence to carry out final year projects.
- An opportunity to conceptualize an idea in to a system or product based on the theoretical
- Knowledge gained in the specific domain.
- Knowledge and practice in writing project report and its presentation to the expert committee.

OUTCOMES:

Learners will be able to

CO1	identify a specific engineering problem and formulate a detailed problem statement by integrating knowledge of mathematics, science, and engineering.	**K4**
CO2	design a functional system for the defined problem statement by exploring existing methods and utilizing modern engineering tools.	**K4**
CO3	analyze the societal, ethical, and environmental impacts of the proposed solution, ensuring it adheres to relevant safety and legal standards.	**K4**
CO4	apply engineering and management principles to execute the project within a multidisciplinary team while managing resources effectively.	**K3**
CO5	prepare and deliver structured reports and presentations, demonstrating clear communication and technical documentation skills.	**K4**

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	2	2	-	2	2	2
CO2	3	3	2	2	2	-	-	-	2	2	-	2	2	2
CO3	3	3	2	2	2	2	2	3	2	2	-	2	2	2
CO4	3	2	1	1	2	-	-	-	2	2	3	2	2	2
CO5	3	3	2	2	2	-	2	-	2	2	2	2	2	2
CO	**3**	**2.8**	**1.8**	**1.8**	**2**	**2**	**2**	**3**	**2**	**2**	**2.5**	**2**	**2**	**2**

21AF03/21MF03/21CF03/21LF03/21TF03/21EF03/21NF03/21PF03/21FF03

MINI PROJECT – II

(Common to all Branches)

0 0 2 1

PRE-REQUISITES: None

OBJECTIVES:

- To provide an opportunity to transform theoretical knowledge acquired into practice.
- Sufficient confidence to carry out final year projects.
- An opportunity to conceptualize an idea in to a system or product based on the theoretical knowledge gained in the specific domain.
- Knowledge and practice in writing project report and its presentation to the expert committee.

OUTCOMES:

Learners will be able to

CO1	identify a specific engineering problem and formulate a detailed problem statement by integrating knowledge of mathematics, science, and engineering.	**K4**
CO2	design a functional system for the defined problem statement by exploring existing methods and utilizing modern engineering tools.	**K4**
CO3	analyze the societal, ethical, and environmental impacts of the proposed solution, ensuring it adheres to relevant safety and legal standards.	**K4**
CO4	apply engineering and management principles to execute the project within a multidisciplinary team while managing resources effectively.	**K3**
CO5	prepare and deliver structured reports and presentations, demonstrating clear communication and technical documentation skills.	**K4**

Guidelines

Maximum of 4 students per group will do the project.

- Each batch will select and carry out their project under the guidance of a teaching faculty.
- The project will be evaluated by the guide and coordinator nominated by the HOD as per the following details:

Category	Marks	Evaluated by
Project Selection and Design	20	Guide
Implementation and Validation	40	
Project Report	20	Guide and Coordinator
Viva-Voce	20	

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	2	2	-	2	2	2
CO2	3	3	2	2	2	-	-	-	2	2	-	2	2	2
CO3	3	3	2	2	2	2	2	3	2	2	-	2	2	2
CO4	3	2	1	1	2	-	-	-	2	2	3	2	2	2
CO5	3	3	2	2	2	-	2	-	2	2	2	2	2	2
CO	**3**	**2.8**	**1.8**	**1.8**	**2**	**2**	**2**	**3**	**2**	**2**	**2.5**	**2**	**2**	**2**

21AF04/21MF04/21CF04/21LF04/21TF04/21EF04/21NF04/21PF04/21FF04
COMPREHENSION
(Common to all Branches)

0 0 0 -

PRE-REQUISITES: None

The Comprehension is aimed to assess the students understanding in various subjects they studied during their B.E/B.Tech course of study. The comprehension course may be evaluated for 100 marks by the department committee. The members of the department committee will be the Head of the Department or his/her nominee and two senior faculty members of the department.

The Comprehension will cover the topics in the discipline and all the allied disciplines as per the regulation of the programme. The comprehension course offered in 7th semester shall have two oral presentations (each of 50 marks) before the department committee within the semester.

The criteria for successful completion of the comprehension shall be 50 marks total out of 100 from the two presentations.The student‟s performance satisfa tory" or "nonsatisfa tory" shall be communi ated to Controller of Examinations through proper channel by the department.

There is no End semester Examination for this course.

