R.V.R. & J.C.COLLEGE OF ENGINEERING

(Autonomous)

Regulations (R-20)
Scheme of Instruction, Examinations and Syllabi
for
Four year B.Tech. Degree Programme

(w.e.f. 2020-2021)

Computer Science & Engineering

R.V.R. & J.C.COLLEGE OF ENGINEERING

Accredited by NBA and NAAC with "A+" Grade
Chowdavaram, Guntur- 522019

RVR & JC College of Engineering

Department of Computer Science & Engineering
R20 Regulations B.Tech.(CSE)

Semester - I (First Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT111	Mathematics – I	3	0	30	70	3	BS
2	CS/IT112	Engineering Physics	3	0	30	70	3	BS
3	CS/IT113	Basic Electrical & Electronics Engineering	3	0	30	70	3	ES
4	CS/IT114	Programming for Problem Solving	3	0	30	70	3	ES
5	CS/IT151	Engineering Physics Lab	0	3	30	70	1.5	BS
6	CS/IT152	Basic Electrical & Electronics Engineering Lab	0	3	30	70	1.5	ES
7	CS/IT153	Engineering Graphics and Design Lab	1	4	30	70	3	ES
8	CS/IT154	Programming for Problem Solving Lab	0	3	30	70	1.5	ES
9	CS/IT MC1	Constitution of India	2	0	100	-	-	MC
10		Three-weeks orientation program	-	-	-	-	-	
		TOTAL	**15**	**13**	**340**	**560**	**19.5**	

Category	CREDITS
Basic Science Courses	7.5
Engineering Science Courses	12
TOTAL CREDITS	**19.5**

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Semester - II (First Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT121	Mathematics – II	3	0	30	70	3	BS
2	CS/IT122	Engineering Chemistry	3	0	30	70	3	BS
3	CS/IT123	Digital Electronics	3	0	30	70	3	ES
4	CS/IT124	English for Communication Skills	3	0	30	70	3	HS
5	CS/IT125	Programming in Python	2	0	30	70	2	ES
6	CS/IT161	Engineering Chemistry Lab	0	3	30	70	1.5	BS
7	CS/IT162	Programming in Python Lab	0	2	30	70	1	ES
8	CS/IT163	Computer Engineering Workshop	0	3	30	70	1.5	ES
9	CS/IT164	English Language Communication Skills Lab	0	3	30	70	1.5	HS
10	CS/IT MC2	Environmental Science	2	0	100	-	-	MC
		TOTAL	**16**	**11**	**370**	**630**	**19.5**	

Category	CREDITS
Basic Science Courses	7.5
Engineering Science Courses	7.5
Humanities and Social Science Courses	4.5
TOTAL CREDITS	**19.5**

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Semester - III (Second Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT211	Probability and Statistics	3	0	30	70	3	BS
2	CS/IT212	Discrete Mathematics	3	0	30	70	3	PC
3	CS/IT213	Computer Organization	3	0	30	70	3	PC
4	CS/IT214	Data Structures	3	0	30	70	3	PC
5	CS/IT215	Object Oriented Programming	3	0	30	70	3	PC
6	CS/IT251	Probability and Statistics with R Lab	0	3	30	70	1.5	PC
7	CS/IT252	Data Structures Lab	0	3	30	70	1.5	PC
8	CS/IT253	Object Oriented Programming Lab	0	3	30	70	1.5	PC
9	CSSL1	Skill Oriented Course-I	1	2	100	-	2	SC
10	CS/IT MC3	Design Thinking & Product Innovation	2	0	100	-	-	MC
		TOTAL	**18**	**11**	**440**	**560**	**21.5**	

Category	CREDITS
Basic Science Course	3
Professional Core Courses	16.5
Skill Oriented Basic Course	2
TOTAL CREDITS	**21.5**

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Semester - IV (Second Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT221	Computational Statistics	3	0	30	70	3	BS
2	CS/IT222	Database Management Systems	3	0	30	70	3	PC
3	CS/IT223	Operating Systems	3	0	30	70	3	PC
4	CS/IT224	Software Engineering	3	0	30	70	3	PC
5	CS/IT225	Web Technologies	3	0	30	70	3	PC
6	CS/IT261	Computational Statistics Lab	0	3	30	70	1.5	PC
7	CS/IT262	Database Management Systems Lab	0	3	30	70	1.5	PC
8	CS/IT263	Web Technologies Lab	0	3	30	70	1.5	PC
9	CSSL2	Skill Oriented Course-II	1	2	100	-	2	SC
10	CS/IT MC4	Ethics & Human Values	2	0	100	-	-	MC
		TOTAL	**18**	**11**	**440**	**560**	**21.5**	
Internship of Minimum 6 Weeks is mandatory during Summer Vacation (Will be evaluated in Fifth Semester)								
Registration for Honors/Minor degree permitted in this semester (Maximum Two additional courses are permitted per semester for Honors/Minor								

Category	CREDITS
Basic Science Course	3
Professional Core Courses	16.5
Skill Oriented Basic Course	2
TOTAL CREDITS	**21.5**

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Semester- V (Third Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT311	Automata Theory & Formal Languages	3	0	30	70	3	PC
2	CS/IT312	Computer Networks	3	0	30	70	3	PC
3	CS/IT313	Design & Analysis of Algorithms	3	0	30	70	3	PC
4	CS314	Professional Elective - I	3	0	30	70	3	PE
5	CS315	Open / Job-oriented Elective - I	3	0	30	70	3	OE
6	CS/IT351	Design & Analysis of Algorithms Lab	0	3	30	70	1.5	PC
7	CS/IT352	Data Analysis Lab	0	3	30	70	1.5	PC
8	CS/IT353	Summer Internship	-	-	100	-	1.5	PR
9	CSSL3	Skill Oriented Course – III	1	2	100	-	2	SC
		TOTAL	**16**	**8**	**410**	**490**	**21.5**	

Category	CREDITS
Professional Core Courses	12
Professional Elective Course	3
Open Elective Course/Job Oriented Elective	3
Soft Skills- Skill Oriented Course*	2
Summer Internship	1.5
TOTAL CREDITS	**21.5**

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Semester- VI (Third Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT321	Artificial Intelligence	3	0	30	70	3	PC
2	CS/IT322	Cryptography & Network Security	3	0	30	70	3	PC
3	CS/IT323	Machine Learning	3	0	30	70	3	PC
4	CS324	Professional Elective -II	3	0	30	70	3	PE
5	CS325	Open / Job Oriented Elective - II	3	0	30	70	3	OE
6	CS/IT361	Artificial Intelligence lab	0	3	30	70	1.5	PC
7	CS362	Machine Learning Lab	0	3	30	70	1.5	PC
8	CS/IT363	Term Paper	0	3	100	-	1.5	PR
9	CSSL4	Skill Oriented Course – IV	1	2	100	-	2	SC
		TOTAL	**16**	**11**	**410**	**490**	**21.5**	
Internship minimum of 6 weeks is mandatory during summer vacation. (Will be evaluated in Seventh Semester)								

Category	CREDITS
Professional Core Courses	12
Professional Elective Course	3
Open Elective Course/Job Oriented Elective	3
Skill Advanced Course	2
Project/Term Paper	1.5
TOTAL CREDITS	**21.5**

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Semester -VII (Fourth Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS411	Humanities and Social Sciences (Elective)	3	0	30	70	3	HS
2	CS412	Professional Elective - III	3	0	30	70	3	PE
3	CS413	Professional Elective - IV	3	0	30	70	3	PE
4	CS414	Professional Elective – V (**MOOCS**)	0	0	-	100	3	PE
5	CS415	Open / Job Oriented Elective - III	3	0	30	70	3	OE
6	CS416	Open / Job Oriented Elective – IV (**MOOCS**)	0	0	-	100	3	HS
7	CS451	Internship / Professional Certification	-	-	100	-	3	PR
8	CSSL5	Skill Oriented Course – V	1	2	100	-	2	SC
TOTAL			**13**	**2**	**320**	**480**	**23**	

Category	CREDITS
Professional Elective Courses	9
Open Elective Course/Job Oriented Elective	3
Humanities And Social Science Elective	6
Skill Advanced Course	2
Industrial/Research Internship	3
TOTAL CREDITS	**23**

Semester - VIII (Fourth Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category Code
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS/IT461	Project Work (Project Work, Seminar and internship)	0	12	30	70	12	PR
TOTAL			**0**	**12**	**30**	**70**	**12**	

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Professional Elective Courses				
S.NO	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**CR**
III/IV B.Tech. (Vth Sem)				
CS314				
1.	CSEL01	Digital Image Processing	3-0-0	3
2.	CSEL02	Information Retrieval	3-0-0	3
3.	CSEL03	Data Engineering	3-0-0	3
III/IV B.Tech. (VIth Sem)				
CS324				
4.	CSEL04	Compiler Design	3-0-0	3
5.	CSEL05	Distributed Systems	3-0-0	3
6.	CSEL06	Principles of Cloud Computing	3-0-0	3
7.	*CSEL07	Industry Recommended Course(IRC)*	3-0-0	3
IV/IV B.Tech. (VIIth Sem)				
CS412				
1.	CSEL08	DevOps (LBD)	3-0-0	3
2.	CSEL09	Cyber Security(LBD)	3-0-0	3
3.	CSEL10	Web and Micro Services(LBD)	3-0-0	3
IV/IV B.Tech. (VIIth Sem)				
CS413				
4.	CSEL11	Internet of Things(LBD)	3-0-0	3
5.	CSEL12	Visual Programming(LBD)	3-0-0	3
6.	CSEL13	Natural Language Processing(LBD)	3-0-0	3
7.	*CSEL14	Industry Recommended Course(IRC)*	3-0-0	3

