B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

SYLLABI 2023-2024

(CHOICE BASED CREDIT SYSTEM)

Department of Computer Science and Engineering

FACULTY OF ENGINEERING

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)

(Accredited with A+ Grade by NAAC in Second Cycle)

Pollachi Main Road, Eachanari Post

Coimbatore - 641021.

KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established Under Section 3 of UGC Act 1956)
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FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

List of PEOs, POs and PSOs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. To perform well in their professional career by acquiring enough knowledge in the domain of Computer Science and engineering(Cyber Security).

II. To improve communication skills, follow professional ethics and involve in team work in their profession.

III. To update with evolving technology and use it for career advancement.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

a) **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f) **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECFIC OUTCOMES (PSOs):

1.The ability to apply, analyse, design and develop the application software that meet the automation needs of society and industry.

2. The ability to understand the evolutionary changes in computing, apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success, real world problems and meet the challenges of the future.

MAPPING:

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO I	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓
PEO II	✓	✓	✓	✓	✓			✓	✓	✓				✓
PEO III	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓

Credit Distribution:

S.No.	Course Category	Credit Distribution	Percentage
1	Basic Science	29	18.1
2	Engineering Science	20	12.5
3	Humanities and Science	6	3.8
4	Professional Core	64	40.0
5	Professional Elective	18	11.3
6	Open Elective	6	3.8
7	Project Work	15	9.4
8	Mandatory Course	2	1.3
	Total	160	100

FACULTY OF ENGINEERING (FOE)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

UG PROGRAM (CBCS) – B.E COMPUTER SCIENCE AND ENGIN

(CYBER SECURITY)

(2023-2024 Batch and Onwards)

COURSE CODE	COURSE TITLE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
SEMESTER I												
23BECC101	Professional Communicative English	HS	II	h,i,j,l	3	0	0	3	40	60	100	1
23BECC102	Matrices and Calculus	BS	-	a,b,c,,l	3	1	0	4	40	60	100	3
23BECC141	Engineering Chemistry	BS	-	a,b,c,d, f,g,h,i,j,l	4	0	2	5	40	60	100	6
23BECY142	Basic Electrical and Electronics Engineering	ES	-	a,b,c,d, i,j,l	3	0	2	4	40	60	100	9
23BECC143	Programming in C	ES	I,III 1	a,b,c,d, i,j,l	4	0	2	5	40	60	100	12
23BEMC111	Design Thinking	MC	I,II, III	a,b,c,d f,g,h,i,j, l	1	0	2	2	100	-	100	336
23BEMC151	Sports and Yoga	MC			1	0	0	0	100	-	100	338
23BEMC152	தமிழர் மரபும் பண்பாடும்	MC			1	0	0	0	100	-	100	340
SEMESTER TOTAL					**20**	**1**	**8**	**23**	**500**	**300**	**800**	
SEMESTER II												
COURSE CODE	COURSE TITLE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECC201A/ 23BECC201B/ 23BECC201C	Graph Theory/ Computational Methods for Engineers/ Transforms and its applications	BS	-	a,b,c, l	3	1	0	4	40	60	100	15,18, 21

COURSE CODE	COURSE TITLE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECC202	Environmental Studies	BS	-	a,b,f,g,h,i,j,l	3	0	0	3	40	60	100	24
23BECY241	Semiconductor Physics	BS	-	a,b,c,f,,i,j,l	3	0	2	4	40	60	100	27
23BECY242	Fundamentals of Web Design	ES	I,III 2	a,b,c,d,e,f,i,j,l	4	0	2	5	40	60	100	30
23BECC243A/ 23BECC243B	Data Structures and Algorithms/ Object Oriented Programming using Python	ES	I,III 1	a,b,c,i j,l/a,b,c,d,i,j,l	4	0	2	5	40	60	100	33,36
23BEMC251	Soft Skills	MC			1	0	0	0	100	-	100	343
23BEMC252	Women Safety and Security	MC			1	0	0	0	100	-	100	345
SEMESTER TOTAL					19	1	6	21	400	300	700	

SEMESTER III

COURSE CODE	COURSE TITLE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECY301A/ 23BECY301B/ 23BECY301C	Discrete Mathematics/ Numerical Methods/Numerical Linear Algebra	BS	-	a,b,c,, l	3	1	0	4	40	60	100	39,42,44
23BECY302	Computer Architecture	PC	I,III 1	a,b,c,d,i,j,l	3	0	0	3	40	60	100	47
23BECY341	Database Management Systems	PC	I,II,III 2	a,b,c,d i,j,l	3	0	2	4	40	60	100	50
23BECY342A/ 23BECY342B	Data Structures and Algorithms/ Design and Analysis of Algorithms	PC	I,III 1/2	a,b,c,d i,j,l	3	0	2	4	40	60	100	53,56
23BECY343A/ 23BECY343B	Java Programming/ Object Oriented Programming	PC	I,III 2	a,b,c,d,,i,j,l	3	0	2	4	40	60	100	60,63
23BEMC351	Aptitude and Reasoning	MC			1	0	0	0	100	-	100	347
23BEMC352	Foreign Language German and French	MC			1	0	0	0	100	-	100	350,352
23BECY391	Field project / Internship I	PW	I,III, 1,2	a,b,c,d,e,f,g,h,i,j,k,l	0	0	2	1	100	-	100	362

COURSE CODE	COURSE TITLE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
SEMESTER TOTAL					**17**	**1**	**8**	**20**	**500**	**300**	**800**	

SEMESTER IV												
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**PEOs, PSOs**	**POs**	**L**	**T**	**P**	**CREDIT(S)**	**CIA**	**ESE**	**TOTAL**	**Page No.**
23BECY401A/ 23BECY401B	Statistics and Optimizations Techniques /Probability and Statistics	**BS**	III	a,b,c, ,l	3	1	0	4	40	60	100	66,69
23BECY402	Cryptography and Cyber Security	**PC**	I,III 2	a,b,c,d, h,i,j,l	3	1	0	4	40	60	100	72
23BECY4EXX	Professional Elective I	**PE**			3	0	0	3	40	60	100	123-132
23BECY441	Operating Systems	**PC**	I,III 1	a,b.c.d, i,j,l	3	0	2	4	40	60	100	75
23BECY442A/ 23BECY442B	Web Application Development/ Low code application development	**PC**	I,III 2	a,b,c,d, e,h,i,j,l	3	0	2	4	40	60	100	78,81
23BECY443A/ 23BECY443B	Advanced algorithms /Design and Analysis of Algorithms	**PC**	I,III 1/2	a,b,c, d,i,j,l	3	0	2	4	40	60	100	84,87
23BEMC451	Foundation of Entrepreneurship	**MC**			1	0	0	0	100	-	100	354
23BEMC452	Essence of Traditional Indian knowledge and Heritage	**MC**			1	0	0	0	100	-	100	356
SEMESTER TOTAL					**20**	**2**	**6**	**23**	**440**	**360**	**800**	

SEMESTER V												
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**PEOs, PSOs**	**POs**	**L**	**T**	**P**	**CREDIT(S)**	**CIA**	**ESE**	**TOTAL**	**Page No.**
23BECY501	Formal Languages and Automata theory	**PC**	I,III 1	a,b,c,d i,j,l	3	1	0	4	40	60	100	90
23BECY502	Information Security	**PC**	I,III 2	a,b,c,d, f,h,i,j,l	3	1	0	4	40	60	100	93

COURSE CODE	COURSE TITLE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECY5EXX	Professional Elective II	PE			3	0	0	3	40	60	100	135-146
23BECY5EXX	Professional Elective III	PE			3	0	0	3	40	60	100	147-156
23BECY541	Network Architecture and security	PC	I,III 2	a,b,c,d f,h,i,j,l	3	0	2	4	40	60	100	96
23BECY542A/ 23BECY542B	Advanced Web Frameworks / Business data processing	PC	I,III 2	a,b,c,d e,h,i,j,l/ a,b,c,d,i, j,l	3	0	2	4	40	60	100	99 102
23BEMC551	Mobile Application development	MC			2	0	0	0	100	-	100	357
23BECY591	Field project / Internship II	PW	I,III ,1,2	a,b,c,d e,f,g,h, i,j,k,l	0	0	2	1	100	-	100	364
SEMESTER TOTAL					**20**	**2**	**6**	**23**	**440**	**360**	**800**	

SEMESTER VI

COURSE CODE	COURSE TITLE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY601	Machine Learning for Cyber Security	PC	I,III ,2	a,b,c,d, e,i,j,k,l	3	1	0	4	40	60	100	105
23BECY6EXX	Professional Elective IV	PE			3	0	0	3	40	60	100	159-168
23BECY6EXX	Professional Elective V	PE			3	0	0	3	40	60	100	174-185
23BECY6E0X	Open Elective I	OE			3	0	0	3	40	60	100	210-312
23BECY641	Cyber Security Threats and Countermeasures	PC	I,III 1	a,bc,d,e, h,i,j,l	3	0	2	4	40	60	100	108
23BECY642	Digital and mobile forensics	PC	I,III 1	a,b,c,d,e, h,i,j,l	3	0	2	4	40	60	100	111
23BECY651	Universal Human Values	MC			1	0	0	0	-	-	100	359
23BECY691	Mini Project	PW	I,III ,1,2	a,b,c,d,e ,f,g,h,I,j, k,l	0	0	2	1	100	-	100	366
SEMESTER TOTAL					**19**	**1**	**6**	**22**	**340**	**360**	**700**	

SEMESTER VII

COURSE CODE	COURSE TITLE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY701	Principles of Management and Engineering Ethics	HS	II 1,2	f,h,j,l	3	0	0	3	40	60	100	114
23BECY702	Ethical Hacking	PC	I,III 1	a,b,c,e, h,i,j,l	3	1	0	4	40	60	100	116
23BECY703	Devops	PC	I,III 1	a,b,c,d, e,h,i,j,l,	3	0	0	3	40	60	100	119
23BECY7EXX	Professional Elective VI	PE			3	0	0	3	40	60	100	185-197
23BECY7E0X	Open Elective II	OE			3	0	0	3	40	60	100	210-312
23BECY791	Project Work Phase I	PW	I,II, 1,2	a,b,c,d,e, f,g,h,i,j, k,l	0	0	8	4	40	60	100	368
SEMESTER TOTAL					**15**	**0**	**8**	**20**	**240**	**360**	**600**	

SEMESTER VIII

COURSE CODE	COURSE TITLE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY891	Project Work and Viva Voce Phase II	PW	I,II,III 1,2	a,b,c,d, e,f,g,h,I ,j,k,l	0	0	16	8	80	120	200	370
SEMESTER TOTAL					**0**	**0**	**16**	**8**	80	120	200	
PROGRAM TOTAL					**130**	**9**	**64**	**160**	**2940**	**2460**	**5500**	

PROFESSIONAL ELECTIVE I

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	

COURSE CODE	NAME OF THE COURSE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECY4E01	Advanced Data Structures	PE	I,III 1	a,b,c,d i,j,l	3	0	0	3	40	60	100	123
23BECY4E02	BlockChain and Cyber Security	PE	I,III 2	a,b,c,d, i,j,l	3	0	0	3	40	60	100	126
23BECY4E03	Cloud Security	PE	I,II 2	a,b,c, i,j,l	3	0	0	3	40	60	100	129
23BECY4E04	Basics of Cyber Crime And Cyber Security	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	132

PROFESSIONAL ELECTIVE II

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY5E01	Fundamentals of Artificial Intelligence	PE	I,III 2	a,b,c, i,j,l	3	0	0	3	40	60	100	135
23BECY5E02	Robotic Process Automation	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	137
23BECY5E03	OS Security	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	140
23BECY5E04	Cyber Laws and Intellectual Property Rights	PE	I,III 2	a,b,c, i,j,l	3	0	0	3	40	60	100	142
23BECY5E05	Basics of Cyber Forensics	PE	I,III 2	a,b,c i,j,l	3	0	0	3	40	60	100	144

PROFESSIONAL ELECTIVE III

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY5E06	Cognitive Psychology in Cyber Security	PE	I,III 2	a,b,c,d ,i,j,l	3	0	0	3	40	60	100	147
23BECY5E07	Internet Security	PE	I,III 2	a,b,c,d,i ,j,l	3	0	0	3	40	60	100	150
23BECY5E08	Hardware Security	PE	I,III 1	a,b,c,d, i,,j,l	3	0	0	3	40	60	100	153
23BECY5E09	Data Warehousing and Data Mining	PE	I,III 2	a,b,c,d,, i,j,l	3	0	0	3	40	60	100	156

PROFESSIONAL ELECTIVE IV

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY6E01	Forensic Audio and Video Analysis	PE	I,III 2	a,b,c,d e,i,j,l	3	0	0	3	40	60	100	159
23BECY6E02	Agile Methodologies	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	162
23BECY6E03	Advanced Java Programming	PE	I,III 1	a,b,c,d e,i,j,l	3	0	0	3	40	60	100	164
23BECY6E04	Biometric Security	PE	I,III 2	a,b,c,d, i,j,l	3	0	0	3	40	60	100	166
23BECY6E05	Vulnerability Assessment and Penetration Testing	PE	I,III 2	a,b,c,d, e,j,l	3	0	0	3	40	60	100	168

PROFESSIONAL ELECTIVE V

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY6E06	Internet of Things	PE	I,III 2	a,b,c,d h,i,l	3	0	0	3	40	60	100	171
23BECY6E07	Human Computer Interaction	PE	I,III 1	a,b,c, i,j,l	3	0	0	3	40	60	100	173
23BECY6E08	Storage Management and Security	PE	I,III 1	a,b,c,d i,j,l	3	0	0	3	40	60	100	176
23BECY6E09	Secure Coding	PE	I,III 2	a,b,c,d i,j	3	0	0	3	40	60	100	178
23BECY6E10	3D Printing and Design	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	180

PROFESSIONAL ELECTIVE VI

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECY7E01	Social Network Security	PE	I,III 1	a,b,c, h,i,j,l	3	0	0	3	40	60	100	182

COURSE CODE	NAME OF THE COURSE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECY7E02	Secure Software Engineering and Risk Management	PE	I,III 2	a,b,c,d h,i,j,l	3	0	0	3	40	60	100	185
23BECY7E03	UI and UX design	PE	I,III 2	a,b,c, i,j,l	3	0	0	3	40	60	100	187
23BECY7E04	Web Application Security	PE	I,III 2	a,b,c,d,e ,h,i,j,l	3	0	0	3	40	60	100	190
23BECY7E05	Game Development	PE	I,III 2	a,b,c e,i,j,l	3	0	0	3	40	60	100	192

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS FROM CYBER SECURITY

COURSECODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECYOE01	Basics of Cyber Crime And Cyber Security	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	195
23BECYOE02	Basics of Cyber Forensics	PE	I,III 2	a,b,c,d i,j,l	3	0	0	3	40	60	100	198
23BECYOE03	Cyber Laws and Intellectual Property Rights	PE	I,III 2	a,b,c, i,j,l	3	0	0	3	40	60	100	201
23BECYOE04	BlockChain and Cyber Security	PE	I,III 2	a,b,c,d, .i.j,l	3	0	0	3	40	60	100	203

LIST OF OPEN ELECTIVE COURSES OFFERED FROM OTHER DEPARTMENTS

SCIENCE AND HUMANITIES

COURSE CODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BESHOE01 / 23BTSHOE01	Mass communication	OE	II	h,i,j,l	3	0	0	3	40	60	100	207
23BESHOE02/ 23BTSHOE02	Fuzzy mathematics	OE	III	a,b,c,l	3	0	0	3	40	60	100	209
23BESHOE03/ 23BTSHOE03	Material sciences	OE	III	a,b,j,l	3	0	0	3	40	60	100	211
23BESHOE04/ 23BTSHOE04	Green Chemistry	OE	III	a,b,f,g, h,l	3	0	0	3	40	60	100	214

COURSECODE	NAME OF THE COURSE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BTFTOE04	Agricultural Waste and By product Sutilization	OE	III	a,b,c,d, f,g,h,i,j	3	0	0	3	40	60	100	236
23BTFTOE05	Design of Food Process Equipment	OE	III	a,b,c,d f,h,i,j	3	0	0	3	40	60	100	239

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MECHANICAL ENGINEERING

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COURSEC ODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BEMEOE01	Battery Management System	OE	III	a,b,c,d, j,l	3	0	0	3	40	60	100	242
23BEMEOE02	Industrial Safety and Environment	OE	III	a,b,c,d, j,l	3	0	0	3	40	60	100	244
23BEMEOE03	Non Destructive Testing	OE	III	a,b,c,d, j,l	3	0	0	3	40	60	100	246
23BEMEOE04	Operations Research	OE	III	a,b,c,d, j,l	3	0	0	3	40	60	100	249

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CIVIL ENGINEERING

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COURSEC ODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BECEOE01	Housing Plan And Management	OE	III	a,b,c,d, e,f,i,k,l	3	0	0	3	40	60	100	252
23BECEOE02	Building Services	OE	III	a,c,d,e, i,l	3	0	0	3	40	60	100	254
23BECEOE03	Repair and rehabilitation of structures	OE	III	a,b,c,d, e,f,i,k,l	3	0	0	3	40	60	100	257
23BECEOE04	Computer Aided Civil Engineering Drawing	OE	III	a,b,d,f, g,h,i k,l	3	0	0	3	40	60	100	259
23BECEOE05	Contracts Management	OE	III	a,b,d,e, f,g,j,k,l	3	0	0	3	40	60	100	261

COURSECODE	NAME OF THE COURSE	CATEGORY	PEOs, PSOs	POs	L	T	P	CREDIT(S)	CIA	ESE	TOTAL	Page No.
23BECEOE06	Air And Noise Pollution And Control	OE	III	a,b,d,e, f,g,i,k,l	3	0	0	3	40	60	100	264

BIO MEDICAL ENGINEERING

COURSEC ODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BEBMEOE01	Human Anatomy And Physiology	OE	III	a,b,c,f, h,,i,j,l	3	0	0	3	40	60	100	267
23BEBMEOE02	Artificial Organs And Implants	OE	III	a,b,f, g,h,i j,l	3	0	0	3	40	60	100	269

BIO TECHNOLOGY

COURSEC ODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BTBTOE01	Basic Bioinformatics	OE	III	a,b,c,d, e,f,l	3	0	0	3	40	60	100	272
23BTBTOE02	Fundamentals of Nanobiotechnology	OE	III	a,b,c,d, e,h,k	3	0	0	3	40	60	100	275

FACULTY OF PHARMACY

COURSEC ODE	NAME OF THE COURSE	CATEGORY	Objectives and Outcomes		Instruction hours/week			CREDIT(S)	Maximum Marks			Page No.
			PEOs, PSOs	POs	L	T	P		CIA	ESE	TOTAL	
23BP804ET	Pharmaceutical Regulatory Science	OE	III	f,g,h,l	3	0	0	3	40	60	100	279
23BP809ET	Cosmetic Science Theory	OE	III	e,l	3	0	0	3	40	60	100	282

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE											
22BTADOE01	Fundamentals of Data Science	OE	III	a,b,c,d, I,j,l	3	0	0	3	40	60	100	326
22BTADOE02	Fundamentals of Artificial Intelligence	OE	III	a,b,c,d, i,j,l	3	0	0	3	40	60	100	328
22BTADOE03	Internet Programming	OE	III	a,b,c, i,j,l	3	0	0	3	40	60	100	330
22BTADOE04	Robotics And Automation	OE	III	a,b,c,d, i,j,,l	3	0	0	3	40	60	100	333

SEMESTER-I

23BECC101   **PROFESSIONAL COMMUNICATIVE ENGLISH**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Extend the communicative competence of learners.
- Develop usage of language effectively in academic /work contexts
- Make use of Language skills in Reading and Writing
- Utilize language efficiently in expressing their opinions via various forms.
- Extend inter-personal communication skills.

COURSE OUTCOMES

Upon completion of this course students will be able to

- Identify new words by employing vocabulary building techniques.
- Build correct sentence structures and grammatical patterns in oral and written communication
- Construct business letters, proposals and E-Mail communication.
- Adopt the skills of planning, structuring, and delivery techniques in group discussions and presentations.
- Follow leadership, work ethics and management principles..

UNIT I   VOCABULARY BUILDING   9

Word formation process - One word Substitutes – Homophones – Homonyms – British and American vocabulary – Punctuation marks and capitalization

UNIT II FUNDAMENTALS OF ENGLISH GRAMMAR   9

Subject –verb agreement (Concord) – If-conditionals   - Modal verbs - Question types (Wh, Yes or No & Question tag), Prepositions- Articles

UNIT III LANGUAGE SKILLS (READING AND WRITING)   9

Reading (Skimming& Scanning) - Reading Methods (SQR3) – Writing -Business Letters (Job Application Letter & Resume Preparation, sales letter, Quotation letter) – E- Mail communication & etiquettes – Business Proposals (Structure & Types)

UNIT IV PROFESSIONAL SKILLS   **9**

Interview skills – Dos and Don'ts of an Interview, Group Discussion – Dos and Don'ts of GD, Presentation skills – Planning, structuring and Delivering Techniques

UNIT V INTERPERSONAL SKILLS   **9**

Personality development –Conflict management, Team work, Leadership Principles,
Negotiation skills

Note: Students shall have hands on training in improving Speaking skill in the language laboratory @ 2 periods per each unit.

Total :45

TEXT BOOKS:
1. Raman. Meenakshi, Sharma. Sangeeta (). Professional English. Oxford university press. New Delhi.
2. SanjayKumar,Pushpalata, (2011),Communicationskills, 1stEditionOxfordPress.
3. Ashraf Rizvi M, Effective TechnicalCommunication, McGraw Hill Education,First Edition, 2013.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	3	-	3	-	1
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	1
CO3	-	-	-	-	-	-	-	2	2	3	-	2	-	1
CO4	-	-	-	-	-	-	-	3	2	3	-	2	-	1
CO5	-	-	-	-	-	-	-	3	2	3	-	3	-	1
Avg	-	-	-	-	-	-	-	1	2	3	-	3	-	1

SEMESTER-I

23BECC102   **MATRICES AND CALCULUS**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students is to
- Develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- Familiarize the student with the differential calculus of multivariable functions. This is needed in many branches of engineering.
- Acquaint the student with mathematical tools needed in evaluating multiple integrals.
- Make the students acquire sound knowledge in techniques of solving linear ordinary differential equations.
- Provide knowledge about the concepts of partial differential equation with constant coefficients.

COURSE OUTCOMES

Upon completion of this course, the student will be able to:
- Make use of orthogonal transformation to reduce the quadratic form to canonical form.
- Utilize differential calculus of multivariable to optimization problems.
- Apply multiple integrals for finding area and volume.
- Solve the nth order Ordinary Differential Equations(ODE) and Homogeneous equation of Euler's type.
- Solve the nth order Partial Differential Equations.

UNIT I MATRICES   12
Eigenvalues and Eigenvectors of a real matrix– Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS   12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions –Applications: Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III MULTIPLE INTEGRALS   12

Proper and Improper integrals - Bernoulli's extension formula – Double integrals – Change of order of integration – Double integrals in polar coordinates – Area using double integrals – Evaluation of Triple Integrals

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS   12

Linear differential equation of second and higher order with constant coefficients – Euler-Cauchy linear differential equation – Method of Variation of parameters.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS   12

Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations.

TOTAL: 45+15

TEXT BOOKS

1. Grewal, B. S., & Grewal, J. S. (1996). Higher engineering mathematics. 2018, Khanna Publishers, New Delhi.
2. Kreyszig, E. (2007). Advanced Engineering Mathematics 10th Edition with Wiley Plus Set (p. 334). John Wiley & Sons.

REFERENCE BOOKS

1. Thomas, B. T., and Ross L Finney (2002). Calculus and Analytic Geometry, Pearson Publishers, Ninth edition
2. Ross, S. L. (1984). Differential Equation-Jhon Wiley & Sons. Inc. New York.
3. Henner, V., Belozerova, T., &Khenner, M. (2013). Ordinary and partial differential equations. CRC Press.

WEBSITES

1. www.archive.nptel.ac.in/courses/111/108/111108157/
2. www.nptel.ac.in/courses/111107108
3. www.archive.nptel.ac.in/courses/111/104/111104125/
4. www.nptel.ac.in/courses/111108081
5. www.nptel.ac.in/courses/111108144

CO-PO MAPPING

COs	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	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg	3	2	1	-	-	-	-	-	-	-	-	1	-	1

23BECC141   **ENGINEERING CHEMISTRY**   **6H-5C**

Instruction Hours/week: L:4 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for students is to

- Learn the basics of Periodic properties, Intermolecular forces
- Infer the terminologies of electrochemistry and to analyze about energy storage devices
- Build the concept of corrosion and its prevention
- Summarize the basic water technology and its purification.
- Develop an understanding of the range and uses of analytical methods in chemistry

COURSE OUTCOMES:

Upon completion of this course, the student will be able to

- Analyse periodic properties of elements.
- Apply the concepts of electrochemistry in storage devices.
- Illustrate the types of corrosion and its prevention.
- Identify the quality of water and treatment methodologies.
- Explain the principles and working of spectroscopic techniques.

UNIT I PERIODIC PROPERTIES, INTERMOLECULAR FORCES   9

Introduction to Periodic Properties- atomic and ionic sizes, ionization energies, electron affinity and electronegativity, effective nuclear charge. Penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations. Polarizability, oxidation states, coordination numbers. Ionic, dipolar and van Der Waals interactions.

UNIT II ELECTROCHEMISTRY AND STORAGE DEVICE   12

Thermodynamic functions. Free energy and emf. Cell potentials, the Nernst equation and applications. Types of electrodes Standard Hydrogen Electrode (SHE) & Calomel. Energy storage devices Primary and secondary cells- Leclanche cell, Lead Acid Battery, Nickel Cadmium Battery, Lithium Battery Charging and discharging reactions.

UNIT III CORROSION AND ITS CONTROL   12

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion-Corrosion control - Sacrificial anode and Impressed current cathodic methods - Corrosion inhibitors - Protective coatings - Organic coatings-Paints - Constituents and functions Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping

UNIT IV WATER TECHNOLOGY   12

Sources-Characteristics - Specification for drinking water, BIS &WHO-Alkalinity- Types of alkalinity and determination - Hardness - Types and estimation by EDTA method - Domestic water treatment - Disinfection methods (Chlorination, Ozonation. UV treatment) - Boiler feed water - Requirements - Disadvantages of using hard water in boilers - Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) - External conditioning - Demineralization process - Desalination - Reverse osmosis.

UNIT V - SPECTROSCOPIC TECHNIQUES AND APPLICATIONS   12

Spectroscopy (Principles and Instrumentation only). Electronic spectroscopy. Vibrational and rotational spectroscopy. Applications. Surface characterization techniques Scanning electron microscope (SEM) and Transmission electron microscopy (TEM). Fluorescence and its applications in medicine

Total : 60

(ii) LABORATORY

Choice of 10 experiments from the following:

1. Determination of surface tension and viscosity
2. Determination of Sodium Carbonate and Sodium Hydrogen Carbonate in a mixure using volumetric titration
3. Determination of Ca / Mg using complexometric titration
4. Thin layer chromatography
5. Determination of chloride content of water
6. Determination of the rate constant of a reaction
7. Conductometry - Determination of cell constant and conductance of solutions
8. pH Metry - Determination of Acid / Base
9. Potentiometry - determination of redox potentials and emfs
10. Saponification/acid value of an oil
11. Determination of the partition coefficient of a substance between two immiscible liquids

12. Adsorption of acetic acid by charcoal
13. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg

Total : 30

SUGGESTED READINGS

1. P C Jain & Monica Jain, (2015). Engineering Chemistry, 18th edition, Dhanpat Rai Publishing Company
2. B. H. Mahan, (2010).University chemistry, Pearson Education.
3. M. J. Sienko and R. A. Plane,(1976) Chemistry: Principles and Applications. 5th edition, McGraw-Hill Higher Education.
4. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
5. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web-book)
6. P. W. Atkins, (2009).Physical Chemistry, Oxford University Press.
7. K. P. C. Volhardt and N. E. Schore, (2014).5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman Publications.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	1	1	1	1	1	-	1	-	-
CO2	3	2	1	1	-	1	1	1	1	1	-	1	-	-
CO3	2	1	-	-	-	1	1	1	-	1	-	1	-	-
CO4	3	2	1	1	-	1	1	1	1	1	-	1	-	-
CO5	2	1	-	-	-	1	1	1	-	1	-	1	-	-
Avg	2.6	1.8	1.3	1.0	-	1.0	1.0	1.0	1.0	1.0	-	1.0	-	-

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for students to

- Impart the basic knowledge about the Electric circuits.
- Understand the concept of Electrical Machines and Transformers.
- Understand the working of Semiconductor devices and Digital Circuits.
- Impart the basic knowledge of Measuring Instruments and Electrical Installation.
- Know the fundamentals of Electrical Engineering and Practical.

COURSE OUTCOMES

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

- Build the electric circuits DC and AC excitation by applying various circuit laws.
- Illustrate the basic principles, construction and working of AC, DC Motor and transformer
- Identify the various characteristics of semiconductor devices and real time application of digital circuits.
- Explain the principle, construction and operation of moving coil and moving iron instruments, the electrical safety issues and protective devices.
- Compare the different types of Batteries & its application in Electric Vehicle.

UNIT I - DC CIRCUITS   9

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton Theorems.

UNIT II - AC CIRCUITS   9

Representation of sinusoidal waveforms, peak and rms values, Phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III - ELECTRICAL MACHINES AND TRANSFORMER   9

Construction and working of a three-phase and Single-phase induction motor. Construction, working and speed control of DC motor. Magnetic materials, BH characteristics, Construction and working principle of ideal and practical transformer.

UNIT IV- SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS   9

Bipolar Junction Transistor – Characteristics. Introduction to operational Amplifier –Model– Applications. Number systems – binary codes - logic gates - Boolean algebra, laws & theorems

UNIT V- MEASURING INSTRUMENTS AND ELECTRICAL INSTALLATION   9

Principle, construction, and operation of moving coil and moving iron meters-Measurement of Power. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, RCCB, MCCB. Earthing. Types of Batteries and its application in Electric Vehicle, Important Characteristics for Batteries. Elementary calculations for energy consumption and battery back up.

Total : 45

(ii)LABORATORY

COURSE OBJECTIVES

- Impart the basic knowledge about the Electric circuits.
- Observe the speed control experiments in DC motor.
- Acquire the knowledge of energy consumption measurements in single phase system.
- Observe and analyze the electrical parameters in R load
- Experiment the basic laws and logic gates.

COURSE OUTCOMES

At the end of this course, students will be able
- Getting basic practical knowledge about the Electric circuits using law.
- To observe the speed control experiments in DC motor.
- Gathered knowledge of commercial system energy calculations.
- To analysis various parameters in R load circuits.
- To verify the logic gates.

LIST OF EXPERIMENTS
1. Experimental verification of electrical circuit problems using Ohms law
2. Experimental verification of electrical circuit problems using Kirchhoff's Voltage law.
3. Experimental verification of electrical circuit problems using Kirchhoff's Current law.

4. Measurement of electrical quantities – voltage, current, power & power factor in R load.
5. Measurement of energy using single phase energy meter.
6. Speed control of DC Shunt Motor.
7. Verification of truth table of Logic Gates.

Total : 30

TEXT BOOKS:

1. S.K.Bhattacharya, "Basic Electrical Engineering", Pearson, 2019.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010
4. VN Mittle and Arvind Mittal, (2006), Basic Electrical Engineering, McGraw Hill.
5. A.Sudhaka and Shyammohan S Palli, (2013), Circuits and Networks, McGraw Hill.
6. R.Muthusubramanian and S.Salivahanan, (2014), Basic Electrical and Electronics Engineering, McGraw Hill.

WEBSITES:

1. www. nptel.ac.in.
2. www.encyclopedia-magnetica.com/doku.php/co energy.
3. www.en.wikibooks.org/wiki/electronics/measuring instruments.

CO-PO MAPPING

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

Instruction Hours/week: L:4 T:0 P:2 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
- Interpret problem solving using C.
- Apply the concept of arrays and strings.
- Identify the functions of C Language.
- Apply the concept of pointers .
- Develop C Programs using user defined function and file handling.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Apply problem solving techniques for a given problem

- Solve problems using arrays and strings.

- Build modular applications in C using functions.

- Categorize dynamic memory management operators with pointers.

- Examine sequential and random access file processing.

UNIT I INTRODUCTION **12**

An overview of computers and programming - Understanding computer systems - Programming logic - Steps in program development – Algorithm - Using pseudocode and flowchart – types of programming languages – Compiler – Interpreter – Linker - Introduction to C – Structure of C program - Identifiers and Keywords - Data types - Constants and variables - Type conversion – Operators - Expressions. Formatted and Unformatted Input/Output functions - Control structures.

UNIT II ARRAYS AND STRINGS **12**

Arrays in C - Declaring and initializing arrays in C - Defining and processing 1D and 2D arrays - Inserting and deleting elements of an array - Strings - Defining and initializing strings - Processing of string - Character arithmetic - String manipulation functions and libraryfunctions of string.

UNIT III FUNCTIONS   **12**

Functions - Types of Functions - Function prototypes - Function definition - Function call including passing arguments by value and passing arguments by reference - Passing arrays to functions - Math library functions - Recursive functions - Scope rules (local and global scope) - Storage classes in C.

UNIT IV   POINTERS   **12**

Pointers - Pointer declaration and initialization - Types of pointers - Pointer expressions and arithmetic - Operations on pointers - Passing pointer to a function - Pointer and one-dimensional array - Pointers and strings – Command line arguments - Dynamic memory management functions.

UNIT V USER DEFINED TYPES AND FILE HANDLING   **12**

User defined types - Enumerator – Typedef - Structures - Declaration of a structure - Accessing structures - Array of Structures - Structures and pointers - Nested structures – Bit fields – Unions - Declaration of a union – Accessing unions – Union vs Structure - File Input/Output – Preprocessor directives.

                                                  Total :60

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Develop a C Program to find the roots of quadratic equation for non-zero co-efficient using if-else ladder construct.
2. Develop Programs using simple control statements such as if else, while, do while.Example Extracting the digits of an integer, reversing digits, finding sum of digits
3. Develop a C Program to implement a simple calculator to perform addition, subtraction, multiplication and division operations using switch construct. Display appropriate messages for invalid operator and divide by zero error.
4. Deveop C Program to generate Fibonacci sequence,calculation of factorials, printing various patterns and generate the Prime numbers between the ranges m & n using for loop.
5. Develop a C program to read n elements into an integer array, Insert and Delete element from the array. Print the input array and the resultant array with suitable messages.
6. Develop a C program to read two matrices A (m x n) and B (p x q) and compute the product of the two matrices. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.
7. Develop a C function Program to sort the given names in Asecnding Order**.**

8. Develop a C program to count the vowels & consonants in a given string.
9. Develop a C Program to find the GCD of two integers using Euclid's algorithm
10. Develop a recursive C function to find the factorial of a number, n! , defined by fact(n)=1, if n=0. Otherwise fact(n)=n*fact(n-1). Using this function, develop a C program to compute the Binomial coefficient nCr. Perform input validation as well.
11. Develop a C program to find the smallest and largest elements in an array using pointers and then swap these elements and display the resultant array.
12. Develop a C program to find the sum of all the elements of an integer array using pointers.
13. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using structures and pointers

Total : 30

TEXT BOOKS

1. Programming In C By Ashok N. Kamthane,3rd edition, Pearson, 2015.
2. Programming In C, Reema Thareja, Oxford University Press, Second Edition, 2016.

REFERENCES BOOKS

1. "C How To Program" By Paul Deitel And Harvey Deitel, 8th edition, Prentice Hall, 2015.
2. "Programming In Ansi C" By E. Balagurusamy, 8th edition, Mcgraw Hill Education, 2019.
3. "Let Us C", by Yashwant Kanetkar, 17th Edition, Bpb Publications, 2020.
4. "C: The complete reference", Herbert Schildt, 4th edition, Mcgraw Hill Education, 2017.

WEBSITES

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

CO-PO MAPPING

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

SEMESTER-II

23BECC201A   **GRAPH THEORY**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Provide the basic concepts of graphs.
- Impart the knowledge of trees and its properties via various algorithms.
- Afford the adequate knowledge on matrix representation of graphs.
- Inculcate the concept of coloring and dominating sets.
- Understand the concepts and significance of lattices which are widely used in engineering fields.

COURSE OUTCOMES

Upon completion of this course the students will be able to:

- Infer the basic terminologies of directed and undirected graphs.
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cutset through algorithms.
- Apply matrix representation of graphs to explore spectra and energy of graphs.
- Interpret the coloring and domination of a given graph.
- Explain Lattice theory and its operations on discrete structural areas of computing.Lattice theory and its operations on discrete structural areas of computing.

UNIT I-GRAPHS   12

Graphs: Directed and undirected graphs – Konigsberg bridge problem – Handshaking Theorem– Walk, Trail, Path, Circuit, Cycle, sub graphs, induced and spanning subgraphs, connected graphs, complement of a graph – Euler, Hamiltonian graphs - Isomorphism of graphs.

UNIT II TREES   12

Trees: Properties of trees – Distance and centers in tree – Rooted and binary tree Spanning trees – Connectivity and separability – Fundamental Circuits and Cut sets – Algorithm on spanning trees: Kruskal's and Prim's Algorithm – Dijkstra's shortest path algorithm.

UNIT III MATRIX REPRESENTATION OF GRAPHS   12

Matrix Representation of Graphs: Adjacency matrix, Incidence matrix, Circuit matrix, Fundamental circuit matrix, Laplacian matrix, rank of these matrices and its properties – Spectra and Energy of Graphs.

UNIT IV COLORING, COVERING AND PARTITIONING   12

Coloring, Covering and Partitioning: Chromatic number – Chromatic Partitioning: Dominating set – Minimal Dominating set – Domination number- Chromatic Polynomial– Matching – Four color theorem (Statement only).

UNIT V LATTICE THEORY   12

Lattice theory: Partial ordering – Posets – Lattices as posets – Properties of lattices – Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices.

Total : 60

SUGGESTED READINGS

1. Narsingh Deo., "Graph Theory with applications to Engineering and Computer Science", Dover Publications Inc, First Edition, 2016.
2. Karin R Saoub., "Graph Theory – An Introduction to Proofs, Algorithms and Applications", CRC Press, First Edition, 2021.
3. Kenneth H. Rosen., "Discrete Mathematics and Applications", Mcgraw Hill, 7th Edition, 2012.
4. Clark J and Holton D.A., "A First Look at Graph Theory", Allied Publishers, 1995.
5. Grimaldi R.P., "Discrete and Combinatorial Mathematics: An Applied Introduction", Addison Wesley, 2016.
6. J. A. Bondy and U. S. R. Murty., "Graph Theory With Applications", Elseyier Science Publishing, 1976.
7. R. L. Goodstein., "Boolean Algebra", Dover Publications, 2007.

WEBSITES

1. http://math.fau.edu/Locke/Courses/GraphTheory/Spring2019
2. https://onlinecourses.nptel.ac.in/noc22_ma10/preview
3. https://nptel.ac.in/courses/106108054
4. https://onlinecourses.nptel.ac.in/noc21_cs48/preview
5. http://www.cectl.ac.in/images/pdf_docs/studymaterial/cse/s3/dcs4.pdf

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	2
Avg	2.2	1.2	1.0	-	-	-	-	-	-	-	-	1.0	-	2.0

SEMESTER-II

23BECC201B   **COMPUTATIONAL METHODS FOR ENGINEERS**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Provide the knowledge of Vector differentiation and Integration.
- Inculcate the concepts of theories on Numbers.
- Introduce the concepts of Graphs.
- Introduce diversified methods of trees namely the algorithm on spanning trees.
- Afford the adequate knowledge of Linear Programming Problems.

COURSE OUTCOMES

Upon completion of this course, the student will be able to
- Make use of vector calculus for finding area and volume.
- Interpret the concepts of divisibility, prime number, congruence and number theorems.
- Explain the terminology of basic graphs and its matrix representation.
- Illustrate the properties of trees, connectivity, fundamentals of circuits, cut set through algorithms.
- Solve linear programming models by Graphical method, Simplex method and Dual simplex method.

UNIT I VECTOR CALCULUS   12

Vector differential operator – Gradient, divergence and curl – Identities (Statement only) – Directional derivatives – 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.

UNIT II NUMBER THEORY   12

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

UNIT III GRAPH THEORY 12

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

UNIT IV   TREES 12

Trees: Properties of trees – Distance and centers in tree – Rooted and binary tree – Spanning trees– Properties of trees – Algorithm on spanning trees –   Kruskal's algorithm.

UNIT V LINEAR PROGRAMMING PROBLEM 12

Formulation of Linear Programming Problem– Advantages and disadvantages of LPP – Algebraic solution of a LPP - Graphical method - The Simplex method - Principle of duality - Dual and primal problems - Dual Simplex method.

Total 45+15

TEXT BOOKS

1. Grimaldi R.P,"Discrete and Combinatorial Mathematics: An Applied Introduction" Addison Wesley,2016

REFERENCE BOOKS

1. Karin R Saoub," Graph Theory – An Introduction to Proofs, Algorithms and Applications", CRC Press,2021
2. Ramana B V," Higher Engineering Mathematics", McGraw Hill Education, Twenty Ninth Reprint,2017
3. Erwin Kreyszig," Advanced Engineering Mathematics ",John Wiley and Sons, Tenth,2017

WEBSITES:

1**.** https://nptel.ac.in/courses/111105122
2. https://nptel.ac.in/courses/111/101/111101137/
3. https://nptel.ac.in/courses/111/106/111106050/
4. https://nptel.ac.in/courses/111/106/111106050/
5. https://nptel.ac.in/courses/112106134

CO-PO MAPPING

COs	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	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg	2.4	1.4	1	-	-	-	-	-	-	-	-	1	-	1

23BECC201C   **TRANSFORMS AND ITS APPLICATIONS**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Make the students to understand the concept of periodic function and represent them in Fourier series.
- Make the students to understand the applications of partial differential equations.
- Acquaint the students with the concepts of Fourier transform techniques.
- Impart knowledge in Laplace transform techniques and its applications.
- Provide knowledge about solving ordinary differential equations using the Inverse Laplace transform.

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- Illustrate Fourier series representation of periodic functions.
- Apply Fourier series in one dimensional heat flow and wave equation.
- Make use of Fourier transform for converting elementary functionsinto frequency domain.
- Utilize Laplace Transform to convert time-domain systems into frequency-domain systems.
- Apply Inverse Laplace Transform in linear differential equations..

UNIT I FOURIER SERIES   12

Dirichlet's conditions – General Fourier series in the interval (0,2l) & (-l,l) – Half range sine series – Half range cosine series –Harmonic analysis.

UNIT II: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS   12

Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

UNIT III FOURIER TRANSFORMS   12

Fourier transform pair – Complex form of Fourier transform- Fourier sine and cosine transforms – Convolution theorem – Parseval's identity of Fourier transform.

UNIT IV LAPLACE TRANSFORM   12

Transforms of standard functions – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions.

UNIT V INVERSE LAPLACE TRANSFORM   12

Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions– Solution of ordinary differential equations with constant coefficients using Laplace transforms

Total : 45+15

TEXT BOOKS

1. John W. Miles," Integral Transforms in Applied Mathematics", Cambridge University Press, 2008.
2. Erwin Kreyszig," Advanced Engineering Mathematics", John Wiley and Sons, Tenth Edition,2017.

REFERENCE BOOKS

1. Eric W Hansen,"Fourier Transforms: Principles And Applications" John Wiley, 2014
2. N.W. McLachlan," Laplace Transforms and Their Applications to Differential Equations", Dover Publications Inc.,2014.
3. Richard Haberman," Applied Partial Differential Equations with Fourier Series and Boundary Value Problems", Pearson, Fifth edition,2021.

WEBSITES

1. https://nptel.ac.in/courses/111106111
2. https://nptel.ac.in/courses/111107111
3. https://nptel.ac.in/courses/111102129
4. https://nptel.ac.in/courses/111106139
5. https://archive.nptel.ac.in/courses/111/105/111105123/

CO PO MAPPING

COs	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
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg	2.8	1.8	1	-	-	-	-	-	-	-	-	1	-	1

23BECC202   **ENVIRONMENTAL STUDIES**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Create the awareness about environmental problems among people.
- Develop an attitude of concern for the environment.
- Motivate public to participate in environment protection and improvement.
- Gain a variety of experiences and acquire a basic understanding of environment and it's associated problems.
- Relate critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

COURSE OUTCOMES

Upon completion of this course, the student will be able to:

- Outline the ecological processes supporting the life system.
- Infer the importance of environment and impact of human acivities on natural resources.
- Explain the levels and values of biodiversity and its conservation.
- Summarize the problems of environmental pollution and its control measures.
- Interpret the remediation methods for social issues and degraded environment.

UNIT I INTRODUCTION - ENVIRONMENTAL STUDIES& ECOSYSTEMS   9

Environment Definition, Scope and importance; Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grass and Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II - NATURAL RESOURCES - RENEWABLE AND NON RENEWABLE RESOURCES   9

Natural resources - Renewable and Non - Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III - BIODIVERSITY AND ITS CONSERVATION   9

Levels of biological diversity - genetic, species and ecosystem diversity. Ecosystem and biodiversityservices: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV -ENVIRONMENTAL POLLUTION   9

Definition, causes, effects and control measures of Air pollution, Water pollution – Water reuse and recycling, Soil pollution, Noise pollution. Nuclear hazards and human health risks. Solid waste management and control measures of urban, industrial and e-wastes. Role of an individual in prevention of pollution. Case studies

UNIT V - SOCIAL ISSUES AND THE ENVIRONMENT   9

Concept of sustainability and sustainable development. Water conservation -Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Environment Laws (Environment Protection Act, Air Act, Water Act, Wildlife Protection Act, Forest Conservation Act). International agreements (Montreal and Kyoto protocols).Resettlement and rehabilitation of project affected persons. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko, Silent valley, Bishnois of Rajasthan). Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies(e.g.,CNG vehicles in Delhi).Human population growth: Impacts on environment ,human health and welfare.

Total : 45

SUGGESTED READINGS

1. Anubha Kaushik., and Kaushik, C.P. 2004. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
2. Erach Bharucha. 2004. A text book for Environmental Studies, University Grants Commission and Bharat Vidypeeth Institute of Environmental Education Research, New Delhi.
3. Rajagopalan, R. 2016. Environmental Studies: From Crisis to Cure, Oxford University Press.
4. Sing, J.S., Sing. S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
5. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., New Delhi.
6. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.

7. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.
8. Tripathy. S.N., and Sunakar Panda. (2004). Fundamentals of Environmental Studies (2nd ed.). Vrianda Publications Private Ltd, New Delhi.
9. Verma, P.S., and Agarwal V.K. 2001. Environmental Biology (Principles of Ecology). S. Chand and Company Ltd, New Delhi.
10. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	3	3	-	1	-	2	-	-
CO2	2	1	-	-	-	2	3	3	-	1	-	2	-	-
CO3	2	1	-	-	-	2	3	3	-	1	-	2	-	-
CO4	2	1	-	-	-	2	3	3	-	1	-	2	-	-
CO5	2	1	-	-	-	2	3	3	-	1	-	2	-	-
Avg	2	1	-	-	-	2	3	3	-	1	-	2	-	-

23BECY241   SEMICONDUCTOR PHYSICS   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course for students is to
- Understand the fundamentals of electrons flow and band structure.
- Inculcate the characteristics of electronic materials through basics.
- Divulge knowledge on the basics of semiconducting materials for diode applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Impart the basic knowledge of new semiconducting material for engineering applications.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Apply the basics of free electron theory for classification of materials
- Identify the types of semiconductors and its carrier concentration using Hall effect
- Utilize magnetic properties for finding B - H Curve
- Examine the performance of light, laser and optical fibres
- Illustrate the properties of low dimensional materials and its fabrication methods

UNIT I ELECTRONIC THEORY OF SOLIDS   9

Classical free electron theory, Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory - Fermi- Dirac distribution function - Density of states in metals and energy band diagrams, Energy bands in solids, Direct and indirect band gaps, types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effect of temperature on Fermi level.

UNIT II SEMICONDUCTORS   9

Properties of semiconductor, Types: Intrinsic and extrinsic semiconductors – Intrinsic carrier concentration, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift - Hall Effect – Determination of Hall coefficient - Applications

UNIT III MAGNETIC AND DIELECTRIC MATERIALS   9

Magnetic moment, magnetic dipoles - magnetic permeability and susceptibility, types of magnetic materials - Ferromagnetism, Domain Theory, Hysteresis on the basis of domains, Energy product, hysteresis loss, soft and Hard magnetic materials - Dielectric materials: Polarization, Types - dielectric loss, internal field, Clausius - Mosotti relation, dielectric breakdown.