The students, whose performance is rated "nonsatisfatory", shall appear for two presentations in the consecutive semesters until they are rated "satisfatory"

21AF05/21MF05/21CF05/21LF05/21TF05/21EF05/21NF05/21PF05/21FF05
INTERNSHIP – I
(Common to all Branches)

PRE-REQUISITES: None

OBJECTIVES:

- To self motivated and diligent professional
- To involve new learning, expanded growth or improvement on the job
- To enable the students to develop their engineering skills

OUTCOMES:

Learners will be able to

CO1	demonstrate engineering principles to address technical challenges in the internship.	**K3**
CO2	illustrate the workflow, methodologies, and technologies utilized in the organization.	**K2**
CO3	construct reports and presentations to represent technical processes and results.	**K3**
CO4	differentiate professional practices, teamwork roles, and decision-making approaches in real-world scenarios.	**K4**
CO5	integrate the knowledge and skills gained during the internship to plan for career advancement.	**K4**

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	1	-	-	-	-	-	2	3	2
CO2	2	1	1	-	2	-	-	-	-	-	-	2	3	2
CO3	3	2	1	-	2	-	-	2	2	2	-	2	3	2
CO4	3	3	2	1	2	-	1	2	2	2	-	2	3	2
CO5	3	3	2	1	2	1	1	-	1	1	-	2	3	2
CO	**2.8**	**2.2**	**1.4**	**1**	**2**	**1**	**1**	**2**	**1.6**	**1.6**	**-**	**2**	**3**	**2**

21AF06/21MF06/21CF06/21LF06/21TF06/21EF06/21NF06/21PF06/21FF06
INTERNSHIP – II*
(Common to all Branches)

PRE-REQUISITES: None

OBJECTIVES:

- To self motivated and diligent professional
- To involve new learning, expanded growth or improvement on the job
- To enable the students to develop their engineering skills

OUTCOMES:

Learners will be able to

CO1	develop written and oral communication skills for both technical and non-technical environments, utilizing ICT tools for effective presentations.	**K3**
CO2	apply mathematical, scientific, and engineering concepts along with modern tools to effectively communicate the insights gained from the internship.	**K3**
CO3	conduct independent research to explore literature, understand emerging engineering trends, and integrate findings into the study.	**K3**
CO4	demonstrate professional ethics and recognize the societal, cultural, and environmental implications of engineering practices.	**K3**
CO5	analyze engineering knowledge to interpret and effectively communicate findings from diverse publications and studies..	**K4**

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	1	-	1	2	2	-	2	3	2
CO2	3	2	1	1	2	-	-	1	2	2	-	2	3	2
CO3	3	2	1	1	2	-	-	1	2	2	-	2	3	2
CO4	3	2	1	1	2	-	-	1	2	2	-	2	3	2
CO5	3	3	2	2	2	1	-	1	2	2	-	2	3	2
CO	**3**	**2.2**	**1.2**	**1.2**	**2**	**1**	**-**	**1**	**2**	**2**	**-**	**2**	**3**	**2**

21AF25/21MF25/21CF25/21LF25/21TF25/21EF25/21NF25/21PF25/21FF25
PROJECT WORK – PHASE I*
(Common to all Branches)

0 0 4 2

PRE-REQUISITES: None

OBJECTIVES:

- Identification of a real life problem in thrust areas
- Proposing different solutions for the problems based on literature survey
- Developing a mathematical model for solving the above problem
- Finalization of system requirements and specification
- Future trends in providing alternate solutions
- Consolidated report preparation of the above

OUTCOMES:

Learners will be able to

CO1	evaluate complex engineering problems by conducting a comprehensive review of existing solutions, identifying limitations, and formulating a unique problem statement.	**K4**
CO2	design a detailed project proposal by integrating advanced engineering tools, techniques, and methodologies.	**K3**
CO3	assess the potential societal, economic, and environmental impacts of the proposed solution to ensure its sustainability and feasibility.	**K4**
CO4	plan project execution effectively by integrating engineering and management principles, ensuring optimal use of resources.	**K3**
CO5	demonstrate professional communication through detailed reports and presentations of the proposed solution and its relevance.	**K3**

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	1	1	2	2	2	2	2	2	2
CO2	3	2	1	1	2	1	1	2	2	2	2	2	2	2
CO3	3	3	2	1	2	1	1	1	2	2	2	2	2	2
CO4	3	2	1	1	2	1	1	1	2	2	2	2	2	2
CO5	3	2	1	1	2	1	1	1	2	2	2	2	2	2
CO	**3**	**2.6**	**1.2**	**1**	**2**	**1**	**1**	**1.4**	**2**	**2**	**2**	**2**	**2**	**2**

21AF50/21MF50/21CF50/21LF50/21TF50/21EF50/21NF50/21PF50/21FF50
PROJECT WORK – PHASE II*
(Common to all Branches)

0 0 20 0

PRE-REQUISITES: Project Work – Phase I

OBJECTIVES:

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Twelve periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines.