Open Elective courses offered by CSE				
S.NO	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**CR**
1.	CSOL01	Programming with Java	3-0-0	3
2.	CSOL02	Relational Database Management Systems	3-0-0	3

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Skill Oriented Courses			
S.NO	**COURSE NAME**	**L-T-P**	**CR**
Basic Skill Oriented Courses			
CSSL1 Skill Oriented Course - I			
a.	2D-Computer Animation	1-0-2	2
b.	Programming with C++	1-0-2	2
c.	PHP Programming	1-0-2	2
CSSL2 Skill Oriented Course - II			
a.	3D-Computer Animation	1-0-2	2
b.	Linux Programming	1-0-2	2
c.	Mobile Application Development	1-0-2	2
CSSL3	**Skill Oriented Course - III** Soft Skills	1-0-2	2
Advanced Skill Oriented Courses			
CSSL4 Skill Oriented Course - IV			
a.	Automation Testing	1-0-2	2
b.	Object Oriented Modeling and Design	1-0-2	2
c.	Socket Programming	1-0-2	2
CSSL5 Skill Oriented Course - V			
a.	AWS cloud	1-0-2	2
b.	User Interface Design with ReactJS	1-0-2	2
c.	OpenMP & MPI	1-0-2	2
d.	Industry Recommended Course (IRC)*	1-0-2	2

Courses offered for Minor in Computer Science & Engineering

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	CSMR1	Fundamentals of Data Structures	4-0-0	4
2.	CSMR2	Computer Organization and Architecture	4-0-0	4
3.	CSMR3	Operating System Concepts	4-0-0	4
4.	CSMR4	Relational DataBase Management Systems	4-0-0	4
5.	CSMR5	Programming with JAVA	4-0-0	4
6.	CSMR6	Introduction to Algorithms	4-0-0	4
7.	CSMR7	Principles of Software Engineering	4-0-0	4
8.	CSMR8	Computer Networking Concepts	4-0-0	4
• 2 courses to complete through MOOCs with the acceptance of CSE BoS				

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B.Tech. (Hons.) CSE Courses				
S.NO.	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**CR**
		POOL1		
1	CSH11	Advanced Data Structures	4-0-0	4
2	CSH12	Functional Programming	4-0-0	4
3	CSH13	Fuzzy Logic	4-0-0	4
4	CSH14	Computer Graphics	4-0-0	4
		POOL2		
1	CSH21	Advanced Databases	4-0-0	4
2	CSH22	Concurrent Programming	4-0-0	4
3	CSH23	Game Theory	4-0-0	4
4	CSH24	ARM system architecture	4-0-0	4
		POOL3		
1	CSH31	GPU Architectures and Programming	4-0-0	4
2	CSH32	Search Engine Internals	4-0-0	4
3	CSH33	Wireless Sensor Networks	4-0-0	4
4	CSH34	Parallel Algorithms	4-0-0	4
		POOL4		
1	CSH41	Semantic Web Technologies	4-0-0	4
2	CSH42	Deep Learning	4-0-0	4
3	CSH43	Social Network Analysis	4-0-0	4
4	CSH44	Augmented and Virtual Reality	4-0-0	4
		MOOCS		

2 MOOC courses to be done with the acceptance of CSE BoS.

Any of the following two can be opted:

- Knowledge Graphs / Ethical hacking / Digital Forensics / BlockChain Technology.
- Courses from Honors Pools not opted by the concerned student & offered by NPTEL
- Advanced courses offered by NPTEL with the permission of BoS, CSE.

Humanities & Social Sciences Elective for CSE		
S.NO	**COURSE CODE**	**COURSE NAME**
1	HSEL1	Industrial Management and Entrepreneurship
2	HSEL2	Economics for Engineers
3	HSEL3	Introduction to Industrial Management
4	HSEL4	Project Management & Entrepreneurship
5	HSEL5	Human Resources and Organizational Behavior

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Open Elective Courses for CSE (Offered by other Departments)

COURSE CODE	COURSE NAME	COURSE CODE	COURSE NAME
CEOL1	Basic Surveying	CEOL2	Building Materials And Construction
CHOL1	Energy Engineering	CHOL2	Biofuels
EEOL1	Renewable Energy Sources	EEOL2	Utilization of Electrical Energy
MEOL1	Operations Research	MEOL2	Applied Mechanics & Mechanical Engineering
ECOL1	Applied Electronics	ECOL2	Microprocessors and Interfacing
ECOL3	Linear ECs and Applications		

Job Oriented Elective Courses (offered to all branches)

COURSE CODE	COURSE NAME	Dept	COURSE CODE	COURSE NAME	Dept
JOEL01	Big data Processing	CSE	JOEL02	Full Stack Development	CSE
JOEL03	JavaScript Technologies	IT	JOEL04	Cloud Computing using AWS / Azure	IT
JOEL05	DevOps	CSB	JOEL06	Enterprise Programming	CSB
JOEL07	Tableau Software	CSD	JOEL08	Python for Data science	CSD
JOEL09	Interface and programming with IoT Gateway	CSO	JOEL10	IoT Cloud and Data Analytics	CSO
JOEL11	Geospatial Technology	CE	JOEL12	Building Planning	CE
JOEL13	Quantity Estimation	CE	JOEL14	Bio Fuels	ChE
JOEL15	Environmental Engineering	CE	JOEL16	Safety Management	ChE
JOEL17	Non-Conventional Energy engineering	ChE	JOEL18	Biopharmaceutics and Drug design	ChE
JOEL19	Embedded Systems-1	ECE	JOEL20	Embedded Systems-2	ECE
JOEL21	Open Source Systems	CSM	JOEL22	Machine Learning	CSM

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Minor Programs offered by other Departments

- **Minor in Civil Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	CEMR1	Geomatics (Survey, GIS & GPS)	3-1-0	4
2.	CEMR2	Construction Engineering & Management	3-1-0	4
3.	CEMR3	Fundamentals of Structural Engineering	3-1-0	4
4.	CEMR4	Water Resource Engineering	3-1-0	4
5.	CEMR5	Environmental Engineering	3-1-0	4
6.	CEMR6	Geotechnical Engineering	3-1-0	4
7.	CEMR7	Transportation Engineering	3-1-0	4

- **Minor in Chemical Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	CHMR1	Unit Operations	3-1-0	4
2.	CHMR2	Principles of Chemical process calculations	3-1-0	4
3.	CHMR3	Transfer operations	3-1-0	4
4.	CHMR4	Reaction Engineering	3-1-0	4
5.	CHMR5	Industrial Pollution Controll Engineering	4-0-0	4
6.	CHMR6	Principles of Safety Management	4-0-0	4

- **Minor in Mechanical Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	MEMR1	Engineering Mechanics	3-1-0	4
2.	MEMR2	Strength of materials and Fluid mechanics	3-1-0	4
3.	MEMR3	Manufacturing Processes	4-0-0	4
4.	MEMR4	Concepts of Thermal Engineering	3-1-0	4
5.	MEMR5	Concepts of Mechanical Design	3-1-0	4
6.	MEMR6	Computer Aided Design & Manufacturing	4-0-0	4
7.	MEMR7	Additive Manufacturing	4-0-0	4

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- **Minor in Electronics & Communication Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	ECMR1	Electronics Devices & Circuits	3-1-0	4
2.	ECMR2	Digital Logic Design	3-1-0	4
3.	ECMR3	Network Analysis	3-1-0	4
4.	ECMR4	Electronic Circuit Analysis	3-1-0	4
5.	ECMR5	Signals and Systems	3-1-0	4
6.	ECMR6	Microprocessors & Interfacing	3-1-0	4

- **Minor in Electrical & Electronics Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	EEMR1	Electrical Machines Theory & Performance	3-1-0	4
2.	EEMR2	Electrical Power Generation & Utilization	4-0-0	4
3.	EEMR3	Power Systems Engineering	3-1-0	4
4.	EEMR4	Power Converters & Applications	3-1-0	4
5.	EEMR5	Electrical Measurements & Instrumentation	3-1-0	4
6.	EEMR6	Electric Vehicles	4-0-0	4

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Minor Programs offered under Industrial Tracks

- **Minor in Automation & Robotics**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	ARMR1	Robotic Engineering	4-0-0	4
2.	ARMR2	Mechatronics and Microcontrollers	3-1-0	4
3.	ARMR3	Industrial Automation	4-0-0	4
4.	ARMR4	Computer integrated Manufacturing	3-0-0	3
5.	ARMR5	Fluidics and Control Systems	3-1-0	4
6.	ARMR6	Mechanics of Robots	3-1-0	4
7.	ARMR7	3D Printing	4-0-0	4

- **Minor in Cloud Computing**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	CCMR1	Principles of Cloud Computing	3-1-0	4
2.	CCMR2	Cloud Virtualization	3-1-0	4
3.	CCMR3	Cloud Application Development	3-1-0	4
4.	CCMR4	Cloud Security	3-1-0	4
5.	CCMR5	Edge Computing	3-1-0	4
6.	CCMR6	Block Chain Security	3-1-0	4
7.	CCMR7	High Performance Computing	3-1-0	4
8.	CCMR8	Cloud Computing and Distribution Systems (MOOCs)		
9.	CCMR9	Cloud Computing (MOOCs)		