UNIT IV LASER AND FIBER OPTICS   9

LASER: Introduction - characteristics - Einstein's co-efficients derivation Principle of laser action-population inversion- pumping methods -Types of laser - Nd: YAG, CO_2 - Applications of LASER in industry and medicine.

Fiber optics - principle– modes of propagation of light in optical fibers – numerical aperture and acceptance angle – types of optical fibers (Material, refractive index and mode) – fiber optical communication system (block diagram).

UNIT V NANOMATERIALS   9

Density of states in 2D, 1D and 0D (qualitatively), Practical examples of low-dimensional systems such as quantum wells, wires, and dots – Nanostructures: Fabrication technique (Chemical vapour deposition, Physical laser deposition), Properties and its applications – Carbon nanotubes: Properties and applications.

Total: 45

(ii) LABORATORY

LIST OF EXPERIMENTS – PHYSICS (Any 7 Experiments)

1. Determination of Band gap of a semiconductor.
2. Characteristics of photo diode.
3. Determination of Hall Coefficient and carrier type for semi-conducting Materials.
4. Carey Foster Bridge - Determination of specific resistance of a given coil of wire
5. Determination of magnetic materials using B-H Curve.
6. Determination of resistivity of four probe method.
7. Laser- Determination of the wave length of the laser using grating,
8. Optical Fiber – Determination of Numerical Apearture and Acceptance angle of the optical fiber
9. Viscosity of liquids-Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
10. Air wedge – Determination of thickness of a thin sheet/wire.

Total :30

TEXT BOOKS

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, (2015).
2. B.K. Pandey, S. Chaturvedi, Engineering Physics, Cengage Learning India Pvt. Ltd. 2 nd Edition, (2022).
3. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, wiley Publishers, (2006).
4. William T Silfvast, Laser Fundamentals, Cambridge Univ Press. 2012.

REFERENCE BOOKS

1. Halliday.D. Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
2. Charles Kittel, Kittel's, Introduction to Solid State Physics, Wiley India Edition, 2019.
3. Donald A. Neamen, Semiconductor Physics and Devices, McGraw Hill Education private limited; 4 edition, (2021).
4. LeszekMalkinski, Advanced Magnetic Materials, Published by InTech, (2012).
5. Michael Shur, Physics of Semiconductor Devices, Published by Pearson Education; First edition, (2019).
6. Kulkarni, Sulabha K, Nanotechnology: Principles and Practices, Springer International Publishing, (2015).
7. R P Khare, Fiber Optics and Optoelectronics, Oxford, 2012

WEBSITES:

1. https://nptel.ac.in/courses/115102025/
2. https://nptel.ac.in/courses/108/108/108108122/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-fall-2009/lecture-notes/MIT6_012F09_lec01.pdf

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO2	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO3	3	2	-	-	-	-	-	-	2	2	-	1	-	-
CO4	3	3	2	-	-	1	-	-	2	2	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg	2.8	2.0	2.0	-	-	1.0	-	-	2.0	1.8	-	1.0	-	-

Instruction Hours/week: L:4 T:0 P:2　　　　　**Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to

- To understand the principles of web design.
- To gain knowledge of HTML and its elements.
- To infer the concepts of CSS and various layouts for styling a web page.
- To develop designing interactive web pages using JavaScript.
- To learn about responsive web design using Bootstrap.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Develop interactive front-end web user interfaces using responsive web design principles.
- Experiment with HTML tags and its elements for designing static pages.
- Apply the concepts of CSS and layouts for styling web pages.
- Categorize dynamic web pages using JavaScript.
- Analyze responsive web pages using Bootstrap.

UNIT I   THE ESSENTIALS OF WEB DESIGN　　　　　　　　　　　**12**

Introduction to web design – the internet versus the web – web browsers – the design process - defining good design - web page anatomy - grid theory – balance – unity – emphasis – layouts – web trends - responsive design - screen resolutions - responsive web design principles - responsive frameworks – accessibility – site performance - modern web development tools.

UNIT II INTRODUCTION TO HTML　　　　　　　　　　　　　　　**12**

Introduction to HTML - document structure – paragraphs – headings – lists – div – span – improving accessibility with aria – hyperlinks – adding images – table markup – forms – embedded media.

UNIT III CASCADING STYLE SHEETS   12

Introduction to CSS – units of measurement – formatting text with css3 – colours and backgrounds - padding – borders – margins – floating and positioning – CSS layout with Flexbox and Grid.

UNIT IV DYNAMIC WEB PAGES USING JAVASCRIPT   12

Introduction to JavaScript – adding JavaScript to a page – anatomy of a script – the browser object – events – DOM – polyfills – JavaScript libraries.

UNIT V   RESPONSIVE WEB DESIGN USING BOOTSTRAP   12

Introduction to Bootstrap – setting up bootstrap – structuring web page using bootstrap – grid system – typography – tables – forms – images – effects – icons - components.

Total: 60

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Developing static web pages using HTML.
2. Designing web pages with tables and forms using HTML.
3. Developing HTML based web page to demonstrate the use of inline CSS.
4. Developing HTML based web page to demonstrate the use of internal CSS.
5. Developing HTML based web page to demonstrate the use of external CSS.
6. Developing web pages using HTML and CSS Flexbox.
7. Developing dynamic web pages using JavaScript.
8. Validating web pages using JavaScript.
9. Handling web page events using JavaScript.
10. Designing responsive web page using Bootstrap grid system.
11. Designing tables and forms using Bootstrap.
12. Designing responsive website using Bootstrap components

Total: 30

TEXT BOOKS

1. **"**Learning Web Design", Jennifer Niederst Robbins, O'Reilly Media, Inc, Fifth Edition, 2018.
2. **"**Introducing Bootstrap 4", Jorg Krause, Apress Media LLC, Second Edition, 2020.

REFERENCE BOOKS

1. **"**The Principles of Beautiful Web Design", Jason Beaird, James George and Alex Walker, SitePoint Pty. Ltd., Fourth Edition, 2020.

2. **"**Responsive Web Design with HTML5 and CSS", Ben Frain, Packt Publishing, Third Edition, 2020.
3. **"**Mastering Bootstrap 4", Benjamin Jakobus and Jason Marah, Packt Publishing, Second Edition, 2016.

WEBSITES

1. https://www.w3schools.com/html/
2. https://www.w3schools.com/css/
3. https://www.udacity.com/course/responsive-web-design-fundamentals--ud893
4. https://javascript.info/
5. https://getbootstrap.com/docs/4.6/getting-started/introduction/

CO-PO MAPPING

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

23BECC243A   **DATA STRUCTURES AND ALGORITHMS**   **6H-5C**

Instruction Hours/week: L:4 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to

- Understand the concepts of ADTs.
- Learn linear data structures – lists, stacks, and queues.
- Interpret non-linear data structures – trees and graphs.
- Implementd sorting, searching and hashing algorithms.
- Apply Tree and Graph structures to real world scenario.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Build abstract data types for linked list data structure.
- Apply the concepts of stack, queue and its applications.
- Experiment with operations on binary trees.
- Identify the traversal techniques of graphs and its applications.
- Inspect sorting, searching and hashing techniques.

UNIT I LISTS   12

Abstract Data Types (ADTs) – Elementary Data types–List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Doubly-linked lists – Circularly linked lists – Applications of lists – Polynomial ADT –Multilists–Sparse Matrices.

UNIT II STACKS AND QUEUES   12

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions-Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – Deque – Applications of Queues.

UNIT III TREES   **12**

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees –Red-Black Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS   **12**

B-Tree – B+ Tree – Tries – Graph Definition – Representation of Graphs – Types of Graphs - Breadth-first traversal – Depth-first traversal –– Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES   **12**

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –– Quick Sort – Merge Sort – Heap Sort – Radix Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Total: 60

(ii)   LABORATORY

LIST OF EXPERIMENTS

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
5. Implementation of Binary Search Trees and AVL Trees
6. Implementation of Heaps using Priority Queues
7. Implementation of Dijkstra's Algorithm
8. Implementation of Prim's Algorithm
9. Implementation of Linear Search and Binary Search
10. Implementation of Insertion Sort and Selection Sort
11. Implementation of Merge Sort and Quick Sort
12. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

Total: 30

TEXT BOOKS

1. Mark Allen Weiss," Data Structures and Algorithm Analysis in C", Pearson Education, Second Edition, 2005
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein," Introduction to Algorithms", Mcgraw Hill/ MIT Press, Fourth Edition,2022

REFERENCE BOOKS

1.   Narasimha Karumanchi," Data Structures and Algorithms Made Easy", CareerMonk Publications, First Edition,2016
2.   Langsam, Augenstein and Tanenbaum, "Data Structures Using C", Pearson Education, Second Edition,2015
3.   Kamthane," Introduction to Data Structures in C", Pearson Education, First Edition,2007
4.   Kruse," Data Structures and Program Design in C", Pearson Education, Second Edition,2003

WEBSITES

1.   www.nptel.ac.in/courses/106106145
2.   www.nptel.ac.in/courses/106102064
3.   www.coursera.org/learn/data-structures
4.   www.edx.org/learn/data-structures
5.   www.cs.usfca.edu/~galles/visualization/Algorithms.html

CO-PO MAPPING

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

23BECC243B   **OBJECT ORIENTED PROGRAMMING USING PYTHON**   **6H-5C**

Instruction Hours/week: L:4 T:0 P:2   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
- Learn basic python language syntax, semantics and control structures.
- Apply list, tuple, set and dictionary to handle data.
- Solve the problems using functions and modules.
- Infer the object-oriented programming concepts in python.
- Interpret inheritance and exception handling in python.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Apply python control flow statements to solve problems.
- Model data structures using string, tuple, list, set, and dictionary.
- Identify Python built-in functions to write user defined functions.
- Apply object-oriented programming concepts in python.
- Analyze the concepts of exception handling to a real world scenario.

UNIT I - PYTHON FUNDAMENTALS   12

Introduction to Python – language classification - python language syntax - keywords - identifiers - indentation - comments - input - output - escape characters – variables – operators - Control Statements.

UNIT II - DATA STRUCTURES IN PYTHON   12

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.

UNIT III - FUNCTIONS AND MODULES   12

Python built in functions - User defined functions - Creating function – Invoking functions – Types of function arguments – Recursion and lambda or anonymous functions - Defining, Creating and Accessing a Package, importing packages and user defined modules.

UNIT IV - CLASSES AND OBJECTS   12

Object Oriented 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.

UNIT V - INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING   12

Implementing inheritance – Types of inheritance – Implementing Polymorphism - Method overloading – Method overriding – Operator overloading - Abstract Classes - Association and Aggregation - Errors vs exceptions – Handling exceptions – Raising exception – Creating user defined exception.

Total: 60

(ii)   **LABORATORY**

LIST OF EXPERIMENTS

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

TotaL: 30

TEXT BOOKS

1. Think Python: How to Think Like a Computer Scientist Anany Levitin, Allen B. Downey Second Edition, O'Reilly, 2016.
2. Python 3 Object-oriented Programming, Dusty Phillips, Third Edition, Packet Publishing, 2018.

REFERENCES BOOKS

1. The Absolute Beginner's Guide to Python Programming, Kevin Wilson, Apress Media LLC, First Edition, 2022.
2. Python 3 The Comprehensive Guide, Johannes Ernesti, Peter Kaiser, Rheinwerk Publishing Inc., First Edition, 2022
3. Fundamentals of Python Programming, Richard L. Halterman, Southern Adventist University, First Edition, 2019

WEBSITES

1. https://docs.python.org/3/
2. https://www.programiz.com/python-programming
3. https://www.scaler.com/topics/python/
4. https://www.geeksforgeeks.org/python-oops-concepts/
5. https://www.edureka.co/blog/object-oriented-programming-python/

CO-PO MAPPING

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

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Inculcate the concepts of theories on Numbers.
- Extend student's logical and mathematical maturity and ability to deal with abstraction.
- Synthesize methods of solving problems in summation of series and recurrence relations.
- Iintroduce the concept of Theoretical Distributions.
- Make the students to interpret the importance of correlation function and spectral studies.
- Provide a firm basis for further reading and study in the subject.

COURSE OUTCOMES

Upon Completion of this course the students will be able to

- Interpret the concepts of divisibility, prime number, congruence and number theorem.
- Solve a given problem using propositional logic.
- Explain the concept of Mathematical induction and the fundamentals of Probability
- Infer standard distributions of random variables.
- Explain the perceptions of correlation and spectral densities..

UNIT I INUMBER THEORY   12

Divisibility – Fundamental Properties – Euclidean algorithm – Euclid's lemma – Fundamental theorem of arithmetic – Congruence – Fermat's Little theorem (statement only) and the Chinese remainder theorem (statement only)..

UNIT II PROPOSITIONAL CALCULUS   12

Propositional Calculus: Propositions – Logical connectives - compound propositions – conditional and biconditional propositions - Truth tables - Tautologies and contradictions – contrapositive – Logical equivalences and implications – Demorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms.

UNIT III COMBINATORICS   12

Mathematical Induction – Permutations and combinations - Recurrence Relation – Formation of Recurrence relation – Solution of recurrence relation by Generating Functions – Concept of Probability – Conditional– Theorem of Total Probability – Baye's theorem.

UNIT IV THEO*RE*TICAL DISTRIBUTIONS   12

One dimensional Random Variables – Discrete and Continuous Random variables – Probability distribution function – Probability density function - Mathematical Expectations – Moments –. Mean and Variance – Moment generating function of Binomial, Poisson and Normal distributions

UNIT V STOCHASTIC PROCESS   12

Classification of Random Process – Discrete and Continuous cases –– Auto Correlation Functions – Properties – Stationary Random processes – WSS and SSS processes – Power spectral density – properties of power spectral density – Cross-power spectral density and properties – Auto-correlation function and power spectral density of a WSS random sequence

Total : 60

TEXT BOOKS

1. Ralph P Grimaldi,Discrete and Combinatorial Mathematics: An Applied Introduction,5th Edition, Pearson New International Edition,2016
2. Kenneth H. Rosen,Discrete Mathematics and Applications,7th Edition, Mcgraw Hill, Education,2012
3. Peebles P Z,Problems and solutions in probability, random variables and random signal principles (SIE),1st Edition, McGraw Hill Education,2017
4. Roy D Yates and David J Goodman,Probability and Stochastic processes,2nd Edition, Wiley India Pvt Ltd,2005
5. Douglas C. Montgomery& George C.Runger,Applied Statistics and Probability for Engineers,John Wiley, Sixth Edition,2016

REFERENCES

1. Kenneth H Rosen,Discrete Mathematics and its Applications with Combinatorics and Graph Theory,7thRevised Edition, Tata McGraw – Hill Pub Co Ltd,2017.

2. Kishor S Trivedi,Probability and Statistics with reliability, Queueing and Computer Science Applications,2nd Edition, Revised Paperbook, Prentice Hall of India,2016.
3. Peebles P Z,Problems and solutions in probability, random variables and random signal principles (SIE),1st Edition, McGraw Hill Education ,2017.
4. Bernard Kolman, Robert C Busby and Sharon Ross,Discrete Mathematical Structures 6th Edition, Pearson publishers ,2008.

5. Henry Stark and John W Woods,Probability and Random Processes with application to signal processing,3rd Edition, Pearson Education,2002.

WEBSITES
1. https://www.geeksforgeeks.org/proposition-logic/
2. www.tutorialspoint.com/discrete_mathematics/
3. https://nptel.ac.in/courses/108103185
4. https://nptel.ac.in/courses/108106083
5. www.mathworld.wolfram.com

CO-PO MAPPING

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

23BECY301B   **NUMERICAL METHODS**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Inculcate the basic concepts of solving algebraic and transcendental equations.
- Understand the numerical techniques of interpolation in various intervals
- Provide the knowledge of numerical differentiation and integration
- Provide the knowledge of solving ordinary differential equations numerically
- Inculcate various techniques of solving partial differential equations numerically.

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- Solve the systems of linear and nonlinear equations by iterative methods.

- Make use of interpolation methods for finding the missing terms.

- Apply numerical methods for finding differentiation and integration of a given function.

- Solve ordinary differential equations using Euler's, Taylor's, Runge Kutta and Milne Thomson's method.

- Utilize implicit and explicit methods in heat and wave equations

UNIT I SOLUTION OF EQUATIONS   12

Regula Falsi Method - Newton Raphson method for solving algebraic and transcendental equations Solution of system of linear equations - Gauss elimination method - Gauss Jordan method -Gauss Seidel method

UNIT II INTERPOLATION   12

Interpolations with unequal intervals-Lagrange's interpolation -Newton's divided interpolation - Interpolation with equal intervals-Newton's forward and backward interpolation

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION   12

Approximation of derivatives using Newton's forward and backward interpolation - Numerical integration using Trapezoidal, Simpson's 1/3 and 3/8 rule

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS   12

Single step method- Euler's method-Taylor's series method-Fourth order Runge – Kutta method –Multi step method-Milne's predictor corrector method

UNIT V   NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS   12

Solutions of one dimensional heat equation by Bender-Schmidt and Crank Nicholson methods – Numerical solutions of one dimensional wave equation by explicit method

Total : 60

TEXT BOOKS
1. McGraw Hill Education, Seventh Edition,StevenC.Chapra and Raymond P.Canale, Numerical Methods for Engineers,2015.

2. Curtis F. Gerald and Patrick O. Wheatley,Applied Numerical Analysis,Addison Wesley, Thirteenth Edition,2004.

REFERENCE BOOKS
1. Richard L. Burden and J. Douglas Faires,NumericalMethods,Brooks/Cole, 4th edition,2012

2. John Wiley and Sons, Tenth Edition,ErwinKreyszig,Advanced Engineering Mathematics,2011.

WEBSITES
1. https://archive.nptel.ac.in/courses/111/107/111107105/
2. https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/resources/lecture-2-eulers-numerical-method-for-y-f-x-y/
3. http://www.infocobuild.com/education/audio-video-courses/mathematics/numerical-analysis-iit-madras.html
4. http://www.infocobuild.com/education/audio-video-courses/mathematics/NumericalMethods-FiniteDifference-IIT-Roorkee/lecture-06.html

CO-PO MAPPING

COs	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	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg	3	2	1	-	-	-	-	-	-	-	-	1	-	1

SEMESTER-III

| 23BECY301C | NUMERICAL LINEAR ALGEBRA | 4H-4C |

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Import the knowledge of solving system of algebraic equations.
- Provide the concept of Algebraic Structures such as Groups, Ring, Field and Vector spaces.
- Inculcate various spaces namely Null space, Row space, Column space and Range space and its matrix representations.
- Apply the concept of inner product spaces in orthogonalization.
- Afford the adequate knowledge of least square approximation, Singular Value Decomposition and Principal Component Analysis.

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- Solve algebraic equations using direct and indirect methods.
- Infer the basics of vector spaces, subspaces and its properties.
- Explain the properties and matrix representation of a linear transformation.
- Interpret the inner product spaces in Gram Schmidt orthogonalization process and orthogonal projection.
- Apply Least Square Approximation, Singular Value Decomposition and Principal Component Analysis in vector spaces.

UNIT - I NUMERICAL SOLUTION OF SYSTEM OF ALGEBRAIC EQUATION   12

Solving system of equations – Direct methods: Gauss Elimination and Gauss Jordan Methods –Inverses of Matrix by Gauss Jordan method – LU Factorizations – Iterative method: Gauss Seidel method – Power method for finding Eigen values.

UNIT - II VECTOR SPACES   12

Algebraic Structures – Binary Operation – Semi Group, Monoid and Group – Subgroups – Rings and Fields (Concept only) – Vector Spaces – Subspaces – Linear Span – Linear Independence and dependence of vectors - Basis and Dimension.

UNIT – III LINEAR TRANSFORMATION   12

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

UNIT - IV INNER PRODUCT SPACE   12

Inner Products and Norms – Inner Product Spaces – Cauchy-Schwartz inequality – Orthogonal Projection –Projection Theorem -Orthogonal Vectors – Gram- Schmidt Orthogonalization Process – Orthogonal Complement

UNIT - V POSITIVE DEFINITE MATRICES   12

Least Square Approximations – Tests for positive definite, semi definite and indefinite matrices – Positive Definite Matrices – Singular value Decomposition (SVD) – Principal Component Analysis (PCA).

Total: 60

TEXT BOOKS

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence," Linear Algebra", Pearson Education, Fifth Edition,2018
2. Cambridge University Press, First Edition, Gilbert Strang, Linear Algebra and Learning from Data,2019

REFERENCE BOOKS

1. Sheldon Axler," Linear Algebra Done Right", Springer Cham, Third Edition,,2016
2. Kenneth Hoffman, Ray Kunze," Linear Algebra", Springer Cham, Third Edition,2018.
3. Williams, G," Linear Algebra with Applications", Jones & Bartlett Learning, First Indian Edition, New Delhi.,2019.
4. Gene H. Golub, Charles F. Van Loan," Matrix Computations", The Johns Hopkins University Press, Fourth Edition,2013

WEBSITES

1. https://nptel.ac.in/courses/122106033
2. https://nptel.ac.in/courses/127106019
3. https://nptel.ac.in/courses/111105112
4. https://nptel.ac.in/courses/111105111
5. https://nptel.ac.in/courses/111101115
6. https://onlinecourses.nptel.ac.in/noc21_ma38/course

CO-PO MAPPING

COs	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	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	1
Avg	2.4	1.4	1	-	-	-	-	-	-	-	-	1	-	1

	SEMESTER-III
23BECY302 **COMPUTER ARCHITECTURE**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The Goal of this course for the students is to

- Understand the basic principles and organization of computer architecture.
- Impart knowledge of Instruction Level Architecture and Instruction Execution.
- Illustrate how I/O devices are accessed.
- Provide the knowledge on Instruction Level Parallelism.
- Analyze the knowledge on micro programming and advanced pipelining techniques.

COURSE OUTCOMES

Upon completion of this course the student will be able to

- Apply the functionalities of a CPU instruction set.

- Build the hardwired and micro programmed design approach.

- Analyze the peripheral devices for 8085 microprocessor architecture.

- Interpret the working of pipelining functionalities.

- Examine the control logic design for processor unit.

UNIT I INTRODUCTION   9

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

UNIT II INTRODUCTION TO X86 ARCHITECTURE   9

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.Memory system design: semiconductor memory technologies, memory organization.

UNIT III PERIPHERAL DEVICES AND THEIR CHARACTERISTICS   9

Peripheral devices, Interfaces, Modes of I/O Data Transfer, Accessing I/O Devices, Computer Architecture: I/O Processor- Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access.

UNIT IV PIPELINING   9

Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel   Processors: Introduction t o   parallel   processors, Concurrent access to memory and cache coherency. Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache   size   vs. block   size, mapping   functions, replacement algorithms, write policies.

UNIT V CONTROL LOGIC DESIGN   9

Control organization – design of hardwired control –control of processor unit –PLA control. Micro-programmed control: Microinstructions –horizontal and vertical micro instructions – micro-program sequencer –micro programmed CPU organization.

Total :45

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2016.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Eeventh   Edition, Pearson Education, 2018.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
3. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

WEBSITES

1. https://nptel.ac.in/courses/106103068/
2. https://www.javatpoint.com/computer-organization-and-architecture-tutorial

CO-PO MAPPING

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

SEMESTER-III

23BECY341	**DATABASE MANAGEMENT SYSTEMS**	**5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The Goal of this course for the students is to
- Understand the basic concepts of Database Management Systems.
- Learn about the Structured Query Language (SQL) and familiar with subqueries.
- Illustrate the knowledge in control transactions.
- Enhance knowledge in normalization and system privileges.
- Adopt indexing techniques in physical DB design

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Choose databases using Entity Relationship model.
- Implement single row and group functions.
- Apply Structured Query Language (SQL) to a given application.
- Analyze control transactions for maintaining the consistency of the database.
- Inspect database reposiotry using normalization techniques.

UNIT I INTRODUCTION TO DBMS, KEYS AND ER DIAGRAM   9

Introduction of DBMS orientation - Data - Information - Knowledge - Need for DBMS - Database VsFile system - Keys and its importance. Data models - ER Diagram - Cardinality of Relationships - Limit the rows that are retrieved by a query -Sorting rows-Substitution variables - Use the SQL row limiting-Pattern matching.

UNIT II - FUNCTIONS AND JOINS   9

Single row functions - Character - Number - Date - Conversion - General. Group functions-HAVING class. Joins - Equijoins and non-equi joins - self-join -Outer joins - Generate a Cartesian product.

UNIT III - SUBQUERIES AND SET OPERATORS 9

Subqueries - Single-row and multiple-row subqueries - Subqueries in SELECT, FROM and WHERE clauses. Set operators - UNION, UNION ALL , INTERSECT AND MINUS.

UNIT IV - SCHEMA OBJECT CREATION 9

DML DDL-TCL - Control transactions - Data types - Constraints - Schema objects-Create View, Index -Sequences - Synonyms - Data dictionary views-Grant-Revoke privileges.

UNIT V - DATABASE CONCEPTS AND NORMALIZATION 9

ACID Properties - Transaction Processing - Recovery Technique - Serializability-Concurrency Control -Lock-Normalization- Functional Dependency- INF, 2 NF, 3 NF. BOYCE CODD and 4NF. PLSQL -Cursor and Trigger.

Total :45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Design an ER diagram for a sample database and implement it in SQL.
2. Use SQL statements to retrieve, restrict and sort data.
3. Practice using various single-row functions in SQL.
4. Perform different types of joins (equijoin, non-equijoin, self-join, outer join) on sample
5. tables.
6. Experiment with group functions and HAVING clauses.
7. Create and use single-row and multiple-row subqueries in SQL.
8. Use set operators (UNION, UNION ALL, INTERSECT, MINUS) in SQL.
9. Practice creating and modifying schema objects in SQL, including views, indices,
10. sequences, and synonyms.
11. Application Development-I.
12. Application Development-II.

Total : 30

TEXT BOOKS

1. Abraham Silberschatz,Henry F. Korth, S.Sudarshan, "Database System Concepts",McGraw-Hill Education, 2020
2. Ramez Elmasri, Sham Navathe," Fundamentals of Database Systems", Pearson,2016.

REFERENCES BOOKS

1. Renée m. p. teate," SQL for Data Scientists:A Beginner Guide for Building Datasets for Analysis, Wiley,2021.

2. Raghu Ramakrishnan,,Johannes Gehrke," Database Management Systems", McGraw-Hill Education,2014.

WEBSITES

1.www.oracle.com
2. www.microsoft.com/sql
3. www.nptel.ac.in/courses/106106093/
4. www.udemy.com/sql-and-rdbms/
5. www.infytq.infosys.com

CO-PO MAPPING

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

23BECY342A   **DATA STRUCTURES AND ALGORITHMS**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES:

The goal of this course is for the students is to

- Understand the concepts of ADTs.
- Learn linear data structures – lists, stacks, and queues.
- Interpret non-linear data structures – trees and graphs.
- Implementd sorting, searching and hashing algorithms.
- Apply Tree and Graph structures to real world scenario.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Build abstract data types for linked list data structure.
- Apply the concepts of stack, queue and its applications.
- Experiment with operations on binary trees.
- Identify the traversal techniques of graphs and its applications.
- Inspect sorting, searching and hashing techniques.

UNIT I LISTS   9

Abstract Data Types (ADTs) – Elementary Data types–List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Doubly-linked lists – Circularly linked lists – Applications of lists – Polynomial ADT –Multilists–Sparse Matrices.

UNIT II STACKS AND QUEUES   9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – Deque – Applications of Queues.

UNIT III TREES   9

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees –Red-Black Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS 9

B-Tree – B+ Tree – Tries – Graph Definition – Representation of Graphs – Types of Graphs - Breadth-first traversal – Depth-first traversal –– Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort –– Quick Sort – Merge Sort – Heap Sort – Radix Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Total: 45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
5. Implementation of Binary Search Trees and AVL Trees
6. Implementation of Heaps using Priority Queues
7. Implementation of Dijkstra's Algorithm
8. Implementation of Prim's Algorithm
9. Implementation of Linear Search and Binary Search
10. Implementation of Insertion Sort and Selection Sort
11. Implementation of Merge Sort and Quick Sort
12. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

Total: 30

TEXT BOOKS

1. Mark Allen Weiss," Data Structures and Algorithm Analysis in C", Pearson Education, Second Edition, 2005
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein," Introduction to Algorithms", Mcgraw Hill/ MIT Press, Fourth Edition,2022

REFERENCE BOOKS

1. Narasimha Karumanchi," Data Structures and Algorithms Made Easy", CareerMonk Publications, First Edition,2016

2. Langsam, Augenstein and Tanenbaum, "Data Structures Using C", Pearson Education, Second Edition,2015
3. Kamthane," Introduction to Data Structures in C", Pearson Education, First Edition,2007
4. Kruse," Data Structures and Program Design in C", Pearson Education, Second Edition,2003

WEBSITES

1. www.nptel.ac.in/courses/106106145
2. www.nptel.ac.in/courses/106102064
3. www.coursera.org/learn/data-structures
4. www.edx.org/learn/data-structures
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

CO-PO MAPPING

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

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i)   THEORY

COURSE OBJECTIVES

The goal of this course for the students is to
- Understand and apply the algorithm analysis techniques on searching and sorting algorithms.
- Illustrate different algorithm design techniques.
- Critically analyze the efficiency of graph algorithms.
- Solve programming problems using state space tree.
- Examine NP Completeness, Approximation algorithms and randomized algorithms

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Solve the basic problems with asymptotic notations.
- Apply graph traversal algorithms for a given applications.
- Experiment with dynamic programming and greedy techniques.
- Examine backtracking strategy for solving real time problems.
- Analyze the algorithmic techniques for tractable and intractable problems

UNIT I INTRODUCTION   **9**

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties – Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort

UNIT II GRAPH ALGORITHMS   **9**

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – NP algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding kth smallest number

Total :45

(ii)   LABORATORY

LIST OF EXPERIMENTS

1. Implement Linear Search and Binary Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. Develop a program to implement graph traversal using Breadth First Search and Depth First Search
5. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.

10. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.

11. Implement N Queens problem using Backtracking. Approximation Algorithms Randomized Algorithms

12. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Total :30

TEXT BOOKS

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein," Introduction to Algorithms", Mcgraw Hill/ MIT Press, Fourth Edition,2022

2. Anany Levitin," Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition,2012

REFERENCE BOOKS

1. Narasimha Karumanchi," Data Structures and Algorithms Made Easy", CareerMonk Publications, First Edition,2016

2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran," Computer Algorithms/C++", Orient Blackswan, Second Edition,2019

3. S. Sridhar," Design and Analysis of Algorithms", Oxford university Press, First Edition, 2014

4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman," Data Structures and Algorithms", Pearson Education, Reprint Edition,2006

WEBSITES

1. www.nptel.ac.in/courses/106105164
2. www.nptel.ac.in/courses/106106131
3. www.coursera.org/specializations/algorithms
4. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

CO-PO MAPPING

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

23BECY343A   **JAVA PROGRAMMING**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Object Oriented Programming with Python, Data Structures and Algorithms

(i)THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
- Learn the fundamental concepts of Java programming.
- Gain knowledge of inheritance in Java.
- Understand the concepts of abstraction, exception and packages in Java.
- Infer Java Collection API and Multithreading plugins.
- Implement JDBC and Lambda expression in Java.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Solve a given problem using basic object-oriented programming concepts.
- Develop Java programs using inheritance.
- Build Java programs using interface and package for complex problem.
- Analyze the collection API for given problem statement.
- Inspect an application using JDBC connections for C++ programming..

UNIT I- INTRODUCTION TO JAVA   **9**

History of Java - Features of Java - Java Architecture - Comments - Data Types - Variables – Operators Type Conversion and Casting - Flow Control Statements - Reading Input from keyboard, Command Line Arguments, Using Scanner Class,Arrays - Classes and Objects - UML Class diagram - Methods - Constructors - static variables and Methods - this Keyword - Encapsulation -Concept of Access Control.

UNIT II-- INHERITANCE   **9**

Inheritance, Types of Inheritance - Super and Sub Classes - super keyword - final class and methods - Object class - Understanding Polymorphism, Types of polymorphism, Method Overloading, Constructor Overloading, Method Overriding,Dynamic Method Dispatching - garbage collection - String class - StringBuffer class - StringBuilder class

UNIT III- DATA ABSTRACTION   9

Packages, Introduction to Packages, User-Defined Packages, Accessing Packages - Abstract classes and Methods - Interfaces - Defining an interface - implementing interfaces - extending interfaces - Multiple Inheritance Using Interfaces - Exception Handling -Errors vs Exceptions - Exception hierarchy - usage of try, catch, throw, throws and finally - built in exceptions - user defined exceptions.

UNIT IV- COLLECTION API AND MULTITHREADING   9

Introduction to wrapper classes, Predefined wrapper classes, Conversion of types , Concept of Auto boxing and unboxing - Java Collections API - Introduction to Collection - Generics - List implementations - Set implementations - Map implementations - Multithreading:Introduction to Multithreading - Process Vs Thread, Thread life cycle -Thread class, Runnable Interface - Thread creation, Thread control and priorities - Thread synchronization

UNIT V- JDBC AND LAMBDA   9

JDBC - Introduction to JDBC - Establishing connection - Executing query -Processing results - Prepared Statement - Callable Statement - Transactions - Meta-Data objects.Functional Interfaces -Predicates - Functions - Suppliers - Consumers - Lambda Expressions - Accessing local variables- Accessing class variables - Function argument in lambda expression - Sorting - Predicates and Lambda Expressions

Total :45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Programs using flow control statements and arrays.
2. Programs using classes and objects.
3. Programs using inheritance and polymorphism.
4. Programs using String, StringBuffer and StringBuilder class.
5. Programs using package, abstract class and interface.
6. Programs using exception handling mechanism.
7. Programs using user defined exception.
8. Programs using Collection API.
9. Programs using Multithreading.
10. Programs using Thread synchronization.
11. Programs using JDBC.
12. Programs using Lambda Expression.

Total : 30

TEXT BOOKS

1. Herbert Schildt, "Java2: The Complete Reference", Tata McGraw- Hill,Twelth Edition, 2022.
2. Cay S Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Prentice Hall, Eleventh Edition, 2020.
3. Raoul – Gabriel Urma, Mario Fusco and Alan Mycroft," Java 8 in Action: Lambdas, Streams and Functional – style Programming", Manning Publications, First Edition, 2015.

REFERENCES BOOKS

1. David Flanagan and Benjamin Evans," Java in Nutshell", O'Reilly Media, Seventh Edition,2018.
2. Deitel and Deitel," Java How to Program,Early Objects", Prentice Hall,Eleventh Edition,2018.

WEBSITES

1. http://docs.oracle.com/javase/tutorial/java/nutsandbolts
2. http://www.javabeginner.com/learn-java
3. http://www.javapoint.com/creating-thread
4. http://www.ntu.edu.sg/home/ehchua/programming/java/JDBC_Basic.html
5. http://www.javapoint.com/java-8-method-reference

CO-PO MAPPING

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

SEMESTER-III

23BECY343B   OBJECT ORIENTED PROGRAMMING   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Fundamental of Computers

(i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
* Familiar with programming paradigms.
* Understand classes and objects.
* Understand realization of constructor and destructor.
* Know about inheritance and polymorphism concepts.
* Provide knowledge about pointers and exception handling.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
* Illustrate the object oriented concepts and control structures.
* Build C++ program using classes and objects.
* Develop program using inheritance and interfaces.
* Analyze multithreading and exception handling for real time applications.
* Categorize C++ program to handle input and output streams.

UNIT I INTRODUCTION   9

Introduction: Programming paradigms – Procedural programming – Modular programming – Object oriented programming – Basic concepts of OOPS – Procedure versus object oriented programming – Applications of C++

UNIT II BASIC I/O OPERATIONS   9

Tokens – Keywords – Identifiers – Variables – Constants – Data types – Operators – Control structures – Basic I/O operations.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

UNIT III CONSTRUCTORS AND DESTRUCTORS   9

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.

UNIT IV INHERITANCE   9

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 –

UNIT V DYNAMIC MEMORY ALLOCATION   9

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

(ii) LABORATORY

LIST OF EXPERIMENTS

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.

Total :30

TEXT BOOKS

1. Balagurusamy E," Object Oriented Programming with C++", Tata McGraw Hill, Sixth Edition, 2013.

2. YashavantKanetkar," Let us C++", BPB publications, Second Edition, 2017.

REFERENCES BOOKS

1. Herbert Schildt," C++ - The Complete Reference", Tata McGraw Hill Fourth Edition, 2017.
2. Ashok N Kamthane," Programming in C++", Pearson EducationSecond Edition,2013.
3. John R Hubbard, "Programming with C++", Tata McGraw Hill
   Third Edition,2009

WEBSITES

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

CO-PO MAPPING

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

SEMESTER-IV

23BECY401A   **STATISTICS AND OPTIMIZATIONS TECHNIQUES**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course For students is to

- Understand the concept of statistical tools and apply in engineering.
- Understand various statistical techniques from both applied and theoretical points of view.
- Provide the concept of linear programming problem and its various solution procedures.
- Impart the knowledge of transportation and assignment models.
- Afford the adequate knowledge on networking models and game theory.

COURSE OUTCOMES

Upon completion of this course, the student will be able to

- Explain the concept of measures of central tendency and measures of dispersion.
- Apply small and large sample tests in testing of hypothesis.
- Make use of Graphical method, Simplex method and Dual simplex method in linear programming models.
- Interpret solutions for transportation and assignment problems
- Solve network models, 2xn and mx2 games with and without saddle point.

UNIT I   DESCRIPTIVE STATISTICS   **12**

Measures of central tendency – Mean, median, mode, geometric mean and harmonic mean – Dispersions – Range, mean deviation, variance, standard deviation, coefficient of variation – Relative measures – Coefficient of correlation – Pearson's correlation coefficient – Lines of regression.

UNIT II   SAMPLING THEORY   **12**

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.

UNIT III   LINEAR PROGRAMMING PROBLEM   **12**

Advantages and disadvantages of LP - Formulation of LP - Algebric solution of a LP - Graphical method - The simplex method - Principle of duality - Dual and primal problems - Dual simplex method.

UNIT IV   TRANSPORTATION AND ASSIGNMENT MODELS   12

Initial basic feasible solution - North west corner rule, row-minima, column minima, matrix minima and Vogel's approximation methods - MODI method for finding optimum solution - Unbalanced transportation problems – Assignment Model - Initial basic feasible solution - Hungarian algorithm - Unbalanced Assignment Problem - Maximization in assignment problems.

UNIT V   NETWORK MODELS AND GAME THEORY   12

CPM & PERT techniques - Critical path method - PERT approach - Expected length of a project - Probability of project completion by due date - Game theory – Pay-off matrix - Pure strategies: Games with saddle point - The rules of dominance - mixed strategies: Games without saddle point - Solution of 2xn and mx2 games.

Total: 60

TEXT BOOKS

1. Robert V. Hogg,Joseph W. McKeanand Allen T. Craig," Introduction to Mathematical Statistics", Pearson, Eighth Edition,2019
2. Geoffrey Grimmett and David Stirzaker," Probability and Random Processes", Oxford University Press Fourth Edition,2020
3. Hamdy A.Taha," Operations Research – An Introduction, Pearson Prentice Hall of India, Pvt. Ltd., New Delhi, 10th Edition ,2017
4. Kanti Swarup   Gupta P K   Manmohan," Operations Research", Sultan Chand & Sons, Fifteenth edition,2010.

REFERENCE BOOKS

1. Irwin Miller and Marylees Miller," John E Freund's Mathematical Statistics with Applications", Pearson, Eighth Edition,2014
2. Sheldon M Ross," John E Freund's Mathematical Statistics with Applications", Elsevier,
3. Fourth Edition,2014
4. Frederick S.Hillier Gerald J.Lieberman Bodhibrata Nag Preetam Basu," Introduction to Operations Research", Tata McGraw-Hill Education Private Limited,
5. Tenth Edition,2017
6. Ronald L Rardin," Optimization in Operations Research", Pearson,
7. Second edition,2016
8. Ravindran Phillips Solberg."," Operations Research – Principles and Practice", Wiley, Second edition,2007

WEBSITES

1. https://nptel.ac.in/courses/111104120
2. https://nptel.ac.in/courses/110106062
3. https://archive.nptel.ac.in/courses/111/103/111103159/#
4. https://nptel.ac.in/courses/110104063

CO-PO MAPPING

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

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Provide the required fundamental concepts of probability theory and Random variables.
- Introduce the concept of Theoretical Distributions.
- Impart the knowledge of Measures of Central tendencies, Dispersions
- Impart the knowledge of correlation and Regression
- Inculcate the knowledge of testing of hypothesis using small and large sampling tests.

COURSE OUTCOMES

Upon Completion of this course the students will be able to

- Infer the fundamentals of probability and random variables.
- Explainstandard distributions of random variables.
- Make use of statistical data for finding the measures of central tendency and measures of dispersion.
- Interpret the data using correlation and regression.
- Apply small and large sample tests in testing of hypothesis.

UNIT I   PROBABILITY AND RANDOM VARIABLES   12

Concept of Probability – Addition and multiplication laws – Conditional probability – Total Probability – Baye's theorem and its applications – One dimensional Random Variables (Discrete and Continuous) – Mathematical Expectation.

UNIT II   THEORETICAL DISTRIBUTIONS   12

Discrete distributions – Binomial, Poisson, Geometric Distributions – Continuous distributions – Uniform, Exponential and Normal Distributions

UNIT III   DESCRIPTIVESTATISTICS   `   12

Measures of Central Tendency – Mean, Median, Mode – Measures of Dispersion – Mean deviation – Standard deviation – Coefficient of variation.

UNIT IV CORRELATION AND REGRESSION   12

Correlation – Pearson's Correlation coefficient – Spearman's Rank correlation coefficient – Regression –Regression lines- Linear, Multiple Regression- Logistic Regression - Polynomial Regression

UNIT V TESTING OF HYPOTHESIS   12

Large sample tests based on normal distribution – Test for single mean – Difference between means – Proportion – Difference between proportions – 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.

Total : 60

TEXT BOOKS

1. Geoffrey Grimmett and David Stirzaker, Probability and Random Processes
2. Oxford University Press, Fourth Edition, 2020
3. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, Introduction to Mathematical Statistics, Pearson, Eighth Edition, 2019
4. Douglas C. Montgomery& George C. Runger, Applied Statistics and Probability for Engineers, John Wiley, Sixth Edition, 2016

REFERENCES

1. Irwin Miller and Marylees Miller, John E Freund's Mathematical Statistics with Applications, Pearson, Eighth Edition, 2014
2. Sheldon M Ross, Introduction to Probability and statistics for Engineers and scientists
3. Elsevier, Fourth Edition, 2014

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc23_ge25/preview
2. https://nptel.ac.in/courses/111104032
3. https://nptel.ac.in/courses/111106112
4. https://nptel.ac.in/courses/111105042
1. https://nptel.ac.in/courses/103106120

CO-PO MAPPING

COs	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	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	2	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	2	-	1
Avg	2.4	1.4	1	-	-	-	-	-	-	-	-	2	-	1

SEMESTER-IV

23BECY402   **CRYPTOGRAPHY AND CYBER SECURITY**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and authentication schemes
- Understand cyber crimes and cyber security.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Explain the substitution and transposition techniques used in traditional encryption.
- Apply the symmetric key cryptography for encrption and decyption process.
- Apply the public key cryptography for encryption and decryption process.
- Analyze the various Authentication schemes to simulate different applications.
- Categorize cyber crimes and attacks in cyber security.

UNIT I INTRODUCTION TO SECURITY   12

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis

UNIT II SYMMETRIC CIPHERS   12

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices   –   Group,   Rings,   Fields,   Finite   Fields SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria   for   AES   –   Pseudorandom   Number   Generators   –   RC4   –   Key   distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY 12

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm.
ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 12

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication: Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY 12

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

Total: 60

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh
   Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

REFERENCE BOOKS

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc22_cs90/preview
2. https://www.geeksforgeeks.org/cryptography-and-network-security-principles/
3. https://www.tutorialspoint.com/data_communication_computer_network/computer_network_security.html
4. https://www.techtarget.com/searchnetworking/definition/network-security

CO-PO MAPPING

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

SEMESTER-IV

23BECY441   OPERATING SYSTEMS   **5H-4C**

Instruction Hours/week: L: 3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the basic concepts of operating systems.
- Understand the concepts of scheduling techniques.
- Infer different memory management techniques.
- Fmiliarize with the important mechanisms in file systems.
- Appreciate the emerging trends in memory management and networking.

COURSE OUTCOMES

Upon Completion of this course the students will be able to

- Outline the basic services and functionalities of operating systems.
- Experiment with pre-emptive and non-preemptive scheduling algorithms.
- Identify memory management techniques in operating system
- Analyze the functionality of file systems.
- Compare Linux and Windows operating systems.

UNIT I   OPERATING SYSTEM OVERVIEW   9

Operating system structure – Operations – Process – Memory – Storage management – Protection and security – Distributed systems – Computing Environments – Open source operating systems – OS services – Useroperating system interface – System calls – Types – System programs – OS structure – OS generation –System boot – Process concept – Scheduling – Operations on processes – Cooperating processes – Inter process communication – Examples – Multithreading models – Thread libraries – Threading issues – OS examples.

UNIT II SCHEDULING AND DEADLOCK   9

Basic concepts – Scheduling criteria – Scheduling algorithms – Thread scheduling – Multiple processor scheduling – Operating system examples – Algorithm evaluation – The critical section problem – Peterson's solution – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors – Synchronization examples – Deadlocks – System model – Deadlock characterization – Methods for handling deadlocks – Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock

UNIT III MEMORY MANAGEMENT   9

Memory management – Swapping – Contiguous memory allocation – Paging – Segmentation – Example: The Intel Pentium – Virtual memory: Background – Demand paging – Copy on write – Page replacement – Allocation of frames – Thrashing**.**

UNIT IV   FILE SYSTEMS   9

File concept – Access methods – Directory structure – File system mounting – Protection – Directory implementation – Allocation methods – Free space management – Disk scheduling – Disk management– Swap space management – Protection.

UNIT V   THE LINUX AND WINDOWS SYSTEM   9

The Linux system – History – Design principles – Kernel modules – Process management – Scheduling – Memory management – File systems – Input and output – Inter process communication – Network structure – Security – Windows 7 – History – Design principles – System components – Terminal services and fast user – File system – Networking.

Total:45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Basic UNIX commands.
2. Shell Programming.
3. File system related system calls. (Learn to create, open, read, write, seek into, close files;open,read, write, search, close directories).
4. Process management –Fork, Exec (Learn to create a new process and to overlay anexecutablebinary image on an existing process).
5. Inter–process communication between related processes using pipes.
6. Inter–process communication among unrelated processes using message queues.
7. CPU scheduling algorithms.
8. Contiguous memory allocation strategies –best fit, first fit and worst fit strategies.
9. Page replacement algorithms.

Total: 30

TEXT BOOK

1. Abraham Silberschatz, Peter B Galvin andGreg Gagne, Operating System Concepts Essentials, John Wiley and Sons,Ninth Edition, 2012

REFERNCES BOOKS

1. Andrew S Tanenbaum, Modern Operating Systems, Pearson Education, Fourth Edition, 2015
2. Dhamdhere D M, Operating Systems: A Concept–basedApproach, McGraw–Hill, Second Edition, 2012
3. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall, Seventh Edition, 2011

WEBSITES

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

CO-PO MAPPING

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

23BECY442A   **WEB APPLICATION DEVELOPMENT**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

Pre requisites: Java Programming

i)THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to

- Understand the concepts of Servlet API.
- Gain knowledge of JSP and its tags.
- Illustrate the concepts of Hibernate for interacting with database.
- Understand Spring container, Modules, Dependency Injection and aspect-oriented programming.
- Understand how to design and develop application using Spring Boot

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Apply web based applications using Servlet.
- Build user interface for web applications using JSP and JDBC.
- Make use of object relational mapping with hibernate query language.
- Analyze web based applications using Spring MVC.
- Examine web based applications using Spring Boot.