OUTCOMES:

Learners will be able to

CO1	implement the proposed solution for the defined problem statement using advanced engineering tools and techniques.	**K3**
CO2	validate the system performance against predefined objectives and evaluate its reliability, safety, and efficiency.	**K4**
CO3	examine the project's societal, ethical, and environmental impact, ensuring adherence to professional standards and regulations.	**K4**
CO4	apply engineering and management principles to collaborate effectively within a multidisciplinary team and optimize project execution.	**K3**
CO5	present the project outcomes through professional documentation and formal presentations, ensuring effective communication and knowledge dissemination.	**K3**

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	1	1	2	2	2	2	2	2	2
CO2	3	3	2	2	2	1	1	2	2	2	2	2	2	2
CO3	3	3	2	2	2	1	1	1	2	2	2	2	2	2
CO4	3	2	1	1	2	1	1	1	2	2	2	2	2	2
CO5	3	3	2	2	2	1	1	1	2	2	2	2	2	2
CO	**3**	**2.6**	**1.6**	**1.6**	**2**	**1**	**1**	**1.4**	**2**	**2**	**2**	**2**	**2**	**2**

MANDATORY COURSES (MC)

21OG01 ENVIRONMENTAL SCIENCE FOR ENGINEERS

(Common to all Branches)

3 0 2 -

PRE-REQUISITES: Physics and Chemistry at 10th +2 level or equivalent level.

OBJECTIVES:

- To study about the bio systems and their importance.
- To identify the various natural resources and its significances.
- To know about the importance of alternative energy resources.
- To know the various types of pollutions and their control methods.
- To study the integrated themes of environmental protection and population studies.

OUTCOMES:

Learner should be able to

CO1	outline the environmental system and the existence of bio species.	**K2**
CO2	extend the knowledge on the natural resources and their sustainable utility	**K2**
CO3	interpret the significance of alternate energy resources.	**K2**
CO4	relate the impacts of environmental pollutions and implement the eco-friendly technologies..	**K2**
CO5	infer the knowledge on the conservation of environment and impacts of population growth.	**K2**

MODULE I **9**

Environment – Definition, scope and importance – Need for public awareness – Atmosphere - Structure and composition – Concept of an ecosystem - Structure and functions of ecosystem - Biotic components, Food chain and Food web, energy flow in the ecosystem – Nutrient cycle (Nitrogen, Carbon and Phosphorous only) – Biodiversity - definition and types – India as a mega biodiversity nation – Hot spots of biodiversity, endangered and endemic species – Values of biodiversity – Threats to biodiversity - Habitat loss, Poaching, Man-wildlife conflicts – Conservation of biodiversity.

MODULE II **21**

Forest resources – Uses and over exploitation – deforestation – Water resources – Hydrological cycle, over utilization of ground water –Floods –Drought – Construction of dam - benefits and problems – Water quality parameters (major parameters - definition only) – Surface water treatment – Water conservation – Rain water harvesting – Land resources – Soil erosion and Salinity– Energy resources – Non-renewable energy resources – Fossil fuels – Renewable energy resources – Nuclear energy – Nuclear fission and Fusion reactions – Light water nuclear reactor – Hydroelectric energy – Tidal energy – Wind energy – Geothermal energy – Solar energy and its applications –Waste and its types – Hazardous and non-hazardous – E-waste – Waste disposal methods – 3R method, landfill, incineration and composting.

MODULE III **21**

Sources, effects and control methods of Air pollution, Water pollution, Thermal pollution and Noise pollution – Climate change – Acid rain – Global warming – Ozone layer depletion and solutions –Disaster management – Earthquake, Cyclone, Tsunami and Landslides - Population studies – Variation among Nations – Characteristics of population studies – Population Explosion – Environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Environment and Human health – Human rights – Role of individual in Environmental conservation – Role of information technology in environment and human health.