- **Minor in Full Stack Development**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	FSMR1	User Interface Design	3-1-0	4
2.	FSMR2	Client Side Scripting	3-1-0	4
3.	FSMR3	React JS	3-1-0	4
4.	FSMR4	MEAN Stack(Mongo DB, Express, JS, Node JS	3-1-0	4
5.	FSMR5	C# (..Net Framework)	3-1-0	4
6.	FSMR6	Web Application Development using ASP	3-1-0	4
7.	FSMR7	J2ME	3-1-0	4
8.	FSMR8	Modern Application Development (MOOCs)		
9.	FSMR9	Advanced Python Programming (MOOCs)		

- **Minor in Electric Vehicles**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	EVMR1	Energy systems and Electrical Machines	3-1-0	4
2.	EVMR2	Hybrid Electric Vehicles	3-1-0	4
3.	EVMR3	Plug – in Electric Vehicles	3-1-0	4
4.	EVMR4	Electric vehicle power train	3-1-0	4
5.	EVMR5	Autotronics	3-1-0	4
6.	EVMR6	BMS & Charging stations	3-1-0	4

- **Minor in VLSI**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	VLMR1	HDL Programming	3-1-0	4
2.	VLMR2	System Venlog and UVM	3-1-0	4
3.	VLMR3	Synthasis and Formal Verification	3-1-0	4
4.	VLMR4	Design for Testability	3-1-0	4
5.	VLMR5	Physical Design Fundamentals	3-1-0	4
6.	VLMR6	Advanced Physical Design	3-1-0	4

- **Minor in Safety Engineering**

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	SEMR1	Safety Management	4-0-0	4
2.	SEMR2	Chemical Process Safety	4-0-0	4
3.	SEMR3	Hazard Identification and Risk Assessment	4-0-0	4
4.	SEMR4	Fire Technology	4-0-0	4
5.	SEMR5	Environmental Safety	4-0-0	4
6.	SEMR6	Safety in Petroleum and Petrochemical Industries	4-0-0	4

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Semester I (First year)

CS/IT111	Mathematics-I	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. To familiarize the prospective engineers with techniques in basic calculus and linear algebra.
2. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more a level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes:

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

1. Evaluate certain improper integrals apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. Apply Role's theorem which is fundamental application of analysis to Engineering problems.
3. Solve problems related to linear algebra including linear transformations in a Comprehensive manner
4. Find Matrix Eigen values and know diagonalization and orthogonalization.

Course Content:

UNIT I **TextBook-1** **15 Periods**

Evolutes and Involutes, Evaluation of improper integrals: Integrals without infinite limits of integration, Beta function, Gamma function, Relation between beta and gammafunctions (without proof) Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT II **Text Book-1** **15 Periods**

Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin series, Sequences, Series, Series of positive terms, Convergence tests: Comparison test (limit form) D'Alembert's ratio test, Raabe's test for convergence.

UNIT III **Text Book-2** **15 Periods**

Vectors: addition and scalar multiplication, linear dependence and independence of vectors.
Vector space, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank nullity theorem, composition of linear maps, Matrix associated with a linear map.

UNIT IV **Text Book-2** **15 Periods**

Characteristic equation, Eigen values and eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, Eigen basis, Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.

Learning Resources:

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd edition.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 2002.
2. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
3. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

CS/IT112	Engineering Physics	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Introduce the concept of electron motion in periodic potentials and classification of solids, band formation by learning the prerequisite quantum physics.
2. Explain the diode equation and formation of P-N junction from the basics of semiconductors.
3. Introduce interaction of radiation with bulk semiconductors and the relevant Optoelectronic devices with energy band diagrams.
4. Explain the applications of devices in low dimensional materials by understanding the density of states and experimental techniques to be used for measurement of transport properties.

Course Outcomes:

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

1. Demonstrate the necessity of periodical potentials and conditions for explaining the properties and band formation with the help of quantum physics.
2. Explain the theory of P-N junction diode from the basics of semiconductor concepts.
3. Explain the theory and application of Optoelectronic devices.
4. Describe measuring techniques employed in transport phenomena and variation of properties in low dimensions.

Course Content:

UNIT I **CO1** **15 Periods**

Principles of Quantum Mechanics:Wave nature of particles, de Broglie's hypothesis, Davisson and Germer's experiment, Time dependent and Time independent Schrodinger wave equations, Physical significance of wave function, Uncertainty principle, single slit experiment. Particle in a box and extension to 3D box (qualitative treatment only).

Electron Theory of Metals: Salient features of Free electron theory, Fermi - Dirac distribution function, Fermi level, Density of States, Bloch wave function, Kronig-Penney model, E-k curves, Brillouin zones, Effective mass, Degrees of freedom, Distinction of metals, semiconductors and insulators. Concept of hole, Energy band formation insolids.

UNIT II **CO2** **15 Periods**

Semiconductor Physics: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, drift and diffusion equations, Einstein's relation, P-N junction formation, diode equation, Hall effect and applications.

UNIT III **CO3** **15 Periods**

Lasers and Optoelectronic Devices: Direct and Indirect band gap semiconductors, Light-semiconductor interaction: Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Optical loss and gain; Density of states for photons, Semiconducting laser, Homo and Hetero structure lasers with band diagrams, characteristics of laser and LED,PIN diode, Solar cell , working principle andcharacteristics.

UNIT IV **CO4** **15 Periods**

Low Dimensional Structures and Measuring Techniques: Density of states in 2D, 1D and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots. Four-point probe and Van der Pauw measurements for carrier density, resistivity and Hall mobility, Hot-point probe measurement, capacitance-voltage measurements, Parameter extraction from Diode I-V characteristics.

Learning Resources:

Text Book:

1. M.N. Avadhanulu, P.G. Kshirasagar - A Text book of Engineering Physics, S. Chand & Company Ltd., 2018.

Reference Book(s):

1. Donald A.Neeman - Semiconductor Physics and Device : Basic Principle (Fourth edition), TMH, 2012.
2. J.Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
3. B.E.A.Saleh and M.C.Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
4. S.M.Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
5. A.Yariv and P.Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
6. P.Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).

Web Resources:

1. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
2. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

CS/IT113	Basic Electrical & Electronics Engineering	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are :

1. To introduce fundamental laws, basic electrical elements, sources and their characteristics.
2. To develop the ability to apply circuit analysis to AC circuits.
3. To know the principle of operation and characteristics of Diode and transistors.
4. To acquire knowledge on feedback topologies and oscillators.

Course Outcomes:

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

1. Analyse concepts of basic electrical circuits and batteries.
2. Solve problems on AC circuits.
3. Describe the principle of operation and characteristics of Diode and transistors.
4. Summarize feedback topologies and oscillators.

Course Content:

UNIT I **Text Books – 1 & 2 CO1** **16 Periods**

DC Circuits: Batteries: Lead-acid, Nickel-iron, Nickel-Cadmium batteries (Operation only). Elementary calculations for energy consumption. DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.

UNIT II **Text Books – 1 & 2 CO2** **16 Periods**

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

UNIT III **Text Book – 2 CO3** **16 Periods**

Semiconductor Diodes: Semiconductor diode, Zener diode, Half-Wave Rectifier, Full-Wave rectifier, Clippers and Clampers.
Bipolar Junction Transistor: Transistor operation, Common base configuration, Common emitter configuration, Common collector configuration.

UNIT IV **Text Book – 2, Reference Book-4 CO4** **16 Periods**

Amplifiers: Need of biasing, Thermal runaway, Types of biasing-fixed bias, collector base bias, self-bias. Feedback and Oscillator Circuits: Feedback concepts, feedback connection types, Barkhausen criteria, Phase-Shift oscillator, Wien bridge oscillator, Hartley oscillator, Colpitts oscillator.

Learning Resources:

Text Books:

1. Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", 5th Edition, TMH, 2017.
2. M.S. Sukhija, T.K. Nagasarkar, "Basic Electrical & Electronics Engineering", Oxford press, 2012.

Reference Books:

1. V.K. Mehta, "Principles of Electrical Engineering and Electronics", S. Chand, 2010.
2. Mahmood Nahvi and Joseph Edminister, Electric Circuits, 5th Edition, Schaum's outline series, TMH, 2017.
3. S. Salivahanan, A. Vallavaraj, "Electronic Devices and Circuits", TMH, 2011.
4. Robert Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson, 2010.

CS/IT114	Programming for Problem Solving	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to introduce:

1. Basic problem solving process using Flow Charts and algorithms.
2. Basic concepts of control structures in C.
3. Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. Concepts of structures, unions, files and command line arguments in C.

Course Outcomes:

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

1. Develop algorithms and flow charts for simple problems.
2. Use suitable control structures for developing code in C.
3. Design modular programs using the concepts of functions and pointers.
4. Develop code for complex applications using structures and file handling features.

Course Content:

UNIT I **15 Periods**

Introductory Concepts: Block Diagram of Computer, Computer Characteristics, Hardware vs Software, how to Develop a Program, Software Development Life Cycle, Structured Programming, Types of Programming Languages, Introduction to C program, Program Characteristics.
Introduction to C Programming: Character set, Identifiers and Keywords, Data types, Constants, type qualifiers, Declaration and Initialization of variables.
Operators & Expressions: Arithmetic Operators, Unary Operators, Relational and Logical Operators, Assignment Operators, Conditional Operator, Input/ Output functions.

UNIT II **15 Periods**

Control Statements: Branching, Looping, Nested Control Structures, Switch Statement, Break Statement, continue Statement, and Goto Statement
Arrays: Defining an Array, Processing an Array, Multidimensional Arrays & Strings.