UNIT I - SERVLET API   **9**

Introduction to MVC - Features of MVC - Components of MVC. Servlet Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with ServletContext and ServletConfig Object, Attributes in Servelt, Response and Redirection using Request Dispacher, sendRedirect Method, Session Tracking: using Cookies, HTTPSession Performing CRUD (Create,Read,Update,Delete) operation using Servlet with JDBC

UNIT II - JSP API   **9**

Introduction to JSP, Comparison with Servlet, JSP Architecture, JSP: Life Cycle, Scripting Elements, Directives, Action Tags, Implicit Objects, Java Beans in JSP, Expression Language (EL), JSP Standard Tag Libraries (JSTL) Core Tags, Session Management, Exception Handling, CRUD Application.

UNIT III - HIBERNATE API 9

Introduction to Hibernate, Exploring Architecture of Hibernate, Object Relation Mapping (ORM) with Hibernate, Hibernate Annotation, Querying in Hibernate - Hibernate Query Language (HQL) - Criteria Queries - Create queries with Native SQL, Basic O/R Mapping - Collection Mapping - Association Mappings - CRUD Operation using Hibernate API

UNIT IV SPRING MVC 9

Spring: Introduction, Architecture, Spring MVC Module, Life Cycle of Bean Factory, Constructor Injection, Dependency Injection, Inner Beans, Aliases in Bean, Bean Scopes, Spring Annotations, Spring AOP Module, Spring DAO, Database Transaction Management, CRUD Operation using DAO and Spring API. Build Tools – Maven and Gradle, pom.xml and build. gradle, building application using Maven and Gradle

UNIT V - SPRING BOOT 9

Introduction to Spring Boot - Spring Vs. Spring Boot - Internals of Spring Boot - Spring Boot Application Creation - Spring Boot Auto Configuration - Spring Boot Annotations - Spring Data JPA Introduction - Crud Repository and JPA Repository Methods in JPA - Custom Queries in JPA - Spring Boot Profiles - Spring Web MVC - Thymeleaf – Spring boot application with CRUD operation.

Total : 45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Developing web application using Servlets
2. Design an application using Servlet and JDBC
3. Developing application using JSP.
4. Design an application using JSP and JDBC
5. Developing application using Hibernate Annotations
6. Developing application using Hibernate Collection Mapping
7. Developing application using Association Mapping in Hibernate.
8. Developing application using spring MVC.
9. Developing application using Spring MVC with database
10. Building application using Maven and Gradle
11. Developing application using Spring Boot
12. Developing application using Spring Boot application with JPA Repositories

Total : 30

TEXT BOOKS

1. "J2EE: The complete Reference", Jim Keogh, McGraw-Hill, 2017.
2. "Spring and Hibernate (2nd Edition)", Santhosh Kumar, McGraw Hill, 2013.
3. "Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot", Shagun Bakliwal, Packt Publishing Ltd, 2018.

REFERENCE BOOKS

1. "Servlet & JSP: A Tutorial (2nd Edition)", Budi Kurniwan, Brainy Software, 2015.
2. "Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot", Rajput.D, Packt Publishing, 2018.
3. "Developing Java Applications with Spring and Spring Boot", Claudio and Greg, Packt Publishing Ltd, 2018.

WEBSITES

1. https://docs.oracle.com/javaee/7/tutorial/index.html
2. https://javaee.github.io/tutorial/
3. https://hibernate.org/orm/documentation/6.1/
4. https://docs.spring.io/spring-framework/docs/3.2.x/spring-framework-reference/html/mvc.html
5. https://docs.spring.io/spring-boot/docs/current/reference/htmlsingle/

CO-PO MAPPING

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

SEMESTER-IV

23BECY442B   **LOWCODE APPLICATION DEVELOPMENT**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

i) THEORY

COURSE OBJECTIVES

The goal of this course is for the students is to
- Identify the key components of no-code development and explain their applications.
- Demonstrate the ability to use various no-code platforms and tools to create and publish applications.
- Analyze data using machine learning tools and present results in a meaningful way.
- Create voice applications and bots that integrate with external services to enhance functionality.
- Develop basic UI/UX design skills to create and design effective and aesthetically pleasing applications.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Illustrate low-code tools in web scraping
- Build low-code platforms applications with Zapier, voice flow and Figma.
- Experiment with the machine learning algorithm.
- Categorize voice based applications using voice API
- Analyze UI/UX design for Figma application.

UNIT I – WEB SCRAPING AND API PARABOLA WITH NO CODE   9

No-Code Stacks_No-Code Fundamentals. Web Scraping : Scrape Data From Websites_ Initial Scraper Setup_ Defining our data_ Using our Scraped Data. Work With APIs : Filtering Data_ Numerical Formatting_ Exporting Data _ Publishing

UNIT II - BUILD AUTOMATIONS AND CREATE BOTS WITH NO CODE   9

Automations using Zapier : Introduction _ Connecting Google sheets _ Connecting twitter_ Publishing Zapier Automation . Bots : Configuring Slack _ Creating First bot using slack _ Including conditional and helper functions _ Connecting Giphy _Connecting slack to bot _ Publishing our bot.

UNIT III - DATA SCIENCE   9

Introduction to Data science: Data flow_ Machine learning . Obviously AI : Introduction_ Sourcing our data_Uploading our data_Analyze our data _ Publish using Obviously AI.

UNIT IV - VOICE APP   9

Voice App: Introduction_Voice Flow_Initialsetup_Create the launch sequence for voice application_Querying the user_Calling API for data_Returning Data to the user_Testing the application_Publish the voice app.

UNIT V – UI / UX DESIGN FOR APPLICATION   9

UI/UX: Introduction_Business Use case_Tools.Figma :Introduction_Filesetup_Placing Images_ Add logo to the Frame_ Body copy_ Building Forms_ Profile Image_ Proportions_ Project.

Total : 45

ii) LABORATORY

LIST OF EXPERIMENTS

1. Installation of Knime framework in windows operating system.
2. Implement a Knime workflow or architecture to clean a dataset to preprocess the data.
3. Implement a Knime workflow to narrate instances of confusion matrix, accuracy, precision, sensitivity, specificity
4. Implement a Knime workflow or architecture to execute KNN framework on any medical realtime dataset.
5. Implement a Knime workflow or architecture to execute Decision Tree framework on any online shopping dataset.
6. Implement a Knime workflow or architecture to execute Random Forest framework on any realtime dataset.
7. Implement a Knime workflow or architecture to execute SVM framework on any realtime dataset Simulation of patient flows in hospitals to optimize resource allocation and reduce waiting times.
8. Simulation capabilities to model and spread of information or influence within the network.
9. Eliminate Stop words that do not carry significant meaning in a given language (e.g., "the," "is," "and").
10. Sentiment analysis techniques to analyze player sentiment and feedback.
11. Train regression model and evaluate its performance using various metrics for traffic flow and transportation systems.

12. Simulate virtual experiments for designing and evaluating smart city technologies and initiatives.

Total : 30

TEXT BOOKS

1. Paul E Love ,"Mastering No-Code: Create Professional Quality Apps Without Coding" (Vol. 1), 2021.
2. Mikhail Zhilkin," Data Science Without Makeup 1st Edition", 2021.

REFERENCES BOOKS

1. Mittal Akhil," Getting Started with Chatbots", 2019.
2. Fabio staiano," Designing and Prototyping Interfaces with Figma", 2022.

WEBSITES

1. https://www.udemy.com/course/no-code-developer/
2. https://www.nocode.tech/academ
3. **CO-PO MAPPING**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	1	2	2	-	2	-	2
CO2	3	2	1	-	2	-	-	1	2	2	-	2	-	2
CO3	3	2	1	-	2	-	-	1	2	2	-	2	-	2
CO4	3	3	2	1	2	-	-	1	2	2	-	2	-	2
CO5	3	3	2	1	2	-	-	1	2	2	-	2	-	2
Avg	2.8	2.2	1.5	1	1.8	-	-	1	2	2	-	2	-	2

23BECY443A   **ADVANCED ALGORITHMS**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Data Structures and Design Analysis of Algorithms

(i) THEORY

COURSE OBJECTIVES:

The goal of this course for the students is to
- learn programming and mathematical backgrounds for design and analysis of algorithm.
- Study the concept of designing an algorithm.
- Have a complete understanding of the various advanced data structures.
- Implement advanced algorithms using appropriate design techniques.
- Inculcate advanced graph algorithms and applications.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain data structures and mathematical background in programming.
- Solve problems using hungarian algorithm.
- Compare backtracking techniques with branch and bound techniques.
- Examine Eulerian and Hamiltonian paths in graphs
- Analyze searching and pattern matching algorithms.

UNIT I PROGRAMMING LANGUAGE BACKGROUNDS   **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

UNIT II ADVANCED AGORITHMS   **9**

Probability – Modular multiplicative inverse – Matrix exponentiation –Millerrabin primality test– Heavy light decomposition–Convex hull –Hungarian algorithm –Sweep line algorithm – Gaussian algorithm – Pollard rho factorization – Euler's totient function –Burnside lemma.

UNIT III   DYNAMIC PROGRAMMING   **9**

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-Dtree–Treap–Link/cuttree

UNIT IV   GRAPH ALGORITHMS   9

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 and Hamiltonian paths– Graph coloring–Blossom's algorithm – Jarvis algorithm – Graham Scan – Johnson's algorithm.

UNIT V   SEARCHING AND PATTERN MATCHING   9

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

(ii)   LABORATORY

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.

Total : 30

TEXT BOOKS
1. CormenTH, Leiserson CE and Stein C, Introduction to Algorithms, PHI Learning, Third Edition, 2011
2. Yonghui Wu, Jiande Wang," Data structure Practice for Collegiate Programming Contests and Education",2016
3. Steven Halim, Felix Halim, "Competitive Programming, The New Lower Bound of Programming Contests," ",Lulu publication, Third Edition,2013

REFERENCES BOOKS

1. Jon Kleinberg, Eva Tardos," Algorithm design", Pearson Education, First Edition,2006
2. Jeff Edmonds, How to Think about Algorithms, Cambridge University,First Edition,2014
3. Anany Levitin, Introduction to Design and Analysis of Algorithm, Pearson Education,Third Edition, 2017

WEBSITES

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-advancedalgorithms-fall-2005/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	2	-
CO2	3	2	1	1	-	-	-	-	2	2	-	2	2	-
CO3	3	3	2	1	-	-	-	-	2	2	-	2	2	-
CO4	3	3	2	1	-	-	-	-	2	2	-	2	2	-
CO5	3	3	2	1	-	-	-	-	2	2	-	2	2	-
Avg	2.8	2.4	1.8	1	-	-	-	-	2	2	-	2	2	-

SEMESTER-IV

23BECY443B   **DESIGN AND ANALYSIS OF ALGORITHMS**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Data Structures and Algorithms

i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand and apply the algorithm analysis techniques on searching and sorting algorithms.
- Illustrate different algorithm design techniques.
- Critically analyze the efficiency of graph algorithms.
- Solve programming problems using state space tree.
- Examine NP Completeness, Approximation algorithms and randomized algorithms

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Solve the basic problems with asymptotic notations.
- Apply graph traversal algorithms for a given applications.
- Experiment with dynamic programming and greedy techniques.
- Examine backtracking strategy for solving real time problems.
- Analyze the algorithmic techniques for tractable and intractable problems

UNIT I INTRODUCTION   9

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties – Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – searching: linear search, binary search and Interpolation Search, Pattern search: The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. Sorting: Insertion sort – heap sort

UNIT II GRAPH ALGORITHMS   9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort Dynamic programming: Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – NP algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-CNF problem. Approximation Algorithms: TSP - Randomized Algorithms: concept and application - primality testing - randomized quick sort - Finding kth smallest number

Total :45

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein," Introduction to Algorithms", Mcgraw Hill/ MIT Press, Fourth Edition,2022
2. Anany Levitin," Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition,2012

REFERENCE BOOKS:

1. Narasimha Karumanchi," Data Structures and Algorithms Made Easy", CareerMonk Publications, First Edition,2016
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran," Computer Algorithms/C++", Orient Blackswan, Second Edition,2019
3. S. Sridhar," Design and Analysis of Algorithms", Oxford university Press, First Edition, 2014
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman," Data Structures and Algorithms", Pearson Education, Reprint Edition,2006

WEBSITES:

1. www.nptel.ac.in/courses/106105164
2. www.nptel.ac.in/courses/106106131
3. www.coursera.org/specializations/algorithms
4. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
5. www.cs.usfca.edu/~galles/visualization/Algorithms.html

ii) LABORATORY

LIST OF EXPERIMENTS:

1. Implement Linear Search and Binary Search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. Develop a program to implement graph traversal using Breadth First Search and Depth First Search
5. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
6. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
7. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
8. Compute the transitive closure of a given directed graph using Warshall's algorithm.
9. Develop a program to find out the maximum and minimum numbers in a given list of n numbers using the divide and conquer technique.
10. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
11. Implement N Queens problem using Backtracking. Approximation Algorithms Randomized Algorithms
12. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

Total :30

CO-PO MAPPING

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

SEMESTER-V

23BECY501   **FORMAL LANGUAGES AND AUTOMATA THEORY**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students is to
- Develop a formal notation for strings, languages and machines.
- Understand finite automata concepts and to design finite automata to accept a set of strings of a language.
- Understand and apply context free grammars to generate strings.
- Identify the hierarchy of formal languages, grammars and machines.
- Analyze Turing machines and their capability
- Distinguish between computability and non-computability and Decidability and Undesirability.

COURSE OUTCOMES

Upon completion of the course the student will be able to
- Build a finite automaton for a deterministic and non-deterministic finite automata
- Apply concepts of context free grammars for the real-time problems.
- Analyze closure properties, and its role in the theory of computation.
- Analyze the computational capabilities of Turing machines.
- Compare decidability and undecidability for a given language.

UNIT I   INTRODUCTION TO FINITE AUTOMATA   12

Introduction to Finite Automata:Structural Representations, Automata and Complexity, the Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems. Nondeterministic Finite Automata:Formal Definition, an application, Text Search, Finite Automata with Epsilon-Transitions.Deterministic Finite Automata:Definition of DFA, How A DFA Process Strings, The language of DFA, Conversion of NFA with €-transitions to NFA without €-transitions. Conversion of NFA to DFA, Moore and Melay machines

UNIT II   REGULAR EXPRESSIONS   12

Regular Expressions:Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws for Regular Expressions, Conversion of Finite Automata to Regular expressions. Pumping Lemma for Regular Languages,Statement of the pumping lemma, Applications of the Pumping Lemma. Closure Properties of Regular Languages:Closure properties

of Regular languages, Decision Properties of Regular Languages, Equivalence and Minimization of Automata.

UNIT III   CONTEXT-FREE GRAMMARS   12

Context-Free Grammars:Definition of Context-Free Grammars, Derivations Using a Grammar, Leftmost and Rightmost Derivations, the Language of a Grammar, Sentential Forms, Parse Tress, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages.Push Down Automata:Definition of the Pushdown Automaton, the Languages of a PDA, Equivalence of PDA's and CFG's, Acceptance by final state, Acceptance by empty stack, Deterministic Pushdown Automata. From CFG to PDA, From PDA to CFG.

UNIT IVNORMAL FORMS FOR CONTEXT- FREE GRAMMARS   12

Normal Forms for Context- Free Grammars:Eliminating useless symbols, Eliminating €-Productions. Chomsky Normal form Griebech Normal form. Pumping Lemma for Context-Free Languages:Statement of pumping lemma, Applications Closure Properties of Context-Free anguages:Closure properties of CFL's, Decision Properties of CFL's

UNIT V   TURING MACHINE   12
Turing Machines: Introduction to Turing Machine, Formal Description, Instantaneous description, The language of a Turing machine.Types of Turing machine:Turing machines and halting Undecidability: Undecidability, A Language that is Not Recursively Enumerable, An Undecidable Problem That is RE, Undecidable Problems about Turing Machines, Recursive languages, Properties of recursive languages, Post's Correspondence Problem, Modified Post Correspondence problem, Other Undecidable Problems, Counter machines..

Total : 60

TEXT BOOKS
1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education, 2008.
2. Theory of Computer Science – Automata languages and computation, Mishra and Chandrashekaran, 2nd edition, PHI, 2008.

REFERENCE BOOKS
1. Introduction to Languages and The Theory of Computation, John C Martin, TMH,2006.
2. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
3. A Text book on Automata Theory, P. K. Srimani, Nasir S. F. B, Cambridge University Press,2011
4. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning,2013
5. Introduction to Formal languages Automata Theory and Computation, Kamala Krithivasan, Rama R, Pearson,2009.

WEBSITES

1.https://math.mit.edu/~sipser/book.html
2.http://cse.iitkgp.ac.in/~abhij/course/theory/FLAT/Spring20
3.https://cglab.ca/~michiel/TheoryOfComputation/TheoryOfComputation.pdf

CO-PO MAPPING

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

SEMESTER-V

23BECY502   **INFORMATION SECURITY**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Understand the basic concepts of information security.
- Gain knowledge in risk management.
- Be aware of policy standards and practices.
- Analyze different security technologies and security tools.
- Learn about intellectual property rights and patents.

COURSE OUTCOMES

Upon completion of this course the students will be able to:

- Make use of security models and components to impart security features.
- Identify the risk associated with security planning practices.
- Examine firewall and VPNs to protect a distributed system.
- Inspect legal, ethical, professional issues in information security.
- Analyze legal system in solving problems based on intellectual property rights.

UNIT I INTRODUCTION   12

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
.

UNIT II RISK MANAGEMENT   12

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 –

UNIT III SECURITY TECHNOLOGY   12

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.

UNIT IV PROJECT MANAGEMENT 12

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

UNIT V INTELLECTUAL PROPERTY RIGHTS 12

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: 60

TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, "Principles of Information Security", ikas Publishing House, New Delhi, Fourth Edition,2011
2. Gangul," Intellectual Property Rights: Unleasing theKnowledge Economy", Tata McGraw-Hill, First Edition,2008

REFERENCE BOOKS

1. Charles P Pfleeger andShari LawrencePfleeger," 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" iswanathan Pvt. Ltd, First Edition, 2007
4. Stuart McClure, Joel Scrambray andGeorge Kurtz," Hacking Exposed", Tata McGraw-Hill, Seventh Edition, 2012

WEBSITES

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.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1		2	-	3
CO2	3	2	1	-	-	-	-	2	1	1		2	-	3
CO3	3	3	2	1	-	1	-	2	1	1		2	-	3
CO4	3	3	2	1	-	1	-	2	1	1		2	-	3
CO5	3	2	2	1	-	1	-	2	1	1		2	-	3
Avg	3	2.4	1.6	1	-	1	-	2	1	1	-	2	-	3

23BECY541   **NETWORK ARCHITECTURE AND SECURITY**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

(i) THEORY
COURSE OBJECTIVES

The goal of this course is for the students is to

- Outline the fundamental concepts, technologies, and protocols used in computer networks
- Gain knowledge in network design, implementation, and management
- Identify the problems related to network performance and security
- Understand about the principles of data transmission, routing, and switching
- Implement network architecture, including local area networks (LANs), wide area networks (WANs), and internet protocols (IP)

COURSE OUTCOMES

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

- Infer the layered architecture of computer networks functionalities.
- Apply error detection techniques in the data link layer.
- Examine the process of transition mechanisms from IPv4 to IPv6.
- Analyze networking protocols in real-world problems.
- Inspect security architectures for protecting common network attacks..

UNIT I – INTRODUCTION   9

Introduction – history and development of computer networks – Networks topologies – Layering and protocols. Physical Layer: Different types of transmission media – errors in transmission – attenuation – noise. Repeaters – Encoding – NRZ, NRZI, Manchester, 4B/5B MAC Layer: Aloha, CSMA, CSMA/CD, CSMA/CA protocols. Examples: Ethernet, including Gigabit Ethernet and WiFi (802.11). Time permitting, a quick exposure to Token Ring and to Bluetooth, WiMax may also be included.

UNIT II - DATA LINK LAYER   9

Data Link Layer: Error detection (Parity, CRC), Sliding Window, Stop and Wait protocols. LAN: Design, specifications of popular technologies, switching. Design LAN for a campus or a building.

UNIT III - NETWORK LAYER AND TRANSPORT LAYER 9

Network layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Subnetting, Classless addressing, Network Address Translation. Transport layer: UDP, TCP. Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions. Design issues in protocols at different layers.

UNIT IV - NETWORK PROGRAMMING 9

Network Programming: Socket Programming. Session, Presentation, and Application Layers. Examples: DNS, SMTP, IMAP, HTTP, etc.

UNIT V – NETWORK SECURITY 9

Network Security: Concepts of symmetric and asymmetric key cryptography. Sharing of symmetric keys - Diffie Hellman. Public Key Infrastructure. Public Key Authentication Protocols. Symmetric Key Authentication Protocols. Pretty Good Privacy (PGP), IPSec, Firewalls.

Total : 45

(ii) LABORATORY

LIST OF EXPERIMENTS

1. Study of different network devices in detail.
2. Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
3. Study of basic network command and Network configuration commands
4. Implement different LAN topologies using Network Simulator
5. Implement the concept of VLAN using Network Simulator
6. Implement the concept of static routing
7. Implement the concept of dynamic routing (RIP, OSPF, BGP).
8. Packet capture and header analysis by wire-shark (TCP,UDP,IP)

TEXT BOOKS

1. AS Tanenbaum, DJ Wetherall, Computer Networks, 5th Ed., Prentice-Hall, 2010.
2. LL Peterson, BS Davie, Computer Networks: A Systems Approach, 5th Ed., Morgan-Kauffman,2011

REFERENCE BOOKS:

1. JF Kurose, KW Ross, Computer Networking: A Top-Down Approach, 5th Ed., Addison-Wesley., 2009
2. W Stallings, Cryptography and Network Security, Principles and Practice, 5th Ed., Prentice-Hall, 2010

WEBSITE

1. https://in.coursera.org/learn/fundamentals-network-communications
2. https://www.udemy.com/course/the-ultimiate-computer-networks-part-2/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO3	3	3	2	1	-	1	-	2	2	2	-	2	-	2
CO4	3	3	2	1	-	1	-	2	2	2	-	2	-	2
CO5	3	3	2	1	-	1	-	2	2	2	-	2	-	2
Avg	**2.8**	**2.4**	**1.8**	**1**	**-**	**1**	**-**	**2**	**2**	**2**	**-**	**2**	**-**	**2**

23BECY542A   **ADVANCED WEB FRAMEWORKS**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

                                                                   End Semester Exam:3 Hours

PRE-REQUISITES: Web Application Development

i) THEORY

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the fundamental concepts of Git and JavaScript.
- Gain knowledge of Node.js.
- Understand the concepts of working with MongoDB.
- Gain knowledge of ReactJS.
- Create Restful web Services.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Utilize the syntax, semantics of JavaScript for a web application.
- Apply NodeJS concepts in web applications.
- Develop JavaScript's Shell using MongoDB.
- Apply the React JS to web based applications.
- Analyze the backend connection in React JS web applications.

UNIT I – INTRODUCTION TO GIT AND JAVASCRIPT   9

Introduction to Full Stack Development - Intro to Git - Git Commands using CLI - Git vs. GitHub - Git Work Flow - Pull Requests. JavaScript: Variables – Datatypes - Operators - Expressions – Data structures – Control statements – Functions – this keyword – AJAX – Callbacks – Promises – Classes – Modules – Debugging.

UNIT II - NODE JS BASICS   9

Introduction to Node.js – Modules: Common JS – ESM – Custom Modules. Package Manager: npm. Error Handling: Types of Errors – Handling Async Errors – Stack Trace – Asynchronous Programming – Command Line Apps – Working with APIs – Templating Engines.

UNIT III - WORKING WITH MONGODB   9

Introduction to MongoDB – MongoDB through the JavaScript's Shell – Creating and Querying through Indexes – Collections and Documents – MongoDB Query Language – Connecting node.js with MongoDB.

UNIT IV - FRONTEND DEVELOPMENT WITH REACT JS   9

Introduction to ReactJS – CLI tools – Components: Component Basics – Functional Components. Rendering – Hooks: Basic Hooks – Common Hooks – Custom Hooks – Routing using React Router – State Management with Context – Styling using Material UI and Tailwind.

UNIT V - REST API AND TESTING   9

API calls: Axios – react-query – SWR – Testing: React Testing Library – Jest – Playwright – Forms with React Hook Form – Connecting react application to the backend.

Total: 30

ii)   LABORATORY

LIST OF EXPERIMENTS

1. Demonstrate the Git Commands for Version Controlling
2. Programs using flow control statements, arrays and arrow functions.
3. Develop simple application using NodeJS.
4. Develop Rest API with NodeJS.
5. Develop simple application using MongoDB.
6. Develop Rest API with NodeJS and MongoDB.
7. Develop simple application using ReactJS.
8. Develop simple application using ReactJS Components.
9. Develop simple application using React Context with styles.
10. Develop Rest API with Axios.
11. Develop Rest API with react-query and SWR.
12. Developing full stack application using ReactJS and MongoDB.

Total: 30

TEXT BOOKS

1. Jennifer Niederst Robbins, "Fullstack React: The Complete Guide to ReactJS and Friends", Fullstack.IO, First Edition, 2017.
2. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", Apress Media LLC, Second Edition, 2019.

REFERENCES BOOKS

1. Alex Banks and Eve Porcello, "Learning React: Functional Web Development with React and Redux", O'Reilly Media, First Edition, 2017.
2. Sebastian Springer, "Node.js: The Comprehensive Guide to Server-Side JavaScript Programming", Shroff publishers, First Edition, 2022.
3. Shannon Bradshaw, Eoin Brazil and Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Third Edition, 2020.

WEBSITES

1. https://www.w3schools.com/jsrEF/default.asp
2. https://devdocs.io/javascript/
3. https://reactjs.org/docs/getting-started.html
4. https://nodejs.org/en/docs/

CO-PO MAPPING

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

SEMESTER-V

23BECY542B   **BUSINESS DATA PROCESSING**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

i) THEORY

COURSE OBJECTIVES

The goal of this course for students is to
- Understand the fundamentals of business data processing and its significance in modern organizations.
- Gain knowledge of database management systems, including database design principles, relational database concepts, and SQL fundamentals.
- Develop skills in data analysis and visualization techniques for business decision-making and reporting.
- Learn data analysis and visualization techniques.
- Summarize the applications of robotic process automation.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Apply business data processing in modern organizations.
- Build a relational database table using SQL query for normalization technique
- Utilize data analysis and data visualization techniques to support business decision-making.
- Identify Robotic Process Automation (RPA) in business data processing.
- Analyze secure data transmission and storage practices to protect user data.

UNIT I INTRODUCTION TO BUSINESS DATA PROCESSING   9

Introduction - Overview of business data processing - significance in modern organizations - structured - unstructured - and semi-structured data - Data processing lifecycle - data collection - data entry - data storage - data processing - data output - information systems - Ethical and legal considerations.

UNIT II DATABASE MANAGEMENT SYSTEMS   9

Introduction to database management systems - Database design principles - Relational database concepts - tables - relationships - keys - normalization - SQL fundamentals - DDL - DML - Data integrity - Data Security - Privacy

UNIT III DATA ANALYSIS AND VISUALIZATION 9

Introduction - importance in business decision-making - techniques - descriptive - diagnostic - predictive - prescriptive analysis - data visualization tools - techniques - Exploratory data analysis - visualization for business reporting and performance tracking

UNIT IV BUSINESS PROCESS AUTOMATION 9

Introduction to business process automation - Workflow management systems - process modeling - Business process reengineering - process optimization -
Robotic Process Automation (RPA) - its applications in business data processing

UNIT V DATA SECURITY AND PRIVACY IN BUSINESS 9

Overview of data security and privacy concerns - Data protection regulations - compliance - Secure data transmission and storage practices - Access control - user authentication - Data backup - disaster recovery.

Total:45

(ii) LABORATORY

LIST OF EXPERIMENTS:

1. Exploring Data Types and Significance in Business
2. Designing a Relational Database Schema
3. SQL Querying and Data Manipulation
4. Visualizing Data for Business Insights
5. Process Modeling for Business Automation
6. Normalizing Tables for Data Integrity
7. Analyzing Descriptive Statistics in Business Data
8. Predictive Analytics for Forecasting Trends
9. Implementing Robotic Process Automation (RPA)
10. Securing Data and Ensuring Compliance

Total:30

TEXT BOOKS

1. Ramesh Sharda, DursunDelen, Efraim Turban, "Business Intelligence and Analytics: Systems for Decision Support", 11th Edition, Pearson, 2021
2. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation, and Management", 13th Edition, Cengage Learning, 2019

REFERENCE BOOKS

1. Thomas H. Davenport, "Big Data at Work: Dispelling the Myths, Uncovering the Opportunities", Harvard Business Review Press, 2014
2. Alberto Cairo, "The Truthful Art: Data, Charts, and Maps for Communication", New Riders, 2016
3. Randy Krum, "Cool Infographics: Effective Communication with Data Visualization and Design", Wiley, 2013

WEBSITES

1. https://www.coursera.org/specializations/business-data-management-communication
2. https://indiafreenotes.com/business-data-processing/

CO-PO MAPPING

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

SEMESTER-VI

23BECY601   **MACHINE LEARNING FOR CYBER SECURITY**   **4H-4C**

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Provide foundational knowledge in machine learning.
- Implement, train and validate the machine learning models and understand the recent algorithms in machine learning through case studies.
- Understand a range of machine learning algorithms along with their strengths and weaknesses.
- Apply the algorithms to a real-world problem
- Able to formulate machine learning problems corresponding to different applications.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Illustrate the issues and challenges of machine learning: data, model selection, modelcomplexity.
- Apply the features of supervised machine learning algorithms
- Make use of unsupervised machine learning approaches to train a given dataset.
- Analyze the concept of neural networks for learning linear and non-linear activation functions
- Compare the paradigms of supervised and un-supervised learning secured use cases dataset.

UNIT I SUPERVISED LEARNING   9

Foundations of supervised learning - Decision trees and inductive bias, Regression Vs Classification, Supervised: Linear Regression, Logistic Regression, Generalisation, Training, Validation and Testing, Problem of Overfitting, Bias vs Variance, Performance metrics, Decision Tree, Random Forest, Perceptron, Beyond binary classification. Case study: Anomaly detection

UNIT II ADVANCED SUPERVISED LEARNING   9

Advanced supervised learning - Naive Bayes, Bayesian Belief Network, K-Nearest Neighbour, Support vector machines, Markov model, Hidden Markov Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximisation.

UNIT III UNSUPERVISED LEARNING   9

Unsupervised Learning: Curse of Dimensionality, Dimensionality Reduction Techniques, Principal component analysis, Linear Discriminant Analysis Clustering: K-means, Hierarchical, Spectral, subspace clustering, association rule mining. Case Study: Spam filtering / machine learning for end point protection/network protection/ Application security

UNIT IV NEURAL NETWORKS   9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

UNIT V MACHINE LEARNING IN SECURITY   9

Machine Learning in Security: Applications of Machine Learning in Cyber Security Domain, nomaly Detection, Privacy Preserving Nearest Neighbour Search, Machine Learning Applied to Intrusion Detection, Online Learning Methods for Detecting Malicious Executables.

Total: 45

TEXT BOOKS

 1. Tom Mitchell. Machine Learning. First Edition McGraw Hill Education; 2017.

REFERENCE BOOKS

 1. Christopher M Bishop. Pattern Recognition and Machine Learning. Springer 2010
 2. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. Wiley, Second Edition;2007
 3. Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge, Massachusetts, 2012.

WEBSITES

 1. https://towardsdatascience.com/machine-learning-for-cybersecurity-101-7822b802790b
 2. https://arxiv.org/abs/2007.02407
 3. https://www.balbix.com/insights/artificial-intelligence-in-cybersecurity/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	1	1	2	2	-	3
CO2	3	2	1	-	1	-	-	-	1	1	1	2	-	3
CO3	3	2	1	-	1	-	-	-	1	1	1	2	-	3
CO4	3	3	2	1	1	-	-	-	1	1	1	2	-	3
CO5	3	3	2	1	1	-	-	-	1	1	1	2	-	3
Avg	2.8	2.2	1.5	1	1	-	-	-	1	1	1.2	2	-	3

23BECY641   **CYBER SECURITY THREATS AND COUNTERMEASURES**   **5H-4C**

Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

i) THEORY

COURSE OBJECTIVES

The goal of this course s for the students is to

- Learn cybercrime and cyberlaw.
- Understand the cyber attacks and tools for mitigating them.
- To Identify information gathering.
- To infer ways to detect a cyber attack.
- To analyze the possibility to prevent a cyber attack.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Illustrate the basics of cyber security, cyber crime and cyber law to an individual.
- Identify types of attacks and its vulnerabilities to a firewall.
- Apply tools to perform information gathering from unauthorized user.
- Analyze intrusion techniques to detect intrusion in a server.
- Evaluate intrusion prevention techniques in virtual firewall.

UNIT I INTRODUCTION   9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime andPunishment.

UNIT II ATTACKS AND COUNTERMEASURES   9

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach– Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineeringAttack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 9

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Informationfrom E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV INTRUSION DETECTION 9

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 9

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

Total: 45

TEXTBOOKS

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)

REFERENCES BOOKS

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)
3. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007 (Unit 3)
4. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition,
   Pearson Education, 2015 (Units 4 and 5)
5. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014 (Lab)

WEBSITES
1. https://owasp.org/www-project-top-ten/
2. https://www.w3schools.com/cybersecurity/cybersecurity_web_applications.php

ii) LABORATORY:

LIST OF EXPERIMENTS

1. Install Kali Linux on Virtual box
2. Explore Kali Linux and bash scripting
3. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
4. Understand the nmap command d and scan a target using nmap
5. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
6. Use Metasploit to exploit an unpatched vulnerability
7. Install Linus server on the virtual box and install ssh
8. Use Fail2banto scan log files and ban Ips that show the malicious signs
9. Launch brute-force attacks on the Linux server using Hydra.
10. Perform real-time network traffic analysis and data pocket logging using Snort

Total:30

CO-PO MAPPING

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

23BECY642   **DIGITAL AND MOBILE FORENSICS**   **5H-4C**
Instruction Hours/week: L:3 T:0 P:2   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

i) THOERY

COURSE OBJECTIVES

The goal of this course for the students is to
To understand basic digital forensics and techniques.

- Undertand the basic digita forensics process.
- Identify digital crime and investigation.
- Understand how to be prepared for digital forensic readiness.
- Interpret forensics tools for iOS devices and Android devices.
- Infer Challenges in Digital Forensics.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Classify the basics of digital forensics process.
- Analyze digital crime and investigations procedures.
- Examine the frameworks, standards and methodologies for digital forensics.
- Survey digital evidences and tools for iOS devices.
- Categorize digital evidences and forensic procedure for android devices.

UNIT I INTRODUCTION TO DIGITAL FORENSICS   9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process –
Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The
Analysis Phase – The Presentation Phase.

UNIT II DIGITAL CRIME AND INVESTIGATION   9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods
for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

UNIT III DIGITAL FORENSIC READINESS   9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for
Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital
Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS   9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

UNIT V ANDROID FORENSICS   9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

Total: 45

ii)LABORATORY

LIST OF EXPERIMENTS

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.
2. Data extraction from call logs using Sleuth Kit.
3. Data extraction from SMS and contacts using Sleuth Kit.
4. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
5. Process and parse records from the iOS system.
6. Extract installed applications from Android devices.
7. Extract diagnostic information from Android devices through the adb protocol.
8. Generate a unified chronological timeline of extracted records.

Total: 30

TEXT BOOKS

1. Andre Arnes, "Digital Forensics", Wiley, 2018.
2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

REFERENCE BOOKS

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

WEBSITES
1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. https://www.coursera.org/articles/computer-forensics
3. https://resources.infosecinstitute.com/topic/mobile-forensics-process-steps-types/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	2	2	2	-	1	2	-
CO2	3	3	2	1	2	-	-	2	2	2	-	1	2	-
CO3	3	3	2	1	2	-	-	2	2	2	-	1	2	-
CO4	3	3	2	1	2	-	-	2	2	2	-	1	2	-
CO5	3	3	2	1	2	-	-	2	2	2	-	1	2	-
Avg	3	3	2	1	2	-	-	2	2	2	-	1	2	-

23BECY701   **PRINCIPLES OF MANAGEMENT AND ENGINEERING ETHICS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Enable the students to study the evolution of Management
- Learn the functions and principles of management.
- Learn the application of the principles in an organization.
- Infer the effective and barriers communication in the organization
- Study the system and process of effective controlling in the organization.

COURSE OUTCOMES

Upon completion of the course, students will be able to

- Explain the international aspects of management.
- Infer the planning process in the organization.
- Illustrate the managerial role in organizational behavior.
- Outline the factors contributing to leadership.
- Apply the ethical responsibilities of the engineers

UNIT I   MANAGEMENT FUNCTIONS AND STRUCTURE   **9**

Management – Definition – Basic Functions – Contributions of Taylor and Fayol. Types of structure – Line, Staff, Line and Staff, Functional, Committee, Project and Matrix Structures. Departmentalization – Centralization – Decentralization – Span of Control – Management by Objectives – Management by Exception.

UNIT II   MANAGEMENT OF ORGANISATION   **9**

Forms of Business – Industrial Ownership, Sole Trade, Partnership, Company. Performance Appraisal – Basic principles – Pitfalls – Methods to overcome. Industrial Safety – Causes of accidents – How to minimize accidents. Plant Layout and Maintenance – Need, Types and Managerial Aspects

UNIT III   ORGANISATIONAL BEHAVIOUR   **9**

OB-Definition-Nature & Scope- Contributing Disciplines-Importance of OB to Managers. Personality-Definition-Theories-Factors Influencing Personality. Motivation-Definition-Theories. Theory X & Y-Transactional Analysis. Morale & Job Satisfaction-Factors Influencing Job Satisfaction

UNIT IV GROUP DYNAMICS **9**

Group-Definition-Types-Determinants of group cohesiveness. Communication-Process- Barriers-Effective Communication. Leadership Theories-Factors Contributing to effective Leadership. Role of Trade Union in Organizations-Functions of trade Union-Why Trade Unionis Required? - Types of Trade Union

UNIT V PROFESSIONAL ETHICS **9**

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behavior - Codes of Ethics - Encouraging Ethical Behavior - Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) - Intellectual Property Rights (IPR)- Meaning-Laws relating to Intellectual Property Rights (IPRs)

Total:45

TEXTBOOKS:

1. Stephen P. Robbins, David A. Decenzo, 2016. Fundamentals of Management, Pearson Education, 9th Edition
2. Harold Koontz, O'Donnell and Heinz Weihrich, 2012. Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill

REFERENCE BOOKS:

1. Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage. 2014
2. Richard L. Daft, Principles of Management, Cengage Learning. 2009
3. Robbins, Management, 9th edition Pearson Education. 2008

WEBSITES:

1. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_introduction.htm
2. https://www.mtdtraining.com/blog/the-four-principles-of-ethical-management.html.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	3	-	2	-	2	-	-
CO2	-	-	-	-	-	2	-	3	-	2	-	2	-	-
CO3	-	-	-	-	-	2	-	3	-	2	-	2	-	-
CO4	-	-	-	-	-	2	-	3	-	2	-	2	-	-
CO5	-	-	-	-	-	2	-	3	-	2	-	2	-	-
Avg	-	-	-	-	-	2	-	3	-	2	-	2	-	-

SEMESTER-VII

23BECY702	ETHICAL HACKING	4H-4C

Instruction Hours/week: L:3 T:1 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the basics of computer based vulnerabilities.
- Explore different foot printing, reconnaissance and scanning methods.
- Expose the enumeration and vulnerability analysis methods.
- Identify hacking options available in Web and wireless applications.
- Practice tools to perform ethical hacking to expose the vulnerabilities.

COURSE OUTCOMES

Upon completion of this course the students will be able to:

- Illustrate the basics of computer based vulnerabilities.
- Identify foot printing, reconnaissance and scanning methods.
- Apply the enumeration and vulnerability analysis methods
- Solve the hacking options available in web and wireless applications.
- Identify the options for network protection and firewall protection.

UNIT I INTRODUCTION   9

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS   9

 Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS   9

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities -

Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING   **9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade –

UNIT V NETWORK PROTECTION SYSTEMS   **9**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - NetworkBased and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

Total :45

TEXT BOOKS:

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCE BOOKS:

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

WEBSITES:

1. https://www.tutorialspoint.com/ethical_hacking/ethical_hacking_quick_guide.htmL
2. https://www.udemy.com/course/web-security-fundamentals-how-to-hack-and-secure-web-apps/
3. https://onlinecourses.nptel.ac.in/noc22_cs13/preview

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	1	1	1	-	1	2	-
CO2	3	2	1	-	2	-	-	1	1	1	-	1	2	-
CO3	3	2	1	-	2	-	-	1	1	1	-	1	2	-
CO4	3	2	1	-	2	-	-	1	1	1	-	1	2	-
CO5	3	2	1	-	2	-	-	1	1	1	-	1	2	-
Avg	2.8	1.8	2	-	2	-	-	1	1	1	-	1	2	-

23BECY703   **DEVOPS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students **is to**
- Introduce DevOps terminology, definition & concepts
- Understand the different Version control tools like Git, Mercurial
- Identify the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment
- Understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Apply Model View Controller framework to a devops application.
- Build a system using maven and cradle.
- Categorize the Continuous Integration using Jekins.
- Analyze Ansible operations in configuration management.
- Examine Cloud-based DevOps tools using Azure DevOps.

UNIT I INTRODUCTION TO DEVOPS   9

Devops Essentials - DevOps lifecycle–DevOps tools and technologies- Model–View–Controller–Developing MVC applications- Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE   9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand buildusing Gradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS   9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (GitPlugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters).Configuring

Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkinsworkspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE   **9**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE   **9**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

Total:45

TEXT BOOKS

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner
to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

REFERENCES BOOKS

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016
4. Mariot Tsitoara, "Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

WEBSITES

1. https://www.jenkins.io/user-handbook.pdf
2. https://maven.apache.org/guides/getting-started

CO-PO MAPPING

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

B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

PROFESSIONAL ELECTIVES

SEMESTER-IV

23BECY4E01   ADVANCED DATA STRUCTURES   3H-3C

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

PRE–REQUISITES: Data Structures

COURSE OBJECTIVES

The goal of this course for the students is to

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

COURSE OUTCOMES

Upon completion of this course, the students will be able to:

- Interpret the problem solving techniques using asymptotic notations.
- Apply the concepts of trees in a real time application.
- Utilize multi way tree structures for problem solving.
- Examine the single source shortest path for a given graph.
- Analyze pattern matching algorithms.

UNIT I INTRODUCTION TO ALGORITHM DESIGN TECHNIQUES   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.

UNIT II TREES   9

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.

UNIT III MULTI WAY TREES   9

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.

UNIT IV GRAPHS   9

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.

UNIT V ADVANCED ALGORITHMS   9

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

TEXT BOOKS

1. Cormen T H,Leiserson C E and Stein C,"Introduction to Algorithms", PHI Learning, Third Edition 2012.

2. Anany Levitin "Introduction to Design and Analysis of Algorithm", Pearson Education, Third Edition,2017.

REFERENCES BOOKS

1. Jeff Edmonds,"How to Think about Algorithms", Cambridge University Press, Second Edition 2014.

2. Mark Allen Weiss,"Data Structures and Algorithm Analysis in C++",Pearson Education, Fourth Edition 2014.

3. Seymour Lipschutz and VijayalakshmiPai G A, "Data Structures" Tata McGraw–Hill, First Edition 2011.

WEBSITES

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

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	2	3	-
CO2	3	2	1	-	-	-	-	-	1	1	-	2	3	-
CO3	3	2	1	-	-	-	-	-	1	1	-	2	3	-
CO4	3	3	2	1	-	-	-	-	1	1	-	2	3	-
CO5	3	3	1	1	-	-	-	-	1	1	-	2	3	-
Avg	2.8	2.2	1.3	1	-	-	-	-	1	1	-	2	3	-

23BECY4E02   **BLOCKCHAIN AND CYBER SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Network Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Decompose a block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- Illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- Explain the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- Understand the nature of threats and cyber security management goals and technology
- Infer the landscape of hacking and perimeter defense mechanisms

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- Outline the technology components of Block chain and its working principles.
- Utlize Ethereum model and its architectural components.
- Make use of Hyperledger components along with its development framework.
- Identify the nature of threats and cyber security management goals.
- Analyze malicious software attack and wireless network attack.

UNIT I INTRODUCTION OF BLOCKCHAIN TECHNOLOGY   **9**

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization. Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash.– Smart Contracts – Ricardian Contracts.

UNIT II ETHEREUM NETWORK   **9**

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages:Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT III FRAMEWORK FOR HYPERLEDGER FABRIC   **9**

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks – Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger –Corda-Alternative Blockchains.

UNIT IV   CYBER SECURITY   **9**

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security – Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories –perimeter defense and encryption.

UNIT V   WEB APPLICATION ATTACKS   **9**

Malicious Attacks, Threats, and Vulnerabilities- Malware –malicious software attack – social engineering attack – wireless network attack – web application attack –Countermeasures. Creating Mechanisms for IT Security.

                                                        Total: 45

TEXT BOOKS

1. Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained" Packt Publishing, Second Edition 2018.

2. ArshdeepBahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach" VPT Publications,First Edition 2017.

3. David Kim and Michael G. Solomon " Fundamentals of Information Systems Security" Jones &Bartl Learning, Third Edition 2018.

4. Peter Trim and Yang –Im Lee "Cyber Security Management- A Governance, Risk and Compliance Framework" Gower Publishing, First Edition 2014.

REFERENCE BOOKS

1. Andreas Antonopoulos, Satoshi Nakamoto "Mastering Bitcoin", O'Reilly Publishing, Second Edition 2017.

2. Alex Leverington "Ethereum Programming", Packt Publishing, First Edition 2017.

3. John G. Voeller "Cyber Security" John Wiley & Sons,First Edition 2014.

WEB SITES

1. www.nptel.ac.in/courses/106/104/106104220/

2. www.icaew.com/technical/technology/blockchain/blockchain-articles/what-isblockchain/history

3. www.ibm.com/topics/blockchain-security

4. https://blockgeeks.com/guides/ethereum/
5. https://world101.cfr.org/global-era-issues/cyberspace-and-cybersecurity/what-are-cyberspaceand-cybersecurity

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	1	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	1	-	-	-	-	1	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	2
Avg	2.8	2	1.3	1	-	-	-	-	1	1	-	1	-	2

23BECY4E03   **CLOUD   SECURITY**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITE: Network Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Familiar with the architecture of the cloud computing.
- Know the security and the secure operations provided in cloud computing.
- Explore some important cloud computing driven commercial systems and applications.
- Aware of private cloud infrastructure.
- Understand the information security framework.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Interpret concepts of cloud computing, policy and compliance in cloud   environment.
- Illustrate cloud security patterns and architectural element in cloud.
- Analyze the limits of security controls and enhance best practices for security monitoring.
- Examine the security issues involved in cloud computing.
- Test for the security operation activities to solve problems on the cloud.

UNIT I INTRODUCTION   9

Introduction to Cloud computing and security: Understanding cloud computing – The IT foundation for Cloud. An historical view: Roots of Cloud computing – A brief primer on architecture. Security architecture: Cloud computing architecture – Cloud reference architecture – Control over security in the cloud model – Making sense of cloud deployment – Making sense of services models – Real- world cloud usage scenarios.

UNIT II SECURING THE CLOUD   9

Security concerns – Risk issues and legal aspects – Security concerns – Assessing risk tolerance in Cloud Computing – Legal and regulatory issues – Securing the Cloud: Architecture – Security patterns and architectural element – Cloud security architecture – Planning key strategies for secure operation.

UNIT III CLOUD DATA SECURITY   9

Securing the cloud: Data security – Overview of data security in Cloud Computing. Data

encryption: Applications and limits – Cloud data security – Sensitive data categorization – Cloud data storage – Cloud lock-in (the Roach Motel Syndrome). Securing the cloud: Key strategies and Best practices – Overall strategy – Effectively managing risk – Overview of security controls – The limits of security controls – Best practices – Security monitoring.

UNIT IV SECURITY CRITERIA   9

Security criteria: Building an internal cloud – Private clouds – Motivation and overview – Security criteria for ensuring a private cloud – Security criteria – Selecting an external cloud provider – Selecting a CSP – Overview of assurance – Selecting a CSP – Overview of risks – Selecting a CSP

UNIT V EVALUATING CLOUD SECURITY   9

Security criteria – Evaluating cloud security – An information security framework – Evaluating cloud security – Checklists for evaluating cloud security – Metrics for the checklists – Operating a cloud – Architecture to efficient and secure operations – Security operations activities.