TOTAL: 45

LIST OF EXPERIMENTS:

1. Estimation of Total hardness of Water sample by EDTA method.
2. Determination of Alkalinity of water sample by Double indicator method.
3. Determination of Dissolved Oxygen content in water by Winkler's method.
4. Determination of turbidity of given water samples.
5. Determination of total dissolved and suspended solids.
6. Estimation of strength of an acid by pH – Metry.
7. Estimation of Iron content in a water sample by Potentiometric method.
8. Conductometric titration of strong acid against strong base.
9. Estimation of acids in a mixture by Conductometric method.
10. Determination of Iron content in a water sample using spectrophotometer.

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Shashi Chawla	A Textbook of Environmental Studies	McGraw Hill Education, First Edition	2016

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
2.	Anubha Kaushik and Kaushik C P	Environmental Science and Engineering	New Age International, Fifth Edition	2016

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Linda D Williams	Environmental Science	Tata McGraw Hill, Fifth Edition	2017
2.	Tyler G Miller and Scott Spoolman	Environmental Science	Cengage Learning, Fifteenth Edition	2016
3.	DeswalS and Deswal A	A Basic Course in Environmental Studies	Dhanpat Rai and Co., First Edition	2014
4.	ErachBharucha	Textbook of Environmental Studies	Universities Press (I) Pvt. Ltd., First Edition	2004

WEB URLs:

1. www.insightsonindia.com/2013/09/06/environment-biodiversity
2. www.nptelvideos.in/2012/11/energy-resources-and-technology.html
3. www.msubbu.in/ln/environment/
4. www.pollutionissues.com/
5. www.nptel.ac.in/courses/122102006/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	2	-	3	1	-	-	-	-
CO2	3	2	-	-	-	2	2	-	3	2	-	-	-	-
CO3	3	2	-	-	-	2	2	-	3	2	-	1	-	-
CO4	3	3	-	-	-	2	3	-	3	2	-	1	-	-
CO5	3	3	-	-	-	2	3	-	3	2	-	-	-	-
CO	**3.0**	**2.4**	**-**	**-**	**-**	**2.0**	**2.4**	**-**	**3.0**	**1.8**	**-**	**1**	**-**	**-**

21OG02 INDIAN CONSTITUTION
(Common to all Branches)

3 0 0 -

PRE-REQUISITES: None.

OBJECTIVES:

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.
- To know about Constitutional Amendments
- To know about the Right of Women and Children

OUTCOMES:

Learner should be able to

CO1	outline the functions of the Indian government	**K2**
CO2	explain the rules of the Indian constitution	**K2**
CO3	interpret the different culture practiced among people.	**K2**
CO4	extend the rules in the Constitutional Amendments	**K2**
CO5	illustrate on Right of Women and Children	**K2**

MODULE I **9**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

MODULE II **21**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

MODULE III **21**

Indian Federal System – Center – State Relations – President‟s Rule – Constitutional Amendments – Constitutional Functionaries – Assessment of working of the Parliamentary System in India.

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Durga Das Basu	Introduction to the Constitution of India	Prentice Hall of India Twenty first Edition	2015
2.	Agarwal R C	Indian Political System	S.Chand and Company, First Edition.	1997

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Sharma and Brij Kishore	Introduction to the Constitution of India	Prentice Hall of India Seventh Edition	2014
2.	Gahai U R	Indian Political System	New Academic Publishing House	2011
3.	Sharma R N	Indian Social Problems	Media Promoters and Publishers Pvt,Ltd	2009

WEB URLs:

1. www.importantindia.com/2030/right-to-constitutional-remedies-indian-constitution/
2. www.lawteacher.net/free-law-essays/international-law/an-understanding-of-the-indian-legal- system-international-law-essay.php
3. www.blog.ipleaders.in/courts-justice-system-india/
4. www.sakshieducation.com/GK/Story.aspx?cid=20&sid=122&chid=1054&nid=101921/
5. www.accountlearning.com/social-structure-indian-society-features/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	2	2	1	-	-	-	-	-
CO4	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	2	2	1	-	-	-	-	-
CO	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**

21OG03 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(Common to all Branches)

3 0 0 -

PRE-REQUISITES: None.

OBJECTIVES:

- To be aware of the basic Indian Culture, Religions and philosophies of India.
- To know the Indian languages and the Indian literatures
- To understand the various art, dance and music forms of ancient Indians.
- To study the various contributions of India in the field of science.
- To know about the agriculture and trade practices followed in ancient India.