UNIT III **15 Periods**

Functions: Defining a Function, Accessing a Function, Function prototypes, Passing Arguments to a Function, Passing Arrays to Functions, Recursion, Storage Classes
Pointers: Fundamentals, Pointer Declarations, Passing Pointers to a Function, Pointers and Arrays, Dynamic memory allocation, Operations on Pointers, Arrays of Pointers.

15 Periods

UNIT IV

Structures and Unions: Defining a Structure, Processing a Structure, User-Defined Data Types, Structures and Pointers, Passing Structures to Functions, Self-Referential Structures, Unions.
Files Handling: Opening and Closing a Data File, Reading and Writing a Data File, Processing a Data File, Unformatted Data Files, Accessing the File Randomly.
Command line arguments, C-preprocessor directives.

Learning Resources:

Text Book:

1. Programming with C (Schaum's Outlines) by Byron Gottfried, Third Edition, Tata McGraw-Hill.

Reference Books:

1. Programming in C by Stephen G. Kochan, Fourth Edition, Pearson
2. C Complete Reference, Herbert Sheildt, TMH., 2000.
3. Programming with C by K R Venugopal&Sudeep R Prasad, TMH., 1997.
4. The C Programming Language by Brian W. Kernighan & Dennis M. Ritchie, Second Edition, Prentice Hall.
5. A Structured Programming Approach Using C by Behrouz A. Forouzan, Richard F. Gilberg, Third Edition, Cengage 2007.

Web References:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

CS/IT151	Engineering Physics Lab	L	P	C
		0	3	1.5

Course Objectives:

The aim and objective of the Lab course on Physics is to introduce the students of B.Tech. class to the formal structure of Physics so that they can use these in Engineering as per their requirement.

1. To familiarize the students with electronic measuring instrumentsand measure various parameters of the optical components.
2. Design/problem solving skills, practical experience are developed through laboratory assignments which provide opportunities for developing team in multidisciplinary environments.
3. To understand the general, scientific concepts and a wide idea on various components &instruments required for technology.

Course Outcomes:

At the end of the course, the student will be to:

1. Use CRO, Function generator, Spectrometer for making measurements.
2. Test the optical instruments using principles of interference and diffraction.
3. Carrying out precise measurements and handling sensitive equipment.
4. Draw conclusions from data and develop skills in experimental design.

List of Experiments:

1. Measurements using Vernier Calipers, Screw Gauge and Spherometer.
2. Newton's rings - Measurement of radius of curvature of plano-convex lens.
3. Determination of Energy band gap of a Semiconductor.
4. Optical fibers – Determination of Numerical Aperture.
5. Diffraction grating - Measurement of wavelengths using Spectrometer.
6. Magnetic field in Helmholtz coil.
7. PhotoVoltaic Cell – Determination of fill factor.
8. Series LCR resonance circuit –Determination of Q – factor.
9. Four probe method apparatus for measurements of resistivity and conductivity
10. Determination of wavelengths using diffraction grating
11. Variation of magnetic field along the axis of a circular current carrying coil
12. Carey Foster's bridge – Determination of Specific Resistance

Reference Book:

Physics Lab Manual: RVR & JCCE, Guntur

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CS/IT152	Basic Electrical & Electronics Engineering Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this lab course are to:

1. To conduct experiments on electrical circuits.
2. To design experimental setups for theorems.
3. To learn Diode characteristics, and basic diode applications as rectifiers and regulators.
4. To learn BJT characteristics and Oscillators.

Course Outcomes:

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

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Use common electrical measuring instruments.
4. Verify the network theorems.
5. Design Zener voltage regulator to meet the specifications.
6. Verify popular BJT applications experimentally.

List of experiments/demonstrations:

1. Familiarization of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (ELCBs), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables and Earthing.
2. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, measurement of basic parameters.
3. Verification of KVL and KCL.
4. Verification of Superposition Theorem.
5. Verification of Thevenin's Theorem.
6. Verification of Norton's Theorem.
7. Determination of choke coil parameters.
8. Characteristics of Silicon, Germanium diodes.
9. Characteristics of Zener diode.
10. Half Wave Rectifier and Full Wave Rectifier.
11. Transistor Characteristics in CE configuration.
12. Characteristics of FET.
13. Self-Bias circuit.
14. Wein Bridge Oscillator.
15. Colpitt's Oscillator.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CS/IT153	Engineering Graphics & Design Lab	L	P	C
		1	4	3

Course Objectives:

The main objectives of this course are to:

1. Expose the students to standards and conventions followed in preparation of engineering drawings.
2. Make them understand the concepts of orthographic and isometric projections
3. Develop the ability of conveying the engineering information through drawings.
4. Make them understand the relevance of engineering drawing to different engineering domains.
5. Develop the ability of producing engineering drawings using drawing instruments.
6. Enable them to use computer aided drafting packages for the generation of drawings.

Course Outcomes:

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

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software.
3. Use the knowledge of orthographic projections to represent engineering information / concepts and present the same in the form of drawings.
4. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
5. Convert pictorial and isometric views of simple objects to orthographic views.

Course Content:

(**UNIT I to IV** shall be taught in conventional drawing method and Unit V shall be taught with the aid of computer)

UNIT I

General: Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.
Conic sections: Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)
Curves: Cycloid, Epicycloid, Hypocycloid and Involute; and Scales

UNIT II

Method of Projections: Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.
Projections of planes: Projections of planes inclined to both the planes, projections on auxiliary planes.

UNIT III

Projections of Regular Solids: Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids: Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections. (Limited to the cutting plane perpendicular to one of the principal plane).

Development of surfaces: Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT IV

Isometric Projections: Principles of Isometric Projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids.
Orthographic Projections: Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).
Perspective Projections: Introduction to Perspective Projection.

UNIT V

Over view of Computer Aided drafting (AutoCAD): Introduction, starting and customizing AutoCAD screen, usage of different menus, toolbars (drawing, editing, dimension, text, object properties.etc), tabs (Object, snap, grid, polar, ortho, otrack.etc.) and command prompt. Setting units, limits, layers and viewports (Isometric, Top, Front, back, etc.). 2D drawings of various mechanical and structural components, electrical and electronic circuits. Orthographic and Isometric views of mechanical castings and simple structures.

Learning Resources:

Text Book:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.

Reference Books:

1. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
3. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
4. (Corresponding set of) CAD Software Theory and User Manuals

CS/IT154	Programming for Problem Solving Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. Basic problem solving process using Flow Charts and algorithms.
2. Basic concepts of control structures in C.
3. Concepts of arrays, functions, pointers and Dynamic memory allocation in C.
4. Concepts of structures, unions, files and command line arguments in C.

Course Outcomes:

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

1. Develop algorithms and flow charts for simple problems.
2. Use suitable control structures for developing code in C.
3. Design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Lab1 Simple computational problems using arithmetic expressions.
Lab2 Problems involving if-then-else & switch.
Lab3 Iterative problems.
Lab4 1D Array manipulation.
Lab5 Problems on 2D arrays and Strings.
Lab6 Function calling mechanisms (Call by value).
Lab7 Function calling mechanisms (Call by reference).
Lab8 Recursive functions.
Lab9 Dynamic memory allocation.
Lab10 Structures and unions.
Lab11 File operations.
Lab12 Command line arguments.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CS/IT MC1	Constitution of India	L	P	C
		2	0	0

Course Objective:

To provide basic information about Indian Constitution.

Course Outcomes:

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

1. Understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws. It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Know how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

Course Content:

UNIT I **10 Periods**

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III,Leading Cases. Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT II **10 Periods**

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT III **10 Periods**

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT IV **10 Periods**

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

Learning Resources:

Text Book:

1. Durga Das Basu, Introduction to the Constitution of India'' (student edition) Prentice - Hall EEE,19th/20th Edition, 2001.

Reference Books:

1. M.V. Pylee, ''An Introduction to Constitution of India'', Vikas Publishing, 2002.

2. Brij Kishore Sharma, ''Introduction to the Constitution of India'', PHI, Learning Pvt.Ltd., New Delhi,2011.

Semester II (First year)

CS/IT121	Mathematics-II	L	P	C
		3	0	3

Course Objectives:

The objective of this course is to extend concepts developed in Calculus to functions of several variables of multivariable calculus and ordinary differential equations and to develop student understanding and skills in the topic necessary for its applications to science and engineering.

Course Outcomes:

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

1. Optimize functions of several variables essential in many engineering problems'.
2. Evaluate double and triple integrals and find areas and volumes.
3. Concepts like divergence, curl in integration of vector functions.
4. Solve differential equations which model physical processes.

Course Content:

UNIT I **15 Periods**

Multivariable Calculus: Limit, continuity and partial derivatives, total derivative
Maxima, minima and saddle points of two variables, Method of Lagrange multipliers

UNIT II **15 Periods**

Multiple Integrals: Double integrals (Cartesian and polar), change of order of integration, change of variables (Cartesian to polar), area by double integration, triple integrals, volume by triple integrals.

UNIT III **15 Periods**

Scalar and vector point functions, Gradient, directional derivative, divergence and curl, del applied twice to point and product of point functions (without proofs) Vector integration: line integral, surface and volume integrals, Green's theorem (without proof), Stoke'stheorem (without proof), Gauss divergence theorem (without proof)

UNIT IV **15 Periods**

First order ordinary differential equations: Linear, Bernoulli and exact equations Second order ordinary linear equations: Solution by method of variation of parameters,Cauchy's equation, Power series solutions; Legendre polynomials, Besselfunctions of the first kind and their properties

Learning Resources:

Text Book:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42nd edition.