Total : 45

TEXT BOOKS
1. Raghuram Yeluri and Enrique Castro-Leon, Building the Infrastructure for Cloud Security: A Solutions View, Apress, First Edition,2014
2. Ronald L Krutz andRussell Dean Vines, Cloud Security: A ComprehensiveGuide to Secure Cloud Computing, Wiley, First Edition,2010

REFERENCE BOOKS
1. Chris Dotson, Practical Cloud Security A Guidefor Secure Design and Deployment, O'Reilly Media,First Edition,2019
2. Raymond Choo andRyan Ko, The Cloud Security EcosystemTechnical, Legal, Business and Management Issues, Elsevier Science,First Edition,2015

WEBSITES
1. www.oreilly.com/library/view/securing-the-cloud
2. www.infoq.com/articles/cloud-security-architecture-intro/
3. www.techbeacon.com/security/5-critical-features-cloud-security-controls
4. www.omg.org/cloud/deliverables/CSCC-Security-for-Cloud-Computing-10-Steps-to-Ensure-Success.pdf
5. www.ibm.com/cloud/learn/cloud-security

CO-PO MAPPING

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

SEMESTER-IV

23BECY4E04   BASICS OF CYBER CRIME AND CYBER SECURITY   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks:** Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

PRE-REQUSITE: Programming Logics and Design

COURSE OBJECTIVES

The goal of this course for the students is to
- Understand the fundamental concepts of cybercrime.
- Explore knowledge on cybercrimes in wireless devices.
- Infer tools used in the cyber security.
- Familiar with various Indian IT Act in cybercrime and cyber security.
- Enhance the knowledge in handheld devices and digital forensics.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Identify the basics of cyber-crime and information security in safeguarding digital assets.
- Apply the fundamentals concepts for identifying cyber-attacks.
- Make use of tools and methods used in cyber security.
- Analyze theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Examine the effect of cybercrime on digital devices on the public sector, private sector, individual, and societal levels.

UNIT I INTRODUCTION   **9**

Introduction to Cyber Crime: Cyber Crime and Information Security – Classifications of Cyber Criminals – Cyber Crime Legal Perspective and Indian Perspective – Cyber Crime and Indian ITA – A Global perspective on Cyber crimes – Categories of Cyber crimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

UNIT II CYBER CRIME MOBILE AND WIRELESS DEVICES   **9**

Cyber Crime Mobile and Wireless Devices: Proliferation – Trends in Mobility – Credit card frauds – Security challenges – Registry setting – Authentication service – Attacks – Security Implication for Organization – Organizational measures – Organizational Security Policies – Physical security counter measures.

UNIT III TOOLS AND METHODS 9

Tools and methods used in cyber security: Proxy servers and anonymizers – Phishing – Password cracking – Keyloggers and spywares – Virus and worms – Trojan horse – Stegnography – DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

UNIT IV CYBER CRIME AND LEGAL LANDSCAPE 9

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cyber crime and punishment. Understanding Computer Forensics: Need for computer forensics – Cyber forensics and digital evidence – Digital forensics life cycle – Network forensics – Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

UNIT V SPECIAL TOOLS AND TECHNIQUES 9

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cyber crimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

Total: 45

TEXT BOOKS

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

REFERENCE BOOKS

1. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
2. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, FirstEdition, CRC Press, First Edition

WEBSITES

1. www.lexology.com/library/
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.itu.int/en/ITU-D/Cybersecurity

CO-PO MAPPING

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

23BECY5E01 **FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in AI
- Illustrate to represent knowledge in solving AI problems
- Understand the different ways of designing software agents
- Infer about the various applications of AI.

COURSE OUTCOME

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

- Identify the efficiency and effectiveness of search algorithms metrics.
- Build the importance of knowledge representation in artificial intelligence systems.
- Utilize network based knowledge representation and reasoning in AI.
- Construct the concept of adversarial search in decision-making for gaming applications.
- Apply Hidden Markov models in recognizing patterns, predictions in dynamic environments.

UNIT I INTRODUCTION 9

Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION 9

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, in ferencing, monotonic and non monotonic reasoning. Introduction to prolog.

UNIT III NETWORK-BASED REPRESENTATION 9

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

UNIT IV GAME THEORY 9

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alpha-beta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning

UNIT V FUZZY LOGIC 9

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models

Total : 45

TEXT BOOKS

1. Elaine Rich & Kevin Knight ,"Artificial Intelligence", Mc-GrawHill,Third Edition, 2017.
2. Dan W.Patterson, "Introduction to AI & Expert System, PHI, 2020.

REFERENCES

1. "Artificial Intelligence" by Luger (Pearson Education) , 2020.
2. Russel&Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2020.

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1. https://nptel.ac.in/courses/112/103/112103280/
2. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artifciial-intelligence

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO5	3	2	1	-	-	-	-	-	1	1	-	2	-	2
Avg	3	2	1	-	-	-	-	-	1	1	-	2	-	2

SEMESTER-V

23BECY5E02   **ROBOTIC   PROCESS   AUTOMATION**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to:

- Understand the basic concepts of Robotic Process Automation.
- Expose to the key RPA design and development strategies and methodologies.
- Learn the fundamental RPA logic and structure.
- Explore the Exception Handling, Debugging and Logging operations in RPA.
- Learn to deploy and Maintain the software bot.

COURSE OUTCOMES

Upon completion of the course, the student should be able to:

- Interpret the basics of robotic process automation.
- Experiment with automation process activities.
- Utilize app integration, recording and scraping in robotic process automation.
- Analyze exception handling and code management
- Inspect business processes for automation potential and develop automation strategies..

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION   9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES   9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, Ui Explorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING   9

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT   9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE   9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

Total :45

TEXT BOOKS

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.

2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

REFERENCES

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, "Robotic Process Automation RPA A Complete Guide ", 2020

WEBSITES

1. https://www.gartner.com/reviews/market/robotic-process-automation-software
2. https://www.datamation.com/artificial-intelligence/top-15-robotic-process-automation-rpa-companies/

CO-PO MAPPING

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

	SEMESTER-V
23BECY5E03 **OS SECURITY**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Study the basic concepts of OS security.
- Understand the concepts of various information flow secrecy models.
- Illustrate the secure communication processor.
- Understand the working of secure capability systems.
- Familiarize with security kernel and access controls.

COURSE OUTCOMES

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

- Identify the security goals in protecting computer system data.
- Develop information flow secrecy driverto an application.
- Make use of Scomp architecture to enhance its security features.
- Apply the knowledge gained to assess the security of operating systems.
- Analyze the concept of security kernel for enforcing security policies.

UNIT I IINTRODUCTION   9

Introduction – Secure Operating Systems – Security goals – Trust model – Threat model – Access control fundamentals – Reference models. Multics: Fundamentals and system models – Unix security – Windows security.

UNIT II INTEGRITY MODELS   9

Verifiable security goals – Information flow – Information flow secrecy models – Denning's lattice model – Bell-LaPadula model – Information flow integrity models – Security kernels – Secure communications processor

UNIT III SECURING OS   9

Scomp architecture – Scomp hardware – Scomp trusted operating program – Scomp kernel interface package – Scomp applications – Scomp evaluation – Securing commercial operating systems.

UNIT IV SYSTEM SECURITY 9

Secure capability systems – Capability system fundamentals – Capability security – Challenges in secure capability systems – Building secure capability systems – Operating system security and access control – Memory protection – Supervisor mode – Accountability

UNIT V ACCESS CONTROL 9

The reference monitor – Access matrix – Security kernel – Object permissions and file-based access control – Setuid bit and Effective Userid (Euid) – Directory permissions and i-node based example – Symbolic links, hard links and deleting files – Role-based and mandatory access control.

Total : 45

TEXT BOOKS

1. Trent Jaeger, Operating Systems Security, Morgan and ClaypoolPublishers, First Edition,2018
2. Michael J Palmer, Guide to OperatingSystems Security, Thomson/Course Technology,First Edition,2014

REFERENCE BOOKS

1. Abraham Silberschatz,Greg Gagne and Peter B Galvin, Operating SystemConcepts, Wiley,Sixth Edition,2014
2. Paul C Van Oorschot, Computer Security and theInternet Tools and Jewels, Springer Publishing, First Edition,2020

WEBSITES

1. www.unf.edu/public/cop4610/ree/Notes/PPT/PPT8E/CH15-OS8e.pdf
2. www.giac.org/paper/gsec/2776/operating-system-security-secure-operating-systems/104723
3. www.nces.ed.gov/pubs98/safetech/chapter8.asp
4. www.mycwt.com/for-suppliers/information-security-requirements/
5. www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/15_Security.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	2	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	2	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	2	-	2
Avg	2.8	2	1.3	1	-	-	-	-	1	1	-	2	-	2

SEMESTER-V

23BECY5E04 **CYBER LAWS AND INTELLECTUAL PROPERTY RIGHTS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the need for cyber laws and intellectual property rights.
- Acquire knowledge about the protective measures of Intellectual property such ascopyright, patent, Trademark.
- Identify the criminal remedies and defensive measures.
- Provide an insight about the role of certifying authority and cryptography.
- Be aware of Indian IT Act 2000 and 2008 cyber laws.

COURSE OUTCOMES

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

- Interpret the fundamental concepts of cyber laws and intellectual property rights for criminal activities.
- Utilize the concept of work of employment and its implications in copyright infringement cases.
- Choose civil remedies available for design infringement and their application.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Make use of information technology act and its subsequent amendments in cyberspace.

UNIT I INTRODUCTION 9

Intellectual Property: Introduction – Protection of Intellectual Property – Copyright related rights – Patents – Industrial designs – Trademark – Unfair competition – Information technology related intellectual property rights – Computer software and intellectual property – Copyright protection – Reproducing – Defences – Patent protection.

UNIT II INFRINGEMENT 9

Ownership and enforcement of intellectual property – Defences in case of infringement copyright – Work of employment infringement – Defences for infringement – Trademarks – Rights – Protection of good will – Infringement – Passing off defences

UNIT III IP IINTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT 9

Designs – Defences of design infringement. Enforcement of intellectual property rights – Civil

remedies – Criminal remedies – Border – Security measures. Practical aspects of licensing – Benefits – Determinative factors – Important clauses – Licensing clauses.

UNIT IV CYBER LAW   9

Cyber law: Basic concepts of technology and law – Understanding the technology of internet – Scope of cyber laws. Cyber jurisprudence law of digital contracts: The essence of digital contracts – The system of digital signatures – The role and function of certifying authorities

UNIT V   INTELLECTUAL PROPERTY ISSUES   9

The science of cryptography – IT Act 2000 and 2008 – Amendments in IT Act – IPC and Privacy threats in cyber law. Intellectual Property issues in cyber space: Domain names and related issues – Copyright in the digital media – Patents in the cyber world. rights of netizens and e-Governance.

Total : 45

TEXT BOOKS

1. David I Bainbridge, Intellectual Property, Pearson Education,Eighth Edition,2010
2. Talat Fatima, Cyber Law in India, Wolters Kluwer,First Edition,2017

REFERENCE BOOKS

1. Yatindra Singh, Guide to Cyber Laws, Universal Law,Fourth Edition,2010
2. Information Technology Law andPractice- Cyber Laws and Laws Relating to E-Commerce, Universal Law,Third Edition,2011

WEBSITES

1. www.core.ac.uk/download/pdf/144527187.pdf
2. www.nptel.ac.in/courses/110/105/110105139/
3. www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4. www.lawshelf.com/videocoursesmoduleview/
5. www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	2	1	-	-	-	-	-	1	1	-	1	-	2
Avg	2.8	1.8	1	-	-	-	-	-	1	1	-	1	-	2

23BECY5E05   **BASICS OF CYBER FORENSICS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks:** Internal:**40** External:**60** Total:**100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Make aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- Be familiar with the file systems and challenges in the Linux and mac operating system.
- Explore knowledge on the network and different operating systems on mobile devices.
- Learn various services like FaaS and MaaS.
- Enhance the knowledge on database, email and threats in crypto currency.

COURSE OUTCOMES

- Interpret the basic of Forensics investigation process.
- Utlize popular Linux distributions and artifacts associated with Linux systems.
- Make use of iOS forensics and relevant data extraction procedure from iOS devices
- Identify the challenges in cloud forensics.
- Examine Bitcoin forensics and Blockchain artifacts.

UNIT I INTRODUCTION   9

Introduction to Cyber forensics: Forensics investigation process – Forensics protocol – Digital forensics standards –Digital evidence – Types of cyber crime – Notable data breaches – Case study - Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis – Challenges- Case Study.

UNIT II LINUX FORENSICS AND MAC OS FORENSICS   9

Linux forensics: Popular linux – File systems – Process – Artifacts – Linux distribution used for forensics analysis – Challenges – Case study. Mac OS forensics: File systems – Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics: Data wiping and shredding – Trial obfuscation – Encryption – Data hiding – Anti-forensics detection technique

UNIT III NETWORK FORENSICS   9

Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip-off – Micro-read –

Challenges – iOS operating system.

UNIT IV CLOUD FORENSICS 9

Cloud forensics: Cloud computing model – Server-side forensics – Client-side forensics – Challenges –Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis – Tools – Challenges – Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics – Log forensics – Content analysis – File metadata forensics

UNIT V EMAILS AND EMAIL CRIMINALS 9

Emails and email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components –Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.

Total: 45

TEXT BOOKS

1. Niranjan Reddy , Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations, Apress, First Edition, 2019

REFERENCE BOOKS

1. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, ThirdEdition, 2013
2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence,Wiley Publisher, .First Edition, 2012

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1. www.champlain.edu/computer-forensics
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.cs.nmt.edu/~df/lectures.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	2
Avg	2.8	2	1.3	1	-	-	-	-	1	1	-	1	-	2

23BECY5E06   **COGNITIVE PSYCHOLOGY IN CYBER SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand history of scientific Psychology and contributions of prominent scientists.
- Be able to design a psychological experiment.
- Be aware of various type of psychological behavior model.
- Study differ models of memory study in psychology.
- Know about the digital forensic investigations.

COURSE OUTCOMES

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

- Build cognitive basic principle to impart cognitive psychology.
- Apply major concepts of attention in perception and behavior.
- Organize the theories of pain perception in cognitive physiological factors.
- Inference memory factors and its importance in cognitive processes.
- Analyze thinking as a cognitive process in decision-making.

UNIT I INTRODUCTION   9

Introduction to Cognitive Psychology – History and emergence – Psychology an interdisciplinary field Contributions of various schools of Psychology to cognitive Psychology – Introduction to models of cognitive Psychology – Limitations of laboratory studies and importance of ecological validity – Ethical approach to cyber psychology.

UNIT II ATTENTION   9

Attention – Model of attention – Selective attention – Automaticity – Multi-tasking and division of attention – Major concepts in attention – Theories of attention Filter model.

UNIT III SENSATION AND PERCEPTION   9

Sensation and Perception: Theories of perception – Theories of pattern recognition – Theories of Pain perception – Theories of constancies and illusions – Classical and modern psychophysics – Types of Cognitive modeling – Behavior modeling.

UNIT IV MEMORY 9

Memory: Nature – Methods of Study – Types of Memory – Models of Memory – Atkinson and Shiffrin, Levels of Processing – Parallel Distributed Processing. Autobiographical memory – Eye-Witness Testimony – Mnemonics. Forgetting: Nature – Factors, and Theories.

UNIT V LANGUAGE 9

Language: Properties; Structure; and Processes of Language Acquisition. Thinking: Nature; Concept Formation. Problem Solving: Nature, Strategies of Problem Solving. Reasoning: Nature and Types. Digital Forensics Investigations.

Total : 45

TEXT BOOKS

1. Kellogg RT, Fundamentals of Cognitive Psychology, Sage Publication,First Edition,2013
2. Galotti K M, Cognitive Development, Sage Publication,First Edition,2013

REFERENCE BOOKS

1. Ulric Neisser. Cognitive Psychology, Taylor and Francis,First Edition,2014
2. Robert G Crowder, Principles of Learning and Memory, Taylor and Francis, First Edition,2014
3. Thomas D Parsons, Ethical Challenges in Digital Psychology and Cyberpsychology, Cambridge UniversityPress, First Edition,2019

WEBSITES

1. www. nptel.ac.in/content/storage2/courses/109101015
2. www.routledge.com/An-Introduction-to-Cognitive-Psychology-Processes-and-disorders
3. www.simplypsychology.org/attention-models.html
4. www.ncert.nic.in/ncerts/l/kepy105.pdf
5. www.us.sagepub.com/files/13839_book_item_13839

CO-PO MAPPING

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

SEMESTER-V

23BECY5E07   **INTERNET SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn about contemporary knowledge in Internet Security.
- Understand effective measures in providing assurance concerning privacy and security in hardware layers.
- Be aware of flooding attacks and session hijack attacks in transport layer.
- Gain knowledge on the vulnerability occurring in the database layer of an application.
- Impart knowledge on transport layer security handshake and building a Firewall using NetFilter.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Apply the security issues to mitigate the risks in protecting personal information.
- Choose active and passive attacks in network security to protect against attacks.
- Inspect spoofing techniques to protect against spoofing attacks.
- Categorize the structure of Domain Name System and its role as DNS servers.
- Model virtual private networks in securing network communications over public networks.

UNIT I   NETWORK SECURITY   9

Malware and viruses – Spam, Phishing and Hacking Digital Footprints. Unsecured Networks: Issues in connecting to unsecure network. Secure Hotspot usage. Cookies: Types of Cookies – Malicious cookies – Benefits of removing cookies from computer – Using Google Chrome, Firefox, Internet Explorer.

UNIT II PHYSICAL LAYER ATTACKS   9

Jamming attacks – Active and passive attack – hannon's perfect secrecy – Secure communication over Noisy Channels – Channel Coding for secrecy. Data link layer attacks: ARP protocol – ARP cache poisoning – ARP spoofing – Port stealing DHCP attacks.

UNIT III NETWORK LAYER ATTACKS   9

Packet sniffing – Packet spoofing – Spoofing – Endianness – Calculating checksum. Transport layer attacks: TCP protocol – SYN flooding attacks – TCP reset attack – TCP session Hijacking attack.

UNIT IV DOMAIN NAME SYSTEM ATTACKS   9

DNS hierarchy – DNS attack overview – Local and remote cache poisoning attack. Cross site request forgery: Cross site request. SQL injection attack: Introduction – Interacting with web application – Launching SQL injection attacks – Fundamental causes – Counter measures.

UNIT V VIRTUAL PRIVATE NETWORKS   9

Building a VPN – Transport Layer Security (TLS/SSL) – Overview of TLS/SSL – TLS handshake – TLS data transmission – TLS programming (Client and Server side) – Firewalls – Types of firewalls – Net filter – Building firewall using Net Filter. Anti-virus software: Importance of using anti-virus – Need for anti-virus updation.

Total: 45

TEXT BOOKS

1. Wenliang Du, Computer & Internet Security: A Hands-on Approach, Wenliang Du, Second Edition, 2019.
2. Atul Kahate, Cryptography and Network Security, Tata McGraw Hill Second Edition, 2015.

REFERENCES

1. Matthieu Bloch and Joao Barros, Physical Layer Security from Information theory to Security Engineering, Cambridge University Press, First Edition,2011.
2. Gupta Sharma, Computer and Cyber Security: Principles Algorithm Applications and Perspectives, CRC Press, Second Edition,2019.

WEBSITES

1. www.handsonsecurity.net/resources.html
2. www.handsonsecurity.net/video.html
3. www.nptel.ac.in/courses/106/106/106106178/
4. www.cisco.com/c/dam/global/da_dk/assets/docs/presentations/tech2007/Preso_Barbara_Fraser.pdf
5. www.netfilter.org

CO-PO MAPPING

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

23BECY5E08   **HARDWARE SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITE: Computer Networks

COURSE OBJECTIVES

The goal of this course for the students is to
- Study the basic concepts of hardware security.
- Understand the mathematical theory of public key cryptography.
- Explore on fault tolerance of cryptographic hardware security.
- Obtain the knowledge inside channel attacks.
- Infer hardware Trojan and trusted integrated circuit (IC) design.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Apply mathematical concepts and algorithms for public key cryptography to an application.
- Buildphysical unclonable functions in hardware security.
- Make use of verification methods for finite field arithmetic circuits in cryptographic hardware.
- Analyze Trojans to increase the security.
- Inspecthardware security concepts on public infrastructure to increase testing sensitivity.

UNIT I INTRODUCTION TO HARDWARE SECURITY   9

Algebra of finite fields – Basics of the mathematical theory of public key cryptography – Basics of digital design on Field – Programmable Gate Array (FPGA) – Classification using support vector machines – Cryptographic hardware and their implementation – Optimization of cryptographic hardware on FPGA – Introduction to IP protection – Watermarking basics – Watermarking examples – Good watermarks – Fingerprinting – Hardware metering.

UNIT II PHYSICALLY UNCLONABLE FUNCTIONS   9

PUF implementations – PUF quality evaluation – Design techniques to increase PUF response quality – Side-channel attacks on cryptographic hardware.

UNIT III INTRODUCTION TO SIDE CHANNEL ATTACKS   9

Current measurement based side channel attacks – Design techniques to prevent side-channel attacks – Improved side-channel attack algorithms – Cache attacks – Power analysis – Modified modular exponentiation – Fault-tolerance of cryptographic hardware – Fault attacks – Verification of finite field arithmetic circuits

UNIT IV HARDWARE TROJANS   9

Hardware trojan nomenclature and operating modes – Hardware trojan detection methods– Logic testing and side-channel analysis based techniques for trojan detection – Techniques to increase testing sensitivity – Trusted IC – Trusted IC design with HT prevention.

UNIT V INFRASTRUCTURE SECURITY   9

Impact of hardware security compromise on public infrastructure – Defense techniques

Total: 45

TEXT BOOKS

1. Debdeep Mukhopadhyay and Rajat Subhra Chakraborty, Hardware Security: Design, Threats, and Safeguards, CRC press, First Edition,2014.
2. Swarup Bhunia and Mark Tehranipoor, Hardware Security: A Hands-on Learning Approach, Katey Birtcher, First Edition,2018.

REFERENCE BOOKS

2. Mohammad Tehranipoor and Cliff Wang Editors, Introduction to Hardware Security and Trust, Springer-Verlag New York,2012.
3. Ted Huffmire Cynthia and Timothy Sherwood, Handbook of FPGA Design Security, Springer, First Edition,2010.
4. Ahmad-Reza Sadeghi and David Naccache, Towards Hardware-intrinsic Security: Theory and Practice, Springer, First Edition,2010.

WEBSITES

1. www.coursera.org/learn/hardware-security
2. www.nptel.ac.in/courses/106/105/106105194/
3. www.coursera.org/learn/hardware-security
4. www.cylab.cmu.edu/research/hardware-security.html

5. www.kullabs.com/class-miscellaneous/caomputer-basics/computer-security-system/hardwaresecurity

CO-PO MAPPING

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

23BECY5E09   **DATA WAREHOUSING AND DATA MINING**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand various data mining functionalities.
- Inculcate knowledge on data mining query languages.
- Know in detail about data mining algorithms.
- Be familiar with the concepts of data warehouse and data mining,
- Be acquainted with the tools and techniques used for Knowledge Discovery in Databases

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Make use of multidimensional data model and schemas in association mining.
- Model the architectural view for data warehouse repository.
- Build data mining technique for preprocessing of data.
- Apply appropriate classification and clustering techniques for data analysis.
- Analyze spatial databases and spatial data mining techniques..

UNIT I   INTRODUCTION TO DATA WAREHOUSING   9

Evolution of Decision Support Systems- Data warehousing Components –Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

UNIT II   DATA WAREHOUSE PROCESS AND ARCHITECTURE   9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III   INTRODUCTION TO DATA MINING   9

Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – 90 Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV   CLASSIFICATION AND CLUSTERING   9

Decision Tree Induction - Bayesian Classification – Rule Based Classification –Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods - Clustering techniques – , Partitioning methods- k-means Hierarchical Methods - distance-based agglomerative and divisible clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V   ADVANCED TOPICS IN DATA MINING   9

Mining complex data objects, Spatial databases, temporal databases, Multimedia databases, Time series and Sequence data; Text Mining –Graph mining-web mining-Application and trends in data mining.

Total: 45

TEXT BOOKS

1. Cormen T H, Leiserson C E and Stein C, Introduction to Algorithms, PHI Learning,ThirdEdition,2011
2. Anany Levitin, Introduction to Design and Analysis of Algorithm, PearsonEducation, ThirdEdition,2017

REFERENCES

1. Mehmed kantardzic,"Datamining concepts,models,methods, and lgorithms", Wiley Interscience,2003
2. Ian Witten, Eibe Frank, Data Mining; Practical Machine Learning Tools and Techniques, third edition, Morgan Kaufmann, 2011.
3. George M Marakas, Modern Data Warehousing, Mining and Visualization, Prentice Hall, 2003.

WEBSITES

1. https://nptel.ac.in/courses/106105174/

2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/110105076/lec28.pdf

CO-PO MAPPING

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

23BECY6E01   **FORENSIC AUDIO AND VIDEO ANALYSIS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

PRE-REQUISITES: Basics of Programming

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the concepts of digital signal processing and pattern recognition application to identify and verify speakers automatically using speech recognition.
- Examine and authenticate recorded videos by various speech analysis.
- Perform image enhancement and restorations by knowing various video standards and editing process.
- Make forensic analysis of audio/video in video recordings.
- Infer the principles and techniques of video authentication

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Illustrate the anatomical structures involved in speech production
- Apply digital audio processing for forensic speaker identification
- Make use of linguistic and phonetic characteristics for speaker recognition
- Categorize the principles of video authentication to detect potential tampering or alterations
- Analyze visual examination technique for natural scene videos and crowd analysis

UNIT I SPEECH ANATOMY   **9**

Speech anatomy – Mechanism of speech production – Acoustic properties of vocal tract – Uniqueness in person's voice – Interspeaker and intraspeaker variation. Articulation – Phonetics in speaker identification – IPA (The International Phonetic Alphabets) – Forensic phonetics – Effect of context – Audio enhancement – Sound recording/Playback devices.

UNIT II DIGITAL AUDIO PROCESSING   **9**

Quantization – Digital audio formats – Coding and decoding – Computer representation of speech. Speaker recognition: Principles of speaker recognition/identification – Methods – Various approaches in forensic speaker identification – Interpretation of result – Concept of test and error in speaker identification.

UNIT III   PATTERN RECOGNITION   9

Pattern recognition application – Different algorithm of automatic speaker identification. Audio evidence examination: Handling of audio recording evidence – Phonetic transcription – Analysis of linguistic and phonetic characteristics – Temporal measurement – Text-dependent and text independent speaker recognition. Authentication of recorded audio: Type of alterations – Auditory examination. Waveform analysis – Speech spectrographic analysis – Optical method.

UNIT IV   VIDEO STANDARDS   9

Video standards – Recording formats – Introduction to video devices – Linear and non-linear editing – Concept of video film production – Graphics and animation technique. Image perception – Color space and representation – Storage, Image processing application. Introduction to image enhancement – Image restoration – Concept of digital water marking – Image compression – Retrieval of video files – Integrity of images – Facial image recognition.

UNIT V   VIDEO AUTHENTICATION   9

Authentication of video recording – Visual examination technique – Video image analysis – Facial image recognition from video frame image – Video signal analysis. Action representation approaches: Classification of various dimension of representation – View invariant methods – Gesture recognition and analysis – Action segmentation. Case study: Face detection and recognition – Natural scene videos and crowd analysis.

Total:45

TEXT BOOKS

1. Robert C Maher, Principles of Forensic Audio Analysis, Springer, First Edition,2018.
2. Francesco Camastra and Alessandro Vinciarelli, Machine Learning for Audio, Image and Video Analysis, Springer, Second Edition,2015.

REFERENCES BOOKS

1. Ben Gold, Nelson Morgan and Dan Ellis, Speech and Audio Signal Processing: Processing and Perception of Speech and Music, John Wiley, Second Edition,2011.
2. Mark T Maybury, Multimedia Information Extraction, John Wiley, First Edition,2012.

WEBSITES

1. www.forensicsciencesimplified.org/av/AudioVideo.pdf
2.www.annamalaiuniversity.ac.in/studport/download/engg/it/resources/Cyber%20Forensics.pdf
3. www.forensicsciencesimplified.org/av/

4. www.onlinecourses.swayam2.ac.in/cec20_lb06/preview
5. www.forensicsciencesimplified.org/

CO-PO MAPPING

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

23BECY6E02   AGILE METHODOLOGIES   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

PRE-REQUISITES: Software Engineering

COURSE OBJECTIVES

The goal of this course for the students is to
- Understand agile methods and roles.
- Understand the XP lifecycle processing.
- Learn different types of planning anddevelopment methodology.
- Learn issues in real time problems
- Familiarized with development environment.
- Gain knowledge on delivery and cyclicality.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Illustrate principles of agile project development
- Demonstrate releasing, planning and development phases of XP
- Apply releasing, planning and development phases using Agile Methodology
- Analyze Agile approach in global software development
- Categorize the real-time effects on learning in Agile software development

UNIT I INTRODUCTION   9

Agile development – Agile classification methods – Principles – Project Management – Modeling –Story – Evidence – Scrum: Lifecycle, Work products, roles and practices

UNIT II EXTREME PROGRAMMING   9

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

UNIT III VERSION CONTROL   9

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.

UNIT IV AGILE VALUES AND PRINCIPLES 9

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.

UNIT V AGILE REFLECTION 9

Reflection: Reflection on learning in Agile software development. Change: Transition to an Agile software development environment – Organizational changes. Leadership: Styles – The Agile changeleader. Delivery and cyclicality: Reflective session between releases.

Total: 45

TEXT BOOK

1. Craig Larman, Agile and Iterative Development, Pearson Education, Third Edition,2016

REFERENCE BOOKS

1. Orit Hazzan Yael Dubinsky, Agile Software Engineering, Springer International, SecondEdition,2014
2. James Shore and Shane Warden, The Art of Agile Development, O`REILLY, FirstEdition,2013

WEBSITES

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

CO-PO MAPPING

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

23BECY6E03   ADVANCED JAVA PROGRAMMING   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Translate vast data into abstract concepts and to understand JAVA concepts
- Have a clear understanding of subject related concepts
- Develop computational ability in Java programming language.
- Know about multithreading concepts and applications.
- Solve problem in real time scenario.

COURSE OUTCOMES

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

- Illustrate concepts on association and assignment on relationship
- Outline data abstraction concepts on abstract classes and interfaces
- Apply Exception handling to develop efficient and error free codes
- Solve real world problems based on data structure
- Develop programs to solve real-time applications using arrays and linked list

UNIT I ASSOCIATIONS, MODIFIERS   9

Uses A - Association-Diagrammatic representation-Demo on association-Assignment on relationships-Solving MCQs based on relationships between classes-Types of access specifiers-Demo on access specifiers-Assignment on access modifiers-Instance Members-Solving MCQs based on modifiers.

UNIT II INTERFACE & ABSTRACT CLASSES   9

Abstract Classes-Need-Abstract Classes-Abstract Methods-Interfaces-Assignment on abstract classes and interface-Need for packages-Access specifiers & packages-Import classes from other packages.

UNIT III EXCEPTIONS   9

Need for exception handling-try-catch-throw-throws-Creating own exception (Java, Python)-Handling own exceptions.

UNIT IV COLLECTIONS   **9**

ArrayList, LinkedList, List Interface, HashSet, Map Interface, HashMap, Set-Programming questions based on collections-Real world problems based on data structure.

UNIT V LINKED LIST ARRAYS   9

Solving programming questions based on linked list and arrays.

Total: 45

TEXT BOOKS

1. Herbert Schildt , Java The Complete Reference, McGraw-Hill, 9th Edition , 2014

REFERENCE BOOKS

1. John Dean, Introduction to Programming with Java: A Problem-Solving Approach ,2008

WEBSITES

1. https://www.javatpoint.com/java-oops-concepts

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	3	-
CO2	2	1	-	-	-	-	-	-	1	1	-	1	3	-
CO3	3	2	1	-	-	-	-	-	1	1	-	1	3	-
CO4	3	2	1	-	-	-	-	-	1	1	-	1	3	-
CO5	3	3	2	1	1	-	-	-	1	1	-	1	3	-
Avg	2.6	1.8	1.3	1	1	-	-	-	1	1	-	1	3	-

23BECY6E04   **BIOMETRIC SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Network Security/ Information Security

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the fundamental approaches for biometric systems.
- Gain knowledge about biometric face recognition.
- Analyze the process of iris recognition.
- Learn about various biometric security systems.
- Illustrate various attacks on biometric systems.

COURSE OUTCOMES

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

- Illustrate the design cycle of biometric systems
- Demonstrate the face recognition and detection techniques
- Develop algorithms for feature recognition using Iris verification
- Classify acquisition and processing architecture from multiple biometric sources
- Analyze security process in biometric system

UNIT I INTRODUCTION TO BIOMETRICS   **9**

Biometric functionalities – Biometric system errors – The design cycle of biometric systems – Applications of biometric systems – Security and privacy issues – Fingerprint recognition – Fingerprint acquisition – Feature extraction – Fingerprint indexing – Palmprint.

UNIT II FACE RECOGNITION   **9**

Introduction to face recognition – Image acquisition – Face detection – Feature extraction and matching.

UNIT III IRIS RECOGNITION   **9**

Introduction to iris recognition – Design of an iris recognition system – Iris segmentation – Iris normalization - Iris encoding and matching – Iris quality – Biometric traits – Hand geometry – Soft biometrics.

UNIT IV MULTI-BIOMETRICS 9

Multi-biometrics – Sources of multiple evidence – Acquisition and processing architecture – Fusion levels.

UNIT V SECURITY OF BIOMETRIC SYSTEMS 9

Adversary attack – Attacks at the user interface – Attacks on the biometric processing – Attacks on the template database.

Total: 45

TEXT BOOKS

1. Anil K Jain,Arun A Ross and Karthik Nandakumar,I ntroduction to Biometrics, Springer, First Edition,2011.
2. Rachid Guerraoui and Franck Petit, Stabilization, Safety, and Security of Distributed Systems, Springer,First Edition,2010.

REFERENCES

1. Marcus Smith,Monique Mann andGregor Urbas, Biometrics, Crime and Security, Taylor and Francis, First Edition,2018.
2. Ravindra Das, The Science of Biometrics Security Technology for Identity Verification, Taylor and Francis,First Edition,2018

WEBSITES

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2. www.javatpoint.com/biometrics-advantage-and-disadvantage
3. www.idexbiometrics.com/what-does-the-future-hold-for-biometric-security-technology/
4. www.link.springer.com/chapter/10.1007/978-1-4471-0997-6_13
5. www.users.ece.cmu.edu/~jzhu/class/18200/F06/L10A_Savvides_Biometrics.pdf

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	2	2	1	-	-	-	-	1	1	-	1	-	2
Avg	2.6	1.6	1.3	1	-	-	-	-	1	1	-	1	-	2

SEMESTER-VI

23BECY6E05   VULNERABILITY ASSESSMENT AND PENETRATION TESTING   3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the tools that can be used to perform information gathering.
- Identify operating systems, server applications to widen the attack surface and perform vulnerability assessment activity and exploitation phase.
- Understand the vulnerability assessment is carried out by means of automatic tools or manual investigation.
- Learn the web application attacks starting from information gathering to exploitation phases.
- Familiarize with metasploit attacks and the techniques used in penetration testing.

COURSE OUTCOMES

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

- Classify techniques in penetration testing process
- Demonstrate approaches and tools used in information gathering
- Make use of vulnerability scanner to perform host discovery and evading techniques
- Analyze key challenges associated with securing mobile devices
- Design process for testing a website for SSI injection

UNIT I TESTING PROCESS   9

Introduction – Terminologies – Categories of penetration testing – Phases of penetration test /Testing process– Types and techniques– Penetration testing reports Blue/Red teaming – Strategies of testing – Non-disclosure agreement checklist – Phases of hacking – Open-source/proprietary pentest methodologies.

UNIT II INFORMATION GATHERING   9

Information gathering techniques – Active, passive and sources of information gathering – Approaches and tools – Traceroutes, neotrace, whatweb, netcraft,Xcode exploit scanner and NSlookup. Host discovery – Scanning for open ports and services – Types of port.

UNIT III HOST DISCOVERY AND EVADING TECHNIQUES   9

Vulnerability scanner function – Pros and cons – Vulnerability assessment with NMAP – Testing SCADA environment with NMAP – Nessus vulnerability scanner – Safe check – Silent dependencies – Port range vulnerability data resources. Vulnerability scanner: SDN data plane – Control plane – Application plane. SDN security attack vectors and SDN hardening – Overlay model and network model for cloud computing

UNIT IV MOBILE APPLICATION SECURITY   9

Types – Key challenges – Methodology android and ios vulnerabilities – OWASP mobile security risk – Exploiting WM – Blackberry vulnerabilities – Vulnerability landscape for Symbian – Exploit prevention – Handheld exploitation.

UNIT V VULNERABILITY ANALYSIS   9

Testing for vulnerability web application and resources – Authentication bypass with insecure cookie handling – XSS vulnerability – File inclusion vulnerability – Remote file inclusion – Patching file inclusions – Testing a website for SSI injection. Wireless network vulnerability analysis – Exploits.

Total: 45

TEXT BOOKS

1. VivekRamachandran and Cameron Buchanan, Kali Linux Wireless Penetration Testing Beginner's Guide, Packt Publishing, First Edition,2015.
2. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, First Edition,2015
3. Patrick Engebretson and David Kennedy, The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing made easy, Elsevier Science, First Edition,2013.

REFERENCE BOOKS

1. Prakhar Prasad, Mastering Modern Web Penetration Testing, Packt Publishing,First Edition,2016.
2. Abhinav Singh, Metasploit Penetration Testing Cookbook, W.Satllings, Prentice Hall, 2010. Packt Publishing,First Edition,2012.

WEBSITES

1. www.nptel.ac.in/courses/106/106/106106178/
2. www.coursera.org/lecture/proactive-computer-security/penetration-testing-ENTiH
3. www.softwaretestinghelp.com/vulnerability-assessment-tools/
4. www.veracode.com/security/vulnerability-assessment-and-penetration-testing
5. www.hackingarticles.in/penetration-testing/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	2
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	2
CO4	3	3	2	1	-	-	-	-	-	1	-	1	-	2
CO5	3	3	2	1	1	-	-	-	-	1	-	1	-	2
Avg	2.6	2	1.7	1	1	-	-	-	-	1	-	1	-	2

SEMESTER-VI

23BECY6E06   **INTERNET OF THINGS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the basics of Internet of Things.
- Get an idea of application Internet of Things
- Infer the middleware used for Internet of Things
- Know about Arduino board and its uses.
- Understand the IOT protocols and its applications.

COURSE OUTCOMES

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

- Infer the basic concepts of IoT architecture.
- Identify the communication criteria in IoT network layer.
- Build the basic blocks of an IoT device.
- Examine data analytics tools for decision-making in opeartional environment.
- Analyze real time architecture of IoT systems for communication networks.

UNIT I ARCHITECTURES AND MODELS   9

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security, WSN and Sensing Model.

UNIT II CONNECTIVITY   9

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – Application Transport Methods.

UNIT III SYSTEM DEVELOPMENT   9

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV DATA ANALYTICS FOR IOT 9

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics –Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

UNIT V IOT IN INDUSTRY 9

Manufacturing, Architecture, Security Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Use cases – Transportation, Architecture, Use cases.

Total: 45

TEXT BOOKS

1. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012
2. Dieter Uckelmann; Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer, 2011
3. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press - 2010

REFERENCES

1. Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley -2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, 2019

WEBSITES

1. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lec1.pd f
2. https://nptel.ac.in/courses/106105166/
3. https://nptel.ac.in/courses/108108098/

CO-PO MAPPING

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

SEMESTER-VI

23BECY6E07	**HUMAN COMPUTER INTERACTION**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Learn the foundations of Human Computer Interaction.
- Become familiar with the design technologies for individuals and persons with disabilities.
- Illustrate the components mobile HCI.
- Learn the guidelines for user interface.
- Understand about Designing Web Interfaces.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- Identify input and output channels to interact humans with computers.
- Utilize the role of human-computer interaction in the software development life cycle.
- Make use of communication and collaboration models for effective GUI design.
- Select mobile application and mobile information architecture for communication.
- Apply interaction techniques in web interfaces effectively.

UNIT I FOUNDATIONS OF HCI   9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT II DESIGN & SOFTWARE PROCESS   9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design

UNIT III   MODELS AND THEORIES   9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI   9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies.

UNIT V WEB INTERFACE DESIGN   9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies

Total: 45

TEXT BOOKS

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004.
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009

REFERENCE BOOKS

1. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.

WEBSITES

1. www.core.ac.uk/download/pdf/144527187.pdf
2. www.nptel.ac.in/courses/110/105/110105139/
3. www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4. www.lawshelf.com/videocoursesmoduleview/
5. www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	1	-
CO2	3	2	1	-	-	-	-	-	1	1	-	1	1	-
CO3	3	2	1	-	-	-	-	-	1	1	-	1	1	-
CO4	3	2	1	-	-	-	-	-	1	1	-	1	1	-
CO5	3	2	1	-	-	-	-	-	1	1	-	1	1	-
Avg	3	2	1	-	-	-	-	-	1	1	-	1	1	-

23BECY6E08   **STORAGE MANAGEMENT AND SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Computer Networks

COURSE OBJECTIVES

The goal of this course for the students is to

- Study the basic concepts of data storage systems.
- Examine emerging technologies including IP-SAN.
- Describe the different backup and recovery topologies
- Illustrate storage aspects in providing disaster recovery and business continuity capabilities.
- Obtain the knowledge in data storage infrastructure.

COURSE OUTCOMES

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

- Apply the information storage and retrieval concepts in a storage system.
- Utilize storage networking technologies for deploying virtualization.
- Model the SAN, NAS and CAS storage subsystems architectures.
- Identify the security components for the implementation of NAS.
- Analyze CAS architecture archives and forms of virtualization.

UNIT I INTRODUCTION   **9**

Introduction to Storage Systems: Storage System – Introduction to Information Storage and Management – Storage System Environment – Data Protection Raid – Intelligent Storage System.

UNIT II STORAGE AREA NETWORKING   **9**

Storage Area Networking: Storage Networking Technologies and Virtualization – Storage Networks – Network Attached Storage – IP SAN – Content Addressed Storage – Storage Virtualization.

UNIT III BACKUP AND RECOVERY   **9**

Backup and Recovery Mechanisms: Introduction to Business Continuity – Backup and Recovery – Local Replication – Remote Replication.

UNIT IV STORAGE SECURITY 9

Storage Security: Securing the storage Infrastructure – Storage Security Framework – Risk Triad – Storage Security Domains – Security Implementation in Storage Networking.

UNIT V STORAGE INFRASTRUCTURE MANAGEMENT 9

Storage Infrastructure Management: Managing the Storage Infrastructure – Monitoring the Storage Infrastructure – Storage Management Activities – Developing an Ideal Solution – Concepts in Practice – Disaster recovery – Cloud storage-Github.

Total :45

TEXT BOOK

1. Somasundaram Gnanasundaram and Alok Shrivastava "Information Storage and Management, Storing, Managing, and Protecting Digital Information" John Wiley, Second Edition ,2012

REFERENCE BOOKS

1. R. Kelly Rainer and Casey G. Cegielski "Introduction to Information Systems: Enabling and Transforming Business" John Wiley, First Edition 2010
2. David Alexander , Amanda French and David Sutton "Information Security Management Principles" The British Computer Society ,Second Edition 2012

WEBSITES

1. www.nptel.ac.in/courses/106/108/106108058/
2. www.enterprisestorageforum.com/storage-management/data-storage-security-guide.html
3. https://www.oreilly.com/library/view/information-storage and/9781118236963/9781118236963c14.xhtml
4. www.mycloudwiki.com/san/storage-infrastructure-management-overview/
5. www.enterprisestorageforum.com/networking/nas-vs-san-differences-and-use-cases/

CO PO MAPPING

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

SEMESTER-VI

23BECY6E09 **SECURE CODING** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Basics of Network Security
COURSE OBJECTIVES

The goal of this course for the students is to

- Study the basic concepts of software security.
- Understand the principles of software security.
- Familiar different protection schemes.
- Obtain the knowledge cryptography.
- Explore the different aspects of authentication.

COURSE OUTCOMES

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

- Apply the concepts software security in coding a program.
- Build cryptographic techniques to enhance security over data.
- Model network traffic to avoid data loss.
- Apply software security fundamentals to a real time applications
- Analyze cross site scripting to overcome information leak.

UNIT I INTRODUCTION 9

Introduction to software security – Managing software security risk – Selecting software development technologies – An open source and closed source – Guiding principles for software security – Auditing Software – Buffet overflows

UNIT II CRYPTOGRAPHY 9

Access control – Race conditions – Input validation – Password authentication. Anti-Tampering – Protecting against Denial-of-Service attack – Copy protection schemes – Client-side security – Database security

UNIT III SECURITY FUNDAMENTALS 9

Applied cryptography – Randomness and determinism - Buffer overrun – Format string problems – Integer overflow and software security fundamentals – SQL injection - Command injection

UNIT IV ERROR HANDLING 9

Failure to handle errors and security touchpoints- Cross Site Scripting – Magic URLs – Weak passwords – Failing to protect data – Weak random numbers – Improper use of cryptography

UNIT V CROSS SITE SCRIPTING 9

Information leakage – Race conditions – Poor usability – Failing to protect network traffic – Improper use of PKI – Trusting network name resolution – Case study of cross site scripting – Magic URLs – Weak passwords buffet overflows – Access control – Race conditions.

Total : 45

TEXT BOOKS

1. Robert C. Seacord "Secure Coding in C and C++" Pearson Edition, First Edition, 2013
2. Eduardo Fernandez-Buglioni "Security Patterns in practice" Kindle Edition, First Edition 2013

REFERENCE BOOKS

1. Robert C. Seacord "SEI CERT C Coding Standard: Rules for Developing Safe, Reliable, and Secure Systems" Addison-Wesley, First Edition 2016
2. Robert C. Seacord "Java Coding Guidelines: 75 Recommendations for Reliable and Secure Programs" Addison-Wesley, First Edition 2013

WEBSITES

1. www.perforce.com/blog/sca/what-secure-coding
2. www.geeksforgeeks.org/secure-coding-what-is-it-all-about/
3. www.resources.whitesourcesoftware.com/blog-whitesource/secure-coding
4. www.owasp.org/www-project-secure-coding-practices-quick-reference-guide/
5. www.seedsecuritylabs.org/labsetup.html

CO PO MAPPING

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

23BECY6E10   **3D PRINTING AND DESIGN**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Create awareness on rapidly evolving and widely used fabrication technology.
- Make aware of the technology for conceptual modelling, prototyping and rapid manufacturing.
- Impart detailed knowledge of wide applications of Additive Manufacturing (AM) in industry and society; and in particular, key applications of AM such as rapid tooling, medical AM and rapid manufacturing.
- Understand 3D printers and its applications.
- Know about liquid based 3D printing.

COURSE OUTCOMES

Upon completion of the course, the students will be able to:
- Explain the principle of fused deposition modeling using 3D Printing
- Apply AutoCAD software for designing and drafting.
- Model additive manufacturing techniques for a given product.
- Examine the design technology for Stereo lithography.
- Inspect 3D parts using advanced CAD software and 3D printing.

UNIT I INTRODUCTION   9

Introduction to Design, Prototyping fundamentals. Introduction to 3D printing, its historical development, advantages. Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of 3D printing process, Applications to various fields.

UNIT II FDM AND FFM PRINTING   9

Principle of FDM/FFF printing, Basic steps to perform FDM printing, Significant process parameters of FDM printing, layer height, raster angle, raster width, build temperature, Nozzle temperature, orientation, printing speed etc

UNIT III FDM MATERIALS 9

Types of FDM printer Cartesian, Polar, delta, Robotic (SCARA), continuous FDM Materials PLA, ABS, PETG, Nylon, PVA, PC, TPU, Carbon reinforced nylon, ceramics, metals, Dual and multi material etc

UNIT IV LIQUID BASED 3D PRINTING 9

Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies

UNIT V SOLID BASED 3D PRINTING 9

Laminated object manufacturing(LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration

Total : 45

TEXT BOOKS

1. Ian Gibson, Ian Gibson. "Additive manufacturing technologies 3D printing, rapid prototyping, and direct digital manufacturing."2014 Springer International Publishing
2. Harshit K. Dave, J. Paulo Davim Fused Deposition Modeling Based 3D Printing, Springer International Publishing

REFERENCE BOOKS

1. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari, TK Kundra Additive Manufacturing Fundamentals and Advancements CRC press

WEBSITES:

1. https://3dprintingindustry.com/3d-printing-basics-free-beginners-guide/
2. https://make.3dexperience.3ds.com/processes/introduction-to-additive-processes
3. https://markforged.com/resources/learn/3d-printing-basics

CO PO MAPPING

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

23BECY7E01   **SOCIAL NETWORK SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Provide training on the concepts and techniques in social networking.
- Know about social networking for business and professional use;
- Understand social network analysis and social network developer tools;
- Gain knowledge about sector media and privacy issues.
- Use social network concepts for solving real-world issues.