OUTCOMES:

Learner should be able to

CO1	outline of the various aspects of the Indian culture, its religions and philosophy	**K2**
CO2	illustrate on the various languages and literatures of India.	**K2**
CO3	compare the various art, dance and music form of India.	**K2**
CO4	extend on the scientific contributions of ancient India	**K2**
CO5	explain the traditional agricultural methods and Ayurveda form of medicine of India.	**K2**

MODULE I **9**

An Introduction to Indian culture: Characteristics of Indian culture – Significance of geography on Indian culture – Religion and Philosophy in India – Ancient period: Pre-Vedic and Vedic religion – Buddhism and Jainism – Indian philosophy – Vedanta and Mimansa school of Philosophy.

MODULE II **21**

Indian languages and literature – Evolution of script and languages in India – Harappan script and Brahmi script – Short history of the Sanskrit literature – The Vedas and Upanishads and Sutras – Epics: Ramayana and Mahabharata and Puranas. Indian arts and architecture – Gandhara school and Mathura school of art – Hindu temple architecture – Buddhist architecture – Medieval architecture and colonial architecture.

Indian painting tradition – Ancient, medieval, modern indian painting and odishan painting tradition – Performing arts – Divisions of Indian classical music: Hindustani and Carnatic – Dances of India: Various dance forms – Classical and Regional.

MODULE III **21**

Ancient India's contribution to science and technology – Astronomy – Mathematics – Chemistry – Metallurgy in India – The historical evolution of Medicinal traditions in Ancient India – Plant and animal Science in Ancient India – Indian traditional knowledge on environmental conservation – Ayurveda for Life – Health and well-being – Ayurveda and Medicinal plants – Conventional, non-conventional and clean energy sources of India – Science and Its various branches – Indigenous agriculture, Biotechnology and nano-technology – Traditional wisdom of astronomy – India in space – Discovery of gravitational waves.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Sarvepalli Radhakrishnan and Charles A Moore	A Source Book in Indian Philosophy	Princeton University Press	1967
2.	Compilations of Vijnana Bharati	Indian Contributions to Science	Vijnana Bharati, Second Edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Dasgupta and Surendranath	A History of Indian Philosophy (5 vols)	Cambridge University	1922-1955
2.	Subbarayappa B V	Chemistry and Chemical Techniques in India, Project of History of Indian Science	Philosophy and Culture and Centre for Studies in Civilizations, Vol. IV(Part 1)	1999

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
3.	Kim Plofker	Mathematics in India	Princeton University Press	2009
4.	Saxena R, Choudhary S L and Nene Y L	A Textbook on Ancient History of Indian Agriculture.	Asian Agri-History Foundation (AAHF)	2009
5.	D Wujastyk,	The Roots of Ayurveda: Selections from Sanskrit Medical Writings	Penguin Books	2003

WEB URLs:

1. www.archive.org/details/Contemporary.Indian.Philosophy
2. www-history.mcs.st-andrews.ac.uk/history/Indexes/Indians.html
3. www-history.mcs.st-and.ac.uk/HistTopics/Indian_mathematics.html
4. www.weber.ucsd.edu/~dkjordan/arch/metallurgy.html
5. www.tkdl.res.in/tkdl/langdefault/common/Home.asp?GL=Eng

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	2	2	2	-	-	-	-	-	-
CO	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

OPEN ELECTIVES (OE)

21PE02 CLOUD COMPUTING TECHNIQUES

3 0 0 3

PRE-REQUISITES: Computer Networks

OBJECTIVES:

- To understand the fundamentals of cloud computing and its services.
- To know cloud collaborating communities.
- To impart knowledge on various collaboration in cloud management.
- To familiarize different services of cloud in web mail and social networks.
- To explore the concepts of cloud storage

OUTCOMES:

Learner should be able to

CO1	understand the basic concept of cloud computing	**K2**
CO2	classify the types of cloud and its services	**K2**
CO3	outline the purposes of cloud in various collaborations.	**K3**
CO4	analyze various cloud models and apply them to solve real world problems	**K4**
CO5	develop backup strategies for cloud storage based on features	**K3**

MODULE I **9**

Cloud computing introduction – From collaboration to cloud – Working of cloud computing – The pros and cons of cloud computing – Beneficiary – Developing cloud computing services – Types of cloud service development – Discovering cloud services.

MODULE II **21**

Centralizing email communications – Cloud computing for community – Collaborating on schedules – Collaborating on group projects and events – Cloud computing for corporation – Managing schedules managing projects – Presenting on road – Collaborating on calendars, schedules and task management – Exploring online scheduling – Exploring online planning and task management – Collaborating on event management – Collaborating on contact management – Collaborating on project management – Collaborating on word processing – Spreadsheets and databases.