Reference Books:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

CS/IT122	Engineering Chemistry	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. To develop concepts involved in molecular structure, intermolecular forces and make them understand the chemistry behind electrochemical energy systems.
2. To acquire knowledge on the chemical concepts involved in Water treatment and Corrosion.
3. Student shall know about the major organic reactions and end products like conducting polymers.
4. Learn analytical methods useful in characterization of compounds.

Course outcomes:

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

1. Identify stable complexes and suitable electrochemical energy systems for end usage.
2. Apply his knowledge for effective water treatment and corrosion prevention.
3. Identify chemical reactions that are used in the synthesis of molecules and polymers
4. Distinguish the ranges of the electromagnetic spectrum and characterize a given compound using analytical techniques.

Course Content:

UNIT I **CO1** **15 Periods**

Molecular structure, Intermolecular forces and Energy systems:
Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical Phenomena-Andrew's isotherms of CO_2, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO_2)- advantages, Fuel cell (H_2-O_2 cell).

UNIT II **CO2** **15 Periods**

Water Chemistry and Corrosion:
Water Chemistry-WHO standards, Municipal water Treatment-Removal of suspended Impurities-Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, DE chlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodicprotection by sacrificial anodic

method and impressed current method. Electroplating (Cu), Electrolessplating (Ni).

UNIT III **CO3** **15 Periods**

Organic Reactions and Polymers:
Types of organic Reactions-Substitution (SN_1 and SN_2), Elimination (E_1 and E_2), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers-Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (T_o)), Factors affecting T_o.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

UNIT IV **CO4** **15 Periods**

Spectroscopic techniques and its applications:
Beer-Lambert's law, limitations, colorimetric determination of Fe(III)
UV-VIS spectroscopy – electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications – purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy–condition to be IR active, vibrational modes of–AB_2, Block diagram-brief introduction of components, IR spectrum of CO_2 and H_2O molecules, General applications. Fluorescence and its applications in medicine.

Learning Resources:

Text Books:

1. Engineering Chemistry, P.C. Jain and Monica Jain, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering Chemistry, 2nd edition, Wiley India Private Limited.

Reference Books:
1. University Chemistry, Bruce H. Mahan, 3rd edition, Narosa Publishing House.
2. A text book of Engineering chemistry, Shashi Chawla, 3rd edition, Dhanpat Rai Publishing Company.

Web References:
1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin&M.S. Krishnan).
2. http://www.powerstream.com/BatteryFAQ.html#lec.
3. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis.

CS/IT 123	Digital Electronics	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Know the concepts of different number systems, conversions and functionality of logic gates.
2. To analyse and design combinational logic circuits.
3. To analyse and design sequential logic circuits.
4. Understand programmable logic devices.

Course Outcomes:

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

1. Demonstrate the knowledge in number systems, Boolean algebra, Combinational, sequential circuits, Programmable logic devices and Logic families.
2. Analyse and Design various combinational Circuits.
3. Analyse and Design various sequential Circuits.
4. Implement combinational circuit functionality with Programmable logic devices.

Course Content:

UNIT I **CO1, CO2, CO3, CO4** **12 Periods**

Digital Systems: Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, complements, signed binary Numbers.
Codes:BCD, excess – 3, Gray.
Boolean Algebra & Logic Gates: Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Digital Logic gates.
Gate-Level Minimization: The Map Method, Four-Variable K-Map, Five-Variable K-Map, Product of sums simplification, Don't-Care conditions, NAND and NOR implementation.

UNIT II **CO1, CO2, CO3** **12 Periods**

Combinational Logic: Combinational Circuits, Analysis Procedure, Design procedure, Half adder, Full adder, Half subtractor, Full subtractor, Carry look ahead adder, Magnitude comparator, Encoders, Decoders, Multiplexers, Demultiplexers.

UNIT III **CO1, CO2, CO3** **12 Periods**

Synchronous and sequential Logic: Sequential circuits, Latches, Flip-Fops, Analysis of clocked Sequential circuits, State Reduction and Assignment, Design Procedure.

UNIT IV **CO1, CO4** **12Periods**

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters.

Programmable Logic Devices: Programmable Read-Only Memory, Programmable Logic Array, Programmable Array Logic.

Learning Resources:

Text Book:

1. M. Morris Mano, Digital Design, 3rdEdition, Pearson Education, 2009

Reference Books:

1. Z. Kohavi - Switching and Finite Automata Theory,2nd Edition Tata McGraw Hill.
2. R.P. Jain - Modern digital electronics, 4thEdition, McGraw Hill.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117105080/3
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-111-introductory

CS/IT124	English for Communication Skills	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. To enable students, improve their lexical and communicative competence and to equip Students with oral and written communication skills.
2. To help students understand and learn the correct usage and application of Grammar Principles.
3. To get them acquainted with the features of successful professional communication.
4. To enable students, acquire various specific features of effective written communication.

Course Outcomes:

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

1. Use vocabulary contextually.
2. Compose effectively the various forms of professional communication.
3. Apply grammar rules efficiently in spoken and written forms.
4. Improve clarity to locate and learn the required information.

Course Content:

No. of Units	Name of the Topic	COs
UNIT I	**Vocabulary Building:**	
1.1	Root words from foreign languages and their use in English	CO 1
1.2	Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives	CO 1
1.3	Synonyms, Antonyms, and Standard abbreviations.	CO 1
1.4	One word substitutes	CO 1
UNIT II	**Writing Skills**	
2.1	Proposal writing	CO 1,CO 2,CO 3
2.2	Letter-writing	CO 1,CO 2,CO 3
2.3	Techniques for writing precisely (Précis writing)	CO 1,CO 2,CO 3
2.4	E-mail writing	CO1,CO 2,CO 3
UNIT III	**Identifying Common Errors in Writing**	
3.1	Subject-verb agreement	CO 3
3.2	Noun-pronoun agreement	CO 3
3.3	Articles	CO 3

3.4	Prepositions	CO 3
3.5	Tenses	CO 3
3.6	Redundancies	CO 3

UNIT IV	**Nature and Style of sensible writing**	
4.1	Description & Narration. (Paragraph writing)	CO 1,CO2,CO 3
4.2	Essay Writing. (Expository Essay)	CO1,CO 2,CO 3
4.3	Note-Making and Note-Taking	CO1,CO 2, CO 4
4.4	Methods of preparing notes.	CO1,CO 2, CO 4

Learning Resources:

Text Book:

1. Communication Skills, Sanjay Kumar and PushpaLata, Oxford University Press.

Reference Book(S):

1. Remedial English Grammar. F.T. Wood, macmillan,2007
2. On WritingWell, William Zinsser, Harper Resource Book, 2001
3. Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press, 2006
4. Practical English Usage, Michael Swan, OUP, 1995 Press.

CS/IT125	Programming in Python	L	P	C
		2	0	2

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamentals of Python Programming language.
2. Teach students processing of files, mutable and immutable data types.
3. Impart knowledge of Object – Oriented Programming using Python

Course Outcomes:

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

1. Explain the fundamentals of Python programming language.
2. Create user defined functions to solve problems
3. Manipulate the data structures lists, tuples, sets and dictionaries
4. Use Exception handling and Object – Oriented programming features of Python in solving real world problems

Course Content:

UNIT I

The way of the program: What is a program? Running Python, The first program, Arithmetic operators, Values and types

Variables, expressions and statements: Assignment statements, Variable names, Expressions and statements, Script mode, Order of operations, String operations.

Functions: Function calls, Math functions, Composition, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Variables and parameters are local, Stack diagrams, Fruitful functions and void functions, Why functions.

Conditionals and recursion: Floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Stack diagrams for recursive functions, Infinite recursion, Keyboard input.

UNIT II

Fruitful functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Checking types.

Iteration: Reassignment, Updating variables, The while statement, break, Square roots.

Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and counting, String methods, The in operator, String comparison.

Files: Persistence, Reading and writing, Format operator, Filenames and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules,.

UNIT III

Lists: A list is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map, filter and reduce, Deleting elements, Lists and strings, Objects and values, Aliasing, List arguments.
Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters. Looping and dictionaries, Reverse lookup, Dictionaries and lists, Memos, Global variables.
Tuples: Tuples are immutable, Tuple assignment, Tuples as return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples.

UNIT IV

Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying.
Classes and methods: Object-Oriented features, Printing objects, The init method, The_str method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation.
Inheritance: Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Data encapsulation.

Learning Resources:

Text Book:

1. Think Python: How to Think Like a Computer Scientist, Allen Downey, Green Tea Press, Version 2.0.17

Reference Books:

1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus by Dierbach, Wiley
2. Fundamentals of Python Programming : Richard L. Halterman by Southern Adventist University

CS/IT161	Engineering Chemistry Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To know the methods of determining hardness and chloride ion content of water sample.
2. To learn the redox methods to determine Fe2+ ions present in solution.
3. To know principles and methods involved in using instruments like conductivity bridge and potentiometer.
4. To know the molecular properties like surface tension, viscosity.
5. To know synthetic methods for preparation of drugs and polymer.

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

1. Estimate the Fe(II) content of a given solution and chloride/hardness content of water.
2. Measure conductance of solutions, redox potentials of a cell.
3. Synthesize a small drug molecule and polymer.
4. Measure molecular properties such as surface tension, viscosity and determine physical parameters like saponification value, partition co-efficient and Rf value.