COURSE OUTCOMES

Upon completing this course, students will be able to

- Experiment with multiple application of social networks for business and professional use
- Organize human behavior in social web and related communities.
- Apply social network developer tools analyze social network
- Identify proficiency of public sector media and data privacy in social networks.
- Utilize the concepts in social networking to resolve real-world problem.

UNIT I   INTRODUCTION   9

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

UNIT II   MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION   9

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES   9

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS   9

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

Total : 45

TEXT BOOKS

1. Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition, Springer, 2010.

REFERENCES

1. Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.

WEBSITES

1. https://www.academia.edu/9601905/Social_Network_Security_A_Brief_Overview
2. https://thesai.org/Downloads/Volume7No2/Paper_2 Role_of_Security_in_Social_Networking.pdf
3. https://www.researchgate.net/publication/284367906

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	2	-
CO2	3	2	1	-	-	-	-	-	1	1	-	1	2	-
CO3	3	2	1	-	-	-	-	-	1	1	-	1	2	-
CO4	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO5	3	2	1	-	-	-	-	1	1	1	-	1	2	-
Avg	3	2	1	-	-	-	-	1	1	1	-	1	2	-

23BECY7E02   SECURE SOFTWARE ENGINEERING AND RISK MANAGEMENT   3H-3C
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                  End Semester Exam:3 Hours

PRE-REQUISITES: Database Security, Cryptography and Network Security
COURSE OBJECTIVES

The goal of this course for the students is to
- Learn different frameworks considered while modelling a secure system.
- Aware different access controls used in the secure system architecture.
- Know multilevel and multilateral security framework.
- Explore system evaluation and assurance techniques.
- Analyze vulnerabilities and shortcoming in user authentication techniques.

COURSE OUTCOMES

Upon completing this course, students will be able to
- Identify threats in software security and its exploitation techniques.
- Apply the different types of security mechanisms to provide the services.
- Build software requirement specifications using SRS documents.
- Examine security threats, attacks and manage the risks involved in assessment techniques
- Analyze the risks in software engineering and mitigate the risks.

UNIT I INTRODUCTION   9

Introduction – Software assurance and software security – Threats to software security – Sources of software insecurity – Benefits of detecting software security.

UNIT II SOFTWARE SECURE   9

Software secure: Properties of secure software – Influencing the security properties of software – Asserting and specifying the desired security properties.

UNIT III REQUIREMENTS   9

Requirements engineering for secure software: Introduction - The SQUARE process model – Requirements elicitation and prioritization. Secure software architecture and design – Software security practices for architecture and design –

UNIT IV SECURITY PRINCIPLES 9

Architectural risk analysis – software security knowledge for architecture and design – Security principles – Security guidelines and attack patterns – Secure coding and testing – Code analysis – Software security testing.

UNIT V RISK MANAGEMENT 9

Risk management and security planning – Risk management process overview – Cost benefit analysis – Risk analysis – Laws and customs – Human issues – Organizational issues – Information system risk analysis – System approach to risk management – Threat assessment – Assets and safeguards – Modes of risk analysis – Effective risk analysis – Qualitative risk analysis – Value analysis.

Total: 45

TEXT BOOKS

1. Douglas Landoll "The Security Risk Assessment Handbook" CRC Press, Second Edition 2016
2. Michael Howard "The Security Development Lifecycle: SDL: A Process for Developing Demonstrably More Secure Software" Microsoft Press, First Edition 2017

REFERENCE BOOKS

1. Theodor Richardson and Charles N. Thies "Secure Software Design Jones and Bartlett Learning, First Edition 2013
2. John McManus "Risk Management in Software Development Projects" Taylor and Francis, First Edition 2012

WEBSITES

1. www.slideshare.net/aizazhussain234/software-security-engineering-56204635
2. www.slideserve.com/bart/security-engineering-for-software
3. www.cl.cam.ac.uk/teaching/0910/Security/security-part2-1.ppt
4. www.slideshare.net/AbhinyaKalyan/risk-management-16546063
5. www.irmi.com/term/insurance-definitions/risk-management-techniques

CO PO MAPPING

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

SEMESTER-VII

23BECY7E03   **UI AND UX DESIGN**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Provide a sound knowledge in UI & UX

- Understand the need for UI and UX
- Understand the various Research Methods used in Design
- Explore the various Tools used in UI & UX
- Create a wireframe and prototype

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Build user interface for user applications

- Develop user experience design for an product or web application

- Model user experience skills in product development phases.

- Apply sketching principles to wireframing, prototyping and testing

- Build wireframe techniques for a given web based application.

UNIT I FOUNDATIONS OF DESIGN   9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN   9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN   **9**

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING   **9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE   **9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

Total : 45

TEXT BOOKS

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022 2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

REFERENCE BOOKS

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface"
   3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015

WEBSITES

1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature.

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	2	1	-	-	-	-	-	1	1	-	1	-	2
Avg	3	2	1	-	-	-	-	-	1	1	-	1	-	2

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

                                                       End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the fundamentals of web application security
- Focus on wide aspects of secure development and deployment of web applications
- Learn how to build secure APIs
- Learn the basics of vulnerability assessment and penetration testing
- Get an insight about Hacking techniques and Tools

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Apply the basic concepts of security in web application development.
- Experiment with the process for secure development and deployment of web applications
- Identify the skill for securing web applications APIs.
- Analyze the rules for carrying out vulnerability assessment and penetration testing
- Examine the hacker skills to use hacking tool sets.

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY   9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT AND DEPLOYMENT   9

Web Applications Security - Security Testing, Security Incident Response Planning,The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API   9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING   9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Databasebased vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

UNIT V HACKING TECHNIQUES AND TOOLS   9

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

Total : 45

TEXT BOOKS

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCE BOOKS

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc. 2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
2. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
3. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
4. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	1	1	1	-	1	-	1
CO2	3	2	1	-	-	-	-	1	1	1	-	1	-	1
CO3	3	2	1	-	-	-	-	1	1	1	-	1	-	1
CO4	3	3	2	1	1	-	-	1	1	1	-	1	-	1
CO5	3	3	2	1	1	-	-	1	1	1	-	1	-	1
Avg	3	2.8	1.4	1	1	-	-	1	1	1	-	1	-	1

23BECY7E05 **GAME DEVELOPMENT** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Fundamentals of Computer

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the concepts of Game design and development.
- Familiarize the processes, mechanics and issues in Game Design.
- Acquire knowledge of Core architectures of Game Programming.
- Introduce Game programming platforms, frame works and engines.
- Apply computer graphics concepts to develop games.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Identify the concepts of game design and development.
- Apply game loop to facilitate simulation in real time gaming world.
- Make use of software development tools and methods for game development
- Utilize the python programming libraries to generate interactive 2D and 3D games.
- Apply basic artificial intelligence in computer games.

UNIT I ANIMATION **9**

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation, Physics-based Simulation, Scene Graphs.

UNIT II GAME LOGIC **9**

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

UNIT III EVENT MANAGEMENT **9**

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management

UNIT IV GAME STUDIO   9

2D and 3D Game development using Flash, DirectX, Java, Python – Introduction to python-pygame libraries- Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, UnityDX Studio.

UNIT V GAME DESIGN   9

Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multiplayer games. Game project management, Game design documentation, Rapid prototyping and game testing.

Total: 45

TEXT BOOKS

1. Mike Mc Shaffrfy and David Graham "Game Coding Complete Delmar Cengage Learning" Fourth Edition 2012
2. Jason Gregory "Game Engine Architecture" Wiley Publications, Third Edition 2018

REFERENCE BOOKS

1. Josh Glazer, Sanjay Madhav "Multiplayer Game Programming Architecting Networked Games" Pearson Education Second Edition 2015
2. Eric Lengyel "Mathematics for 3D Game Programming and Computer Graphics Course Technology" Third Edition 2011

WEBSITES

1. www.coursera.org/specializations/game-design-and-developmen
2. www.coursera.org/specializations/programming-unity-game-development
3. www.github.com/games50
4. https://logicsimplified.com/newgames/best-game-development-platform-for-cross-game-development/
5. https://www.cs.umd.edu/class/spring2016/cmsc425/Lects/cmsc425-spring16-lects.pdf

CO PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	1	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	1	1	1	-	1	-	2
CO3	3	2	1	-	1	-	-	1	1	1	-	1	-	2
CO4	3	2	1	-	1	-	-	1	1	1	-	1	-	2
CO5	3	2	1	-	1	-	-	1	1	1	-	1	-	2
Avg	3	2	1	-	1	-	-	1	1	1	-	1	-	2

OPEN ELECTIVES

OFFERED

FROM

COMPUTER SCIENCE AND

ENGINEERING(CYBER SECURITY)

23BECYOE01   BASICS OF CYBER CRIME AND CYBER SECURITY   3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Understand the fundamental concepts of cybercrime.
- Explore knowledge on cybercrimes in wireless devices.
- Infer tools used in the cyber security.
- Familiar with various Indian IT Act in cybercrime and cyber security.
- Enhance the knowledge in handheld devices and digital forensics.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Identify the basics of cyber-crime and information security in safeguarding digital assets.
- Apply the fundamentals concepts for identifying cyber-attacks.
- Make use of tools and methods used in cyber security.
- Analyze theoretical and cross-disciplinary approaches in Indian IT Act and in digital devices.
- Examine the effect of cybercrime on digital devices on the public sector, private sector, individual, and societal levels

UNIT I INTRODUCTION   9

Introduction to Cyber Crime: Cyber Crime and Information Security – Classifications of Cyber Criminals – Cyber Cri\me Legal Perspective and Indian Perspective – Cyber Crime and Indian ITA – A Global perspective on Cybercrimes – Categories of Cybercrimes – Criminal plans for attack – Social Engineering – Cyber talking – Cyber cafe and cyber criminals – Botnet – Attack vector – Cloud Computing.

UNIT II   CYBER CRIME MOBILE AND WIRELESS DEVICES   9

Cyber Crime Mobile and Wireless Devices: Proliferation – Trends in Mobility – Credit card frauds – Security challenges – Registry setting – Authentication service – Attacks – Security Implication for Organization – Organizational measures – Organizational Security Policies – Physical security counter measures.

UNIT III   TOOLS AND METHODS USED IN CYBER SECURITY   9

Tools and methods used in cyber security: Proxy servers and anonymizers – Phishing – Password cracking – Keyloggers and spywares – Virus and worms – Trojan horse – Stegnography – DoS and DDoS attack – SQL Injection – Buffer overflow – Attacks on wireless networks – Phishing and Identity theft.

UNIT IV CYBER CRIME AND LEGAL LANDSCAPE   9

Cyber Crime and Legal landscape – Indian IT Act – Digital Signature and Indian IT Act – Amendments to the Indian IT Act – Cybercrime and punishment. Understanding Computer Forensics: Need for computer forensics – Cyber forensics and digital evidence – Digital forensics life cycle – Network forensics – Computer forensics and steganography - Computer forensics from compliance perspective – Challenges

UNIT V   SPECIAL TOOLS AND TECHNIQUES   9

Special tools and techniques –Hand held devices and digital forensics. Cyber security organizational implications: Cost of cybercrimes and IPR – Web threads for organizations – Security and privacy implications – Social media marketing – Incident handling – Forensics best practices for organization.

TOTAL: 45

TEXT BOOKS:

1. Nina Godbole and Sunit Belapure, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publisher, First Edition, 2011

REFERENCE BOOKS:

1. Harish Chander, Cyber Laws and IT Protection, PHI Learning, First Edition, 2012
2. James Graham, Ryan Olson and Rick Howard, Cyber Security Essentials, CRC Press, First Edition, CRC Press, First Edition

WEBSITES:

1. www.lexology.com/library/
2. www.swayam.gov.in/nd2_ugc19_hs25/preview
3. www.educba.com/cyber-security-tools/
4. www.intaforensics.com
5. www.itu.int/en/ITU-D/Cybersecurity

CO-PO MAPPING

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

23BECYOE02   **BASICS OF CYBER FORENSICS**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                                End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Make aware of fundamentals on cyber forensics and usage of cyber forensics tools.
- Be familiar with the file systems and challenges in the Linux and mac operating system.
- Explore knowledge on the network and different operating systems on mobile devices.
- Learn various services like FaaS and MaaS.
- Enhance the knowledge on database, email and threats in crypto currency.

COURSE OUTCOMES

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

- Interpret the basic of Forensics investigation process.
- Utlize popular Linux distributions and artifacts associated with Linux systems.
- Make use of iOS forensics and relevant data extraction procedure from iOS devices
- Identify the challenges in cloud forensics.
- Examine Bitcoin forensics and Blockchain artifacts.

UNIT INTRODUCTION   9
Introduction to Cyber forensics: Forensics investigation process – Forensics protocol – Digital forensics standards –Digital evidence – Types of cyber crime – Notable data breaches – Case study - Challenges in Cyber security – Cyber forensics tools. Windows forensics: Digital Evidence – File systems – Time analysis – Challenges- Case Study.

UNIT II LINUX FORENSICS AND MAC OS FORENSICS   9
Linux forensics: Popular linux – File systems – Process – Artifacts – Linux distribution used for forensics analysis – Challenges – Case study. Mac OS forensics: File systems – Process – Artifacts – Information to collect Mac book forensics investigation – Case study. Anti-forensics:

Data wiping and shredding – Trial obfuscation – Encryption – Data hiding – Anti-forensics detection technique

UNIT III NETWORK FORENSICS AND MOBILE FORENSICS   9

Network forensics: OSI Model – Artifacts – ICPM Attack – Analysis tools. Mobile forensics: Android operating system – Mutual Extraction – Physical acquisition – Chip-off – Micro-read – Challenges – iOS operating system.

UNIT IV CLOUD FORENSICS AND WEB ATTACK FORENSICS   9

Cloud forensics: Cloud computing model – Server-side forensics – Client-side forensics – Challenges –Artifacts – use – Forensics as a Service. Malware forensics: Types – Analysis – Tools – Challenges – Malware as a Service. Web attack forensics: Web attack test – Intrusion forensics – Database forensics– Log forensics – Content analysis – File metadata forensics

UNIT V EMAILS AND EMAIL CRIMINALS   9

Emails and email criminals: Protocols – Email criminals – Email forensics. Solid State device forensics: Components –Data wiping – Analysis. Bit coin forensics: Crypto currency – Block chain – Artifacts – Challenges.

TOTAL: 45

TEXT BOOKS
1. Niranjan Reddy , Practical Cyber Forensics: An Incident-Based Approach to ForensicInvestigations, Apress, First Edition, 2019

REFERENCE BOOKS
1. Marjie Britz T, Computer Forensics and Cyber Crime: An Introduction, Prentice Hall, ThirdEdition, 2013
2. Albert Marcella J and Frederic Guillossou, Cyber Forensics: From Data to Digital Evidence,Wiley Publisher, .First Edition, 2012

WEBSITES
1. www.swayam.gov.in/nd2_ugc19_hs25/preview
2. www.educba.com/cyber-security-tools/
3. www.intaforensics.com
4. www.cs.nmt.edu/~df/lectures.html

3.
4.

5. **CO-PO MAPPING**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	2
Avg	2.8	2	1.3	1	-	-	-	-	1	1	-	1	-	2

23BECYOE03   CYBER LAWS AND INTELLECTUAL PROPERTY RIGHTS   3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Understand the need for cyber laws and intellectual property rights.
- Acquire knowledge about the protective measures of Intellectual property such ascopyright, patent, Trademark.
- Examine the criminal remedies and defensive measures.
- Provide an insight about the role of certifying authority and cryptography.
- Be aware of Indian IT Act 2000 and 2008 cyber laws.

COURSE OUTCOMES

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

- Interpret the fundamental concepts of cyber laws and intellectual property rights for criminal activities.
- Utilize the concept of work of employment and its implications in copyright infringement cases.
- Choose civil remedies available for design infringement and their application.
- Identify the scope and significance of cyber laws that arises from the use of technology.
- Make use of information technology act and its subsequent amendments in cyberspace.

UNIT I INTRODUCTION   9

Intellectual Property: Introduction – Protection of Intellectual Property – Copyright related rights – Patents – Industrial designs – Trademark – Unfair competition – Information technology related intellectual property rights – Computer software and intellectual property – Copyright protection – Reproducing – Defences – Patent protection.

UNIT II INFRINGEMENT   9

Ownership and enforcement of intellectual property – Defences in case of infringement copyright – Work of employment infringement – Defences for infringement – Trademarks – Rights – Protection of good will – Infringement – Passing off defences

UNIT III IP IINTELLECTUAL PROPERTY RIGHTS AND ENFORCEMENT   9

Designs – Defences of design infringement. Enforcement of intellectual property rights – Civil

remedies – Criminal remedies – Border – Security measures. Practical aspects of licensing – Benefits – Determinative factors – Important clauses – Licensing clauses.

UNIT IV CYBER LAW   9

Cyber law: Basic concepts of technology and law – Understanding the technology of internet – Scope of cyber laws. Cyber jurisprudence law of digital contracts: The essence of digital contracts – The system of digital signatures – The role and function of certifying authorities

UNIT V   INTELLECTUAL PROPERTY ISSUES   9

The science of cryptography – IT Act 2000 and 2008 – Amendments in IT Act – IPC and Privacy threats in cyber law. Intellectual Property issues in cyber space: Domain names and related issues – Copyright in the digital media – Patents in the cyber world. rights of netizens and e-Governance.

Total : 45

TEXT BOOKS
1. David I Bainbridge, Intellectual Property, Pearson Education,Eighth Edition,2010
2. Talat Fatima, Cyber Law in India, Wolters Kluwer,First Edition,2017

REFERENCE BOOKS
1. Yatindra Singh, Guide to Cyber Laws, Universal Law,Fourth Edition,2010
2. Information Technology Law andPractice- Cyber Laws and Laws Relating to E-Commerce, Universal Law,Third Edition,2011

WEBSITES
1. www.core.ac.uk/download/pdf/144527187.pdf
2. www.nptel.ac.in/courses/110/105/110105139/
3. www.icsi.edu/media/webmodules/FINAL_IPR&LP_BOOK_10022020.pdf
4. www.lawshelf.com/videocoursesmoduleview/
5. www.lawfaculty.du.ac.in/files/course_material/Old_Course_Material/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO5	3	2	1	-	-	-	-	-	1	1	-	1	-	2
Avg	2.8	1.8	1	-	-	-	-	-	1	1	-	1	-	2

23BECYOE04   **BLOCKCHAIN AND CYBER SECURITY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: Network Security

COURSE OBJECTIVES

The goal of this course is for the students

- Decompose a block chain system's fundamental components, how they fit together and examine a decentralization using block chain.
- Illustrate how Crypto currency works, from when a transaction is created to when it is considered part of the blockchain.
- Explain the components of Ethereum, programming languages for Ethereum and study the basics Hyperledger and Web3.
- Understand the nature of threats and cyber security management goals and technology
- Infer the landscape of hacking and perimeter defense mechanisms

COURSE OUTCOMES

Upon completion of the course the student will be able to

- Outline the technology components of Block chain and its working principles.
- Utlize Ethereum model and its architectural components.
- Make use of Hyperledger components along with its development framework.
- Identify the nature of threats and cyber security management goals.
- Analyze malicious software attack and wireless network attack.

UNIT I   INTRODUCTION OF BLOCKCHAIN TECHNOLOGY   9

History of Blockchain – Types of Blockchain – Consensus – Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization. Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets –Alternative Coins – Theoretical Limitations – Bitcoin Limitations – Name Coin – Prime Coin – Zcash. – Smart Contracts – Ricardian Contracts.

UNIT II ETHEREUM NETWORK 9

The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

UNIT III FRAMEWORK FOR HYPERLEDGER FABRIC 9

Introduction to Web3 – Contract Deployment – POST Requests – Development frameworks – Hyperledger as a protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger –Corda-Alternative Blockchains.

UNIT IV CYBER SECURITY 9

Introduction – Cyberspace – Cyber Crime – Nature of Threat – Cyber security – Policy, Mission and Vision of Cyber security Program. Cyber security management system – goals, technology categories –perimeter defense and encryption.

UNIT V WEB APPLICATION ATTACKS 9

Malicious Attacks, Threats, and Vulnerabilities- Malware –malicious software attack – social engineering attack – wireless network attack – web application attack –Countermeasures. Creating Mechanisms for IT Security.

TOTAL: 45

TEXT BOOKS:

1. Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained" Packt Publishing, Second Edition 2018.
2. Arshdeep Bahga, Vijay Madisetti "Blockchain Applications: A Hands-On Approach" VPT Publications, First Edition 2017.
3. David Kim and Michael G. Solomon "Fundamentals of Information Systems Security" Jones &Bartl Learning, Third Edition 2018.
4. Peter Trim and Yang –Im Lee "Cyber Security Management- A Governance, Risk and Compliance Framework" Gower Publishing, First Edition 2014.

REFERENCE BOOKS:

1. Andreas Antonopoulos, Satoshi Nakamoto "Mastering Bitcoin", O'Reilly Publishing, Second Edition 2017.
2. Alex Leverington "Ethereum Programming", Packt Publishing, First Edition 2017.
3. John G. Voeller "Cyber Security" John Wiley & Sons,First Edition 2014.

WEB SITES:

1. www.nptel.ac.in/courses/106/104/106104220/
2. www.icaew.com/technical/technology/blockchain/blockchain-articles/what-isblockchain/history
3. www.ibm.com/topics/blockchain-security
4. https://blockgeeks.com/guides/ethereum/
5. https://world101.cfr.org/global-era-issues/cyberspace-and-cybersecurity/what-are-cyberspaceand-cybersecurity

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	1	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1	1	-	-	-	-	1	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	2
Avg	2.8	2	1.3	1	-	-	-	-	1	1	-	1	-	2

LIST OF OPEN ELECTIVES

SCIENCE AND HUMANITIES

23BESHOE01/23BTSHOE01   **MASS COMMUNICATION**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Outline the basic concepts of communication and its types.
- Extend the knowledge with process of mass communication and their relevance.
- Explain the functions of mass communication with real time experience.
- Utilize the mass communication theories in media communication.
- Plan research proposals using international concepts in mass communication.

COURSE OUTCOMES

On completion of the course, student will be able to

- Identify the process and types of human communication.
- Recognize the function and characteristics of mass communication.
- Describe correlation and culture of mass communication.
- Replicate the concepts of mass communication theories in real life situation.
- Explain the impact of media theory in International communication.

UNIT I BASIC CONCEPTS OF COMMUNICATION

Communication: Nature and process of human communication, functions of communication, verbal and non- verbal communication, intra-personal, inter-personal, small group, public and mass communication.

UNIT II MASS COMMUNICATION

Nature and process of mass communication, media o f mass communication, characteristics and typology of audiences. Social Functions of Mass Communication, Scope of Mass Communication.

UNIT III FUNCTIONS OF MASS COMMUNICATION

Functions of Mass Communications – Surveillance, Correlation, Cultural transport, Marketing Mass Culture- Evaluate the impact of issues of media monopoly.

UNIT IV MEDIA THEORY

Communication Theories: Authoritarian; Libertarian; Socialistic; social-responsibility; Normative theories; Development media theory; Democratic participation media theory.

UNIT V FOLK MEDIA AND INTERNATIONAL COMMUNICATION THEORY

Folk Media and Electronic Media; International Communication Theories: World Systems, Dependency and Structural Media Monopoly – Cross Media Ownership.

TEXT BOOKS

1. Mass Communication in India – By Keval J. Kumar, 1994
2. Mass Communication Theory: Foundations, Ferment and Future – By Stanley J. Baran and Dennis K. Devis, 2015.
3. Introduction to Communication Studies – By John Fiske, 2010.
4. Mcquail's Mass Communication Theory – By Denis Mcquail, 2010.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	2	-	-
CO3	-	-	-	-	-	-	-	2	2	3	-	2	-	-
CO4	-	-	-	-	-	-	-	2	2	3	-	2	-	-
CO5	-	-	-	-	-	-	-	2	2	3	-	2	-	-
Avg	-	-	-	-	-	-	-	1.8	2	3	-	2	-	-

23BESHOE02/23BTSHOE02   FUZZY MATHEMATICS   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Understand basic knowledge of fuzzy sets and fuzzy logic
- Apply basic knowledge of fuzzy operations.
- Know the basic definitions of fuzzy relations
- Apply basic fuzzy inference and approximate reasoning
- Know the applications of fuzzy Technology.
- Provide a firm basis for further reading and study in the subject.

COURSE OUTCOMES

Upon completion of this course, the student will be able to
- Infer the basics of Fuzzy sets and functions.
- Utilize the method of operations in fuzzy sets.
- Interpret the concept of Fuzzy relations and relational equations
- Make use of the Possibility theory and Probability measures in Fuzzy sets
- Apply Fuzzy logic for decision making

UNIT I   FUZZY SETS   9

Fuzzy Sets: Basics Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions - Zadeh's Extension Principle

UNIT II   OPERATIONS ON FUZZY SETS   9

Operations on Fuzzy Sets Operations on [0,1] – Fuzzy negation, triangular norms, tco norms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

UNIT III   FUZZY RELATIONS   9

Fuzzy Relations Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations – Fuzzy Relational Equations

UNIT IV   FUZZY MEASURES   9

Possibility Theory Fuzzy Measures – Evidence Theory – Necessity and Belief Measures – Probability Measures vs Possibility Measures

UNIT V   FUZZY INFERENCE   9

Approximate Reasoning Fuzzy Decision Making - Fuzzy Relational Inference – Compositional rule of Inference - Efficiency of Inference - Hierarchical

SUGGESTED READINGS

1. George J Klir and Bo Yuan,(2003) Fuzzy Sets and Fuzzy Logic : Theory and Applications, Prentice Hall of India, New Delhi.
2. Zimmermann H.J.(2001) Fuzzy Set Theory and its Applications, Kluwer Academic publishers, USA.
3. Michal Baczynski and BalasubramaniamJayaram,(2008) Fuzzy Implications, Springer-Verlag publishers, Heidelberg.
4. Kevin M Passino and Stephen Yurkovich,(1998) Fuzzy Control, Addison Wesley Longman publishers,USA.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Avg	2.6	1.6	1	-	-	-	-	-	-	-	-	1	_	_

23BESHOE03/23BTSHOE03   MATERIAL SCIENCES   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Inculcate the fundamental principles and concepts of magnetic materials for different engineering applications.
- Impart basic knowledge of superconductivity and associated applications.
- To serve the fundamental concepts of dielectric materials for diverse applications in energy engineering.
- Divulge the basics of crystals, their structures and different crystal growth techniques.
- Make the students familiar in the fundamentals of ceramics, composites and nonmaterial's.

COURSE OUTCOMES

Upon completion of this course the students will be able to:

- Illustrate the theory of magnetism and magnetic properties of materials
- Explain the theory of superconductivity and its application in SQUID
- Infer the types of polarization and dielectric breakdown
- Outline the basics of crystals, structures and its defects
- Summarize the types of ceramics, metallic glsses and alloys

UNIT I   MAGNETIC MATERIALS   9

Origin of magnetic moment; Bohr magneton; comparison of Dia, Para and Ferro magnetism; Langevin theory of diamagnetism and paramagnetism; Quantum theory of paramagnetism; Curie-Weiss law; Temperature dependence of saturation magnetization; Domain theory; Hysteresis; soft and hard magnetic materials; antiferromagnetic materials; Ferrites and its applications.

UNIT II   SUPERCONDUCTING MATERIALS   9

Superconductivity, properties; Meissner effect; Type I and Type II superconductors; London equation; BCS theory of superconductivity (Qualitative), Flux quantization; High Tc superconductors; Josephson superconductor tunnelling, DC and AC Josephson effect; Applications of superconductors, SQUID, cryotron, magnetic levitation.

UNIT III   DIELECTRIC MATERIALS   9

Electrical susceptibility, dielectric constant; electronic, ionic, orientational and space charge polarization; frequency and temperature dependence of polarisation; internal field; Clausius - Mossotti relation (derivation); dielectric loss; dielectric breakdown, uses of dielectric materials (capacitor and transformer); ferroelectricity and applications.

UNIT IV   CRYSTAL PHYSICS   9

Lattice, Unit cell, Bravais lattice; Lattice planes; Miller indices; d spacing in cubic lattice; Calculation of number of atoms per unit cell, Atomic radius, Coordination number, Packing factor for SC, BCC, FCC and HCP structures; Crystal imperfections; Crystal growth techniques; solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative).

UNIT V   NEW MATERIALS   9

Ceramics; types and applications; composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics; metallic glasses: types , glass forming ability of alloys, melt spinning process, applications; shape memory alloys: phases, shape memory effect, applications; nanomaterials: preparation (bottom up and top down approaches), properties and applications.

Total :45

TEXT BOOKS
1. C. Kittel, Introduction to Solid State Physics, 7th Edition, Wiley Eastern, New Delhi, 2006.
2. A. J. Dekker, Solid State Physics, Published by Macmillan India, 2000
3. William D CallisterJr, "Materials Science and Engineering – An Introduction", John Wiley and Sons Inc.,7th edition, New York, 2006
4. S.O. Pillai, Solid State Physics. New Age International(P) Ltd., publishers, 2009
5. M.A. Wahab, Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
6. M. Arumugam, Materials Science. Anuradha publishers, 2010.

JOURNALS
- Nature Physics
- Journal of Applied Mechanics (ASME)
- Journal of Electronic Materials (IEEE/TMS)
- Applied Thermal Engineering (Elsevier)
- Physical Review B (American Physical Society).
- Nature Nanotechnology

WEBSITES

1. https://nptel.ac.in/courses/122/103/122103011/
2. https://nptel.ac.in/courses/113/104/113104081/
3. https://nptel.ac.in/courses/108/108/108108122/
4. http://hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg	**2**	**1**	-	-	-	-	-	-	-	**1**	-	**1**	-	-

23BESHOE04/23BTSHOE04   GREEN CHEMISTRY   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

                                                  End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Make the students conversant about the green chemistry
- Make the student acquire sound knowledge of the atom efficient process and synthesis elaborately.
- Acquaint the student with concepts of green technology.
- Develop an understanding of the basic concepts of renewable energy resources.
- Acquaint the students with the basics information on catalysis.
- Apply the concepts of green catalysts in the synthesis.

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Outline the basic principles of green chemistry.
- Explain the chemical synthesis in terms of atom efficiency.
- Relate the concepts of green chemistry in biotechnology.
- Illustrate the importance of renewable feedstocks.
- Extend the phenomena of catalysis in green synthesis.

UNIT I-INTRODUCTION TO GREEN CHEMICAL PRINCIPLES   9

Definition, tools, and twelve principles of green chemistry, solvent-less reactions and reactions in water, microwaves and fluorous solvents, green resolution of racemic mixtures, materials for a sustainable economy, chemistry of longer wear, agrochemicals: problems and green alternate solutions.

UNIT II - ATOM EFFICIENT PROCESSES   9

Atom efficient processes, evaluating chemical reagents according to their yield and atom efficiency, examples of efficient stoichiometric and catalytic processes, atom economy and homogeneous catalysis, halide-free synthesis and alternatives to Strecker synthesis.

UNITIII-BIOTECHNOLOGY AND GREEN CHEMISTRY   9

Bio technology and its applications in environmental protection - Bio informatics-Bio remediation, biological purification of contaminated air. Green chemistry for clean technology-Significance of green chemistry-Basic components of green chemistry, Industrial applications of

green chemistry, green fuels-e-green propellants and bio catalysts.

UNIT IV-RENEWABLE RESOURCES   9

Use of renewable materials, evaluating feedstock and starting materials and their origins, toxicity, sustainability and the downstream implications of the choice of feedstock, commodity chemicals from glucose and biomass conversion.

UNIT V-CATALYSIS IN GREEN CHEMISTRY   9

Catalysis, energy requirements and usage, optimization of the reaction by minimizing the energy requirements, examples of efficient catalytic reactions including the use of heterogeneous catalysis, zeolites, oxidation using molecular oxygen.

Total: 45

SUGGESTED READINGS

1. Sanjay K. Sharma, Ackmez Mudhoo (2010) Green Chemistry for Environmental Sustainability CRC Press , London
2. Chandrakanta Bandyopadhyay (2019) An Insight into Green Chemistry, Books and Allied (P) Ltd, Kolkata.
3. Ahluwalia V. K. (2018) Green Chemistry A Textbook 4th Reprint Narosa Publishing House Pvt. Ltd, New Delhi.
4. Ahluwalia V. K. and M.Kidwai (2007) New Trends in Green Chemistry 2nd edition Anamaya publishers., New Delhi.
5. Dr. Sunita Ratan (2012) A Textbook of Engineering Chemistry S.K. Kataria and Sons., New Delhi
6. Mukesh Doble. Ken Rollins, Anil Kumar (2007) Green Chemistry and Engineering, 1st edition Academic Press, Elesevier., New Delhi.
7. Desai K. R. (2005) Green Chemistry Himalaya Publishing House, Mumbai.

WEBSITES
1. http://www.organic-chemistry.org/topics/green-chemistry.shtml
2. http://www.essentialchemicalindustry.org/processes/green-chemistry.html
3. http://www.chm.bris.ac.uk/webprojects2004/vickery/green_solvents.html
4. http://www.epa.gov/research/greenchemistry/
5. http://www.amazon.in/Green-Chemistry-Catalysis

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	2	3	-	1	-	2	-	-
CO2	2	1	-	-	-	2	2	3	-	1	-	2	-	-
CO3	2	1	-	-	-	2	2	3	-	1	-	2	-	-
CO4	2	1	-	-	-	2	2	3	-	1	-	2	-	-
CO5	2	1	-	-	-	2	2	3	-	1	-	2	-	-
Avg	2	1	-	-	-	2	2	3	-	1	-	2	-	-

LIST OF OPEN ELECTIVES

ELECTRICAL

AND

ELECTRONICS ENGINEERING

23BEEEOE01   RENEWABLE ENERGY SYSTEMS   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students is to

- Gain the knowledge about environmental aspects of energy utilization.
- Understand the basic principles of solar cells, photovoltaic conversion.
- Understand the basic principles of wind energy conversion.
- Gain the knowledge about hydro and ocean energy.
- Understand the basic principles of Biomass, fuel cell, Geo thermal power plants and MHD.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Outline the environmental issues associated with fossil fuels and other energy resources.
- Make use of Solar PV systems for practical applications.
- Choose the Wind Turbine systems for application based on their working.
- Explain the operation of Hydro electric Plant and Ocean Energy
- Compare the working of Biomass Power Generation ,Fuel Cell, Geo thermal plants and MHD.

UNIT I INTRODUCTION   9

Energy scenario - Different types of Renewable Energy Sources - Environmental aspects of energy utilization-Energy Conservation and Energy Efficiency-Need sand Advantages, Energy Conservation Act 2003.

UNIT II SOLAR ENERGY   9

Introduction to solar energy: solar radiation, availability, measurement and estimation–Solar thermal conversion devices and storage – solar cells and photovoltaic conversion –PV systems – MPPT Applications of PV Systems– solar energy collector sand storage.

UNIT III   WINDENERGY   9

Introduction– Basic principles of wind energy conversion-components of wind energy conversion system - site selection consideration – basic–Types of wind machines. Schemes for electric generation – generator control, load control, energy storage – applications of wind energy – Interconnected systems.

UNIT IV   HYDROENERGY   9

Hydropower, classification of hydropower, Turbine selection, Ocean energy resources, ocean energy routes. Principles of ocean thermal energy conversion systems, ocean thermal power plants. Principles of ocean waveen energy conversion and tidal energy conversion.

UNIT V OTHER SOURCES   9

Bio energy and types – Fuel cell, Geo-thermal power plants ; Magneto-hydro-dynamic (MHD) energy conversion.

Total :45

SUGGESTED READINGS

1. Rai.G.D,Non-conventionalsourcesofenergyKhannapublishers,2011
2. Khan.B.H,Non-Conventional EnergyResources ,TheMcGraw Hills, Secondedition,2012
3. John W Twidell and Anthony D Weir , Renewable Energy Resources , Taylor and Francis – 3rdedition ,2015

CO-PO MAPPING

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

23BEEEOE02	HYBRID ELECTRIC VEHICLES	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Understand the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals.
- Familiarize the plug – in hybrid electric drive- Train Topologies.
- Analyze electric drives suitable for hybrid electric vehicles.
- Discuss different energy storage technologies used for hybrid electric vehicles and their control.
- Demonstrate energy management strategies in hybrid electric vehicles.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals
- Analyze the use of train topologies inhybrid electric drive.
- Interpret electric drives suitable for hybrid electric vehicles.
- Explain the use ofenergy storage devices used for hybrid electric vehicles.
- Analysis the performance of Energy Management strategies in HEVs.

UNIT I INTRODUCTION   9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

UNIT II HYBRID ELECTRIC DRIVE-TRAINS   9

Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

UNIT III ELECTRIC PROPULSION UNIT   9

Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV ENERGY STORAGE 9

Introduction Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.

UNIT V ENERGY MANAGEMENT STRATEGIES 9

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Total:45

SUGGESTED READINGS

1. C.Mi,M.A.Masrurand D.W.Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley&Sons,2011.
2. S.Onori, L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer,2015.
3. M.Ehsani,Y.Gao,S.E.Gayand A.Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press,2004.
4. T.Denton,"Electric and HybridVehicles",Routledge,2016.

WEBSITES

1. https://www.energy.gov/eere/electricvehicles/electric-vehicle-basics
2. https://swayam.gov.in/nd1_noc20_ee18/preview3.https://nptel.ac.in/courses/108103009/
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/106105166/lecpdf
4. https://nptel.ac.in/courses/106105166/
5. https://nptel.ac.in/courses/108108098/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	1	-	-	-	-	1	-	-
CO2	3	3	2	2	2	-	1	-	-	-	-	1	-	-
CO3	2	2	1	1	1	-	1	-	-	-	-	1	-	-
CO4	3	3	2	2	2	-	1	-	-	-	-	1	-	-
CO5	3	3	2	2	2	-	1	-	-	-	-	1	-	-
Avg	2.6	2.6	1.6	1.6	1.6	0.4	1	-	-	-	-	1	-	-

LIST OF OPEN ELECTIVES

ELECTRONICS AND COMMUNICATION

ENGINEERING

23BEECOE01	**REAL TIME EMBEDDED SYSTEMS**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to :

- Introduce students to the embedded systems, its hardware and software.
- Introduce devices and buses used for embedded networking.
- Study about task management.
- Learn about semaphore management and message passing.
- Study about memory management.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain the Embedded system's hardware and software.
- Outline the operating system for embedded applications.
- Analyse the tasks performed by Embedded system.
- Examine the activities of multiple processes in an embedded system.
- Interpret the memory management system.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM   9

Introduction- Embedded systems description, definition, design considerations & requirements-Overview of Embedded System Architecture (CISC and RISC)-Categories of Embedded Systems- embedded processor selection & tradeoffs- Embedded design life cycle -Product specifications- hardware / software partitioning- iterations and implementation- hardware software integration – product testing techniques–ARM7.

UNIT-II OPERATING SYSTEM OVERVIEW   9

Introduction–Advantage and Disadvantage of Using RTOS–Multitasking–Tasks - RealTime Kernels – Scheduler- Non-Preemptive Kernels – Preemptive Kernels – Reentrancy-ReentrantFunctions– Round Robin Scheduling- Task Priorities- Static Priorities– Mutual Exclusion–Deadlock– Inter task Communication–Message Mailboxes–Message Queues-Interrupts- TaskManagement–Memory Management-Time Management–Clock Ticks.

UNIT-III TASK MANAGEMENT   9

Introduction-µ C/OS-II Features-Goals ofµ C/OS-II-Hardware and Software Architecture–Kernel Structures: Tasks–Task States–Task Scheduling–Idle Task–Statistics Task–Interrupts Underµ C/OS-II–Clock Tick-µ C/OS- II Initialization. Task Management: Creating Tasks–Task Stacks–

Stack Checking – Task's Priority – Suspending Task – Resuming Task. Time Management: Delaying a Task–Resuming a Delayed Task–System Time. Event Control Blocks-Placing a Task in the ECB Wait List–Removing a Task from an ECB wait List.

UNIT IV   SEMAPHORE MANAGEMENT AND MESSAGE PASSING   9

Semaphore Management: Semaphore Management Overview– Signaling a Semaphore. Message Mailbox Management: Creating a Mailbox –Deleting Mailbox–Waiting for a Message box– Sending Message to a Mailbox- Status of Mailbox. Message Queue Management: Creating Message Queue– Deleting a Message Queue–Waiting for a Message Queue–Sending Message to a Queue– Flushing a Queue.

UNIT-VMEMORY MANAGEMENT   9

Memory Management: Memory Control Blocks–Creating Partition-Obtaining a Memory Block–Returning a Memory Block. Getting Started withµ C/OS-II–Installingµ   C/OS-II–Portingµ C/OS-II:Development Tools–Directories and Files– Testing a Port -IAR Workbench withµ C/OS-II-µ   C/OS- II Porting on a 8051CPU– Implementation of Multitasking- Implementation of Scheduling and Rescheduling –Analyze the Multichannel ADC with help ofµ C/OS-II.

Total :45

SUGGESTED READINGS

1. JeanJ. Labrosse, Micro C/OS–II The Real Time Kernel, CMPBOOKS, 2009.
2. David Seal, ARM Architecture, Reference Manual, Addison-Wesley, 2008.
3. Steve Furbe, ARM System-on-Chip, Architecture,Addison-Wesley Professional, California, 2000.
4. K.C. Wang, Embedded and Real-Time Operating Systems, Springer, 2017.
5. JanezPuhan, Operating systems, Embedded systems and Real-time systems, CIP - Cataloging In Publication, 2015.

WEBSITES

1. https://nptel.ac.in/courses/10810505.
2. https://onlinecourses.nptel.ac.in/noc21_cs98/preview.
3. https://nptel.ac.in/courses/108102045.
4. https://archive.nptel.ac.in/courses/106/105/106105193/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	2	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	2	-	-	-	-	-	-	-	-	-
CO5	1	2	2	-	3	-	-	-	-	-	-	-	-	-
Avg	3	3	3	2	2	-	-	-	-	-	-	-	-	-

23BEECOE02   **CONSUMER ELECTRONICS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to:
- Study about various speakers and microphone.
- Learn the fundamental of television systems and standards.
- Learn the process of audio recording and reproduction.
- Study various telephone networks.
- Discuss about the working of home appliances.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Explain working of loud speakers and Microphones
- Interpret the fundamentals of Television systems.
- Record the Audio Signal and reproduce it.
- Classify telecommunication networks.
- Examine the working of home appliances.

UNIT I   LOUDSPEAKERS AND MICROPHONES   9

Introduction Loudspeaker, types of loud speakers, Loudspeaker characteristics, Dynamic Loudspeaker, Electrostatic loudspeaker, Permanent Magnet Loudspeaker, Woofers and Tweeters – Introduction Microphone, Types of Microphone, Microphone Characteristics, Carbon Microphones, Dynamic Microphones and Wireless Microphones.

UNIT II   TELEVISION STANDARDS AND SYSTEMS   9

Introduction to TV system - Components of a TV system–Scanning – types of scanning-interlacing–Colour TVFundamentals - Additive Mixing- Subtractive Mixing- Need for Synchronization-Aspect Ratio-Video Bandwidth -Positive and Negative Transmission-Advantages of Negative Transmission-composite video signal - Colour TV system– Luminance and Chrominance signal- Monochrome and Colour Picture Tubes- Color TV systems– NTSC, PAL, SECAM.

UNIT III   AUDIO RECORDING AND REPRODUCTION   9

Introduction to Audio disc - Audio Disc– Processing of the Audio signal–Readout from the Disc –Reconstruction of the audio signal–Introduction to Video Disc recording –video disc mastering

and replication - Video disc formats- Recording Systems–Playback Systems.

UNIT IV   TELECOMMUNICATION SYSTEMS   9

Introduction to telecommunication Systems – Modes of telecommunication system-line system characteristics – Radio system characteristics –Signaling- Station Interconnection - Telephone services-telephone networks–switching system principles–PAPX or PBX switching–Data Services - Circuit, Packet and Message Switching, Telephone Networks - LAN, MAN and WAN, Integrated Services Digital Network. Introduction to Mobile radio systems- Wireless Local Loop – the role of WLL – types of WLL - VHF/UHF radio systems- Limited range Cordless Phones – Introduction to cellular communication - cellular modems.

UNIT V   HOME APPLIANCES   9

Introduction to home appliances – types of home appliances- Microwaves - Basic principle and block diagram of microwave oven -Washing Machine- electronic controller for washing machines - washing machine hardware and software –Introduction to air conditioners and refrigerators - Components of air conditioning systems – types of air conditioning systems-Refrigeration –Refrigeration systems – types of Refrigeration systems.

Total : 45

SUGGESTED READINGS

1. S.P. Bali," Consumer Electronics Pearson Education",2007
2. J.S.Chitode, "Consumer Electronics", Technical Publications,2007
3. Philip Hoff, Philip Herbert Hoff, "Consumer Electronics for Engineers", Cambridge University Press,1998
4. R.G.Gupta ,"Audio & Video Systems", Tata Mc Graw hill Publishing Company Ltd, 2004

WEBSITES

1. https://nptel.ac.in/courses/117105133
2. https://archive.nptel.ac.in/courses/117/104/117104127/
3. https://nptel.ac.in/courses/117102059
4. https://nptel.ac.in/courses/108101091

CO-PO MAPPING

COs	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	2	-	-	-	-	-	-	2	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	1	-	-
CO5	3	2	2	1	2	-	-	-	-	-	-	2	-	-
Avg	2.6	2	1.7	1.7	2	-	-	-	-	-	-	1.7	-	-

LIST OF OPEN ELECTIVES

FOOD TECHNOLOGY

23BTFTOE01	PROCESSING OF FOOD MATERIALS	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Explain the milling, extraction and manufacture of tremendous products from cereals, pulses and oilseeds.
- Summarize the production and processing methods of fruits and vegetables.
- Discuss the chemical composition, processing, production, spoilage and quality of milk and milk products.
- Outline the overall processes involved in the production of meat, poultry and fish products.
- Review the production and processing methods of plantation and spice products.

COURSE OUTCOMES

Upon completion of this course, students will be able to,

- Discuss the basics of food processing.
- Demonstrate the various processing technologies involved in fruits and vegetables, dairy, cereals, meat, fish, egg and plantation products.
- Infer the basics on microbiology of food products.
- Describe the process of manufacture of various food products.
- Outline the various methods of food preservation.

UNIT I CEREAL, PULSES AND OILSEEDS TECHNOLOGY   9

Rice milling, Pulse milling, Wheat milling – Recent trends in milling process- Oilextraction – different methods in oil extraction - Methods of manufacture of Bread - differentprocessesofmanufacture-typesofbreads-buns,biscuits,cakesandcookies-Pastaproducts-Tortilla-Method of manufacture.

UNIT II FRUITS AND VEGETABLE PROCESSING   9

ProductionofFruitsandvegetablesinIndia,Maturitystandards,Causeforheavylosses,preservationtreatments-BasicsofCanning,MinimalprocessingandHurdletechnologyas applied to Vegetable and Fruit processing, Processing of fruit juices, Dehydration, Aseptic processing- Indian Food Regulation and Quality assurance Fruit Juice / pulp/Nectar/Drinks, concentrates.

UNIT III DAIRY PROCESSING 9

Basic dairy terminology, composition, General tests at reception, Dairy Processing -Method of manufacture of Standardized, toned and double toned milk, milk powder -Equipments - Pasteurizers, homogenizers and pumps - Method of manufacture of dairy products - Ice-cream, Cheese, Paneer, Yoghurt - Pasteurization and microorganismsinvolvedinspoilageofmilk– Majorpathogens,Plantconstruction,Sanitationmanagement,Cleaning equipment.

UNIT IV-MEAT, POULTRYAND FISH PROCESSING 9

Meat composition from different sources, Definitions and measurements, Carcass Processing, Meat Products, Processing of Poultry Products, Common path ogens, Sanitation management, Sanitizers for meat & poultry plants, Fish and other Marine Products Processing, Sources of sea food contamination.