MODULE III **21**

Evaluating web mail services – Evaluating instant messaging services – Evaluating web conference tools – Creating groups on social networks – Evaluating online groupware – Collaborating via blogs and wikis. Understanding cloud storage – Evaluating online file storage and sharing services – Exploring online bookmarking services – Exploring online photo editing applications – Exploring photo sharing communities – Controlling it with web based desktops.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Michael Miller	Cloud Computing: Web Based Applications That Change the Way You Work and Collaborate	Que Publishing, First Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Kumar Saurabh	Cloud Computing: Insights into New-era Infrastructure	Wiley India First Edition	2011
2.	Dan C Marinescu	Cloud Computing Theory and Practice	MK Publisher Second Edition	2017

WEB URLs:

1. www.chettinadtech.ac.in/storage/11-12-30/11-12-30-10-52-02-1373-mahendra.pdf
2. www.tutorialspoint.com/cloud_computing/cloud_computing_tutorial.pdf
3. www.thbs.com/downloads/Cloud-Computing-Overview.pdf
4. www.tutorial.wmlcloud.com/windows_azure/Using-Cloud-Services---Collaborating-on-Word-Processing-(part-1).aspx
5. www.techrepublic.com/blog/the-enterprise-cloud/cloud-app-vs-web-app-understanding-thedifferences

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	3	-	-	-	2	1	-	2	1	2
CO2	3	3	2	2	3	-	-	-	2	1	-	3	1	2
CO3	3	3	3	2	3	-	-	-	3	2	-	3	1	2
CO4	3	2	3	3	3	-	-	-	3	3	-	3	1	2
CO5	3	3	3	3	3	-	-	-	3	3	-	3	1	2
CO	**3**	**2.6**	**2.6**	**2.6**	**3**	**-**	**-**	**-**	**2.6**	**2**	**-**	**2.8**	**1**	**2**

21PD08 COMPUTER ARCHITECTURE

4 0 0 4

PRE-REQUISITES: Fundamentals of Computers

OBJECTIVES:

- To be familiar with fundamentals of computer system.
- To know the concepts of RISC and CISC instructions.
- To learn the concepts of pipelining.
- To solve binary arithmetic operations.
- To learn about memory management systems

OUTCOMES:

Learner should be able to

CO1	identify the functional units in a digital computer system.	**K2**
CO2	explain the memory operations and execution of instructions.	**K3**
CO3	build the pipelining and superscalar operations.	**K3**
CO4	develop the various methodologies in binary arithmetic operations.	**K3**
CO5	illustrate the memory systems and parallel processing.	**K2**

MODULE I **12**

Functional units – Basic operational concepts – Number representation and arithmetic operations –Character representation – Performance – Historical perspective –The Assembly Process-Linker-Compiler-Debugger-Operating System.

MODULE II **24**

Memory locations and addresses – Memory operations – Instructions and instruction sequencing– Addressing modes – Assembly language – Stacks – Subroutines – Additional instructions – Dealing with 32-Bit immediate values – CISC instruction sets – RISC and CISC styles – Basic processing unit – Fundamental concepts – Instruction execution – Hardware component – Instruction fetch and execution steps – Control signals – Hardwired control – CISC style processors – Pipelining – Basic concepts – Pipeline organization – Pipelining issues – Data dependencies – Memory delays – Branch delays – Resource limitations – Performance evaluation – Superscalar operation – Pipelining in CISC processors.

MODULE III **24**

Addition and subtraction of signed numbers–Design of fast adders – Multiplication of unsigned numbers – Multiplication of signed numbers – Fast multiplication – Integer division – Floating-Point numbers and operations – Memory system – Basic concepts – Semiconductor RAM memories – Direct memory access – Memory hierarchy – Cache memories – Virtual memory – Memory management requirements – Secondary storage – RAID architecture – Storage systems – RAID architecture-Storage Systems – Parallel processing – Hardware multithreading – Vector (SIMD) processing – Shared-Memory multiprocessors – Cache coherence – Message-passing multicomputer.