List of Experiments:

1. Estimation of Mohr's salt using KMnO4. CO1
2. Estimation of Mohr's salt using K2Cr2O7. CO1
3. Determination of chloride ion content of water. CO1
4. Determination of Hardness of water using EDTA method. CO1
5. Determination of Fe(II) strength using K2Cr2O7 potentiometrically. CO1& CO2
6. Determination on strength of NaOH using HCI conduct metrically. CO2
7. Preparation of p-bromo acetanilide. CO3
8. Preparation of Phenol Formaldehyde resin. CO3
9. Determination of surface tension. CO4
10. Determination of Viscosity. CO4
11. Determination of Saponification / acid value of oil. CO4
12. Determination of partition co-efficient of I2 in water. CO4
13. Determination of Rf value using TLC. CO4
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal. CO4

CS/IT162	Programming in Python Lab	L	P	C
		0	2	1

Course Objectives:

The main objectives of this course are to:

1. To introduce the fundamentals of Python Programming language.
2. To make the students process files, mutable and immutable data.
3. To impart knowledge of Object – Oriented Programming using Python

Course Outcomes:

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

1. Illustrate the fundamentals of Python programming language.
2. Create user defined functions to solve problems
3. Write programs to manipulate the data structures lists, tuples, sets and dictionaries
4. Use Exception handling and Object – Oriented programming features of Python in solving real-world problems.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Lab1 Simple Programs to demonstrate Input - Output operations.
Lab2 Programs to demonstrate the behavior and use of various operators.
Lab3 Programs to emphasize the usage of Conditional Control Statements.
Lab4 Programs to emphasize the usage of Iterative control statements.
Lab5 Programs on the usage of Built-in functions.
Lab6 Programs to demonstrate the creation and usage of User Defined Functions.
Lab7 Programs to demonstrate Recursion.
Lab8 Programs on creation and importing of modules.
Lab9 Programs on Lists and its operations
Lab10 Programs on List Processing. (Sortings, Searchings, Permutations...)
Lab11 Programs to demonstrate Exception Handling.
Lab12 Programs to demonstrate OOP concepts.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CS/IT163	Computer Engineering Workshop	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To make the students aware of the basic hardware components of a computer and installation of operating system.
2. To introduce Raptor Tool for flowchart creation.
3. To get awareness of cyber hygiene to protect the personal computer from getting infected with the viruses, worms and other cyber-attacks.
4. To introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and power point presentations using open office tools.

Course Outcomes:

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

1. Apply knowledge for computer assembling and software installation.
2. Draw flowcharts for the given problems
3. Troubleshoot hardware and software level problems.
4. Prepare professional word documents using the Microsoft office.

Apply the tools for preparation of PPT, and budget sheet etc.

TASK 1: PC Hardware: PC Hardware introduces the students to a personal computer and its basic peripherals, the process of assembling a personal computer, installation of system software like MS Windows, Linux and the required device drivers. In addition, hardware and software level troubleshooting process, tips and tricks would be covered.

Every student should identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor. Every student should disassemble and assemble the PC back to working condition.

TASK 2: Software Installation: Every student should individually install operating system like Linux or MS windows on the personal computer. The system should be configured as dual boot with both windows and Linux.

TASK 3: Hardware Troubleshooting: Students have to be given a PC which does not boot due to improper assembly or defective peripherals. They should identify the problem and fix it to get the computer back to working condition.

Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

TASK 4: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate how to access the websites and email.

TASK 5: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured. Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. Usage of search engines like Google, Yahoo, ask.com and others should be demonstrated by student.

TASK 6: Cyber Hygiene: Students should learn about viruses on the internet and install antivirus software. Student should learn to customize the browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

TASK 7: Drawing flowcharts (Raptor Tool): Students should draw flowcharts for the problems

validating an email id entered by user, printing first fifty numbers and preparing electricity bill.

TASK 8: Productivity tool: Microsoft (MS) office: Importance of MS office, Details of the three tasks and features that should be covered in each, MS word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter. Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Using MS Word to create project certificate: Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colours, Inserting Header and Footer, Using Date and Time option in Word.

TASK 9: Spread sheet Orientation: Accessing, overview of toolbars, saving spreadsheet files, Using help and resources. Creating a Scheduler: - Gridlines, Format Cells, Summation, auto fill, Formatting Text

TASK 10: Creating Power Point: Student should work on basic power point utilities and tools in Ms Office which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows, Hyperlinks, Inserting Images, Tables and Charts.

** Minimum 8 tasks should be done by the student to get eligibility to appear for the exam
** Tasks 1 to 7 are mandatory

Learning Resources:

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech.
3. Computer Fundamentals, l e, Anita Goel, Person Education.

Reference Books:

1. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.

CS/IT164	English Language Communication Skills Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To identify speaker's purpose and tone; make inferences and predictions about spoken discourse, discuss and respond to content of a lecture or listening passage orally and/or in writing.
2. To acquaint the students with the Standard English pronunciation, i.e., Receive Pronunciation (RP), with the knowledge of stress and intonation.
3. To develop production and process of language useful for social and professional life.
4. To develop in them communication and social graces necessary for functioning. Improve the dynamics of professional presentations.
5. To develop critical reading and comprehension skills at different levels.

Course Outcomes:

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

1. Comprehend relationships between ideas and make inferences and predictions about spoken discourse.
2. Speak English with a reasonable degree of accuracy in pronunciation.
3. Develop appropriate speech dynamics in professional situations.
4. Use effective strategies and social graces to enhance the value of communication.
5. Develop effective communication and presentation skills and using language effectively to face interviews with success.

List of Exercises / Activities:

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Interviews.
5. Formal Presentations.
6. Reading Comprehension.

Reference Book(S):

1. Communication Skills. Sanjay Kumar and PushpaLata. Oxford University Press.
2. Practical English Usage. Michael Swan. OUP. 1995 Press.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University.
4. Technical English M. Sambaiah, Wiley Publications, New Delhi.

CS/ITMC2	Environmental Science	L	P	C
		2	0	0

Course Objectives:

The main objectives of this course are to:

1. Understand that humans are an integral part of environment and hence their activities reflect on the environment.
2. Realize and appreciate the importance of ancient practices and their importance in the present times
3. Appreciate the contribution of individuals for the upkeep of environmental standards, in turn help the humans live better.

Course Outcomes:

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

1. Evaluate the implications of human activities and thereby promote ecofriendly technologies.
2. Promote awareness among the members of the society for a sustainable environment.
3. Include and give priority to environmental protection in all developmental projects.

Course Content:

A. AWARENESS ACTIVITIES - SMALL GROUP MEETINGS

I. Source of water for human consumption/activities:

a. collection of information pertaining to water resources and consumption in Andhra Pradesh

b. Water resource on campus: General / Laboratory use and

c. Drinking water - understand the background and adopt judicious management.

d. Recycled water for Gardening - Particularly Lawns.

e. Cut down wastage of electricity in class rooms / labs / hostels etc. by avoiding misuse.

II. After the group meetings and exposure to the local issues and healthy practices, students motivated to make:

a. Posters

b. Slogans/One liners for promoting awareness

III. Lectures from Experts (at least 2 in the course duration)

IV. A walk in the neighborhood to promote a chosen theme on environmental consciousness.

B. ACTUAL ACTIVITIES

1. Plantation on Campus and on the sides of approach road.
2. Distribution of saplings to the local colony dwellers and encourage plantation.
3. Development of Kitchen garden on campus - Cultivation of at least leafy vegetables
4. and creepers like cucumber etc. for use in college canteen/hostels etc.
5. Adoption of "NO PLASTICS" on campus.
6. Field trip to gain knowledge of biodiversity, water shed, mining, pollution and other
7. local issues.
8. Preparation of working models for energy generation/transformation etc.

C. THEORY SYLLABUS FOR ASSESSMENT

Part-I

1. Introduction to Environmental Studies, Scope and Importance.
2. Natural resources Renewable and Non-Renewable; Definition and importance of the following resources in detail: a. Forest b. Water c. Land d. Energy
3. Sustainable development - Concept and Measures.
4. Biodiversity - Definition, Types of Biodiversity, Values and threats to Biodiversity, Conservation of biodiversity, IUCN classification: Endangered, Threatened, Vulnerable, Rare species; Endemic and Exotic species.
5. Climate change - Global warming, Ozone depletion and Acid rain.

Part-II

6. Water shed, water shed management in detail.
7. Solid wastes and Solid waste management.
8. Environmental Legislation, Environmental acts - Wild life protection act, Water act, Forest conservation act, Air act and Environmental protection act.
9. Case studies: Chernobyl nuclear disaster, Bhopal gas tragedy, Narmada bachaoandolan, Silent valley, Story of Tuvalu, Story of Ganga.
10. Earth summit and Kyoto protocol; Measures at individual level for conservation of natural resources and sustainable development.

Learning Resources:

Text Books:

1. Anubha Kaushik and C.P. Kaushik - Environmental Studies, 3rd Edition, New Age International Publishers, New Delhi., 2012.
2. R. Rajagopalan - Environmental studies from crisis to cure, 3rd Edition, Oxford University press, 2012.

Assessment

1. Two assessments each of 40 marks will be done in the semester. The split up of each assessment is as follows:
   a. Two internal theory examinations will be conducted for 18 marks each.
   b. Evaluation of the prepared activity sheets and working models will be done for 12M (continual evaluation) twice in the semester in line with the theory examination.
   c. 5 Marks for attendance and 5 marks for oral test.