UNIT V-PLANTATIONPRODUCT TECHNOLOGY 9

Processing of Tea, Coffee and Cocoa – Outline of the methods of manufacture of-greentea, black tea, instant tea, Instant coffee, Cocoa and Chocolate. Outline of the methods of processing of Pepper, cardamom, ginger, vanilla and turmeric. By products from plantation crops and spices.

Total:45

SUGGESTED READINGS

1. Srivastava R.P. and Kumar S. Fruit and Vegetable Preservation: Principles and Practices. International BookDistributingCo.Lucknow.3rdEdition.2010.
2. ChakravertyA.,MujumdarA.S.,RaghavanG.S.VandRamaswamyH.S.Handbook of Post-harvest Technology: Marcel Dekker Press. USA. 1st Edition.2003.
3. SukumarDe. Outlines of Dairy Technology. Oxford University Press. NewDelhi. 23rd impression. 2016.
4. JamesG.Brennan.2006.FoodProcessingHandbook.Wiley-VCHVerlagGmbH&Co. KGaA, Weinheim,Germany

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	2	1	-	2	2	2	-	-	-	-
CO2	1	2	1	3	2	1	-	2	2	2	-	-	-	-
CO3	1	2	1	3	2	1	-	2	-	-	-	-	-	-
CO4	1	2	1	3	2	1	-	2	-	-	-	-	-	-
CO5	1	2	1	3	2	1	-	2	-	2	-	-	-	-
Avg	1	2	1	3	2	1		2	2	2	2		-	-

| 23BTFTOE02 | NUTRITION AND DIETETICS | 3H-3C |

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100
    End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Explain the basic concepts of food and nutrition.
- Define the overall classification, function, and source of carbohydrates, lipids and proteins.
- Summarize the availability, source, deficiency and physiological role of fat and water-soluble vitamins.
- Outlinetheroleofhealthandnutritionalimportanceofmicroandmacrominerals.
- Discuss there cent trend sand developments in nutrition.

COURSE OUTCOMES

Upon completion of this course, students will be able to

- Explain the basics in the area of nutritional assessment in health and disease.
- Outline the biological functions of various macro molecules in terms of food and health.
- Discuss the balanced diet for healthy life to avoid or prevent the deficiency disorders.
- Infer an appropriate diet, products that prevent vitamin deficiency disorders.
- Identify the proper foods rich in minerals to live a healthy life.

UNIT I   HUMAN NUTRITION   9

Six classes of nutrients - Historical perspective of nutrient requirements – Assessment of nutritional status - recommended dietary allowances of macronutrients for all age groups - Assessment of protein quality - Malnutrition and related disorders –Balanced Diet. Factors influencing dietary intake: Food habits, food fads and fallacies, their influence on health and wellbeing.

UNIT II   BIOMOLECULES   9

Carbohydrates-Definition, classification, Functions, Sources of Carbohydrates, Deficiency. Lipids – Definition, classification, function, sources, Properties of fats and oils, Refined & Hydrogenated fats process. Proteins - Definitions, Classification, Function, Amino Acids, Sources of Proteins, Texturized proteins.

UNIT III VITAMINS

9

Physiological role, bio-availability, requirements, sources and deficiency of FatSolubleVitamins:VitaminA,VitaminD,E&K. ƒWatersolublevitamins:VitaminC,Thiamine,Ribo flavin, Niacin, Pantothenic acid, Biotin, Folic acid, Vitamin B12, VitaminB6.Stabilityunderdifferent food processing conditions.

UNIT IV MINERALS AND WATER

9

Physiological role, bio-availability, requirements, sources and deficiency of Macrominerals : Calcium, Phosphorus Magnesium, Sodium, Potassium chloride. Microminerals: Iron, Zinc, copper, selenium, chromium, iodine, manganese, Molybdenum and fluoride - Chemistry and physical properties of free, bounded and entrapped water, water activity, quality parameters of drinking and mineral water.

UNIT V RECENT TRENDS IN NUTRITION

9

Principles of dietary managementing out, rheumatism, AIDS/HIV – Cancer – risk factors, symptoms, dietary management, and role of food in prevention of Cancer. Role of functional foods Health foods and novel foods, organically grown foods, personalized nutrition, recent concepts in human nutrition like nutrigenomics, nutraceuticalsetc.

Total : 45

SUGGESTED READINGS

1. Sunetra Roday. Food Science and Nutrition. Oxford Higher Education/Oxford University Press. 3rdedition 2018. (ISBN-13:9780199489084).
2. Charis Galanakis. Nutraceutical and Functional Food Components. Academic Press, 1st edition, 2017. (ISBN:9780128052570).
3. Ashley Martin. Nutrition and Dietetics.Syrawood Publishing House.1stEdition,2016. (ISBN:9781682860588).
4. RobertE.C.Wildman.Handbook of Nutraceuticals and Functional Foods.CRCPress,2nd Edition, 2016.(ISBN-10: 9781498770637).
5. Srilakshmi. B. Nutrition Science. New Age International Pvt. Ltd, Publishers. 6thEdition.2017.(ISBN-13:9789386418883).

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	-	-	-	2	2	2	-	-	-	-
CO2	1	2	1	3	-	-	-	2	2	2	-	-	-	-
CO3	1	2	1	3	-	-	-	2	-	-	-	-	-	-
CO4	1	2	1	3	-	-	-	2	-	-	-	-	-	-
CO5	1	2	1	3	-	-	-	2	-	2	-	-	-	-
Avg	1	2	1	3	-	-	-	2	2	2	-	-	-	-

23BTFTOE03	**READY TO EAT FOOD**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Outline the current status of snack food Industry.
- Describe the production, processing and marketing trends of potato and tortilla chips.
- Outline the overall processing of popcorn.
- Explain the production and processing of fruits involved in snack food preparation.
- Summarize the sensory analysis methods and packaging techniques of snack foods

COURSE OUTCOMES

Upon completion of this course, students will be able to

- Outline the various manufacturing process in snack food industries.
- Summarize the current production and marketing status of Snack foods.
- Explain the advantages of Sensory Evaluation.
- Describe packaging technologies in Snack Food Industries.
- Demonstrate the equipments involved in the snack production processes.

UNIT I INTRODUCTION TO SNACK FOODS   9

Introduction- Types – processing methods - Nutrition- Quality and standards for snack foods - GHP and GMP for snack food industries - Outline of snack food industry –Domestic Snack Food Market-Global Market.

UNIT II POTATO AND TORTILLA CHIPS PROCESSING   9

Potato Production- selection and grading of potato - Potato snack Ingredients- Potato Analysis and Composition-Potato chip manufacturing process-Unit Operations-Other value added products from Potato. Tortilla chips - Raw Materials- Processing steps -Equipment involved-Reconstitution of Dry Maize Flour-Unit operations – Nutritional properties of potato and tortilla chips.

UNIT III POPCORN PROCESSING   9

Introduction – Raw popcorn selection and preparation – Popping Methods – Home preparation of Popcorn – Equipments - Industrial manufacturing process - Flavorings and Applicators-Popcorn Packaging-Relative Nutrition-Marketing.

UNIT IV FRUITBASED SNACKS 9

Introduction-production and processing of fruit crops – fruit purees – fruit powders –canned fruit snacks – alcoholic preservation of fruit snacks – fruit candies – fruit bars –exotic fruits – Nutritions and health benefits of fruit snacks.

UNIT V SENSORY EVALUATION AND PACKAGING 9

Introduction- importance of sensory evaluation–Analytical methods-Sensory methods - Sensory Aspect of Processing- Limitations of sensory evaluation- Quality properties of Snack Foods and Packaging Materials-Automated Bag- Pouch Packaging- Cartoning Case Packing- Labelling requirements –Current Issues in Snack Foods Packaging.

Total :45

SUGGESTED READINGS

1. Lusas,E.W and Rooney,L.W.Snack Foods Processing.CRCPress,1stEdition2001.
2. Panda, H. The Complete Technology Book on Snack Foods, National Institute of Industrial Research, Delhi. 2ndEdition 2013.
3. SergioO Serna-Saldivar, Industrial Manufacture of Snack Foods ,Kennedys Books Ltd. 2008.
4. Lusas,E.WandRooney,L.W.SnackFoodsProcessing.CRCPress,1stEdition 2001.
5. SergioOSerna-Saldivar,Industrial Manufacture of Snack Foods,Kennedys BooksLtd. 2008.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	-	-	-	2	2	2	-	1	-	-
CO2	1	2	1	3	-	-	-	2	2	2	-	1	-	-
CO3	1	2	1	3	-	-	-	2	-	-	-	1	-	-
CO4	1	2	1	3	-	-	-	2	-	-	-	1	-	-
CO5	1	2	1	3	-	-	-	2	-	2	-	1	-	-
Avg	1	2	1	3	-	-	-	2	2	2	-	1	-	-

23BTFTOE04   AGRICULTURAL WASTE AND BYPRODUCTS UTILIZATION   3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Categorize the types of agricultural wastes
- Outline the production and utilization of biomass
- Explain the various parameters considered to be important in the designing of biogas units
- Discuss the methods employed in the production of alcohol from agricultural wastes/ byproducts
- Summarize the overall aspects involved in the production of paperboards and particleboards from agricultural wastes

COURSE OUTCOMES

Upon successful completion of this, students will be able to

- List and classify the types of agricultural wastes
- Collect and generate number of value added products from agricultural wastes
- Recall the techniques involved in the production and utilization of biomass
- Assess the various parameters considered to be important in the designing of biogas units
- Illustrate the various methods employed in the production of alcohol from the by products of agricultural wastes
- Choose the appropriate materials to produce paperboards and particleboards from agricultural wastes

UNIT I TYPES OF AGRICULTURAL WASTES   9

Introduction and Background Agricultural Waste, Crop Waste, Agricultural Residues (annual crops), Technical terms, properties of agricultural waste- storage and handling - rice by-products utilization-rice bran and germ, rice bran oil, economic products from agriculture waste/by-products.

UNIT II BIOMASS PRODUCTION AND UTILIZATION   9

Biomass – types – production and utilization Technology used for the utilization of agricultural wastes:Biomass Gasifier, Nimbkar Agricultural Research Institute (NARI) Gasifier, Rice-Husk

Based Gasifier, Heat andSteam from Sugarcane Leaf andBagasse.

UNIT III BIOGAS DESIGN AND PRODUCTION 9

Biogas: Definition, composition, history of biogas, Production of biogas – factors affecting the efficiency; types of biogasplant (floating drum type and fixed dome type) and their components (inlet, outlet, stirrer, slanting pipe, digester, gas holder and gas outer pipe), Selection and Design of biogasplant.

UNIT IV PRODUCTION OF ALCOHOL FROM WASTE MATERIALS 9

Production of Alcohol from waste materials: Introduction, Production methods, Cellulolysis (biological approach): Pretreatment, Cellulolytic processes (Chemical and Enzymatic hydrolysis), Microbial fermentation, Gasification process (thermochemical approach).

UNIT V PRODUCTION OF PAPER BOARD AND PARTICLE BOARDS FROM AGRICULTURAL WASTE 9

Production and testing of Paperboards and Particleboards from Agricultural Waste: Introduction, History, Terminology and classification, Raw materials, Production steps- Pulping, Classifications of pulp, Bleaching, Plies, Coating, Grades.

REFERENCE BOOKS

1. Efthymia Alexopoulou. Bio energy and Biomass from Industrial Crops on Marginal Lands. Elsevier, 1st Edition, 2020. (ISBN:9780128188644)
2. Navanietha Krishnaraj Rathinam, Rajesh Sani. Biovalorisation of Wastes to Renewable Chemicals and Biofuels. Elsevier, 1st Edition, 2019. (ISBN:9780128179529)
3. SimonaCiuta,DemetraTsiamis,MarcoJ.Castaldi.GasificationofWasteMaterials.Academic Press, 1st Edition, 2017. (ISBN:9780128127162)
4. Nicholas E. Korres, Padraig O'Kiely, John A.H. Benzie, Jonathan S. West. Bioenergy Production by Anaerobic Digestion: Using Agricultural Biomass and Organic Wastes. Routledge, 1st Edition, 2013. (ISBN-13:9780415698405)
5. Albert Howard, Yashwant Wad. The Waste Products of Agriculture. Benediction Classics, 1st Edition, 2011. (ISBN-13:9781849025

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	-	1	3	2	2	2	-	-	-	-
CO2	1	2	1	3	-	1	3	2	2	2	-	-	-	-
CO3	1	2	1	3	-	1	3	2	-	-	-	-	-	-
CO4	1	2	1	3	-	1	3	2	-	-	-	-	-	-
CO5	1	2	1	3	-	1	3	2	-	2	-	-	-	-
Avg	1	2	1	3	-	1	3	2	2	2	-	-	-	-

23BTFTOE05   DESIGN OF FOOD PROCESS EQUIPMENT   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Illustrate the types of materials used in the food processing equipments.
- Discuss the materials and designing of differents to ragevessel.
- Explain the importance of reaction vessel and their destining techniques.
- Explain the materials and designing of heat exchanger and evaporators.
- Discuss the importance of dryersin food processing industries.

COURSE OUTCOMES

Upon successful completion of this, students will be able to

- Outline the materials suitable for the construction of equipment's.
- Summarize the vessels used for food storage in the industries.
- Classify types of reaction vessel used for different purposes.
- Discuss the importance of heat exchanger in the designing of food processing equipment's.
- Infer the significance of dryersin food processing.

UNIT I MATERIALS   9

Metals and non-metals, design of pressure vessels – cylindrical shell –internal and external pressure - under continued loadings. Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes Numerical problem and design of pressure vessel.

UNIT II STORAGE VESSELS   9

Design of storage vessels – Rectangular Tank without stiffeners –with stiffeners – shell design – Numerical problem and design. Design of agitators and baffles. Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations;

UNIT III REACTION VESSELS 9

Design of Reaction vessels – materials -classification – jackets-Design of vessel shell with half coil – Design of vessel shell with jacket – Numerical problem and design. Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices.

UNIT IV HEAT EXCHANGERS 9

Design of Heat exchangers – types – materials – Design pressure and temperature- shell design – tubes - Numerical problem. -Design of Equipment. Evaporator: Materials of concentration – types –design- consideration – Design of agitators – power requirements – Design based on Torque – criticalspeed.

UNIT V DRYERS 9

Types - General considerations – Design of Tray dryer, Rotary Dryer, fluidized bed dryer, spray dryer, vacuum dryer, microwave dryer – Material Balance, Thermal energy Requirements , electrical energy Requirements, Performance Indices

Total :45

REFERENCE BOOKS

1. Maroulis Z.B. and Saravacos G.D. Food Process Design, Marcel Dekker Inc. ISBN-0824743113,2003.
2. Joshi M.V, "Process Equipment Design", Macmillan IndiaLtd.,1985
3. Coulson ,J.M. and Richardson, J. F,"Chemical Engineering " Butterworth-Heinemnn Elsevier, ISBN-0750644451,2002

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	3	-	1	-	2	2	2	-	-	-	-
CO2	1	2	1	3	-	1	-	2	2	2	-	-	-	-
CO3	1	2	1	3	-	1	-	2	-	-	-	-	-	-
CO4	1	2	1	3	-	1	-	2	-	-	-	-	-	-
CO5	1	2	1	3	-	1	-	2	-	2	-	-	-	-
Avg	1	2	1	2	-	1	-	2	2	2	-	-	-	-

LIST OF OPEN ELECTIVES

MECHANICAL ENGINEERING

23BEMEOE01   **BATTERY MANAGEMENT SYSTEM**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Demonstrate familiarity with alternative energy sources and their role in sustainability.
- Analyze energy requirements for different hybrid and electric vehicles.
- Examine the principles and components of lithium-ion batteries.
- Explore advancements in battery technologies.
- Apply knowledge of battery management systems and ensure safety in high-voltage batteries.

COURSE OUTCOMES

Upon successful completion of this, students will be able to

- Apply the alternative energy and sustainability to electric transportation.
- Analyze energy needs for hybrid and electric vehicles.
- Choose the appropriate operations for manufacturing lithium-ion batteries.
- Outline the advancements in battery technology.
- Utilize battery management system and prioritize safety in high-voltage batteries.

UNIT I ENERGY STORAGE SYSTEMS   9

General background on alternative energy sources and sustainability, Introduction to electric-based transportation, Overview of on-road vehicle electrification, EVs configuration, Energy and power requirements for various HEVs and EVs Vehicle performance and driving cycles.

UNIT II LITHIUM BATTERIES   9

Li-ion batteries - Principle of operation, Battery components and design Electrode, cell and battery fabrications, Building block cells, battery modules and packs and applications. All solid-state batteries and future developments, Li-Sulphur battery, Li-Air battery, Sodium-battery, Magnesium battery, Aluminium battery, Silicon battery.

UNIT III HIGH TEMPERATURE BATTERIES FOR BACK-UP APPLICATIONS   9

Advance Ni-MH batteries for transportation, Future prospects of Ni-MH batteries vs. lithium ion batteries, Zebra cell, Li-iron sulphide cells, Vanadium and iron-based batteries, Semi-fluid flow batteries for large scale grid application, Ni-H2cells for space applications.

UNIT IV FUEL CELLS AND BATTERY RECYCLING TECHNOLOGY   9

Introduction to fuel cells, Proton-exchange membrane and alkaline fuel cells for transportation, Solid oxidefuel cells, Technology and economic aspects of battery recycling, Environmental effect and controlling ofpoisonouschemicals contamination.

UNIT V BATTERY MANAGEMENT   9

Fundamentals of battery management systems and controls, Battery Thermal Management - Passive cooling, Active cooling-Liquids and air systems. Regulations and Safety Aspects of High Voltage Batteries, Code and Standards, Safe handling of Lithium Batteries, Safety of high voltage battery.

Total : 45

TEXT BOOKS:

1. Gerardus Blokdyk, Battery Management System A Complete Guide, Springer, 2019 Edition.
2. Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications, 1st Edition. Springer, 2018.

REFERENCE BOOKS:

1. Alfred Rufer, Energy Storage: Systems and Components, 1st Edition, CRC Press, 2017.
2. Arno Kwade and Jan Diekmann, Recycling of Lithium-Ion Batteries: The LithoRec Way (Sustainable Production, Life Cycle Engineering and Management), 1st Edition. Springer, 2018.

WEBSITES:

1. https://nptel.ac.in/courses/108/103/108103009/
2. https://web1.eng.famu.fsu.edu/~patelsa/Files/FinalReport.pdf

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	1	-	1	-	-
Avg	3	2.4	1.2	1	-	-	-	-	-	1	-	1	-	-

23BEMEOE02   **INDUSTRIAL SAFETY AND ENVIRONMENT**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to
- Provide in-depth knowledge on various techniques of non-destructive testing.
- Acquaint the student with the need and awareness of the safety concepts.
- Understand the importance of various safety techniques involved in industrial sector.
- Introduce the concepts of accident zone and prepare reports related to it.
- Develop an understanding of safety monitoring.

COURSE OUTCOMES

Upon successful completion of this, students will be able to
- Explain the need of safety.
- Outline the safety techniques involved in industrial sector.
- Develop the report for the accident zones.
- Inspect the safety strategies in industrial sector.
- Illustrate training sessions based on safety.

UNIT I CONCEPTS OF SAFETY ENGINEERING   9

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety-Safety Committee-budgeting for safety.

UNIT II TECHNIQUES OF SAFETY ENGINEERING   9

Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit.

UNIT III ACCIDENT INVESTIGATION AND REPORTING   9

Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention, Supervisory role- Role of safety committee – Accident causation models - Cost of accident. Overall accident investigation process –Response to accidents, India reporting requirement, Planning document, Planning matrix, Investigators Kit, functions of investigator, four types of evidences, Records of accidents, accident reports.

UNIT IV SAFETY PERFORMANCE MONITORING   **9**

Reactive and proactive monitoring techniques - Permanent total disabilities, permanent partial disabilities, temporary total disabilities - Calculation of accident indices, frequency rate, severity rate, frequency severity incidence, incident rate, accident rate, safety "t" score, safety activity rate– problems.

UNIT V SAFETY EDUCATION AND TRAINING   **9**

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice – motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training. Modern safety equipment and technics – Case study.

                                           Total : 45

TEXT BOOKS:
1. Accident Prevention Manual for Industrial Operations,3rd edition, N.S.C.Chicago, 2020 (digital).
2. Heinrich H.W. "Industrial Accident Prevention", 2ndedition, Tata McGraw-Hill, New York, 2017.

REFERENCE BOOKS:
1. Krishnan N.V, Safety Management in Industry,1st edition, Jaico Publishing House, Bombay, 2017.
2. John R Ridley, Safety at Work,3rd edition, Elsevier, 2019.

WEBSITES:

1. https://onlinecourses.nptel.ac.in/noc19_me40/preview
2. https://www.studocu.com/in/document/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO4	3	3	2	1	-	-	-	-	-	1	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	1	-	-
Avg	3	1	2	1	-	-	-	-	-	1	-	1	-	-

23BEMEOE03	NON DESTRUCTIVE TESTING	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- The main objectives of this course are to introduce the concept of non-destructive testing among the students and make them understand various types of non-traditional practices available for manufacturing industry.
- Provide in-depth knowledge on various techniques of non-destructive testing.
- Provide an overview of destructive and non-destructive tests and state their applications.
- Study the features of NDT techniques for various products and to understand the established NDE techniques and basic familiarity of emerging NDE techniques.
- Expose students to skills needed for selection of appropriate NDT technique(s) for new inspection jobs.

COURSE OUTCOMES

Upon successful completion of this, students will be able to,

- Summarize the codes, standards and specifications related to NDT.
- Classify the destructive and non-destructive tests and their applications.
- Develop NDT techniques for mechanical components.
- Compare the eddy current and visual testing methods.
- Explain the NDE techniques and its applications.

UNIT I INTRODUCTION   9
Properties of Engineering Materials – Types of Defects – Surface and Sub-Surface of a component – Characteristics of Ferrous, Non-ferrous and Alloys. Classification of Destructive testing and Non-Destructive testing – Uses and applications. Codes, Standards and Specifications of NDT (ASME, ASTM, AWS etc.). Importance and Scope of NDT, Non-destructive testing methods

UNIT II PENETRANT TESTING AND MAGNETIC PARTICLE INSPECTION   9
Introduction to Penetrant Testing – Liquid Penetrants and Dye Penetrants - Apparatus required for LPT - An Illustration of Penetrant Testing, Application, Advantages and Disadvantages of Penetrants Testing. Introduction to Magnetic Particle Inspection – MPT equipments and devices - An Illustration of Magnetic Particle Inspection, Application, Advantages and Disadvantages of Magnetic Particle Crack Detection.

UNIT III ULTRASONIC FLAW DETECTION AND RADIOGRAPHY INSPECTION   9

Introduction to Ultrasonic Flaw Detection, UT equipments and devices, An Illustration of Ultrasonic Flaw Detection, Application, Advantages and Disadvantages of Ultrasonic Flaw Detection. Principle of Radiography Inspection, RT equipments and devices Radiation sources, uses of x-rays and gamma rays Attenuation in the specimen, Radiographic imaging, Inspection Techniques, Application and limitations, Safety from Radiation.

UNIT IV EDDY CURRENT TESTING AND VISUAL TESTING METHODS   9

Introduction to Eddy Current Testing. ECT equipments and devices, An Illustration of Eddy Current Testing Equipment, Application, Advantages and Disadvantages of Eddy Current Testing. Introduction to visual testing method, Equipments required for VT - An Illustration of visual testing method, Application, Advantages and Disadvantages of visual testing method.

UNIT V NON-DESTRUCTIVE INSPECTION(NDI) AND ITS APPLICATIONS   9

Inspection of Raw Products, Inspection for In-Service Damage, Power Plant Inspection, Storage Tank Inspection, Automobile component Inspection, Jet Engine Inspection, Pressure Vessel Inspection, Bridge Inspection, Pipeline Inspection.

Total : 45

TEXT BOOKS:

1. Sadashiva. M – Non - Destructive Testing Paperback – 15 July 2021.
2. Ramachandran. S and Anderson. A - Non-Destructive Testing – Kindle Edition – 2018.

REFERENCE BOOKS:

1. J. Prasad and C. G. Krishnadas Nair - Non-Destructive Test and Evaluation of Materials Hardcover – 2017.
2. Lari and Kumar - Basics of Non - Destructive Testing Paperback – 1 January 2013.

WEBSITES:

1. https://ndttrainingonline.com
2. https://onlinendts.com/

CO-PO MAPPING:

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

23BEMEOE04	OPERATIONS RESEARCH	3H-3C

Instruction Hours/week: L:3 T:0 P:0　　　　**Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Provide students the knowledge of optimization techniques and approaches.
- Enable the students, apply mathematical, computational and communication skills needed for the practical utility of Operations Research.
- Understand the Engineering and Managerial situations in Transportation.
- Make the student acquire sound knowledge on sequences to perform operation among various alternatives.
- Teach students about networking, inventory, queuing, decision and replacement models.

COURSE OUTCOMES

Upon successful completion of this, students will be able to
- Solve Linear programming technique in industrial optimization problems.
- Examine transportation problems using OR techniques.
- Explain various OR models for optimization.
- Make use of OR tools in a wide range of applications in industries.
- Identify the advanced techniques for group replacement.

UNIT I   INTRODUCTION TO OPERATIONS RESEARCH   9
Operations research and decision–making – types of mathematical models and constructing the model – Role of computers in operations research –Linear Programming Techniques: Formulation of linear programming problem, applications and limitations, graphical method, simplex method – The Big –M method – the two–phase method.

UNIT II   TRANSPORTATION PROBLEMS   9
Least cost method, North west corner rule, Vogel's approximation method, modified distribution method,unbalanceanddegeneracyintransportationmodel,shortestroutealgorithm–dijkestra algorithm.

UNIT III ASSIGNMENT MODELS AND SCHEDULING   9
Assignment models - Hungarian algorithm, unbalanced assignment problems - maximization case in assignment problems, traveling salesman problem. Scheduling – processing n jobs

through two machines, processing n jobs through three machines, processing two jobs through 'm' machines, processing n jobs through m machines.

UNITIV   INVENTORY CONTROL AND QUEUING THEORY   9

Variables in inventory problems, inventory models with penalty, shortage and quantity discount, safety stock, multi-item deterministic model. Queuing Models: Queues–Notation of queues, performance measures, The M/M/1queue, The M/M/mqueue, batch arrival queuing system, queues with breakdowns.

UNITV   PROJECT MANAGEMENT AND REPLACEMENT MODELS   9

Basic terminologies, constructing a project network, network computations in CPM and PERT, cost crashing, Replacement Models: Replacement of Items due to deterioration with and without time value of Money, Group replacement policy, Staff replacement

Total :45

TEXT BOOKS

1. Kanti Swarup, Operations Research, 12th edition, Sultan Chand and Sons, New Delhi, 2010.
2. Viswanathan N and Narahari Y, Performance Modeling of Automated Manufacturing Systems,2nd edition, Prentice Hall of India, New Delhi, 2005.

WEBSITES

https://www.techtarget.com/whatis/definition/operations-research-OR

https://en.wikipedia.org/wiki/Operations_research

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO2	3	3	2	1	-	-	-	-	-	1	-	1	-	-
CO3	2	1	3	-	-	-	-	-	-	1	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	1	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	1	-	1	-	-
Avg	2.8	2.6	1.6	0.3	-	-	-	-	-	1	-	1	-	-

LIST OF OPEN ELECTIVES

CIVIL ENGINEERING

23BECEOE01   HOUSING PLAN AND MANAGEMENT   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Examine the role and tasks of basic housing policies and building bye laws
- Understand the process of integrated service delivery in the context of economic, social, environmental and institutional factors
- Analyze the Innovative construction methods and Materials
- Analyze city management strategies and strengthen the urban governance through a problem solving approach
- Know the Importance of basic housing policies and building bye laws
- Use Housing Programmes and Schemes

COURSE OUTCOMES

Upon ccompletion of the course, the students will be able to

- Know the Importance of basic housing policies and building bye laws
- Use Housing Programmes and Schemes
- Plan and Design of Housing projects
- Examine Innovative construction methods and Materials
- Know Housing finance and loan approval procedures
- Understand Construction as well as managing techniques

UNIT I INTRODUCTION TO HOUSING   9

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

UNIT II HOUSING PROGRAMMES   9

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations.

UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS   9

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units

(Design Problems)

UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS   9

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation.

UNIT V HOUSING FINANCE AND PROJECT APPRAISAL   9

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing o f Housing Units, Rents, Recovery Pattern (Problems).

Total : 45

TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd.,New Delhi, 2002.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House,Bombay, 2001.

REFERENCES BOOKS

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS(Habitat), Nairobi, 2000.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	-	-	2	-	2	2	-	-
CO2	3	3	3	3	3	2	-	-	2	-	2	2	-	-
CO3	3	3	2	2	2	2	-	-	2	-	2	2	-	-
CO4	3	3	3	3	2	2	-	-	2	-	2	2	-	-
CO5	3	3	2	2	2	2	-	-	2	-	2	2	-	-
Avg	3	3	2.6	2.4	2.2	2	-	-	2	-	2	2	-	-

23BECEOE02   BUILDING SERVICES   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Defining and identifying of engineering services systems in buildings.
- Know the role of engineering services systems in providing comfort and facilitating life of users of the building.
- Understand the basic principles of asset management in a building & facilities maintenance   environment
- Learn the Importance of Fire safety and its installation techniques.
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design

COURSE OUTCOMES

Upon completion the course, the students will be able to

- Machineries involved in building construction
- Understand Electrical system and its selection criteria
- Use the Principles of illumination & design
- Know the principle of Refrigeration and application
- Importance of Fire safety and its installation techniques
- Know the principle behind the installation of building services and to ensure safety in buildings

UNIT I MACHINERIES   9

Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity

UNIT II ELECTRICAL SYSTEMS IN BUILDINGS   9

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations

UNIT III PRINCIPLES OF ILLUMINATION & DESIGN   9

Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilization factor – Depreciation factor – MSCP – MHCP –Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering. Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.

UNIT IV REFRIGERATION PRINCIPLES & APPLICATIONS   9

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Sub cooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems

UNIT V FIRE SAFETY INSTALLATION   9

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers

Total : 45

TEXT BOOKS

1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 2002.

2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 2005.

REFERENCE BOOKS

1. Philips Lighting in Architectural Design, McGraw-Hill, New York, 2000.
2. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press,London, 2005.
3. National Building Code.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	2	1	2	-	-	2	-	-	2	-	-
CO2	3	-	2	2	1	2	-	-	2	-	-	2	-	-
CO3	3	-	2	2	1	2	-	-	2	-	-	2	-	-
CO4	3	-	2	2	1	2	-	-	2	-	-	2	-	-
CO5	3	-	2	2	1	2	-	-	2	-	-	2	-	-
Avg	3	-	2	2	1	2	-	-	2	-	-	2	-	-

23BECEOE03   **REPAIR AND REHABILITATION OF STRUCTURES**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to,

- Learn various distress and damages to concrete and masonry structures
- Know the influence of corrosion in durability of structures
- Understand the importance of maintenance of structures
- Study the various types and properties of repair materials
- Learn various techniques involved in demolition of structures
- Assess damage of structures and various repair techniques

COURSE OUTCOMES

After completing the course, the students will be able to

- Various distress and damages to concrete and masonry structures
- Durability of structures and corrosion mechanism
- The importance of maintenance of structures, types and properties of repair materials etc
- Assessing damage of structures and various repair techniques
- the various types and properties of repair materials
- Modern technique and equipment being adopted for the demolition of structures

UNIT I INTRODUCTION   9

Quality assurance for concrete construction as built concrete properties strength, permeability, thermalproperties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors.

UNIT II DURABILITY OF STRUCTURES   9

Corrosion mechanism – diagnosis- causes and effects - cover thickness and cracking, measurements for corrosion - methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT III MAINTENANCE AND REPAIR STRATEGIES   9

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT IV MATERIALS FOR REPAIR   9

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete. eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete.

UNIT V TECHNIQUES FOR REPAIR AND REPAIR OF STRUCTURES   9

Non-destructive Testing Techniques, Corrosion protection techniques, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure Engineered demolition techniques for dilapidated structures - case studies.

TEXT BOOKS
1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials,Maintenance andRepair", Longman Scientific and Technical UK, 1991.
2. Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
3. Shetty M.S., "Concrete Technology – Theory and Practice", S.Chand and Company, 2008.

REFERENCE BOOKS
1. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and
2. Rehabilitation of Concrete Structures", Allied Publishers, 2004.
3. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013
4. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
5. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
6. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.
7. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011

CO-PO MAPPING

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

23BECEOE04   COMPUTER AIDED CIVIL ENGINEERING DRAWING   3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD - The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact.
- To Communicate a design idea/concept graphically/ visually

COURSE OUTCOMES

After completing the course, the students will be able to
- Develop Parametric design and the conventions of formal engineering drawing
- Produce and interpret 2D & 3D drawings
- Communicate a design idea/concept graphically/ visually
- Examine a design critically and with understanding of CAD – The student learn to interpret drawings, and to produce designs using a combination of 2D and 3D software.
- Get a Detailed study of an engineering artifact
- Planning and designing of structures

UNIT I INTRODUCTION   9

Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

UNIT II SYMBOLS AND SIGN CONVENTIONS   9

Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards.

UNIT III MASONRY BONDS 9

English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall

UNIT IV BUILDING DRAWING 9

Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity.

UNIT V: PICTORIAL VIEW 9

Principles of isometrics and perspective drawing. Perspective view of building, Software's

Total : 45

TEXT BOOKS
1. Venugopal (2007), "Engineering Drawing and Graphics + AUTOCAD", New Age International Pvt.Ltd.,
2. Subhash C Sharma & Gurucharan Singh (2005), " Civil Engineering Drawing" , Standard Publishers

REFERENCE BOOKS
1. (Corresponding set of) CAD Software Theory and UserManuals.
2. Malik R.S., Meo, G.S. (2009) Civil Engineering Drawing, Computech Publication LtdNewAsian.
3. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S.K.Kataria&Sons.
4. Ajeet Singh (2002), " Workingwith AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, NewDelhi

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	1	2	1	-	2	-	1	2	-	-
CO2	3	2	-	2	1	2	1	-	2	-	1	2	-	-
CO3	3	2	-	2	1	2	1	-	2	-	1	2	-	-
CO4	3	2	-	2	1	2	1	-	2	-	1	2	-	-
CO5	3	2	-	2	1	2	1	-	2	-	1	2	-	-
Avg	3	2	-	2	1	2	1	-	2	-	1	2	-	-

23BECEOE05	CONTRACTS MANAGEMENT	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to
- Have developed a more detailed appreciation for construction planning and scheduling
- Apply their learned knowledge as it pertains to upper level construction management skills and procedures.
- Evaluate the best practices associated with the development of contract parameters.
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Apply project Procurement management concepts in a project environment.
- Describe techniques used to procure resources within a project's scope and techniques to reduce procurement risks.
- Evaluate the best practices associated with the development of contract parameters.
- Understand the legal aspects of acts governing the contracts
- Discuss techniques for appropriate risks and changes, monitoring and measuring the contract closure
- Understand the basics of the bid process, important points in a tender document, and unbalanced contracts.

UNIT I CONTRACT MANAGEMENT   9

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.

UNIT II CONTRACT PARAMETERS   9

Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

UNIT III VARIOUS ACTS GOVERNING CONTRACTS   9

Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,

UNIT IV BID PROCESS AND BID EVALUATION   9

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNIT V MANAGING RISKS AND CHANGE   9

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance-Introduction, Monitoring and Measurement.

Total:45

TEXT BOOKS
1. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
2. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.
3. Sustainable Construction: Green Building Design and Delivery. Third Edition, Charles J.Kibert, New York: John Wiley & Sons, 2012.

REFERENCE BOOKS
1. Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibertet al, New York: John Wiley & Sons, 2011.
2. Varghese, P.C., "Building Construction", Prentice Hall India,2007.
3. National Building Code, Bureau of Indian Standards, New Delhi,2017.
4. Chudley, R., Construction Technology, ELBS Publishers,2007.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011
6. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006
7. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson EducationIndia, 2015
8. Punmia, B.C., Khandelwal,K.K.,Project Planning with PERT and CPM,Laxmi Publications, 2016.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	2	1	2	1	-	2	-	2	2	-	-
CO2	3	1	-	2	1	2	1	-	2	-	2	2	-	-
CO3	3	1	-	2	1	2	1	-	2	-	2	2	-	-
CO4	3	1	-	2	1	2	1	-	2	-	2	2	-	-
CO5	3	1	-	2	1	2	1	-	2	-	2	2	-	-
Avg	3	1	-	2	1	2	1	-	2	-	2	2	-	-

23BECEOE06   AIR AND NOISE POLLUTION AND CONTROL   3H-3C

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course for the students is to

- Impart knowledge on the principles and design of control of indoor/ particulate / gaseous air pollutant and its emerging trends
- Induce operational considerations under the processing and control monitoring.
- Apply sampling techniques of gaseous contaminants.
- Control noise pollution by specific measurements, standard and preventive measures.
- Enable to evaluate the behavior of air pollutants.
- Have knowledge about appropriate control measures of air pollution

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Have knowledge about appropriate control measures of air pollution.
- To apply sampling techniques and suggest suitable air pollution prevention equipment's and techniques for various gaseous and particulate pollutants.
- Have knowledge about the air pollution monitoring and modeling.
- Understand causes of air pollution and Analyze different types of air pollutants.
- Evaluate air pollutant behavior in the atmosphere.
- Enable to evaluate the behavior of air pollutants.

UNIT I: INTRODUCTION   9

Structure and composition of Atmosphere – Sources and classification of air pollutants -Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices Emission Inventories.

UNIT II: AIR POLLUTION MONITORING AND MODELLIN   9

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants -Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air PollutionClimatology.

UNIT III: CONTROL OF PARTICULATE CONTAMINANTS   9

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate

Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring –Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT IV: CONTROL OF GASEOUS CONTAMINANTS   9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V: AUTOMOBILE AND NOISE POLLUTION   9

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution: Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control.

Total : 45

TEXT BOOKS
1. Anjaneyulu D, "Air pollution and control technologies", Allied Publishers, Mumbai, 2002.
2. Khitoliya R K, "Environmental Pollution", 2/e, S. Chand Publishing, 2012.

REFERENCE BOOKS
1. Rao C.S, "Environmental pollution control engineering", Wiley Eastern Ltd., New Delhi,1996.
2. Rao M.N, and Rao H.V.N, "Air Pollution Control" Tata-McGraw-Hill, New Delhi, 1996.
3. David H.F Liu, Bela G.Liptak, "Air Pollution", Lewis Publishers, 2000.
4. Mudakavi, J R, "Principles and Practices of Air Pollution Control and Analysis" IK International, 2010.
5. Air Pollution act, India, 1998.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO2	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO3	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO4	3	2	-	2	1	2	1	-	2	-	2	2	-	-
CO5	3	2	-	2	1	2	1	-	2	-	2	2	-	-
Avg	3	2	-	2	1	2	1	-	2	-	2	2	-	-

LIST OF OPEN ELECTIVES

BIO MEDICAL ENGINEERING

23BEBMEOE01   HUMAN ANATOMY AND PHYSIOLOGY   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   Marks: Internal:40 External:60 Total:100

                                                                                          End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students

- Discuss all the organelles of an animal cell and their function.
- Perceive structure and functions of the various types of systems of human body.
- Outline about eye, ear and Endocrine glands of human
- Learn organs and structures involving in system formation and functions.
- Infer basic understanding of the inter connection of various organ systems in human body

COURSE OUTCOMES

Upon completion of this course, students will be able to

- Explain the basic structure and functions of cells and organells .
- Outline the anatomy and physiology of cardiac and nervous system).
- Illustrate the working mechanism of human respiratory and musculoskeletal system .
- Infer the functions of digestive, excretory and lymphatic system .
- Model the sensory and endocrine systems of human body .

UNIT I   CELL   9

Structure of Cell– Organelles and description–Function of each component of the cell–Membranepotential–Action Potential–Generation and Conduction –Electrical Stimulation. Blood Cell–Composition –Origin of RBC–Blood Groups–Estimation of RBC, WBC and Platelet-Tissues and its functions-.Homeostasis - Tissue: Types – Specialized tissues– functions.

UNIT II CARDIAC AND NERVOUS SYSTEM   9

Heart, Major blood vessels– Cardiac Cycle – ECG-Conducting system of heart--importance of blood groups – identification of blood groups- Nervous Control of Heart-Cardiac output–Coronary and Peripheral Circulation–Structure and function of Nervous tissue–Neuron-Synapse-Reflexes-Receptors-Brain-Brainstem-Spinalcord–Reflexaction.

UNIT III RESPIRATORY SYSTEM AND MUSCULOSKELETAL SYSTEM   9

Physiological aspects of respiration–Trachea and lungs -Exchange of gases–Regulation of Respiration -Disturbance of respiration function -Pulmonary function test-Types of respiration -Oxygen and carbon dioxide transport and acid base regulation-Muscles-tissue-types-structure of skeletal muscle-types of muscle and joints.

UNIT IV DIGESTIVE,EXCRETORY AND LYMPHATIC SYSTEM   **9**

Organisation of GI System, Digestion and absorption –Movements of GI tract–Intestine-Liver-Pancreas- Structure of Nephron–Mechanism of Urine formation–Urine Reflex–Skin and SweatGland–Temperature regulation, Lymphatic: Parts and Functions of Lymphatic systems–TypesofLymphaticorgansandvessels.

UNIT V EYE, EAR&ENDOCRINE GLANDS   **9**

Optics of Eye–Retina–Photochemistry of Vision–Accommodation-Neurophysiology of vision–EOG, Physiology of internal ear–Mechanism of Hearing–Auditory Pathway, Hearing Tests–Endocrine-Pituitary and thyroid glands.

                                                  Total:45

TEXTBOOKS

    1**.** Textbook Equity Edition, Anatomy and Physiology : Volume 2 of 3, Lulu.com, 2014

REFERENCE BOOKS

1. William F. Ganong, Review of Medical Physiology, Mc Graw Hill, New Delhi, 26th Edition, 2019
2. Arthur C. Guyton, Text book of Medical Physiology, Elsevier Saunders, 12th Edition, 2011

WEBSITES

1. https://dth.ac.in/medical/course.php
2. https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

CO-PO MAPPING

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

23BEBMEOE02   ARTIFICIAL ORGANS AND IMPLANTS   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for students is to

- Have an overview of artificial organs &transplants
- Describe the principles of implant design with a case study
- Explain the implant design parameters and solution
- Study about various blood interfacing implant
- Study about soft tissue replacement and hard tissue replacement

COURSE OUTCOMES

Upon completion of this course, students will be able to

- Outline the concepts of organ replacements.
- Infer the principles of implant design.
- Interpret the implant design parameters.
- Summarize the functions of neural and cardiovascular implants.
- Illustrate the artificial organ implants in gastrointestinal and cosmetic applications.

UNIT I ARTIFICIAL ORGANS & TRANSPLANTS   9

ARTIFICIAL ORGANS:-Introduction, Outlook for organ replacements, Design consideration – Evaluation process.

TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, Individual organs –kidney, liver, heart and lung, bone marrow, cornea.

UNIT II   PRINCIPLESOFIMPLANTDESIGN   9

Principles of implant design - body response to implants, Clinical problems requiring implants for solution, The missing organ and its replacement, Tissue engineering, scaffolds, Biomaterials, Regenerative medicine & Stem cells.

UNIT III IMPLANT DESIGN PARAMETERS AND ITS SOLUTION   9

Biocompatibility, Local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration. Limb prosthesis, Externally Powered limb Prosthesis.

UNIT IV   BLOOD INTERFACING IMPLANTS   9

Neural and neuromuscular implants, Heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, Prosthetic cardiac valves, Artificial kidney-dialysis membrane and artificial blood.

UNIT V   IMPLANTABLE MEDICAL DEVICES AND ORGANS   9

Gastrointestinal system, Dentistry, Soft tissue replacement & Hard tissue replacement –sutures, surgical tapes, adhesive, percutaneous implants, internal fracture fixation devices, joint replacements. Maxillofacial and craniofacial replacement, Recent advancement and future directions.

Total :45

TEXT BOOKS

1. Kopff W.J, Artificial Organs, John Wiley and sons, New York, 1st edition, 1976
2. Park J.B, Biomaterials Science and Engineering, Plenum Press, 2011

REFERENCES

1. J D Bronzino, Biomedical Engineering handbook Volume II, (CRC Press / IEEE Press), 2000.
2. R S Khandpur, Handbook of Biomedical Instrumentation, Tata Mc Graw Hill, 2003
3. Joon B Park, Biomaterials – An Introduction, Plenum press, New York, 1992.
4. Yannas, I. V, ―Tissue and Organ Regeneration in Adults‖, New York, NY: Springer, 2001.
5. Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph.D, Bronzino, Clinical Engineering‖, CRC Press, 1st edition, 2010.
6. Standard Handbook of Biomedical Engineering & Design , Myer Kutz, McGrawHill, 2003

WEBSITES

1. https://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	1	-	1	1	1	-	1	-	-
CO2	2	1	-	-	-	1	1	1	1	1	-	1	-	-
CO3	2	1	-	-	-	1	1	1	1	1	-	1	-	-
CO4	2	1	-	-	-	1	-	1	1	1	-	1	-	-
CO5	2	1	-	-	-	1	-	1	1	1	-	1	-	-
Avg	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**-**

LIST OF OPEN ELECTIVES

BIOTECHNOLOGY

23BTBTOE01	**BASIC BIOINFORMATICS**	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

END SEMESTER EXAM:3 HOURS

COURSE OBJECTIVES

The goal of this course is for students to

- Elaborate the available tools and databases for performing research in bioinformatics.
- Expose students to sequence alignment tool in bioinformatics.
- Construct the phylogenetic trees for evolution.
- Discuss the 3D structure of protein and classification.
- Acquire basic knowledge in protein secondary structure prediction.

COURSE OUTCOMES

Upon completion this course, the students will be able to

- Summarize the basic concepts of bioinformatics.
- Outline the sequence retrieval and analysis tools using bioinformatics.
- Infer the methods used to construct phylogenetic tree for evolution analysis.
- Apply the protein structure knowledge for modeling
- Make use of bio-informatics principles towards biological applications

UNIT I OVERVIEW OF BIOINFORMATICS   **9**

Aims and tasks of Bioinformatics-applications of Bioinformatics-challenges and opportunities. The scope of bioinformatics; bioinformatics & the internet; useful bioinformaticssites. Data acquisition: sequencing DNA, RNA & proteins; determination of protein structure; gene& protein expression data; protein interaction data. Databases– contents, structure & annotation: fileformats; annotated sequence databases; miscellaneous databases.

UNIT II RETRIEVAL OF BIOLOGICAL DATA   **9**

Data retrieval with Entrez & DBGET/ LinkDB; data retrieval with SRS (sequence retrieval system).Searching sequence databases by sequence similarity criteria: sequence similarity searches; amino acid substitution matrices; database searches, FASTA & BLAST; sequence filters; iterative database searches & PSI-BLAST. Multiple-sequence alignment, gene & protein families: multiple-sequence alignment & family relationships; protein families & pattern databases; protein domain families.

UNIT III   PHYLOGENETICS   9

Introduction to Phylogenetics, Molecular Evolution and Molecular Phylogenetics, Phylogenetic tree, Forms of Tree Representation, Rooted and un-rooted trees, Phylogenetic Tree Construction Methods: Distance based methods- NJ, UPGMA PGMA , cladistics & ontology; building phylogenetictrees; evolution of macro molecular sequences. Sequence annotation: principles of genome annotation annotation tools & resources.

UNIT IV STRUCTURAL BIOINFORMATICS   9

Protein sequence data-bases-Swiss Prot/TrEMBL,PIR, Sequence motifdatabases-Pfam, PROSITE,Protein structure databases, Protein DataBank-SCOP,CATH,KEGG, Chembank, Sequence, structure and function relationship. Conceptual models of protein structure; the relationship of protein three-dimensional structure to protein function; the evolution of protein structure & function; obtaining, viewing& analyzing structural data; structural alignment; classification of proteins of known three-dimensional structure; introduction to protein structure prediction; Protein structure prediction, modeling.

UNITV:MICROARRAYDATAANALYSIS   9

Microarray data, analysis methods; microarray data, tools & resources; sequence sampling &SAGE.Bioinformatics in pharmaceutical industry: informatics & drug discovery; pharmainformatics resources. Basic principles of computing in bioinformatics: running computer software; computer operating systems;software downloading & installation; database management.