TOTAL: 60

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian	Computer Organization and Embedded Systems	TataMcGraw Hill, Sixth Edition	2012

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	David A Patterson and John L Hennessy	Computer Organization and Design: The Hardware/Software Interface	Morgan Kaufmann, Fifth Edition	2014
2.	William Stallings	Computer Organization and Architecture –Designing for Performance	Pearson Education, Eight Edition	2010
3.	John P. Ha yes	Computer Architecture and Organization	Tata McGraw Hill, Third Edition	2012

WEB URLs:

1. www.csie.nuk.edu.tw/~kcf/course/96_Spring/Architecture/Arch_Chapter1.pdf
2. www.phy.ornl.gov/csep/ca/node2.html
3. www.studytonight.com/computer-architecture/
4. www.docsity.com/en/study-notes/computer-science/computer-architecture-and-organization/
5. www.nptel.ac.in/courses/106103068/5

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	-	-	-	-	-	-	-	-	-	2	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO	**2.8**	**2.2**	**1.5**	-	-	-	-	-	-	-	**-**	-	**1.4**	**1.4**

21LE09 CRYPTOGRAPHY AND NETWORK SECURITY

3 1 0 4

PRE-REQUISITES: NIL

OBJECTIVES:

- To acquire basic knowledge about different methods of classical encryption technique and number theory.
- To understand data encryption standard.
- To provide in-depth knowledge on secure and hash function.
- To impart knowledge in authentication applications.
- To understand the system security threats, including intruders, viruses and worms.

OUTCOMES:

Learner should be able to

CO1	illustrate the working principles of classical encryption techniques and number theory	**K2**
CO2	analyze the algorithms for des, aes, and rsa for secure data encryption	**K4**
CO3	evaluate the functionality of hash functions and digital signatures in authentication systems	**K4**
CO4	develop security mechanisms for networks using firewalls, intrusion detection, and virus protection	**K3**
CO5	demonstrate cryptographic techniques for image processing and secure communication	**K3**

MODULE I **9**

Overview – OSI security architecture – Attacks and services – Security mechanism – Classical encryption techniques – Basic concepts in number theory and finite fields – Prime numbers – Fermat and Euler's theorem – Primality testing.

MODULE II **21**

Data Encryption Standard – Block cipher design principles – DES example – The Strength of DES – Triple DES – AES – Modes of operation – RSA – Attacks – Diffie-hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography – ElGamal Public key cryptosystems – Hash functions – Secure Hash – Birthday attack – MD5 – Digital signature.

MODULE III **21**

Authentication applications – Kerberos – X.509 – PKI – Electronic Mail security – PGP – S/MIME – IP security – Web security – SSL – TLS – SET –Virtual protocol –System security – Intruders – Malicious software – Viruses – Firewalls – Security standards.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	William Stallings	Cryptography and Network Security – Principles and Practices	Pearson Education, Fifth Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mao W	Modern Cryptography – Theoryy and Practice	Pearson Eduction, Second Edition	2007
2.	Charles P Pfleeger and Shari Lawrence Pfleeger	Security in Computing	Prentice Hall, Fifth Edition	2015
3.	Behruz A Forouzan and Debdeep Mukhopadhyay	Cryptography and Network Security	Tata McGraw Hill, Third Edition	2016

WEB URLs:

- www.users.abo.fi/ipetre/crypto/lecture12.
- www.algorithmdesign.net.
- www.engineering.purdue.edu
- www.cs.columbia.edu
- www.cs.fsu.edu

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	-	-	-	-	-	-	-	-	2	2	1
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	1
CO5	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO	**2.6**	**1.6**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.7**	**2**	**1**

21PD15 DATA COMMUNICATION AND COMPUTER NETWORKS **3 0 2 4**

PRE-REQUISITES: NIL

OBJECTIVES:

- To acquire basic knowledge about different methods of classical encryption technique and number theory.
- To understand data encryption standard.
- To provide in-depth knowledge on secure and hash function.
- To impart knowledge in authentication applications.
- To understand the system security threats, including intruders, viruses and worms.

OUTCOMES:

Learner should be able to

CO1	explain the fundamental concept of data communication and functionalities of all the layers	**K2**
CO2	articulate the concepts of various network protocols, routing techniques, congestion and flow control techniques	**K3**
CO3	discover routing techniques using TCP / UDP protocols	**K3**
CO4	connect encrypt and decrypt algorithms using public key cryptosystems	**K4**
CO5	appraise the significance of protocols-based network applications	**K4**

MODULE I **9**

Overview – OSI security architecture – Attacks and services – Security mechanism – Classical encryption techniques – Basic concepts in number theory and finite fields – Prime numbers – Fermat and Euler's theorem – Primality testing.

MODULE II **21**

Data Encryption Standard – Block cipher design principles – DES example – The Strength of DES – Triple DES – AES – Modes of operation – RSA – Attacks – Diffie-hellman key exchange – Elliptic curve arithmetic – Elliptic curve cryptography – ElGamal Public key cryptosystems – Hash functions – Secure Hash – Birthday attack – MD5 – Digital signature.