Semester - III (Second Year)

CS/IT211	**Probability and Statistics**	**L**	**P**	**C**
		3	**0**	**3**

Course Objectives:

The student who successfully completes this course will have:

1. The ability to understand the basic principles of various probability distributions.
2. The ability to know the sample distributions of the data
3. The basic concepts of testing of hypothesis and their applications for the data.
4. The skill to predict the future behaviour based on time series data.

Course Outcomes:

On completion of this course, students will be able to:

1. CO1: Apply various formulae to analyze and interpret the data.
2. CO2: Apply the knowledge of distribution theory to both software and hardware design problems.
3. CO3: Apply the basic concepts of testing of hypothesis and derive the conclusions for the data.
4. CO4: Forecast the behavior of the data by various models in time series.

Course Content

UNIT I **14 periods**

Probability distributions: Random Variables, Binomial distribution, Poisson distribution, and Geometric distribution.

Probability densities: Continuous random variables, Normal distribution, Normal approximation to the Binomial distribution, Uniform distribution, Log-normal distribution, Gamma distribution, Beta distribution, Weibull distribution.

UNIT II **14 periods**

Sampling distribution: Population and samples, the sampling distribution of mean (σ known), the sampling distribution of mean (σ unknown), the sampling distribution of variance.

Testing of Hypotheses (Parametric Tests):
Inferences Concerning Means: Point estimation, Interval estimation, tests of hypothesis, null hypothesis and tests of hypothesis, hypothesis concerning one mean, inferences concerning two means

UNIT III **14 periods**

Testing of Hypotheses (Parametric Tests) (Contd…):
Inferences Concerning Variances*:* The estimation of variances, hypothesis concerning one variance, hypothesis concerning two variances.

Inferences Concerning Proportions:The estimation of proportions, hypothesis concerning one proportion, hypothesis concerning several proportions, The analysis of r×c tables, Goodness of fit.

UNIT IV **14 periods**

Testing of Hypotheses (Non-Parametric Tests): Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Tolerance region.

Basics of Time Series Analysis & Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

Learning Resources:

Text Book:

1. Miller &Freund's Probability and Statistics for Engineers – Richard A. Johnson

Reference Books:

1. U. Dinesh Kumar, Business Analytics: The science of data- driven decision making.
2. S.M Ross, Introduction to Probability and Statistics for Engineers and Scientists.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley.
5. S.C. Gupta and V.K. Kapoor., Fundamentals of Mathematical Statistics, Sultan Chand &Co.

CS/IT212	Discrete Mathematics	L	P	C
		3	0	3

Course Objectives:

At the end of the course, the student will

1. Introduce the concepts of mathematical logic.
2. Understand the combinatorial problems using counting principles,
3. Create generating functions and solve recurrence relations.
4. Use Directed & Un-Directed Graphs concepts and its applications.

Course Outcomes:

At the end of the course, the student will be able to

1. Apply formal methods of proof and propositional & First order logic to validate the propositional statements.
2. Apply techniques for counting the occurrences of discrete events including permutations, combinations with or without repetitions.
3. solvegenerating function and recurrence relations.
4. Solve the real-world problems using directed and undirected graphs.

Course Content:

UNIT I **13 periods**

Foundations: Sets, Relations and Functions, Fundamentals of Logic, Logical Inferences, Methods of Proof of an implication, First order Logic & Other methods of proof, Rules of Inference for Quantified propositions, Mathematical Induction.

UNIT II **10 periods**

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Combinations and Permutations with Constrained Repetitions.

UNIT III **13 periods**

Recurrence Relations: Generating functions of sequences, Calculating Coefficients of Generating Functions, solving recurrence relations by Substitution and generating functions. The methods of characteristic roots, solutions of inhomogeneous recurrence relations.

UNIT IV **14 periods**

Relations & Digraphs: Properties & Equivalence relations, Operations on relation, Directed Graphs and Adjacency Matrices, Ordering relations, Lattices and Enumerations.

Graphs: Isomorphism's and Sub graphs, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four Color Problem.

Learning Resources:

Text Book:

1. Joe L. Mott, Abraham Kandel & Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, PHI 2nd edition.

Reference Books:

1. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.
2. Discrete and Combinational Mathematics- An Applied Introduction-5th Edition– Ralph. P. Grimaldi. Pearson Education
3. Discrete Mathematical Structures with applications to computer science Trembly J.P. & Manohar. P, TMH
4. Discrete Mathematics and its Applications, Kenneth H. Rosen, FifthEdition.TMH.

CS/IT213	Computer Organization	L	P	C
		3	0	3

Course Objectives:

The objectives of the course are:

1. To introduce the functional units of computer system, architecture and its operations.
2. To discuss the basic processing unit and I/O devices.
3. To impart the knowledge on memory system.
4. To demonstrate the arithmetic operations in a computer system.
5. To instruct the instruction level parallelism

Course Outcomes:

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

1. Describe components, architecture of a computer system and its working.
2. Demonstrate instruction execution and control system.
3. Illustrate a pipeline system for the execution of instruction.
4. Explain various I/O handling mechanisms and its interfaces.
5. Discuss computer arithmetic algorithms.
6. compare various memory systems.

Course Content:

UNIT I **12 Periods**

Basic structure of computers: Computer types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic, Character Representation, Performance.

Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Stacks, Subroutines, Additional Instructions, Encoding of Machine Instructions.

UNIT II **14 Periods**

Basic Processing Unit: Some Fundamental Concepts, Instruction Execution, Hardware Components, Instruction Fetch and Execution Steps, Control Signals, Hardwired Control.
Pipelining: Basic Concept-The Ideal Case, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delays, Branch Delays, Resource limitations.

UNIT III **10 Periods**

Basic Input/ Output: Accessing I/O Devices: I/O Device Interface, Program-Controlled I/O; Interrupts: Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling I/O Device Behavior, Processor Control Registers.

Input/output Organization: Bus Structure, Bus Operation: Synchronous Bus, Asynchronous Bus; Arbitration, Interface Circuits; PCI Bus, SCSI Bus.

UNIT IV **14 Periods**

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-only Memories, Direct Memory Access, Cache Memories, Performance Considerations.

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication-Bit-Pair recoding of Multipliers, Integer Division, Floating-Point Numbers and Operations.

Learning Resources:

Text Book(s):

1. Computer Organization and Embedded Systems, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books:

1. Computer Architecture and Organization, 3rd Edition by John P. Hayes, WCB/McGraw-Hill.
2. Computer Organization and Architecture: Designing for Performance, 10th Edition by William Stallings, Pearson Education.

CS/IT214	Data Structures	L	P	C
		3	0	3

Course Objectives:

The objectives of this course are:

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize searching and sorting techniques

Course Outcomes:

After successful completion of the course, student will be able to:

1. Analyze computation complexity of algorithms
2. Implement searching, sorting and hashing techniques
3. Apply operations on linear and non-linear data structures
4. Develop solutions for computational problems using appropriate data structures

Course Content:

UNIT I **10 Periods**

Introduction: Basic Concepts-Algorithm Specification, Data Abstraction, Performance Analysis-Time complexity, Space complexity, Asymptotic Notations

Searching and Sorting: Linear Search, Binary Search, insertion sort, selection sort.

UNIT II **14 Periods**

Lists: Pointers, Singly Linked Lists, Polynomials, Circular Linked Lists: Operations & their algorithms, Polynomials: Addition, Multiplication

Hashing: Static Hashing - Hash Tables, Hashing Functions, Overflow Handling

UNIT III **12 Periods**

Stacks and Queues: Stack ADT, Queue ADT, Evaluation of Expressions, Multiple Stacks and Queues, Dynamically Linked Stacks and Queues

UNIT IV **14 Periods**

Trees: Introduction, binary trees, Binary Tree Traversals, Binary Search Trees, AVL Trees, Heaps, Heap sort, B-Trees and B+ Trees

Graphs: The Graph Abstract Data Type, representations of graphs, Elementary Graph Operations - Depth First Search, Breadth First Search, Connected Components.

Learning Resources:

Text Book:

1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

Reference Book(S):

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
2. Y. Langsam, M.J.Augeustein and A.M. Tenenbaum, Data Structures Using C, Pearson Education Asia, 2004.
3. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
4. Jean Paul Trembly and P.G.Sorenson, An Introduction of Data Structures with Applications

CS/IT215	Object Oriented Programming	L	P	C
		3	0	3

Course Objectives:

The learning objectives of this course are:

1. To make the students understand Java fundamental concepts
2. To elucidate the fundamentals of object-oriented programming in Java
3. To create awareness on exception handling and multithreading
4. To familiarize students with the concepts of Event Handling, Generics and Collections

Course Outcomes:

By the end of the course, the students will be able to

1. Comprehend the concepts of OOP and fundamentals of Java Programming.
2. Develop reusable and efficient programs using Inheritance & Polymorphism.
3. Demonstrate the importance of packages and interfaces.
4. Use the concept of exception handling to create error free codes and avoid abnormal program terminations.
5. Design multi-tasking applications using Multithreading.
6. Develop Event Driven applications and generic programs

Course Content:

UNIT I **(CO1)** **12 Periods**

Introduction: The history and evolution of Java, Java Buzz words, object-oriented programming, Data Types, Variables and Arrays, Operators, Control Statements.

Classes and Objects: Concepts, methods, constructors, types of constructors, constructor overloading, usage of static, access control, this keyword, garbage collection, finalize()method, overloading, parameter passing mechanisms, final keyword, nested classes and inner classes.