Total :45

TEXT BOOKS

1. Dan E krane Michael L Rayme. (2004). Fundamental concepts of Bioinformatics. PearsonEducation.
2. Andreas D Baxevanis B.F. Franchis Ouellette. (2004). Bioinformatics: A practical guide totheanalysis ofgenesandproteins. Wiley-Interscience.
3. DavidW.Mount.(2004).SequenceandGenomeAnalysis. ColdSpringHarborLaboratory.

REFERENCE BOOKS

1. JonathanPevsner.(2015).Bioinformaticsandfunctionalgenomics.wiley-Liss.
2. Rastogi, S. C., Parag Rastogi, and Namita Mendiratta(2013). Bioinformatics Methods AndApplications: Genomics Proteomics And Drug Discovery. 4 th Edition, PHI Learning Pvt.Ltd.,

WEBSITES

1. https://www.ncbi.nlm.nih.gov/pmc/
2. https://biology.mit.edu/faculty-and-research/areas-of-research/computational-biology/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	1	-	-	1	-	-	-	-	-	-	1	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	-	1	1	-	-	-	-	-	2	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	2	-	-
Avg	2.4	1.0	2.0	1.0	1.0	1.0	-	-	-	-	-	1.6	-	-

23BTBTOE02 **FUNDAMENTALS OF NANO BIOTECHNOLOGY** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Impart the skills in the field of nanotechnology and its applications.
- Acquire knowledge in nano particle synthesis and its characterization.
- Gain the basic knowledge on the application of bionanomaterials in biotechnology
- Provide the knowledge in the field of medical nanotechnology.
- Analysis the ethical issues involve in nnanotechnology

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Summarize the basics of nanotechnology and its applications.
- Outline the techniques involves in nanoparticles synthesis and characterization.
- Apply the principles of biomolecules for the fabrication of nanoparticles
- Develop nanoscale devices for the medical applications.
- Analyze the socio-economic and ethical issues in Nano biotechnology.

UNIT I INTRODUCTION 9

Introduction to Nanotechnology: Properties at nanoscale, Scope and Overview, Importance of Nanoscale and Technology, History of Nanotechnology, Future of Nanotechnology: Nano Technology Revolution; Silicon based Technology, Nanotechnology in Different, Application of Nanotechnology

UNIT II NANOPARTICLES 9

Introduction, Types of Nanoparticles, Techniques to Synthesize Nanoparticles, Characterization of Nanoparticles- MEMS/NEMS, Atomic Force Microscopy, Self-assembled monolayers/ Dip- pen Nanolithography, Soft Lithography, PDMS Molding, Nano Particles, Nano wires and Nanotubes. X-ray diffraction technique; Scanning Electron Microscopy with EDX;Transmission Electron Microscopy including high-resolution imaging.

UNIT III BIONANOMATERIALS   9

Bionanomaterials- Introduction, biomolecule for designing nanostructures, properties of DNA and motor proteins, fabrication and applications of DNA nanowires, nanoprinting of DNA, RNA and proteins; DNA nanostrucutres, DNA robot , DNA microarrays, Bio-MEMS, Biological and medical applications of bionanomaterials

UNIT IV MEDICAL NANOTECHNOLOGY   9

Nanomedicine, Nanobiosensor and Nanofludics. Nanocrystals in biological detection, Electrochemical DNA sensors and Integrated Nanoliter systems. Nano-Biodevices and Systems. Fabrication of Novel Biomaterials through molecular self assembly- Small scale systems for in vivo drug delivery- Future nanomachine. Case study on drug delivery ofgold nanoparticles against breast cancer

UNIT V ETHICAL ISSUES IN NANOTECHNOLOGY   9

Introduction, Socioeconomic Challenges, Ethical Issues in Nanotechnology: With Especial Reference to Nanomedicine, Nanomedicine Applied in Nonmedical Contexts, Social Issues Relating to Nanomedicine. Social and Ethical Issues, Economic Impacts, Other Issues, Nanotechnology and Future Socio-economic challenges.

. **Total :45**

TEXT BOOKS

1. Goodsell,D.S. (2004).Bionanotechnology.John Wiley and Sons,Inc.
2. Shoseyov, O. and Levy, I (2008).Nanobiotechnology: Bioinspired Devices and Materialso f the Future. Humana Press.

REFERENCE BOOKS

1. Bhushan,B.(2017).Springer H and book of Nanotechnology.Springer-Verlag BerlinHeidelberg.
2. Freitas JrR.A(2006) Nanomedicine.L and esBiosciences.
3. Kohler,M.andFritzsche,W.(2008).Nanotechnology–AnIntroduction to Nanostructuring Techniques.Wiley-VCH.
4. Niemeyer, C. M., and CA Mirkin, C. A., (2010); NanoBiotechnology II – More concepts,and applications. First edition, Wiley–VCH publications

WEBSITES
1. https://mitnano.mit.edu/
2. https://nptel.ac.in/courses/118102003

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	1	1	-	1	-	-	-	-	-	1	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
CO4	2	-	1	1	1	-	-	-	-	-	2	-	-	-
CO5	3	2	2	2	-	-		2	-	-	-	-	-	-
Avg	2.4	1.6	2.0	1.3	1.0	-	-	2.0	-	-	1.5	-	-	-

LIST OF OPEN ELECTIVES

FACULTY OF PHARMACY

23BP804ET   PHARMACEUTICAL   REGULATORY   SCIENCE   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.
- Know the process of drug discovery, development and generic product development
- Understand the regulatory approval process and registration procedures for API and drugproducts in various countrie
- Learn the basic understanding of regulations of India with other global regulated markets
- Understand the basics of developing clinical trial protocols

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Explain the process of drug discovery, development and generic product development
- Describe the regulatory approval process and registration procedures for API and drug productsin various countries.
- Understand the regulatory authorities and agencies governing the manufacture and sale ofpharmaceuticals in India and other global regulated markets.
- Explain basic understanding of developing clinical trial protocols
- Understand the concept of pharmacovigilance and its significance.
- Understand the guidance and laws in regulations is regulatory market.

UNIT I NEW DRUG DISCOVERY AND DEVELOPMENT   9

Stages of drug discovery, Drug development process, pre- clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.

UNIT II REGULATORY APPROVAL PROCESS   9

Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.

Regulatory authorities and agencies: Overview of regulatory authorities of India, United States, European Union,   Australia, Japan, Canada (Organization structure and types of applications)

UNIT III REGISTRATION OF INDIAN DRUG PRODUCT IN OVERSEAS MARKET   9

Registration of Indian drug product in overseas market: Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.

UNIT IV CLINICAL TRIALS   9

Clinical trials: Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials.

UNIT V REGULATORY CONCEPTS   9

Regulatory Concepts: Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book.

Total :45

TEXT BOOKS

1. Drug Regulatory Affairs by Sachin Itkar, Dr. N.S. Vyawahare, Nirali Prakashan.
2. The Pharmaceutical Regulatory Process, Second Edition Edited by Ira R. Berr y and Robert P.Martin, Drugs and the Pharmaceutical Sciences,Vol.185. Informa Health care Publishers.
3. New Drug Approval Process: Accelerating Global Registrations By Richard A Guarino,MD, 5th edition, Drugs and the Pharmaceutical Sciences,Vol.190.
4. Guidebook for drug regulatorysubmissions / Sandy Weinberg. By John Wiley &Sons. Inc.
    FDA Regulatory Affairs: a guide for prescription drugs, medical devices, and biologics/edited by Douglas J. Pisano, David Mantus.
5. Generic Drug Product Development, Solid Oral Dosage forms, Leon Shargel and Isader Kaufer, Marcel Dekker series, Vol.143.
6. Clinical Trials and Human Research: A Practical Guide to Regulatory ComplianceBy Fay A. Rozovsky and Rodney K. Adams.
7. Principles and Practices of Clinical Research, Second Edition Edited by John I. Gallin and Frederick P. Ognibene.
8. Drugs: From Discovery to Approval, Second Edition By Rick Ng.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	3	2	-	-	-	2	-	-
CO2	-	-	-	-	-	3	3	2	-	-	-	2	-	-
CO3	-	-	-	-	-	3	3	2	-	-	-	2	-	-
CO4	-	-	-	-	-	3	3	2	-	-	-	2	-	-
CO5	-	-	-	-	-	3	3	2	-	-	-	2	-	-
Avg	-	-	-	-	-	3	3	2	-	-	-	2	-	-

23BP809ET   **COSMETIC SCIENCE THEORY**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                 End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for students to

- Know the cosmetics in day to day life.
- Understand the formulation characteristics of cosmetic preparations
- Understand the role of herbs in cosmetic science
- Demonstrate the evaluation procedures in the formulation of cosmetics
- Identify the problems encountered during the usage of cosmetics
- Illustrate the role of nutraceuticals in day to day life

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Discover the cosmetics in day-to-day life.
- Formulation's Development and characteristics of various cosmetic products.
- Understand about principles and building blocks of skin and hair care products.
- Understand the role of herbs in cosmetic science
- Understand the principles of cosmetic evaluation including various parameters
- Illustrate the important role of nutraceuticals in day -to -day life.

UNIT I INTRODUCTION   9

Classification of cosmetic and cosmeceutical products definition of cosmetics as per Indian and EU

regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives.

Classification and application.

Skin: Basic structure and function of skin.
Hair: Basic structure of hair. Hair growth cycle.
Oral Cavity: Common problem associated with teeth and gums**.**

UNIT II BUILDING BLOCKS OF SKIN CARE PRODUCTS   9

Principles of formulation and building blocks of skin care products: Face wash, Moisturizing

cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these

products in formulation of cosmeceuticals. **Antiperspants & deodorants**- Actives & mechanism of

action.

Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hairconditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III ROLE OF HERBS IN COSMETICS   9

Sun protection, Classification of Sunscreens and SPF.
Role of herbs in cosmetics: Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove

Analytical cosmetics: BIS specification and analytical methods for shampoo, skin- cream and toothpaste**.**

UNIT IV PRINCIPLES OF COSMETIC EVALUATION   9

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.

UNIT V COSMETIC PROBLEMS   9

Oily and dryskin, causes leading to dryskin, skin moisturisation. Basic understanding of the terms comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

. **Total :45**

TEXT BOOKS

1. Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
2. Cosmetics – Formulations, Manufacturing and Quality Control,

   P.P. Sharma, 4thEdition, Vandana Publications Pvt. Ltd., Delhi.
3. Text book of cosmelicology by Sanju Nanda & Roop K. Khar, Tata Publishers.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	-	-	2	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-	2	-	-
CO3	-	-	-	-	-	2	-	-	-	-	-	2	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	2	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	2	-	-
Avg	-	-	-	-	-	2	-	-	-	-	-	2	-	-

LIST OF OPEN ELECTIVES

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

| 23MBAPOE301 | ORGANISATIONAL BEHAVIOUR | 3H-3C |

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES
 The goal of this course is for the students to
- Understand the basic concepts of organizational behaviour.
- Analyze the individual behaviour traits required for performing as an individual or group.
- Obtain the perceiving skills to judge the situation and communicate the thoughts and ideas.
- Understand how to perform in group and team and how to manage the power, politics andconflict.
- Recognize the importance of organizational culture and organizational change.

COURSE OUTCOMES
Upon completion o fthis course the students will be able to
- Analyse organizational behaviour issues in the context of the organizational behaviour theories and concepts.
- Assess the behaviour of the individuals and groups in organization and manage the stress.
- Manage team, power, politics and conflict arising between the members.
- Explain how organizational change and culture affect the working relationship within organizations.
- Understand and exhibit the communication skills to convey the thoughts and ideas of case analysis to the individuals andgroup.

UNIT I - ORGANIZATION BEHAVIOUR: INTRODUCTION   9

Organization Behavior: Meaning and definition - Fundamental concepts of OB - Contributing disciplines to the OB field – OB Model - Significance of OB in the organization success - Challenges and Opportunities for OB.

UNIT II- BEHAVIOUR AND PERSONALITY   9

Attitudes – Sources - Types - Functions of Attitudes. Values – Importance - Types of Values. Personality – Determinants of personality- Theories of Personality - psycho-analytical, social learning, job-fit, and trait theories.

UNIT III- PERCEPTION   9

Perception – factors influencing perception - Person Perception – Attribution Theory – Frequently Used Shortcuts in Judging Others- Perceptual Process- Perceptual Selectivity - Organization Errors of perception – Linkage between perception and Decision making.

UNIT IV- GROUP AND STRESS MANAGEMENT   9

Foundation of Group Behavior - Types of Groups - Stages of Group Development - Group Norms - Group Cohesiveness – Stress – Causes of stress – Effects of Occupational Stress- Coping Strategies for Stress.

UNIT V- ORGANIZATION CULTURE AND CHANGE   9

Organizational culture- Characteristics of Culture- Types of Culture – Creating and Maintaining an Organizational Culture. Organizational change – Meaning - Forces for Change - Factors in Organizational Change - Resistance to change- Overcoming resistance to change.

Total: 45

SUGGESTEDREADINGS

1. Fred Luthans. (2017). Organizational Behavior: An Evidence - Based Approach, 12thedition, Mcgraw Hill Education, NewDelhi.
2. Steven Mcshane and Mary Ann VonGlinow (2017), Organizational Behavior, 6th edition, McGraw Hill Education, NewDelhi.
3. Robbins, S. P., and Judge, T.A. (2016). Organizational Behaviour.(16thedition).New Delhi: Prentice Hall of India.
4. Laurie J. Mullins (2016), Management and Organisationalbehaviour, 10thedition, Pearson Education, NewDelhi
5. Robbins, S. P., and Judge, T.A. (2016). Essentials of Organizational Behavior.13 edition, Pearson Education.

WEBSITES

1. https://nptel.ac.in/courses/110/105/110105033/

CO-PO MAPPING

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

23PHPOE301   **MATERIAL CHARACTERIZATION**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students**:**

- Study materials is always important, for any application, including fabrication of satellites.
- Introduce various methods available for characterizing the materials. The characterization of materials specifically addresses that portfolio with which researchers and educators must have working familiarity.
- Provide an introduction to materials characterization and its importance
- Discuss different types of characterization techniques and their uses.
- Introduce the students to the principles of optical and electron microscopy, X-ray diffraction and various spectroscopic techniques Introduction:

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Handle with X-ray, thermal, microscopic, and electrical methods of characterization.
- Understand and describe the fundamental principles behind the methods of characterization which are included in the curriculum
- Analyze, interpret and present observations from the different methods.
- Evaluate the uncertainty of observations and results from the different methods.
- Understand the history of materials science with basic understanding of metals, binary alloys, magnetic materials, dielectric materials and polymers

UNIT I- X-RAY TECHNIQUE   9

X-ray techniques for materials characterization X-ray diffraction: Principle, measuring system and applications for characterization of powdered materials. X-ray diffraction profile and analysis: FWHM and line broadening, Crystallite size effect and Scherrer formula, Effect of strain (tensile vs compressive, uniform vs. non-uniform) Introduction to Extended X-ray absorption fine structure (EXAFS), Surface extended X-ray absorption (SEXAFS).

UNIT II- MICROSCOPIC TECHNIQUES   9

Microscopic techniques Principles, instrumentations and applications of Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) for

characterization of different samples. Energy dispersive X-ray microanalysis (EDS) - Basic aspects of Atomic force microscopy (AFM).

UNIT III- SPECTROSCOPIC METHODS   9

Spectroscopic methods Principle, instrumentation and applications of UV-Visible Diffuse Reflectance (UV-Vis DRS) spectroscopy, Ft-Ir, Raman and Fluorescence spectroscopy. Hand of experience on operation of UV-Vis-DRS, FT-IR, Raman and data analysis..

UNIT IV- THERMOANALYTICAL METHODS   9

Thermoanalytical Methods Principle, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Temperature Analysis (DTA) and Differential Scanning Calorometry (DSC). Factors affecting the TGA/DTA/DSC results and their interpretations. Hand on on experience of operation of TG/DSC and data analysis.

UNIT V- ELECTROANALYTICAL TECHNIQUES   9

Electroanalytical Techniques Voltammetric principles, hydrodynamic voltammetry, stripping voltammetry, cyclic voltammetry, criteria of reversibility of electrochemical reactions, quasi-reversible and irreversible processes, qualitative and quantitative analysis current-potential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms and parameters obtainable from voltammograms. Hand on experience on operation of CV and data analysis.

Total: 45

TEXT BOOKS

1. Theory and Applications of UV Spectroscopy, H.H.Jaffe and M.Orchin, IBH-Oxford.
2. Inorganic spectroscopic methods, A.K. Brisdon, Oxford Chem. Primers, 1997, New York.
3. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L.Ho, Wiley Inter science.

REFERENCES BOOKS

1. Introduction to Spectroscopy, Pavia, Brooks/Cole Cenage, 4th edition, 2009, Belmont.
2. Introduction to Photoelectron Spectroscopy, P.K.Ghosh, John Wiley.
3. Fundamental of Molecular Spectroscopy, C. N. Banwell and E. McCash, Tata McGraw Hill, 4th edition, 1994, New Delhi.

WEBSITES

https://onlinecourses.nptel.ac.in/noc22_mm14/preview

CO-PO MAPPING

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

23PHPOE302   **NUMERICAL METHODS AND PROGRAMMING**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- Computational physics may be broadly defined as 'the science of using computers to assist in the solution of physical problems, and to further physics research.
- Equip the students of M.Sc. Physics with knowledge of programming in C, roots of equation, interpolation, curve fitting, numerical differentiation, numerical integration, solution of ordinary differential equations
- Introduce students to computational methods for simulating physical systems and solving problems arising in physics and astronomy, as well as in other related fields
- Computers now play a role in almost every branch of physics like large scale quantum mechanical calculations in nuclear, atomic, molecular and condensed matter physics, large scale calculations in such fields as hydrodynamics, astrophysics, plasma physics, meteorology and geophysics etc.
- The huge increase in the power of computers in recent years has made an impact on the role of computational physics.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Programme numerical methods and their implementation like applying to problem in physics, including modeling of classical physics to quantum system as well as data analysis (Linear and non linear).
- Analysis techniques for propagating error, representing data graphically. Create, solve and interpret basic mathematical tool.
- Program independently computers using leading-edge tools,
- Formulate and computationally solve a selection of problems in physics,

UNIT I   INTRODUCTION   9

Errors, different type of errors. Representation of numbers in computer, computer arithmetic, zero in floating point number.

UNIT II OPERATORS 9

Operators –finite differences, average, differential, etc., their inter-relations. Difference of polynomials. Difference equation. Interpolation. Lagrange's methods, error terms. Uniqueness of interpolating polynomial.

UNIT III INTERPOLATION 9

Newton's fundamental interpolation. Forward, backward and central difference interpolations. Interpolation by iteration. Spline interpolation, comparison with Newton's interpolation. Hermite's interpolation. Bivariate interpolation, Lagrange and Newton's methods. Inverse interpolation.

UNIT IV   APPROXIMATION 9

Approximation of function. Least square method. Use of orthogonal polynomials. Approximation by Chebyshev polynomials, Max-min principle. Economization of power series.

UNIT V PYTHON PROGRAMMING 9

Python Programming –Loops- Conditional statements- Functions- Object-oriented programming- Array computing- 2 and 3d visualizations

Total: 45

TEXT BOOKS

1. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1999
2. W.H. Press, B.P. Flannery et al., "Numerical Recipes: Art of Scientific Computing", 3rd Edition, Cambridge Press, 2007.
3. J. M. Mathews and K. Fink, "Numerical Methods using MATLAB ", 4rd Edition, Prentice Hall Publication, 2004
4. Dr. B.S. Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication.
5. Robert J schilling, Sandra l harries , " Applied Numerical Methods for Engineers using MATLAB and C.", Thomson Brooks/cole.

REFERENCES BOOKS

1. Richard L. Burden, J. Douglas Faires, "Numerical Analysis", Thomson / Brooks/cole
2. John. H. Mathews, Kurtis Fink ,"Numerical Methods Using MATLAB" ,Prentice Hall publication
3. Jaan kiusalaas, "Numerical Methods in Engineering with MATLAB", Cambridge publication

WEBSITES

1. https://archive.nptel.ac.in/content/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	1	-	-	-	1	-	-	-	-	-	-	1	-	-
CO4	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	1	-	-	-	1	-	-	-	-	-	-	1	-	-

B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

23CAPOE301   **ROBOTICS PROCESS AUTOMATION**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSEOBJECTIVES

The goal of this course is for the students

- Learn the concepts of RPA, its benefits, types and models
- Gain the knowledge in application of RPA in Business Scenarios
- Identify measures and skills required for RPA
- Adopt to the implementations of Automation
- Able to process information and draw inference

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Demonstrate the benefits and ethics of RPA
- Understand the Automation cycle and its techniques
- Draw inferences and information processing of RPA
- Understand the Automation concepts
- Implement & Apply RPA in Business Scenarios

UNIT I –INTRODUCTION   9

Introduction to RPA - Overview of RPA - Benefits of RPA in a business environment - Industries & domains fit for RPA - Identification of process for automation - Types of Robots - Ethics of RPA & Best Practices - Automation and RPA Concepts - Different business models for implementing RPA - Centre of Excellence – Types and their applications - Building an RPA team - Approach for implementing RPA initiatives.

UNIT II - AUTOMATION   9

Role of a Business Manager in Automation initiatives - Skills required by a Business Manager for successful automation - The importance of a Business Manager in automation - Analyzing different business processes - Process Mapping frameworks - Role of a Business Manager in successful implementation – Part 1 - Understanding the Automation cycle – First 3 automation stages and activities performed by different people

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UNIT III - AUTOMATION IMPLEMENTATION   9

Evaluating the Automation Implementation Detailed description of last 3 stages and activities performed by different people - Role of a Business Manager in successful completion – Part 2 - Activities to be performed post-implementation - Guidelines for tracking the implementation success - Metrics/Parameters to be considered for gauging success - Choosing the right licensing option - Sending emails - Publishing and Running Workflows

UNIT IV - ROBOT   9

Ability to process information through scopes/systems - Understand the skill of information processing and its use in business - Leveraging automation - Creating a Robot - New Processes. Establish causality by variable behavior - Understand the skill of drawing inference or establishing causality by tracking the behavior of a variable as it varies across time/referenced variable - Leveraging automation for this skill - Robot & new process creation.

UNIT V –ROBOT SKIL   9

Inference from snapshots of curated terms – Omni-source data curation - Multisource trend tracking - Understand the skill of drawing inference from the behavior of curated terms by taking snapshots across systems in reference to time/variable(s) - Leveraging automation for this skill – Robot creation and new process creation for this skill.

Total: 45

TEXT BOOKS

1. Tom Taulli, February 2020. "The Robotic Process Automation Handbook" Apress , Reference Books 1 Steve Kaelble" Robotic Process Automation" John Wiley & Sons, Ltd.
2. Alok Mani Tripathi, March 2018. "Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool", Packet Publishing Limited

WEBSITES

1. https://www.tutorialspoint.com/uipath/uipath_robotic_process_automation_introduction.ht mhttps://www.javatpoint.com/rpa 3
2. https://onlinecourses.nptel.ac.in/noc19_me74/preview

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	--	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	3	2	-	-	-	-	-	-	-	-	-	-
CO5	-	-	3	-	-	-	-	-	2	-	-	-	-	-
Avg	3	3	3	2	-	-	-	-	2	-	-	-	-	-

23BCPOE301	**NUTRITION AND DIETETICS**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students is to

- Understand the Fundamentals of food, nutrients, and their relationship to health
- Identify deriving maximum benefit from available food resources
- Understand the consequences of vitamin and mineral deficiency/ excess vitamin
- Describe the nutrition deficiency diseases and their consequences
- Explain food adulteration and prevention of food adulteration.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Understand the fundamentals of nutrition and their relationship to health
- Identify the maximum benefits from available food resources
- Outline the consequences of vitamin and mineral deficiency/excess vitamin
- Illustrate nutrition deficiency diseases and their consequences
- Explain the sources of food adulteration and measures to prevent it

UNIT I BASIC CONCEPTS   9

Basic concepts in food and nutrition- Understanding relationship between food, nutrition and health, Functions of food- Physiological, psychological and social. Dietary guidelines for Indians food pyramid. Junk foods and its causes**.**

UNIT II NUTRIENTS   9

Nutrients - Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients: Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E and K, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron and iodine

UNIT III PHYSIOLOGICAL CHANGES   9

Physiological changes, RDA, nutritional guidelines, nutritional concerns and healthy food choices -Adult, Pregnant woman, Lactating mother, Elderly. Nutrition during childhood -Growth and development, nutritional guidelines, nutritional concerns and healthy food choices -Infants, Preschool children, School children, Adolescents. Nutritional needs of nursing mothers and infants, determinants of birth weight and consequences of low birth weight, Breastfeeding biology, Breastfeeding support and Counselling, Infant and young child feeding and care - Current feeding practices and nutritional concerns, guidelines for infant and young child feeding, Breast feeding, weaning and complementary feeding. Assessment and management of moderate and severe malnutrition among children, Micronutrient malnutrition among preschool children. Child health and morbidity, neonatal, infant and child mortality.

UNIT IV NUTRITIONAL DEFICIENCY DISEASES   9

Introduction to Nutritional deficiency diseases -Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Flurosis Nutritional needs during pregnancy, common disorders of pregnancy (Anaemia, HIV infection, Pregnancy induced hypertension), relationship between maternal diet and birth. Maternal health and nutritional status, maternal mortality and issues relating to maternal health.

UNIT V DIETETICS   9

Dietetics : Diet for diabetes mellitus-Nutrition recommendations for patient with diabetes, Meal planning, Exchange list of different food groups, Glycemic index based formulation of diet for diabetic individual, Diabetic diets menu wise. Diet for Cardiovascular Diseases -Dietary management and general guidelines for coronary heart disease, Dietary recommendations of WHO. Diet for Acute cardiac diseases. Influence of diet on carcinogenesis, Dietary risk factors and cancers at various sites in the human body, diet therapy, diet for cancer patients, managing eating problems during treatment. Hormonal imbalance-Poly cystic ovarian syndrome, hypogonadism, cushing syndrome. Causes of hormonal imbalance. Treatment- Dietary and stress management protocols to be followed.

Total: 45

SUGGESTED READING

1. Gordon M, Wardlaw and Paul M. (2012).   Perspectives in Nutrition: U.S.A. McGraw Hill Publishers. 9rd Edition. New Delhi
2. Srilakshmi.B.(2014) Nutrition Science:New Age International (P) Ltd.Publishers.4th Edition. New Delhi**.**

3. Srilakshmi.B. (2015) Food Science:. New Age International (P) Ltd. Publishers. 6nd Edition., New Delhi
4. Darshan Sohi (2012). A Comprehensive Textbook of Nutrition & Therapeutic Diets. Jaypee Brothers Medical Publishers Pvt. Ltd.

WEBSITES

1. https://nptel.ac.in/courses/126104004
2. https://onlinecourses.swayam2.ac.in/cec19_ag02/preview

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	1	-	-	-
Avg	2	1	-	-	-	-	-	-	-	-	1.2	-	-	-

23CSPOE301   **CYBER FORENSICS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                End Semester Exam:3 Hours

COURSE OBJECTIVES
The goal of this course is for the students
- Understand about computer forensics and investigations.
- Know about digital evidence and crime.
- Analyse and validate forensics data.
- Know about e-mail investigation.
- Understand about mobile device forensics.

COURSE OUTCOMES
Upon completion of this course the students will be able to
- Define, understand and explain various investigation procedures and summarize duplication of digital evidence.
- Apply the knowledge of digital evidences.
- Design and develop various forensics tools and analyse the network forensics.
- Demonstrate the systematic study of high-tech forensics
- Understand the importance of reports.

UNIT I INTRODUCTION   9

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach–Procedures for corporate high-tech investigations–Data recovery work stations and software– Conducting an investigation.

UNIT II DATA ACQUISITION   9

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 search-seizing digital evidence at the scene-storing digital evidence –Reviewing a case**.**

UNIT III FORENSICS TOOLS   9

Current computer forensics tools–Software tools–Hardware tools–The Macintosh file structure and boot process – Computer forensics analysis and validation – Addressing data –Hiding techniques.

UNIT IV   VIRTUAL MACHINES   9

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions –
email investigations – Investigating e-mail crimes and violations – Understanding e-mail servers –
Cell phone and mobile device forensics.

UNIT V MOBILE DEVICE FORENSICS   9

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

1. Bill Nelson, Amelia Phillips and Christopher Steuart. (2018). Computer Forensics and
   Investigations, Cengage Learning, 5th Edition.
2. Eoghan Casey. (2017). "Handbook of Digital Forensics and Investigation", Academic
   Press, 1st Edition.

REFERENCES BOOKS

1. John R Vacca,.(2016)."Computer Forensics", Cengage Learning, 2nd Edition.

WEBSITES:

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.php
3. www.nptel.ac.in/courses/106101060
4. www.samsclass.info/121/ppt/ch11.ppt
5. www.garykessler.net/library/role_of_computer_forensics.html
6. www.ukessays.com/essays/information-technology/computer-forensics-and-crime
   investigations-information-technology-essay.php

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	2	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	2	-	-
CO5	1	1	1	1	-	-	-	-	-	-	-	2	-	-
Avg	2.2	2.2	2.2	1.8	-	-	-	-	-	-	-	2	-	-

23CMPOE301	**PERSONAL FINANCE AND PLANNING**	**3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- Familiarize with regard to the concept of Investment Planning and its methods
- Examine the scope and ways of Personal Tax Planning;
- Analyze Insurance Planning and its relevance
- Develop an insight in to retirement planning and its relevance.
- Construct an optimal portfolio in real life situations

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Familiarize with regard to the concept of Investment Planning and its methods
- Examine the scope and ways of Personal Tax Planning;
- Analyze Insurance Planning and its relevance
- Develop an insight in to retirement planning and its relevance.
- Construct an optimal portfolio in real life situations

UNIT I - INTRODUCTION TO FINANCIAL PLANNING   9

Introduction to Financial Planning - Financial goals, Time value of money, steps in financial planning, personal finance/loans, education loan, car loan & home loan schemes. Introduction to savings, benefits of savings, management of spending & financial discipline, Net banking and UPI, digital wallets, security and precautions against Ponzi schemes and online frauds such as phishing, credit card cloning, skimming.

UNIT II - INVESTMENT PLANNING   9

Investment Planning - Process and objectives of investment, Concept and measurement of return & risk for various assets class, Measurement of portfolio risk and return, Diversification & Portfolio formation. Gold Bond; Real estate; Investment in Greenfield and brownfield Projects; Investment in fixed income instruments- financial derivatives & Commodity market in India. Mutual fund schemes including SIP; International investment avenues.

UNIT III -PERSONAL TAX PLANNING 9

Tax Structure in India for personal taxation, Scope of Personal tax planning, Exemptions and deductions available to individuals under different heads of income and gross total income, Special provision u/s 115BAC vis-à-vis General provisions of the Income-tax Act, 1961. Tax avoidance versus tax evasion.

UNIT IV - INSURANCE PLANNING 9

Insurance Planning Need for Protection planning. Risk of mortality, health, disability and property. Importance of Insurance: life and non-life insurance schemes. Deductions available under the Income-taxAct for premium paid for different policies.

UNIT V - RETIREMENT BENEFITS PLANNING 9

Retirement Benefits Planning - Retirement Planning Goals, Process of retirement planning, Pension plans available in India, Reverse mortgage, New Pension Scheme. Exemption available under the Income-tax Act, 1961 for retirement benefits.

Total: 45

TEXTBOOKS

1. Indian Institute of Banking & Finance. (2017). Introduction to Financial Planning. New Delhi: Taxmann Publication.
2. Pandit, A. (2014). The Only Financial Planning Book that You Will Ever Need. Mumbai: Network Publications Ltd.
3. Sinha, M. (2008). Financial Planning: A Ready Reckoner. New York: McGraw Hill Education.

REFERENCESBOOKS

1. Halan, M. (2018). Let's Talk Money: You've Worked Hard for It, Now Make It Work for You. New York: HarperCollins Publishers.
2. Tripathi, V. (2017). Fundamentals of Investment. New Delhi: Taxmann Publication.

CO-PO MAPPING

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

23CHPOE301   **CHEMISTRY IN EVERYDAY LIFE**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSEOBJECTIVES

The goal of this course is for the students

- Gain knowledge in the importance of chemistry in food industry.
- Understand the chemistry of medicines and cosmetics.
- Evaluate the solar energy utilization and its storage.
- Knowledge about the production of electricity by a nuclear reactor.
- Know about the chemistry of soaps, detergents and textiles.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Know the importance of chemistry in food industry.
- Understood the chemistry of medicines and cosmetics.
- Evaluate the solar energy utilization and its storage.
- Understood the production process of electricity by a nuclear reactor.
- Know about the chemistry of soaps, detergents and textiles.

UNIT I - IMPORTANCE OF CHEMISTRY IN FOOD   9

Chemicals in food, colouring agents, artificial preservatives, flow stabilizers, binding substance, flavours and sweeteners, antioxidants, minerals, vitamins. Chemistry at the breakfast table, raising agents- gluten, the taste maker- glutamic acid, stimulants-Caffeine, chemistry of onion, garlic and curcumin.

UNIT II - CHEMISTRY IN MEDICINES AND COSMETICS   9

Elements in the human body, drugs and their classification, drug-target interaction, action of different classes of drugs, antiseptics and disinfectants.

Cosmetics: Chemistry behind the lotions, fragrances, talcum powder, sunblock and sunscreen, toothpaste, lipsticks, nail polishes.

UNIT III - CHEMISTRY IN ENERGY 9

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries - photovoltaics - stealing the sun - nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity and the hazards of radioactivity - living with nuclear power.

UNIT IV - IMPORTANCE OF CHEMISTRY IN SOAPS, DETERGENTS AND TEXTILES 9

Detergents and soaps, types of soaps and detergents, saponification, cleansing action of soaps and detergents, perfumes used in soaps.
Textiles: Chemistry behind wool, silk, jute, cotton, glass fibre, polyester, acrylic, nylon, and other raw materials.

UNIT V - CHEMISTRY OF POLYMERS, FUEL AND AGRICULTURE 9

Polymers, types, polyethylene, plastics, disposal of plastics, degradation of polymers and plastics using nano materials. Petrochemistry, petrol, diesel, LPG, CNG, kerosene, oils, and other fuels. Agriculture: fertilizers, herbicides, insecticides, and fungicides.

Total: 45

TEXT BOOKS

1. Tripathy, S. N., &Sunakar Panda (2004). Fundamentals of Environmental Studies (II Edition). New Delhi: Vrianda Publications Private Ltd.
2. Arvind Kumar (2004). A Textbook of Environmental Science. New Delhi: APH Publishing Corporation.
3. Anubha Kaushik, C. P., & Kaushik (2004). Perspectives in Environmental Studies. New Delhi: New Age International Pvt. Ltd. Publications.

REFERENCES BOOKS

1. Seymour R. B., & Charles, E. (2003). Seymour's Polymer Chemistry: An Introduction. Marcel Dekker, Inc.
2. Stocchi. E, (1990). Industrial Chemistry (Vol–I). UK: Ellis Horwood Ltd.
3. Jain, P. C., & Jain, M. (2004). Engineering Chemistry. Delhi: Dhanpat Rai & Sons.
4. Sharma, B. K., & Gaur, H. (1996). Industrial Chemistry. Meerut : Goel Publishing House.

WEBSITES

1. https://nptel.ac.in/courses/104106119
2. https://nptel.ac.in/courses/104105103

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg	2	-	-	2	-	-	-	-	-	-	-	1	-	-

23MBPOE301   **FERMENTATION TECHNOLOGY**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- Encompass the use of microorganisms in the manufacture of food or industrial products on the basis of employment.
- Get equipped with a theoretical and practical understanding of industrial microbiology
- Appreciate how microbiology is applied in the manufacture of industrial products
- Know how to source microorganisms of industrial importance from the environment
- Know about the design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer
- Understand the rationale in medium formulation & design for microbial fermentation, and sterilization of medium and air.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Provides knowledge in the large scale production of industrial product, and teaches the modern employment trends to cater the needs of industry.
- Students will differentiate the types of fermentation processes.
- Understand the biochemistry of various fermentations.
- Identify techniques applicable for Improvement of microorganisms based on known biochemical pathways and regulatory mechanisms.
- Comprehend the techniques and the underlying principles in downstream processing.
- Students can able to explore the practical skills in research activities.

UNIT I - BASICS OF FERMENTATION PROCESSES

Definition, scope, history, and chronological development of the fermentation industry. Component parts of the fermentation process. y. Component parts of fermentation process. Microbial growth kinetics, batch and continuous, direct, dual or multiple fermentations; scaleup of fermentation, comparison of batch and continuous culture as investigative tools, examples of the use of fed batch culture.

UNIT II ISOLATION AND PRESERVATION

Isolation, preservation, and strain improvement of industrially important microorganisms. Use of recombination system (Parasexual cycle, protoplast fusion techniques), application of recombinant strains, and the development of new fermentation products.

UNIT III –SCREENING AND INOCULUM DEVELOPMENT

Screening (primary and secondary screening); detection and assay of fermentation products (Physico-chemical assay, biological assays). Inoculum development, criteria for transfer of inoculum, development of inoculum: Bacteria, Fungi and Yeast.

UNIT IV–MICROBIAL PRODUCTION

Fermentation type reactions (Alcoholic, bacterial, mixed acid, propionic acid, butanediol and acetone-butanol). Microbial production of enzymes (amylases, Proteases, cellulases, pectinases and lipases) primary screening for producers, large scale production. Immobilization methods.

UNIT V – ALCOHOLS AND BEVERAGES

Fermentative production of industrial alcohol, production of beverages. Production of organic acids: citric acid, aminoacids: glutamic acid, production of vitamins. fungal enzymes and Single cell protein.

SUGGESTED READINGS

1. Casida, L.E.2007. Industrial microbiology, New age international (P) Ltd., New Delhi.
2. Clark, D.P and Pazdernik, N.J.2009. Biotechnology applying the genetic revolution, Elsevier Academic Press, UK.
3. Glazer, A and Nikaido.1995. Microbial biotechnology fundamentals of applied microbiology, W.H.Freemn and company, USA.
4. Glick, B.R and Pasternak, J.J.2003. Molecular Biotechnology Principles and Applications of Recombinant DNA, 3rd edition, ASM Press, USA.
5. Harider, S.I. and Ashok, A. 2009. Biotechnology, A Comprehensive Training Guide for the Biotechnology Industry, CRC Press, New York.
6. Sridhar, S.2010. Industrial Microbiology, Dominant Publishers, New Delhi.
7. Tanuja.S and Purohit, S.S. 2008. Fermentation Technology, Agrobios Publication, Jodhpur, India.

CO-PO MAPPING

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

23EGPOE301 **ENGLISH FOR COMPETITIVE EXAMINATIONS** **3H-3C**

Instruction Hours/week: L:3 T:0 P:0 **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSEOBJECTIVES

The goal of this course is for the students

- Train learners to crack competitive exams
- Know of various tools that is essential for competitive exams
- Enhance their ability to speak in english and face an interview.
- Make the student apply, prepare and clear the competitive exams.
- Prepare the student to concentrate, stay positive and confident.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- The student may settle in life with a government job.
- The student may develop various skills
- The successful student may guide other students to success.
- Analyse logical reasoning questions, error analysis, and correct usage of words
- Develop the knowledge of grammatical system of English language.

UNIT I GRAMMAR **9**

Number-Subject, Verb and Agreement-Articles-Sequences of Tenses-Common Errors

UNIT II WORD POWER **9**

Idioms and Phrases-One word substitution-Synonyms-Antonyms-Words often confused

UNIT III PARAGRAPH **9**

Expansion of an idea

UNIT IV WRITING **9**

Essay- Letters-Memos-Agenda-Resume writing

UNIT V SPEAKING **9**

Public Speaking-Group discussion-Interview-Spoken English

Total: 45

TEXT BOOKS

1. V. Saraswathi, Maya K. Mudbhatkal (2014). English for Competitive Examinations. Emerald: Chennai.

WEBSITES

1. https://onlinecourses.nptel.ac.in/noc23_hs52/preview
2. https://onlinecourses.nptel.ac.in/noc22_hs33/preview

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO2	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO3	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO4	-	-	-	-	-	-	-	-	1	2	-	1	-	-
CO5	-	-	-	-	-	-	-	-	1	2	-	1	-	-
Avg	-	-	-	-	-	-	-	-	1	2	-	1	-	-

23BTPOE301	SERICULTURE	3H-3C

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students

- Apply knowledge and skills of seribiotechnology for development new mulberry variety and silkworm breeds suitable for varied agro-climatic zones.
- Apply tools and techniques of biostatics for critical analysis and interpretation of data accrueded.
- Use bioinformatics tools and techniques for the analysis and interpretation of bimolecular data for better understating mulberry and silkworm.
- Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of seribiotechnology.
- Thorough knowledge and application of good laboratory and good manufacturing practices in sericulture and biotech industries.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Know the different components and chain link of sericulture industry.
- Understand concepts of sericulture industry and demonstrate interdisciplinary skills
- Acquired in mulberry plant cultivation and silkworm rearing.
- Demonstrating the Laboratory and field skills in mulberry cultivation and silkworm
- rearing with an emphasis on technological aspects.

UNIT I INTRODUCTION   9

Introduction to Sericulture - History of Sericulture – Sericulture organization in India, By products of silk industry. Mulberry and Non – mulberry silkworm types–Morphology and Life cycle of Bombyxmori

UNIT II MULBERRY CULTIVATION   9

Mulberry Cultivation: Mulberry Varieties – Methods of Irrigation –Nutrient Management and Weed control. Pruning and Harvesting – Crop improvement – Mechanism in Moriculture – Pest and Disease, deficiencies and symptoms in Mulberry.

UNIT III   REARING OF SILKWORM   9

Rearing of silkworm – Rearing Appliances – rearing operation. Harvesting and marketing of cocoons. Cocoon processing and reeling - Appliances used for reeling. Pre reeling process – Cocoon boiling. Reeling technology – re-reeling technology.

UNIT IV SCOPE OF NON-MULBERRY SERICULTURE   9

Non – Mulberry Sericulture Scope of Non-mulberry Sericulture - Non-mulberry silk varieties and fauna, tasar, muga, eri – Silk Production and Marketing – Tropical tasar / muga – Morphology, anatomy grainage

UNIT V DISEASES OF SILKWORM   9

Diseases of silkworm –Pebrine Protozoan, Flacherie bacterial, Nuclear Polyhedrosisviral and Muscardine fungal diseases. Pests of Silkworm.

Total: 45

TEXT BOOKS

1. Krisnamoorthy S., Improved Method of Rearing Young Age Silk Worms: Reprinted by CSB, Bangalore, 1986.

2. Tanaka Y., Sericology, CSB, Pub., Bangalore, 1964.

3. Ullal S.R., and Narasimhan M.N., Hand Book of Practical Sericulture, CSB, Bangalore, 1987.

4. HisaoAruga, Principles of sericulture, Oxford and IBH Publishing Company, 1994.

5. Hrccrama Reddy, G. 1998. Silkworm Breeding, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

6. Otsuki el.al. 1987. Silkworm Egg Production (Translated from Japanese Language), Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCES BOOKS

1. Yasuji Hamamura, 2001 Silkworm Rearing on Artificial Diet (Translated from Japanese Language),Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Mahadevappa, D. Halliyal, V.G., Sankar, D.G and Bhandiwad, R. 2000. Mulberry Silk Reeling Technology, Oxford wild IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Dandin, S.B et.al. 2003. Advances in Tropical Sericulture, National Academy of Sericulture Sciences India, Central Silk Board, Bangalore, India.
4. Ganga G., Sulochanachetty. J. An Introduction of Sericulture. Oxford, New Delhi – 1977.
5. Johnson M., and Kesary M., Sericulture, CSI Press, Marthandam, 2008.
6. Text Book of Tropical Sericulture, Pub., Japan Overseas Volunteers, 1975

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-	-	1	-	-
CO5	2	2	-	2	-	-	2	-	-	-	-	-	-	-
Avg	1.8	1.5	1	1.5	-	-	1.5	-	-	-	-	1	-	-

OPEN ELECTIVES

OFFERED

FROM

COMPUTER SCIENCE AND ENGINEERING

23BECSOE01   **INTERNET OF THINGS**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Understand the basics of Internet of Things.
- Identify an idea of some of the application areas where Internet of Things can be applied.
- Infer the middleware for Internet of Things.
- Express the concepts of Web of Things .
- Examine the concepts of Cloud of Things with emphasis on Mobile cloud computing.
- Inspect the IOT security protocols.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Infer the basic concepts of IoT architecture.
- Identify the communication criteria in IoT network layer.
- Build the basic blocks of an IoT device.
- Examine data analytics tools for decision-making in opeartional environment.
- Analyze real time architecture of IoT systems for communication networks.

UNIT I INTRODUCTION TO IOT   9

Introduction to IoT – IoT Architectures – Core IoT Functional Stack, Sensors and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and Compute Stack, Fog Computing, Edge Computing, Cloud Computing – Sensors, Actuators, Smart Objects, Sensor networks. Middleware for IoT: Overview – Communication middleware for IoT – IoT Information Security, WSN and Sensing Model.

UNIT II IOT COMMUNICATION   9

Communications Criteria – Access Technologies – IP as IoT Network Layer – Business case – Optimization – Profiles and compliances – Application Protocols – Transport Layer – Application Transport Methods.

UNIT III DESIGN METHODOLOGY 9

Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV DATA ANALYTICS FOR IOT 9

Data Analytics for IoT – Big Data Analytics Tools and Technology – Edge Streaming Analytics – Network Analytics Applications. Security history, challenges, variations – Risk Analysis Structures – Application in Operational Environment.

UNIT V IOT IN INDUSTRY 9

Manufacturing, Architecture, Security Protocols – Utilities, Grid Blocks - Smart Cities, Architecture, Use cases – Transportation, Architecture, Use cases.

Total: 45

TEXT BOOKS

1. Honbo Zhou "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2013
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer Berlin, 2011
3. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010

REFERENCE BOOKS:

1. Olivier Hersent, Omar Elloumi and David Boswarthick,"The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2018
2. Olivier Hersent, David Boswarthick, Omar Elloumi,"The Internet of Things – Key applications and Protocols", Wiley, 2019

WEBSITES:

1. https://www.javatpoint.com/iot-internet-of-things
2. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
3. https://www.tutorialspoint.com/internet_of_things/index.htm
4. https://www.startertutorials.com/blog/physical-design-of-iot.html
5. https://www.guru99.com/iot-tutorial.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	3
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	3
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	3
CO4	3	3	2	1	-	-	-	-	1	1	-	1	-	3
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	3
Avg	3	2	2	1	-	-	-	-	1	1	-	1	-	3

23BECSOE02   **MACHINE LEARNING**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to
- Introduce the basic concepts and techniques of Machine Learning.
- Understand Supervised and Unsupervised learning techniques.
- Study the various probability based learning techniques.
- Learn Dimensionality Reduction Techniques.
- Infer Evolutionary Models and Graphical models of machine learning algorithms.

COURSE OUTCOMES

Upon completion of this course, the students will be able to
- Infer the basics of machine learning techniques and its types.
- Apply machine learning algorithms for a given problem.
- Build mathematical relationships using machine learning algorithms.
- Examine the art of machine learning to predictive data analytics.
- Analyze machine learning algorithms to enhance classification efficiency..

UNIT I: MACHINE LEARNING BASICS   9
Introduction to Machine Learning (ML) - Essential concepts of ML – Types of learning – Machine learning methods based on Time – Dimensionality – Linearity and Non linearity – Early trends in Machine learning – Data Understanding Representation and visualization.

UNIT II: MACHINE LEARNING METHODS   9
Linear methods – Regression -Classification –Perceptron and Neural networks – Decision trees – Support vector machines – Probabilistic models —Unsupervised learning – Featurization

UNIT III: MACHINE LEARNING IN PRACTICE   9
Ranking – Recommendation System - Designing and Tuning model pipelines- Performance measurement – Azure Machine Learning – Open-source Machine Learning libraries – Amazon's Machine Learning Tool Kit: Sagemaker

UNIT IV: MACHINE LEARNING AND DATA ANALYTICS 9

Machine Learning for Predictive Data Analytics – Data to Insights to Decisions – Data Exploration – Information based Learning – Similarity based learning – Probability based learning – Error based learning – Evaluation – The art of Machine learning to Predictive Data Analytics.