MODULE III **21**

Authentication applications – Kerberos – X.509 – PKI – Electronic Mail security – PGP – S/MIME – IP security – Web security – SSL – TLS – SET –Virtual protocol –System security – Intruders – Malicious software – Viruses – Firewalls – Security standards.

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	William Stallings	Cryptography and Network Security – Principles and Practices	Pearson Education, Fifth Edition	2011

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Mao W	Modern Cryptography – Theoryy and Practice	Pearson Eduction, Second Edition	2007
2.	Charles P Pfleeger and Shari Lawrence Pfleeger	Security in Computing	Prentice Hall, Fifth Edition	2015
3.	Behruz A Forouzan and Debdeep Mukhopadhyay	Cryptography and Network Security	Tata McGraw Hill, Third Edition	2016

WEB URLs:

- www.users.abo.fi/ipetre/crypto/lecture12.
- www.algorithmdesign.net.
- www.engineering.purdue.edu
- www.cs.columbia.edu
- www.cs.fsu.edu

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	1	1
CO2	3	2	1	-	1	-	-	-	1	1	-	1	2	1
CO3	3	2	1	-	2	-	-	-	2	1	-	1	1	1
CO4	3	3	2	1	2	-	-	-	2	2	-	1	2	2
CO5	3	3	2	1	2	-	-	-	2	2	-	1	2	2
CO	**2.8**	**2.2**	**1.5**	**1**	**1.7**	**-**	**-**	**-**	**1.6**	**1.4**	**-**	1	**1.6**	**1.4**

21SE25 INDUSTRY 4.0

3 0 0 3

PRE-REQUISITES: Basics of Internet of Things (IoT)

OBJECTIVES:

- Introducing the role of IoT in the modern industry and new economy
- Explain how IoT can improve product value and customer experience
- Bring the IoT perspective in designing and building solutions
- Introduce the tools and techniques that enable IoT solution and Security aspects

OUTCOMES:

Learner should be able to

CO1	understand and explain the concepts, structure and design of operation system	**K2**
CO2	apply various concepts related with deadlock to solve problems related with resource allocation	**K3**
CO3	analyze and implement the process, resource control, scheduling, i/o files and memory management	**K4**
CO4	design, implement and evaluate a computer-based system, process, component or program to meet desired needs	**K6**
CO5	conduct experiments to work with shell script, inter-process communication, scheduling and memory management	**K3**

MODULE I **9**

Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

MODULE II **21**

IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models, Industrial IoT-Protocol Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking -Big Data Analytics and Software Defined Networks, Machine Learning and Data Science, Julia Programming, Data Management with Hadoop.

MODULE III **21**

Industrial IoT: Security and Fog Computing - Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT - Industrial IoT (Robotics)- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries), Real case studies : Milk Processing and Packaging Industries, Manufacturing Industries

TOTAL: 45

TEXT BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Alasdair Gilchrist	Industry 4.0: The Industrial Internet of Things	Apress First edition	2017

REFERENCES BOOKS:

SI.No.	Author(s)	Title of Book	Publisher	Year of Publication
1.	Giacomo Veneri, Antonio Capasso	Hands-On Industrial Internet of Things: Create a powerful Industrial IoT	Packt Publishing Birmingham, UK	2021
2.	Sabina Jeschke, Christian Brecher, Houbing Song and Danda B Rawat	Industrial Internet of Things: Cyber Manufacturing Systems	Springer First Edition	2017

WEB URLs:

1. www.trendmicro.com/vinfo/us/security/definition/industrial-internet-of-things-iiot
2. www.i-scoop.eu/internet-of-things-guide/industrial-internet-things-iiot-saving-costsinnovation/industrial-internet-things-iiot/
3. www.zdnet.com/article/what-is-the-iiot-everything-you-need-to-know-about-the-industrial-internet-ofthings/
4. www.ebos.com.cy/chariotforum/posts/m169-fog-computing--fog-networking--fogging
5. www.rambus.com/iot/industrial-iot/

COURSE ARTICULATION MATRIX

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	1	-	3	-	-	-	-	-	-	-	-	-	-	1
CO4	1	-	2	-	-	1	-	-	-	-	-	-	1	1
CO5	1	-	2	2	1	-	1	1	-	-	1	1	1	-
CO	**1.4**	**-**	**2.3**	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**1**