UNIT V: APPLICATIONS OF MACHINE LEARNING 9

Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

Total: 45

TEXT BOOKS

1. Ameet V Joshi, Machine Learning and Artificial Intelligence, Springer Publications, 2020

2. John D. Kelleher, Brain Mac Namee, Aoife D' Arcy, Fundamentals of Machine learning for Predictive Data Analytics, Algorithms, Worked Examples and case studies, MIT press,2015

REFERENCES

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer Publications, 2011
2. Stuart Jonathan Russell, Peter Norvig, John Canny, Artificial Intelligence: A Modern Approach, Prentice Hall, 2020 3. Machine Learning Dummies, John Paul Muller, Luca Massaron, Wiley Publications, 2021

WEBSITES

1. https://www.tutorialspoint.com/machine_learning/index.htm
2. https://www.hackerearth.com/practice/machine-learning/challenges-winning-approach/machine-learning-challenge-one/tutorial/
3. https://www.javatpoint.com/machine-learning
4. https://www.geeksforgeeks.org/machine-learning/

CO-PO MAPPING

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

23BECSOE03   **BLOCKCHAIN TECHNOLOGIES**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
                                                 End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Comprehend the importance of the Blockchain framework and its practical uses.
- Scrutinize the verification of Bitcoin transactions through the utilization of the Blockchain.
- Recognize the constituent elements of smart contracts required for achieving consensus in a Permissioned Blockchain.
- Furnish the essential infrastructure and boost the effectiveness, efficacy, and transactions of diverse business procedures by utilizing Hyperledger.
- Examine the scope of utilization of Blockchain in diverse governmental and non-governmental entities.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Interpret block elements in a blockchain cryptographic methods.
- Apply consensus algorithm in securing the networks.
- Build permissioned blockchain for asset transfer.
- Identify the transaction flow in Hyperledger fabric and validation process.
- Apply blockchain adoption in Non-Governmental and Governmental organizatio

UNIT I INTRODUCTION   9
Introduction – Block Structure – Architecture – Block Header – Genesis Block – Merkle Trees – Hashing - Signature & Encryption Schemes – Business Applications

UNIT II BITCOIN BASICS   9
Bitcoin Basics – Wallet - Decentralized Consensus – Aggregate transactions - Proof of Work – Miners – Consensus Algorithms – Double Spending - Verifying Transactions – Fork – Reward

UNIT III PERMISSIONED BLOCKCHAIN   9

Permissioned Block Chain – Smart Contracts - Consensus – Raft – Byzantine – Paxos – Degree of Decentralization – Asset Transfer - Enterprise Application

UNIT IV FABRIC ARCHITECTURE   9

Fabric Architecture – Transaction Flow – Channel – Ordering Service –Membership & Identity Management – Network Setup – Hyperledger Composer – Roles – Network Administration

UNIT V BLOCKCHAIN USE CASES & SECURITY   9

Financial Services – Supply Chain – Government – Digital Identities – Land Record Registry – Security Overview – Membership & Access Control – Privacy

Total: 45

TEXT BOOKS

1. Andreas M. Antonopoulos, "Mastering Bitcoin", 2nd Edition, O'Reilly Media, 2017
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", 1st Edition, O'Reilly Media, 2017

REFERENCE BOOKS

1. Nitin Gaur, Luc Desrosiers, Et al, "Hands-On Blockchain with Hyperledger", Packt Publisher, June 2018
2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publisher, March 2017

WEBSITES

1. https://nptel.ac.in/courses/106105184
2. https://www.hyperledger.org/projects/fabric
3. https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html
4. https://www.javatpoint.com/blockchain-tutorial

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	3
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	3
CO3	3	2	1	-	1	-	-	-	1	1	-	1	-	3
CO4	3	2	1	-	1	-	-	-	1	1	-	1	-	3
CO5	3	2	1	-	1	-	-	-	1	1	-	1	-	3
Avg	2.8	1.8	1	-	1	-	-	-	1	1	-	1	-	3

23BECSOE04   **CLOUD COMPUTING**   **3H-3C**
Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**
End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Learn the basic concepts of cloud computing.
- Learn types of cloud services and its applications.
- Understand the key components of Amazon Web Services.
- Collaborate with real time cloud services.
- Understand the security risk and application of cloud computing.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Infer the basic concepts of cloud computing and its usage.
- Outline the types of cloud computing services.
- Illustrate the functions collaborating with cloud application.
- Identify the importance of virtualization along with their technologies.
- Categorize cloud management and administration tools for application development.

UNIT I CLOUD INTRODUCTION   9

Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications, Business models around Cloud – Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus – Open Nebula, CloudSim.

UNIT II CLOUD SERVICES AND FILE SYSTEM   9

Types of Cloud services : Software as a Service - Platform as a Service – Infrastructure as a Service - Database as a Service - Monitoring as a Service – Communication as services. Service providers - Google App Engine, Amazon EC2, Microsoft Azure, Sales force. Introduction to MapReduce, GFS, HDFS, Hadoop Framework.

UNIT III COLLABORATING WITH CLOUD   9

Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing ,Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools –

Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

UNIT IV ABSTRACTION AND VIRTUALIZATION   9

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT V MANAGING AND SECURING CLOUD   9

Managing & Securing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, Establishing Identity and Presence. Case-Studies: Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services

TotaL: 45

TEXT BOOKS:

1. John Ritting house & James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2018.
2. Rao M.N., Cloud Computing, PHI Learning Private Limited, 2018.

REFERENCES:

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition), 2015.
2. Antohy T Velte , Cloud Computing : "A Practical Approach", McGraw Hill,2018.

WEBSITES:

1. https://nptel.ac.in/courses/106105167/
2. https://www.javatpoint.com/cloud-computing

CO-PO MAPPING

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

OPEN ELECTIVES

OFFERED

FROM

ARTIFICIAL INTELLIGENCE

AND DATA SCIENCE

23BTADOE01   **FUNDAMENTALS OF DATA SCIENCE**   **3H-3C**

Instruction Hours/week:L:3 T:0 P:0   **Marks:**Internal**:40** External**:60** Total**:100**

End Semester Exam: 3Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Study the basic concepts of Data Science and data life cycle
- Understand the theoretical and mathematical aspects of Data Science models
- Learn common random variables and their uses, and with the use of empirical distributions
- Obtain the knowledge in data management tools
- Explore the major techniques for data science

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Identify the key concepts in data science and data processing.
- Apply sampling and probabilistic models to a real time application.
- Make use of data normalization and data management tools.
- Distinguish between supervised and unsupervised machine learning techniques.
- Inspect different analytics used in business intelligence.

UNIT I INTRODUCTION   9

The Big Picture: What is Data Science? –The data life cycle: pre-processing, analysis, post-processing – Pre-processing: Data gathering, cleansing, visualization, and understanding (Mean, Variance, Standard Deviation. Percentiles.)–Data Storage (Relational databases, e.g. MySQL)

UNIT II PROBABILISTIC MODELS   9

Sampling – Probability Models for Statistical Methods: Discrete and continuous probability distributions, density functions. Random variables, expected values, variance, correlation.

UNIT III NORMALIZATION   9

Data Normalization (z-values, transforms) –Random processes –Data Management: Tools for Data Analysis, Case Study: Data analysis using Python-Arrays, Visualization.

UNIT IV DATA MINING 9

Major Techniques in Data Science: Data mining, Data warehousing, Data mining vs Data warehouse–Machine Learning- Supervised Learning, Unsupervised Learning.

UNIT V BUSINESS INTELLIGENCE AND ANALYTICS 9

Business Intelligence –Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics– Cloud computing-definition, Cloud services, types of clouds, some of commercial and non commercial cloud service providers.

TOTAL: 45

TEXT BOOKS:

1. Glenn J. Myatt, Wayne P. Johnson, Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining, John Wiley & Son Publication, Second Edition, 2014.
2. Saltz Jeffrey S, An Introduction to Data Science, Sage Publications Inc, Second Edition, 2019.

REFERENCE BOOKS:

1. Murtaza Haider, Getting Started with Data Science: Making Sense of Data with Analytics, IBM Press, First Edition, 2015.
2. Peter Bruce & Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly Publication, First Edition, 2017.

WEBSITES:

1. https://www.inferentialthinking.com/chapters/intro
2. https://swayam.gov.in/nd1_noc20_cs36/preview
3. https://swayam.gov.in/nd1_noc19_cs60/preview
4. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO2	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	3	2	1	-	-	-	-	1	1	-	1	-	2
CO5	3	3	2	1	-	-	-	-	1	1	-	1	-	2
Avg	**3**	**2.4**	**1.4**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**-**	**2**

B.E COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)   **2023-2024**

23BTADOE02   FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE   **3H-3C**

Instruction Hours/week:L:3 T:0 P:0   **Marks:** Internal**: 40** External**:60** Total**:100**

End Semester Exam: 3Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in AI
- Represent knowledge in solving AI problems.
- Illustrate the different ways of designing software agents
- Know the various applications of AI.

COURSE OUTCOME

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

- Apply search algorithms in real world scenarios.
- Identify methods of knowledge representation.
- Examine description logic and conceptional dependencies.
- Inspect strategies for optimal decision-making in the context of game-playing scenarios.
- Categorize the properties of Markov process and the concept of transition probabilities.

UNIT I INTRODUCTION   9

Introduction: Objective, scope and outcome of the course Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. Analysis of search methods. A* algorithm, and their analysis. Introduction to Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION   9

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression, semantic Tableau. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction, theorem proving, inferencing, monotonic and non monotonic reasoning. Introduction to prolog.

UNIT III NETWORK-BASED REPRESENTATION 9

Network-based representation and reasoning, Semantic networks, Conceptual Graphs, frames. Description logic (DL), concept language, reasoning using DL. Conceptual dependencies (CD), scripts, reasoning using CD. Introduction to natural language processing.

UNIT IV GAME THEORY 9

Adversarial search and Game theory, classification of games, game playing strategies, prisoner's Dilemma. Game playing techniques, minimax procedure, alpha-beta cut-offs. Complexity of alpha-beta search. Automated planning, classical planning problem, forward planning, partial order planning, planning with proposal logic, hierarchical task planning, multiagent planning.

UNIT V FUZZY LOGIC 9

Reasoning in uncertain environments, Fuzzy logic, fuzzy composition relation, operations on fuzzy sets. Probabilistic reasoning, Bayes theorem, construction of Bayesian networks, belief propagation. Markov processes and Hidden Markov models.

TOTAL: 45

TEXT BOOKS:

1. "Artificial Intelligence",ElaineRich,Kevin Knight,Mc-GrawHill,2020.
2. "Introduction to AI & Expert System",Dan W.Patterson,PHI,2020.

REFERENCE BOOKS:
1. "Artificial Intelligence" by Luger (Pearson Education),2020.
2. Russel&Norvig, "Artificial Intelligence: A Modern Approach",Pearson Education,2020.

WEBSITES:

1. https://www.pluralsight.com/blog/data-professional/fundamentals-of-artificial-intelligence

CO-PO MAPPING

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

23BTADOE03   **INTERNET PROGRAMMING**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks:** Internal**: 40 External:60 Total:100**

End Semester Exam:3Hours

COURSE OBJECTIVES

The goal of this course is for the students

- Recall fundamental tags used in HTML5 and CSS to create simple web application.
- Rephrase the concept to create static and dynamic webpage with validation controls and event handling methods.
- Make use of servlets and JSP tag to develop server-side scripting.
- Summarize the tags in PHP and XML to create simple php web application.
- Interview the basic concept and tags are used in web service application using ajax.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Develop a basic website using HTML and Cascading Style Sheets.
- Build dynamic web page with validation using Java Script objects and event handling mechanisms.
- Examine server-side programs using Servlets and JSP.
- Model a web pages in PHP and represent data in XML format.
- Develop web service application using Ajax.

UNIT I – WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0   9

Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls – CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II - CLIENT-SIDE PROGRAMMING   9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, -Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III – SERVER-SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web ServerDATABASE CONNECTIVITY: JDBC perspectives, JDBC program example – JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code

UNIT IV – PHP AND XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions – File handling – Cookies – Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V – INTRODUCTION TO AJAX AND WEB SERVICES 9

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

TOTAL: 45

TEXT BOOKS:

1. Anuratha A Puntembekar,"Internet Programming", Technical Publication,2020.
2. John Dean, "Web Programming with HTML5,CSS and JavaScript",Jones & Partleft Learning,2018.
3. Sriram K Vasudevan, Meenakshi Sundaram, and Chandni Suresh"Essential of Internet Programming"DreamTech Press,Willey,2015.

REFERENCE BOOKS:

1. Abiket Nagane,"Internet Programming II",Nirali Prakashan,2016.
2. Max Bramer,"Web Programming With PHP and MySQL",A Practical guide,Springer,2015
3. Gopalan N.P. and Akilandeswari J., ―Web Technology‖, Prentice Hall of India, 2011.
4. UttamK.Roy, ―Web Technologies‖, Oxford University Press, 2011.

WEBSITES:

1. https://www.geeksforgeeks.org/internet-and-web-programming/
2. http://www.eie.polyu.edu.hk/~em/it0506pdf/4%20Internet%20Programming.pdf

3. https://www.techopedia.com/definition/23898/web-programming
4. https://www.tutorialspoint.com/internet_technologies/index.htm

CO-PO MAPPING

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

23BTADOE04   **ROBOTICS AND AUTOMATION**   **3H-3C**

Instruction Hours/week: L:3 T:0 P:0   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students

- Introduce the functional elements of Robotics.
- Impart knowledge on the forward and inverse kinematics.
- Interpret the manipulator differential motion and control.
- Educate on various path planning techniques.
- Understand about hydraulics system.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Interpret basic concept of robotics fundamental principles, components, and applications of robotic systems.
- Identify the dynamics of robotic systems and implications for planning and control.
- Utilize the principles of state estimation and steps involved in the Kalman filtering process.
- Identify the components, working principles, applications of Pneumatic and Hydraulic system.
- Utilize the principles of fluidic devices and fluidic logic circuits. automation.

UNIT I KINEMATICS CONCEPTS   9

Introduction – Actuators – Sensors – Rigid body – coordinate systems – Kinematics – Forward Kinematics & Inverse Kinematics – Velocity Kinematics – Angular velocity – Linear velocity – Singularity – Force and torque.

UNIT II MOBILE ROBOTS   9

Dynamics – Mobile Robots – Planning and Control – Path & Trajectory planning – Probabilistic Roadmaps – Localization.

UNIT III PROBABILISTIC METHODS FOR ROBOTICS   9

Basics of probability – Kalman Filtering – Extended Kalman – Particle filter – Localization – Computer Vision – Vision Based Controls.

UNIT IV AUTOMATION FUNDAMENTALS AND PRINCIPLES   **9**

Automation – Basic Laws and Principles – Basic Pneumatic and Hydraulic system – Pumps and compressors – Fluid accessories.

UNIT V ELECTRICAL AND ELECTRONIC CONTROLS   **9**

Cylinders and Motors – Control valves – Circuits – Pneumatic logic circuits – Fluidics – Electrical and electronic controls – Transfer devices and Feeders.

TEXT BOOKS:

1. "Robot Modeling and Control", Mark W.Spong,Seth Hutchinson and Vidyasagar. M, Wiley Publishers, Second Edition, 2020.
2. "Robot Building for Beginners", David Cook, Apress Publishers, Third Edition, 2015.

REFERENCE BOOKS:

1. "Industrial Automation and Robotics", Gupta. A.K and S.K Arora, University Science Press, Third Edition, 2013.
2. "Industrial Robotics", Groover. M.P, Weiss. M, Nageland. R.N and Odrej. N.G, Tata McGraw Hill, Singapore, Second Edition, 2017.
3. "Embedded Systems & Robotics", Ghoshal. S, Cengage Learning, First Edition, 2009.
4. "Introduction to Robotics Mechanics and Control", John J.Craig, Pearson Education, Third Edition, 2009.

WEBSITES:

1. www.nptel.ac.in/courses/112/101/112101099/
2. www.nptel.ac.in/courses/112/101/112101098/
3. www.toptal.com/robotics/programming-a-robot-an-introductory-tutorial
4. www.cyberbotics.com/doc/guide/tutorial-1-your-first-simulation-in-webots
5. www.ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO2	2	1	-	-	-	-	-	-	1	1	-	1	-	2
CO3	3	2	1	-	-	-	-	-	1	1	-	1	-	2
CO4	3	2	1		-	-	-	-	1	1	-	1	-	2
CO5	3	1	1		-	-	-	-	1	1	-	1	-	2
Avg	2.6	1.4	1	-	-	-	-	-	1	1	-	1	-	2

LIST OF

MANDATORY COURSES

SEMESTER-I

23BEMC111   **DESIGN THINKING**   **3H-2C**

Instruction Hours/week: L:1 T:0 P:2   **Marks: Internal:40 External:60 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to
- Illustrate design thinking concepts and principles
- Utilize design thinking methods in every stage of the problem
- Identify the different phases of design thinking
- Plan for various product and service communication in design thinking
- Interpret the use of tools for the design process

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Explain the design thinking process, tools and theories.
- Identify the types of users and the requirements of customers.
- Explore the concepts of Prototyping and its testing.
- Analyze design thinking strategies in product and service design.
- Customize existing products by utilizing design thinking strategies.

UNIT I INTRODUCTION   6

Understanding Design thinking and tools - Human-Centric Design Process - Design Thinking Process - DT Activity with case studies.

UNIT II EMPATHISE WITH USERS   6

Five Whys - Needs of user - Types of user research -Customer Journey Mapping - Observational Research

UNIT III PROTOTYPING   6

Ideas to presentable concepts - Scenario-based Prototyping – Testing prototypes - Usability and ergonomic testing - Rapid prototyping.

UNIT IV PRODUCT AND SERVICE DESIGN   6

Product Design - Interaction Design - Service Design - Communication Design - Transportation Design.

UNIT V DESIGN AND INNOVATION 6

DT For strategic innovations - Extreme Competition - Experience design - Standardization - Humanization - Creative Culture.

Total : 30

TEXT BOOKS

1. BalaRamadurai, "Karmic Design Thinking", 2020.
2. Christian Mueller-Roterberg, "Handbook of Design thinking", Amazon Digital Services LLC - KDP Print US, 2018.
3. Tim Brown, "Change by Design", Harper Business Publisher, 2019
4. HassoPlattner, ChristophMeinel and Larry Leifer, "Design Thinking: Understand Improve – Apply", Springer, 2011
5. IdrisMootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	-	-	-	1	1	1	-	3	-	2
CO2	3	2	1	-	-	-	-	2	1	1	-	3	-	2-
CO3	3	2	2	1	-	2	1	2	2	2	-	3	-	2
CO4	3	3	2	1	-	2	1	2	2	2	-	3	-	2
CO5	3	3	2	1	-	2	1	2	2	2	-	3	-	2
Avg	2.8	2.2	1.6	1	-	2	1	1.8	1.6	1.6	-	3	-	2

23BEMC151 SPORTS AND YOGA

Instruction Hours/week: L:1 T:0 P:0Marks: Internal**:100** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to
- Have knowledge of Physical fitness and exercise management to lead better quality life
- Enable to officiate, supervise various sports events and organize sports events
- Acquire the knowledge of Physical Education, Sports and Yoga and understand the purpose and its development
- Gain knowledge to plan, organize and execute sports events

COURSE OUTCOMES

Upon completion of this course the students will be able to:
- Practice physical activities and yoga for strength, flexibility and relaxation.
- Use techniques for increasing concentration and decreasing anxiety for stronger academic performance.
- Perform yoga exercises in various combination and forms.
- Improve personal fitness through participation in sports and yoga activities.
- Follow sound nutritional practices for maintaining good health and physical performance.

UNIT I   INTRODUCTION TO PHYSICAL FITNESS

Explain importance of physical education - Describe importance of Physical Fitness & Wellness - Explain the components of physical fitness - Demonstrate healthy life style -   Prevent health threats by changing life style

UNIT II FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN SPORTS & YOGA

Explain importance of anatomy and physiology - Describe effects of exercise in various body systems - Describe concept of correct posture - Explain corrective measures for posture deformities.

UNIT III YOGA & PRANAYAMA

Explain importance of yoga - Perform various pranayama for increasing concentration - Use meditation and other relaxation techniques for improving concentration.

TEXT BOOKS

1. AjmerSingh, ModernTrendsandPhysical Education class 11&class12, KalyaniPublication,NewDelhi
2. B.K.S. Iyengar, LightonYoga, Thomson's Publication, New Delhi,
3. V.K.Sharma, HealthandPhysicalEducation, NCERT Books; Class11,12 Saraswati HousePublication, NewDelhi
4. AcharyaYatendra, YogaandStressManagement, FingerprintPublishing
5. Swami Vivekanand, PatanjaliYogaSutras, Fingerprint PublishingISBN:9389567351.
6. Ramdev, PranayamRahasya, Patanjali-DivyaPrakashan, HaridwarISBN:978-8189235017
7. Ramdev, YogaitsPhilosophy&Practice, DivyaPrakashan,Haridwar.

23BEMC152   தமிழர் மரபும் பண்பாடும்   **1H - 0C**

Instruction Hours/week: L:1 T:0 P:0 Marks: Internal:**100** Total:**100**

End Semester Exam:3 Hours

பாடத்திட்டபயன்விளைவு

- வரலாற்றிற்குமுற்பட்டதமிழகத்தைமாணவர்களுக்குஅறிமுகப்படுத்துதல்

- பழந்தமிழர்பண்பாடுசார்ந்தவாழ்க்கைமுறையைமாணவர்கள்அறியஊக்குவித்தல்

- தமிழ்மொழியின்பழைமையும், திராவிடமொழிகளில்தமிழ்மொழியின்தனிச்சிறப்பையும்மாணவர்களுக்குஅறிமுகப்படுத்துதல்.

- தமிழர்களின்வாழ்வியல், தமிழர்கலைகள், ஆற்றங்கரைப்பண்பாடுகள்குறித்துமாணவர்கள்அறியச்செய்தல்.

- இந்தியக்குடியுரிமைப்பணிமுதலானபோட்டித்தேர்வுகளில்விருப்பப்பாடமாகஇடம்பெறுகின்றதமிழ்நாகரிகமும்பண்பாடும்குறித்தமுழுமையானஅறிமுகம்பெற்றிருத்தல்

பாடத்திட்டப்பொதுநோக்கம்

1. இந்தியக்குடியுரிமைப்பணிமுதலானபோட்டித்தேர்வுகளில், விருப்பப்பாடமாகஇடம்பெறுகின்ற,'தமிழ்இலக்கியவரலாறு' குறித்தமுழுமையானஅறிமுகம்பெற்றிருத்தல்.

2. கல்வெட்டியல்,ஓலைச்சுவடியியல்மற்றும்தொல்லியல்சார்ந்தஆவணத்தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களைஅணுகுதல்.

3. தமிழின்வளர்ச்சித்துறையாகிய,   'அறிவியல்தமிழ்';'இணையதமிழ்' குறித்தபன்நோக்குஅணுகுமுறையிலானஆய்வுச்சிந்தனைமேம்பாடு.

4. வேலைவாய்ப்புக்குரியசுயதிறன்மேம்பாட்டுடன், படைப்பாக்கத்திறன்மேம்பாடும்பெற்றிருத்தல் .

5. சமுதாயமற்றும்வாழ்வியல்மதிப்புகளைப்பேணுவதற்குக்கருவியாகஇலக்கியங்களை நாடுகின்றமனப்பான்மைவளர்ச்சி.மொழிபெயர்ப்புத்துறைசார்ந்தவேலைவாய்புத்திற ன்பெற்றிருத்தல்.

அலகு:1 தமிழர்மரபு

மரபு-விளக்கம்-சங்ககாலதமிழர்மரபு – திணைப்பகுப்பும்தமிழர்மரபும்-உலகப்பொதுமை – அகத்திணைமரபு – புறத்திணைமரபு- இடைக்காலத்தமிழர்மரபு – பிற்காலமரபும்மாற்றமும் – தற்காலதமிழர்மரபு - வளர்ச்சி.

அலகு: 2 தமிழர்பண்பாடு

பண்பாடு – விளக்கம் – பழந்தமிழர்பண்பாடு – இயற்கைசார்ந்தவாழ்வியல் – தமிழர்சமயம் – அரசியல்நிலை–சமூகப்பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல்அறங்கள் – வணிகம்போன்றவை.

அலகு:3 தமிழர்கலைகள்

தமிழகத்தில்கலைகளின்வளர்ச்சி – சிற்பக்கலைவளர்ச்சி –கோயில்கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை– இசைக்கலைபோன்றவை.

அலகு: 4 தமிழர்சமயம்

பழந்தமிழரின்சமயம் – சங்ககாலசமயம் – தொல்காப்பியத்தில்சமயம் – சைவசமயம் – வைணவம் – தமிழ்ப்பண்பாட்டில்பௌத்தம் – தமிழ்ப்பண்பாட்டில்சமணத்தின்தாக்கம்– தமிழ்ப்பண்பாட்டில்இசுலாம்மற்றும்கிறித்துவசமயத்தின்தாக்கம்-தமிழர்பண்பாட்டில்

விழாக்கள்-   கோயில்களும்   விழாக்களும்-சமூகஒருங்கிணைப்பில்விழாக்களின்பங்கு-சங்கஇலக்கியத்தில்விழாக்கள்பற்றியகுறிப்புகள்-இடைக்கால

இலக்கியங்களில்விழாக்கள்பற்றியசெய்திகள்   –   விழாக்களின்சமூகப்பங்களிப்பு   – தற்காலத்தில்தமிழர்விழாக்கள் – விளையாட்டும்விழாக்களும்.

அலகு: 5 இலக்கியங்களில்தமிழர்பண்பாட்டுப்பதிவுகள்

சங்கஇலக்கியமும்வாழ்வியலும்-திருக்குறளில்வாழ்வியல்நெறிகள் –
இரட்டைக்காப்பியங்களும்வாழ்வியலும் – சிற்றிலக்கியங்களில்வாழ்வியல்பதிவுகள்-
இக்காலஇலக்கியமும்வாழ்வியலும்.

பார்வைநூல்கள்:

1. தமிழ்இலக்கியவரலாறு – தமிழண்ணல், மீனாட்சிபுத்தகநிலையம்- மதுரை-
   இரண்டாம்பதிப்பு-ஜூலை – 2000.

2. தமிழர்நாகரிகமும்பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப்பதிப்பகம், சென்னை,
   திருத்தியபதிப்பு – 2022.

3. தமிழர்வரலாறும்பண்பாடும், நா. வானமாமலை, நியூசெஞ்சுரிபுக்ஹவுஸ், சென்னை,
   ஆறாம்பதிப்பு - 2007 .

4. தமிழகவரலாறுமக்களும்பண்பாடும், கே.கே. பிள்ளை, உலகத்தமிழராய்ச்சிநிறுவனம்,
   சென்னை.

SEMESTER-II

23BEMC251   **SOFT SKILLS**   **1H - 0C**

Instruction Hours/week: L:1 T:0 P:0Marks: Internal**:100** Total**:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to

- Encourage all round development of the students by focusing on soft skills.
- Make the students aware of critical thinking and problem-solving skills.
- Develop leadership skills and organizational skills through group activities.
- Function effectively with heterogeneous teams.
- Develop social and work-life skills as well as personal and emotional well-being.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.

UNIT I COMMUNICATION SKILLS

Introduction, meaning, significance of soft skills –definition, significance, types of communication skills -Intrapersonal & Inter-personal skills

UNIT II CRITICAL THINKING

Active Listening –Observation –Curiosity –Introspection –Analytical Thinking –Open-mindedness –Creative Thinking- Public Speaking

UNIT III PROBLEM SOLVING & DECISION MAKING

Meaning & features of Problem Solving –Managing Conflict –Conflict resolution –Methods of decision making –Effective decision making in teams –Methods & Styles - Time Management

Total :15

TEXT BOOKS

1. Personality Development and Soft Skills (English, Paperback, MitraBarun K.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, DrShikhaKapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)
3. Soft skills: personality development for life success by Prashant Sharma, BPB publications,2018

SEMESTER-II

23BEMC252 WOMEN SAFETY AND SECURITY   **1H - 0C**

Instruction Hours/week: L:1 T:0 P:0   **Marks:** Internal:**100** Total:**100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course is for the students to
- Highlight the social construction of gender in Indian society and the role of social institutions in the socialization process.
- Make aware about the practical issues concerning gender and politics.
- Classify the students in engendering national policies and programmes.
- Observe the liability of women and women's work in the context of globalization.
- Acquaint knowledge about the political participation of women and the gendered structures of governance and polity.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Infer into the basic concepts related to sex, gender, femininity etc.
- Demonstrate the rationale for women's studies
- Compare Gender Equality Issues and Movements in Women's Studies
- Summarize the Social construction of Gender, Gender Roles and Genderstereotyping.
- Illustrate Social Structures, Changing Status of Women in India.

UNIT I FUNDAMENTAL CONCEPTS OF WOMEN'S STUDIES

Definition- Objectives of Women's Studies; Importance of Women's Studies; Women's Studies as an Academic Discipline; Role of UGC Centre for Women's Studies

UNIT II SOCIAL EMPOWERMENT

Women in Higher Education; Gender issues in Health, Environment, Family welfare Measures, Indecent representation of Women in media; Women in Difficult circumstances; Constitutional.

UNIT III POLITICAL EMPOWERMENT

Women leaders in politics-Women in Local Governance- Barriers- Reservation policies- Women's Political Rights, Property Rights - Violence against Women -Women's work

Total :15

TEXT BOOKS

1. Amy s. Wharton. (2005). "the sociology of gender: an introduction to theory and research". (keythemes in sociology) blackwell publishing, uk, indian reprint, kilaso books, new delhi.
2. Devakijain and pam rajput (ed). (2003). "narratives from the women"s studies
   Family: recreating knowledge, sage, and new delhi.
3. Jasbirjain (ed). (2005). "women in patriarchy: cross cultural". Rawat publication jaipur.

SEMESTER-III

23BEMC351 APTITUDE AND REASONING   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0Marks: Internal:100 External:0 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the studentsis to

- Categorize, apply, and use thought processes to distinguish between concepts of Quantitative methods.
- Prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- Critically evaluate numerous possibilities related to puzzles.
- Understand and solve puzzle-related questions from specific and other competitive tests.
- Solve questions related to Time and distance and time and work etc.

COURSE OUTCOMES

Upon completion of this course, the students will be able to

- Explain the basics of quantitative ability.
- Solve questions related to Logaraithm, Permutation and Combinations, Probability, Basic Accountancy, Time, Speed, distance, work, Ratio and area etc.
- Utilize satisfactory competency in Verbal Reasoning Questions.
- Solve campus placements aptitude papers covering Quantitative Ability and verbal skills.
- Apply Quantitative and Verbal reasoning in puzzle-related questions.

UNIT -I 1. QUANTITATIVE ABILITY (BASIC MATHEMATICS)

1.1. Number Systems
1.2. LCM and HCF
1.3. Decimal Fractions
1.4. Simplification
1.5. Square Roots and Cube Roots
1.6. Problems on Ages
1.7. Surds & Indices
1.8. Percentages

UNIT II 2. QUANTITATIVE ABILITY (APPLIED & ENGINEERING MATHEMATICS)

2.1. Logarithm
2.2. Permutation and Combinations
2.3 Probability
2.4 Profit and Loss

2.5 Simple and Compound Interest

2.6. Time, Speed and Distance

2.7. Time & Work

2.8. Ratio and Proportion

2.9. Area

2.10 Mixtures and Allegation

UNIT III 3. VERBAL - APTITUDE

1.1 Words

1.2 Idioms

1.3 Phrases in Context

1.4 Reading comprehension techniques

1.5 Narrative sequencing

1.6 Data interpretation

Total :15

TEXTBOOKS

1. A Modern Approach to Verbal & Non-Verbal Reasoning By R S Agarwal

2. Analytical and Logical Reasoning BySijwali B S

3. Quantitative aptitude for Competitive examination By R S Agarwal

4. Analytical and Logical Reasoning for CAT and other management entrance tests By Sijwali B S

5. Quantitative Aptitude by Competitive Examinations by AbhijitGuha 4th edition

WEBSITES

1. https://prepinsta.com/

2. https://www.indiabix.com/

3. https://www.javatpoint.com/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO2	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO3	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO4	-	-	-	-	-	-	-	1	2	3	-	2	-	-
CO5	-	-	-	-	-	-	-	1	2	3	-	2	-	-
Avg	-	-	-	-	-	-	-	1	2	3	-	2	-	-

SEMESTER-III

23BEMC352   FOREIGN LANGUAGE GERMAN   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0Marks: Internal:100 External:0 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVE:

The goal of this course is for the students to,

- Discuss topics utilizing basic vocabulary from a variety of themes/topics including:
- use correct verb forms (conjugation)
- Identify the correct gender and plural forms of nouns and use appropriate pronouns
- distinguish between the nominative and accusative cases (definite and indefinite articles)
- Identify numbers for use in counting, dates, and telling time

COURSE OUTCOMES:

Upon completion of this course the students will be able to,

- Learn the proper pronunciation of words
- Use two tenses of verbs(present tense and present perfect),in the active voice;
- Conduct simple conversations in German by using learned patterns;
- Translate short passages of German to English;
- Use German language in e-communication

UNITI:Herzlichwillkommen!   -WieistdeinName   ?   -IchtrinkegernKaffee.-Wirkonjugieren die Verben.

UNITII: A bit of history and ZAHLEN - Verben, W-Fragen, Ja-Nein Fragen, Imperativ-das Alphabet, die Woche, das Jahr -Was sinddeineHobbys ?Formular ausfüllen

UNITIII: Mein Lehrbuch | MeinepersönlichenDaten-MeinArbeitsbuch -WirbeginnenLektion - WirlesenLektion 3

UNITIV:formeller Brief- Wielernst du Deutsch ? -Wirhöreneindeutsches Lied- Wirlernen Hörverständnis | WirbeginnenLektion

UNITV :Eine E-Mail schreiben | EineWohnungbeschreiben- ImKaufhaus | Welche/Diese-Gesund und munter

Total: 15

TEXTBOOKS

1. NETZWERK Deutsch alsFremdsprache A1(Goyal, New Delhi, 2015)
2. Schulz-Griesbach: Deutsch alsFremdsprache. Grundstufe in einem Band (for Grammar)

WEBSITES

1. https://www.tatsachen-ueber-deutschland.de/en
2. https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html

SEMESTER-III

23BEMC352   FOREIGN LANGUAGE FRENCH   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0Marks: Internal:100 External:0 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVE

The goal of this course is for the students to

- Facilitate students to develop proficiency in communication in French Language and to be globally competent
- Develop creative and innovative abilities using French Language, to meet the challenges of the constantly evolving industry and to identify entrepreneurial opportunities
- Enable students to be leaders and develop inter personal skills to perform effectively in diverse teams of MNC using French Language.
- Appraise the students of the different customs, traditions, sociohistorical aspects and trends in French society and literature.
- Assess and interpret authentic documents in French Language

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Explain linguistic requirements of French Language grammar and vocabulary
- Demonstrate basic written communicative skills with emphasis on creative writing in French Language.
- construct syntactically correct answers in basic French Language comprehension
- Develop basic oral skills in French Language for possible situations.
- Use of French Language in e-communication

UNIT I Recognize the French letters, Identify the letter-combinations that are characteristic of the French language, Identify the remaining letter-combinations that are characteristic of the French language,

UNIT II Use the imperative in the affirmative form, Say the time in French, Talk about the weather in French, .Talk about actions that just happened, Speak about actions that are yet to happen

UNIT III Learn a few basic and commonly used 2nd group verbs, Understand the concept of French 'modal verb, Learn a few basic and commonly used 3rd group verbs, Learn what reflexive verbs, Distinguish between moods and tenses

UNIT IV Place an order in a restaurant, Learn a third past tense, .Identify a direct object, Identify an indirect object, Use direct and indirect objects pronouns in a single sentence

UNIT V Learn the various positions of the object pronouns -   Use object pronouns in the negative imperative -   Use object pronouns in the affirmative imperative -   Learn the word order specific to the indirect object pronouns associated with the 3rd person singular and plural

Total : 15

TEXT BOOKS

1. Alter Ego - Méthode de Français, A1 (2006): Berthet, Hugot et al., Hachette
2. Alter Ego – Cahier d'activités, A1 (2006): Berthet, Hugot et al., Hachette
3. Écho - Méthode de Français, A1 (2013): Girardet, Pecheur, CLE International

WEBSITES

1. www.leo.org
2. WWW. Nptel.com

SEMESTER-IV

23BEMC451   FOUNDATION OF ENTREPRENEURSHIP   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0   **Marks: Internal:100 External:0 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Equip and develop the learners entrepreneurial skills and qualities essential to undertake¬ business.
- Impart the learners entrepreneurial competencies needed for managing business efficiently and¬ effectively.
- Understand basic concepts in the area of entrepreneurship
- Develop personal creativity and entrepreneurial initiative
- Adopt the key steps in the elaboration of business idea

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Gain entrepreneurial competence to run the business efficiently.
- Undertake businesses in the entrepreneurial environment
- Prepare business plans and undertake feasible projects.
- Be efficient in launching and develop their business ventures successfully
- Monitor the business effectively towards growth and development

UNIT I ENTREPRENEURIAL COMPETENCE

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality-Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur.

UNIT II ENTREPRENEURIAL ENVIRONMENT

Business Environment - Role of Family and Society - Entrepreneurship Development

UNIT III BUSINESS PLAN PREPARATION

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership

UNIT IV LAUNCHING OF SMALL BUSINESS

Finance and Human Resource Mobilization - Operations Planning - Market and Channel Selection - Growth Strategies

UNIT V MANAGEMENT OF SMALL BUSINESS

Monitoring and Evaluation of Business - Effective Management of small Business - Case Studies.

Total :15

TEXT BOOKS

1. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.
2. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.
3. Rajeev Roy ,Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
4. Donald F Kuratko,T.VRao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.

23BEMC452 ESSENCE OFTRADITIONAL INDIANKNOWLEDGE AND HERITAGE   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0Marks: Internal:100 External:0 Total:100

End Semester Exam:3 Hours

COURSE OBJECTIVES

The goal of this course for the students is to

- Impart a holistic understanding about Indian Culture and Thoughts from a Historical perspective.
- Encourage critical appreciation of the Indian thoughts and cultural manifestations.
- Introduce the students to important concepts from the diverse intellectual traditions of India.
- Make use of Indian cultural heritage and various epistemological inquiries.
- Gain knowledge of Indian heritage.

COURSE OUTCOMES

Upon completion of this course the students will be able to

- Understand the cultural diversity
- Infer the need of cultural unty
- Know the Dravidian culture
- Realize the power of Indian educational system called gurukul
- Come to know the concepts of vedic thought

UNIT I INTRODUCTION TO INDIAN THOUGHT AND CULTURE

Plurality of Indian culture - Cultural Diversity and Cultural Unity -Different manifestations of Indian Culture: Indus valley culture -Vedic culture and Dravidian culture.-The Medieval Bhakti Culture

UNIT II TRADITIONAL KNOWLEDGE SYSTEMS OF INDIA

Introduction to the Traditional Indian Education system of Gurukul - Parampara -Understanding Indian Philosophy: Vedic thought and the nine schools of philosophy - Indigenous Knowledge and Women in India

TEXT BOOKS

1. Chatterjee, Satishchandra and DhirendramohanDatta. (2007) Introduction to Indian Philosophy.Rupa Publications, New Delhi.
2. Husain,S. Abid. (2003). The National Culture of India. National Book Trust, New Delhi.

SEMESTER-V

23BEMC551 MOBILE APPLICATION DEVELOPMENT   **2H-0C**

Instruction Hours/week: L:2 T:0 P:0   **Marks: Internal:100 External:0 Total:100**

End Semester Exam:3 Hours

PRE-REQUISITES: JavaProgramming

COURSE OBJECTIVES

The goal of this course for the students is to
- Develop knowledgeabout mobileapplicationdevelopment.
- Understand the building blocks of mobile apps.
- Gain knowledge about graphics and animations in mobile apps.
- Know about testing of mobile apps.
- Learn the advantages and limitations of development frameworks.
- Understandmoreabouthowtodistributeappsonmobilemarketplace.

COURSE OUTCOMES

Upon completion of this course the students will be able to
- Define, understand and explain the overview of android with its states and lifecycle.
- Apply the mobile applications for e-marketing in Android and iPhone.
- Analyze mobile databases and various types of testing.
- Develop the simple android applications.
- Evaluate alternative mobileframeworks,and contrast different programming platforms.
- Implement the android applications in different field with modern tools.

UNIT I

Mobilitylandscape–Mobileplatforms–Mobileappsdevelopment–Overviewofandroidplatform–
Settingupthemobileappdevelopmentenvironmentalongwithanemulator–
Acasestudyonmobileappdevelopment.

UNIT II

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, asynctask, services–States and lifecycle, Notifications, Broadcast
receivers.

UNIT III

Telephony and SMS APIs – Native data handling – On-device file I/O – Shared preferences –
Mobiledatabases such as SQLite, and enterprise data access (via Internet/Intranet). Graphics
and animation –Custom views – Canvas – Animation APIs – Multimedia – Audio/video

playback   and   record–Locationawarenessand
nativehardwareaccess(sensorssuchasaccelerometerandgyroscope).

UNIT IV
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 –Distributingappsonmobilemarketplace.IntroductiontoobjectiveC–iOSfeatures

UNIT V

UI implementation – Touch frameworks – Location aware applications using core location and mapkit – 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 :15

TEXT BOOK

    1.AnubhavPradhanand Anil V Deshpande,Composing Mobile Apps, Wiley,First Edition2014

REFERENCE BOOK

    1.Barry Burd,Android Application Development All-in-one for Dummies, John
      Wiley,FirstEdition2012

WEBSITES

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

SEMESTER-V

23BECY651 UNIVERSAL HUMAN VALUES   **1H-0C**

Instruction Hours/week: L:1 T:0 P:0   **Marks: Internal:100 External:0 Total:100**

End Semester Exam:3 Hours

COURSE OBJECTIVES:

The goal of this course is for students:

- To see the need for developing a holistic perspective of life
- To facilitate the development of a Holistic perspective among students towards life and profession
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct
- To sensitise the student about the scope of life – individual, family (inter-personal relationship), society and nature
- To develop more confidence and commitment to understand, learn and act accordingly

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

- Build comfortable relationship with each other
- Recall technical education without study of human values can generate more problems than solutions
- Infer that lack of understanding of human values is the root cause of most of the present day problems
- Demonstrate that the natural acceptance (intention) is always for living in harmony
- Differentiate between the characteristics and activities of different orders

UNIT I ASPIRATIONS AND CONCERNS

Individual academic – career - Expectations of family – peers - society - nation - Fixing one's goals

UNIT II SELF MANAGEMENT

Self confidence- peer pressure- time management- anger- stress- Personality development- self improvement

UNIT III HARMONY OF THE SELF AND BODY

Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body-Mental and physical health -Health issues- healthy diet- healthy lifestyle -Hostel life

UNIT IV HARMONY IN RELATIONSHIP

Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship- gratitude towards parents, teachers and others - Ragging and interaction-Competition and cooperation -Peer pressure.

UNIT V HARMONY IN THE SOCIETY

Understanding Harmony in the Society- Participation in society- Participation in nature/ existence.

Total : 15

TEXT BOOKS

1. R R Gaur, R Asthana, G P Bagaria,   A Foundation Course in Human Values and Professional Ethics   2nd Revised Edition, Excel Books, New Delhi2019
2. A.N. Tripathi   Human ValuesNew Age Intl. Publishers, New Delhi2004

WEBSITES
1. http://uhv.ac.in
2. http://www.uptu.ac.in
3. http://www.storyofstuff.com

LIST OF
PROJECT WORK

SEMESTER III

23BECY391 FIELD PROJECT / INTERNSHIP I   **2H-1C**

Instruction Hours/week: L:0 T:0 P:2   **Marks: Internal: 100 External:0 Total:100**

End Semester Exam:3 Hours

PRE- REQUISITES: None
COURSE OBJECTIVES

The goal of this course for the students is to
- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES

Upon completion, the students will be able to
- Develop written and oral communication skills in both technical and non-technical Environment and use ICT for effective presentation of the study/internship
- Function effectively as an individual to identify the mathematical concepts, science concepts, Engineering concepts and modern engineering tools necessary to communicate the identified Study /internship
- Engage in independent study to research literature and understand engineering trends in the Identified study
- Apply and analyze the knowledge of engineering concepts to effectively communicate the Results from various publications
- Emphasize the need and abide by professional ethics
- Emphasize the role of engineering concepts on environmental, cultural and social concepts

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2
Avg	3	3	3	3	3	2	2	2	2	2	2	3	3	2

SEMESTER V

23BECY591 FIELD PROJECT/INTERNSHIP II   **2H-1C**

Instruction Hours/week: L:0 T:0 P:2   **Marks:** Internal:**100**External:**0**Total:**100**

End Semester Exam:3 Hours

PRE- REQUISITES: None

COURSE OBJECTIVES

Thegoal of thiscourseforthe students is to

- Be self motivated and diligent professional
- Involve new learning, expanded growth or improvement on the job
- Enable the students to develop their engineering skills

COURSE OUTCOMES

Upon completion , the students will be able to

- Develop written and oral communication skills in both technical and non-technical environment and use ICT for effective presentation of the study/internship
- Function effectively as an individual to identify the mathematical concepts, science concepts, engineering concepts and modern engineering tools necessary to communicate the identified study /internship
- Engage in independent study to research literature and understand engineering trends in the identified study
- Apply and analyze the knowledge of engineering concepts to effectively communicate the results from various publications
- Emphasize the need and abide by professional ethics
- Emphasize the role of engineering concepts on environmental, cultural and social concepts

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2
Avg	3	3	3	3	3	2	2	2	2	2	2	3	3	2

23BECY691   **MINI PROJECT**   **2H-1C**

Instruction Hours/week: L:0 T:0 P:2Marks: Internal:**100** External:**0** Total:**100**

End Semester Exam:3 Hours

PRE- REQUISITES: None
COURSE OBJECTIVES

The goal of this course for the students is 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 into 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.

COURSE OUTCOMES

Upon completion , the students will be able to
- Apply and analyze the engineering concepts to solve the identified research work through literature survey
- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and societal need and validate the results of the identified work leading to publications
- Abide by the norms of professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team and mentor/lead the team
- Communicate effectively through presentation and demonstration of the project and preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project
- Function effectively as an individual to engage in independent learning.

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	Guide and Coordinator
Project Report	20	
Viva-Voce	20	

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2
Avg	3	3	3	3	3	2	2	2	2	2	2	3	3	2

SEMESTER VII

23BECY791	PROJECT WORK PHASE I8H-4C

Instruction Hours/week: L:0 T:0 P:8 Marks: Internal:**40** External:**60** Total:**100**

End Semester Exam:3 Hours

PRE- REQUISITES: None
COURSE 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

COURSE OUTCOMES

Upon completion , the students will be able to

- Apply and analyze the engineering concepts to solve the identified research work through literature survey
- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work
- Design systems using hardware components/software tools considering health, safety and Societal need and validate the results of the identified work leading to publications
- Abide by the norms of professional ethics and meet societal and environmental needs
- Perform in the team, contribute to the team and mentor/lead the team
- Communicate effectively through presentation and demonstration of the project and
   Preparation of the report and video
- Apply the principles of project management and finance during the implementation of the project
- Function effectively as an individual to engage in independent learning

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2
Avg	3	3	3	3	3	2	2	2	2	2	2	3	3	2

SEMESTER VIII

23BECY891   PROJECT WORK AND VIVA VOCE PHASE II   20H-10C

Instruction Hours/week: L:0 T:0 P:20   **Marks:** Internal:**80** External:**120**Total:**200**

End Semester Exam:3 Hours

COURSE OBJECTIVES

- The objective of the project work is to enable the students in convenient groups of not more than 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. Twenty 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.

COURSE OUTCOMES

Upon completion , the students will be able to

- Apply and analyze the engineering concepts to solve the identified research work through Literature survey

- Arrive at an exhaustive list of available engineering tools, and select the tool for implementing the identified research work

- Design systems using hardware components/software tools considering health, safety and Societal need and validate the results of the identified work leading to publications

- Abide by the norms of professional ethics and meet societal and environmental needs

- Perform in the team, contribute to the team and mentor/lead the team

- Communicate effectively through presentation and demonstration of the project and
   Preparation of the report and video

- Apply the principles of project management and finance during the implementation of the Project

- Function effectively as an individual to engage in independent.

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO4	3	3	3	3	3	2	2	2	2	2	3	3	3	2
CO5	3	3	3	3	3	2	2	2	2	2	3	3	3	2
Avg	3	3	3	3	3	2	2	2	2	2	2	3	3	2