Utility Classes: Date, Calendar, Scanner, Random

UNIT II **(CO2, CO3)** **12 Periods**

Inheritance: Basic concepts, access specifiers, usage of super key word, method overriding, using final with Inheritance, abstract classes, dynamic method dispatch, Object class.

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.

Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.

Strings: Exploring the String class, String buffer class, Command-line arguments

UNIT III **(CO4, CO5)** **12 Periods**

Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, multiple catch clauses, nested try, Built-in exceptions, creating own exception sub classes.

Multithreading: The Java Thread model, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, Inter Thread Communication, Deadlock.

Applets: Concepts of Applets, life cycle of an applet, creating applets

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.

UNIT IV (CO6) **12 Periods**

AWT: AWT Components, , File Dialog boxes, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar.

GUI with Swing– Swings introduction, JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons. Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables

Generics: Basics of Generic Methods, Generic Classes

Collections: Collection Interfaces, Collection Classes**,** Accessing a Collection via an Iterator

Learning Resources:

Text Book:

1. Java The Complete Reference - Herbert Schildt 11th Edition, Mc Graw Hill Education.

Reference Books:

1. Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
2. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
3. Cay.S.Horstmann and Gary Cornell, Core Java 2, Vol 1, Fundamentals 7th Edition, Pearson Education.
4. H.M.Dietel and P.J.Dietel, Java How to Program, Sixth Edition, Pearson Education/PHI.
5. Barbara Liskov, Program Development in Java, Addison-Wesley, 2001.
6. Cay Horstmann, John Wiley and Sons ,Big Java 2nd Edition, ,Pearson Education.

CS/IT251	Probability & Statistics Lab	L	P	C
		0	3	1.5

Course Objectives:

The student who successfully completes this course will have:

1. The knowledge to use R for statistical programming, computation, modelling and graphics.
2. The skill to write functions and use R in an efficient way.
3. The ability to fit some basic types of statistical models using R.
4. The idea to expand the knowledge of R on their own.

Course Outcomes

On completion of this course, students will be able to:

1. Write the programs in R to solve the statistical problems.
2. Apply various built in functions in R to solve the computational and modelling problems.
3. Interpret the statistical data by various functions of graphical representation.
4. Understand- reading, writing, working and manipulating the data in various data frames.

Lab – Course Content:

Introduction to R

Functions

Control flow and Loops

Working with Vectors and Matrices

Reading in Data

Writing Data

Working with Data

Manipulating Data

Simulation

Linear model

Data Frame

Graphics in R

Pre – Requisites

CS/IT-151– C Programming.

Lab – Course Plan & Delivery:

LIST OF EXPERIMENTS	PERIODS
1. Graphical representation of data **a)** Bar plot b)Frequency polygon	**3**
2. Graphical representation of data **a)** Histogram b)Pie chart c) Scatter plot	**3**
3. Measures of central tendency **a)** Mean b)Median c)Mode	**3**
4. Measures of central tendency a)Geometric Mean e)Harmonic Mean	**3**
5. Measures of dispersion **a)** Range b)Quartile deviation	**3**
6. Measures of dispersion **a)** Mean deviation b)Standard deviation	**3**
7. Goodness of fit a) Binomial b)Poisson	**3**
8. Goodness of fit **a)** Normal b)Contingency table	**3**
9. Parametric tests **a)** t-test for one-mean b) t-test for two means	**3**
10.Parametric tests a) paired t-test b) F-test	**3**
11. Non-parametric tests **a)** Sign test b) Wilcoxon-Signed rank test	**3**
12. Non-parametric tests **a)** Mann-Whitney test b)Kolmogorov-Smirnov test	**3**
13. Time series a) Trend line b)Non-linear trend line	**3**
14. Time series **a)** Moving averages b)ARIMA	**3**

Evaluation Methods:

Internal Lab Exam : 40 Marks

Final Lab Exam : 60 Marks

Topics Covered Beyond The Curriculum:

Statistical concepts regarding testing of hypothesis

Differences between C and R Programming

Semester End Observations for Future Guidance:

Case studies to be explained are revised.

Identified new problems to be assigned for the next academic year students.

Learning Resources:

Text Books:

1. Hands-on Programming with R, Garrett Grolemund, O'Reilly.
2. R for Everyone: Advanced Analytics and Graphics, Jared P. Lander, Addison-Wesley

CS/IT252	Data Structures Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To illustrate operations of linear and non-linear data structure
2. To demonstrate computational problems using suitable data structures
3. To familiarize searching and sorting techniques

Course Outcomes:

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

1. Implement linear and non-linear ADTs
2. Develop solutions for the given problems using appropriate data structures
3. Solve real world problems using searching and sorting algorithms

List of Experiments to implement

week 1: List ADT

week 2: Applications of List

week 3: Single Circular List ADT

week 4: Doubly Linked List ADT

week 5: Stack ADT

week 6: Applications on Stack

week 7: Queue ADT

week 8: Applications of Queue

week 9: Double Ended Queue ADT

week 10: BST ADT

week 11: Priority Queue ADT

week 12: Searching and Sorting Techniques

week 13: Graph traversal techniques

week 14: Hashing Techniques

CS/IT253	Object Oriented Programming Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To introduce java compiler, interpreter
2. To make the students learn an object oriented way of solving problems using java
3. To make the students write programs using multithreading concepts and exception handling
4. To make the students understand the usage of Event handling, generics, collections

Course Outcomes:

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

1. Write simple java programs using java fundamentals and basic OOP concepts.
2. Design programs using inheritance and polymorphism.
3. Demonstrate inter process communication using multithreading.
4. Demonstrate the user defined exceptions by exception handling keywords (try, catch, throw, throws and finally).
5. Develop Event driven applications and Generic programs

List of Experiments:

The programming concepts to be implemented in the Lab are

Week 1: Fundamentals of classes and objects

Week 2: static keyword, this keyword, variable length arguments

Week 3: inner classes, constructor overloading

Week 4: Types of inheritances

Week 5: Method overloading, Method Overriding, usage of final and super

Week 6: Abstract classes, interfaces, Dynamic method dispatch.

Week 7: String class and its methods

Week 8: Packages

Week 9: Exception Handling Techniques

Week 10: Multithreading concepts

Week 11: Applets and event handling

Week 12: Awt components and delegation event model

Week 13: MVC architecture in Swing

Week 14: Generics and collections

CSSL1(a)	2D- Computer Animation	L	P	C
	Skill Oriented Course – I	1	2	2

Course objectives:

The main objectives of this course are to:

1. To familiarize the students with various approaches, methods and techniques ofSketching , Perspective Drawings, Photoshop Image Editing and 2D Animation Technology.
2. To develop competencies and skills needed for becoming an effective Animator.
3. Mastering traditional & digital tools to produce stills and moving images.
4. Exploring different approaches in computer animation.

Course Outcomes:

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

1. Make use of software to develop storyboards and 2-dimensional animation including creating, importing and sequencing media elements to create multi-media presentations.
2. Explain conceptualization, creativity, and visual aesthetics.
3. Organize various aspects of animation using a variety of 2 dimensional software.
4. Develop concepts, storyboarding and production of several 2 dimensional animations will be accomplished.

Course Content:

UNIT I **CO1** **5 periods**

2D Sketching :Understanding Fundamentals of Drawing and Free hand sketching, , Landscape sketching, Perspective
Drawings: 1point, 2 point and 3 point Character Face Design

UNITII **CO2** **10 periods**

Photoshop Basics Introduction UI, Selection tools, Brush tools, Pen tool, Eraser tool, Layer Pallet, Mask options, Text tool, Layer Styles, Gradient tools and Custom shapes.

UNIT III **CO3** **10 periods**

Photoshop Concepts Boucher Creation, Poster design, Matte painting, Black and White to Colour, Colour corrections and
Logo Design.

UNIT IV **CO4** **10 periods**

Animate CC Introduction UI, Layers, Tools, Image placing and Tracing, Character Design, Walk Cycle animation,
Shape Tween.

Learning Resources:

Text Books:

1. pdfcoffee.com_perspective-drawing-eguide-3-pdf
2. Adobe Photoshop CC Classroom in a Book
3. Adobe Animate CC Classroom in a Book

CSSL1 (b)	Programming with C++	L	P	C
	Skill Oriented Course – I	1	2	2

Course Objectives:
The main objectives of this course are to:

1. Introduce to the student the fundamentals of C++ language.
2. To make the students understand the principles of data abstraction, inheritance and polymorphism
3. To create awareness about generic programming and exception handling
4. To make the students familiar with IO streams, STL.

Course Outcomes:

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

1. Differentiate POP and OOP and then use C++ fundamentals and various function modifiers to create and manipulate classes and objects.
2. Make use of the advantages of Compile time polymorphism and also develop reusable programs by applying inheritance.
3. Use runtime polymorphism, generic programming and exception handling techniques for developing efficient programs.
4. Demonstrate C++ streams, Name Spaces and STL.

Course Content:

UNIT I **12 periods**

An Overview of C++: The Origins of C++, What is Object Oriented Programming, some C++ fundamentals, Old-Style Vs Modern C++, Introducing C++ Classes, Function Overloading, Operator Overloading, Inheritance, Constructors and Destructors, The C++ Keywords, The General Form of a C++ Program

Classes and Objects: Classes, Structures and Classes, Unions and Classes are Related, Friend Functions, Friend Classes, Inline Functions, Parameterized Constructors, Static Class Members, When Constructors and Destructors are Executed, Scope Resolution Operator, Nested Classes, Local Classes, Passing and Returning Objects, Object Assignment, arrays of objects.

UNIT II **12 periods**

Function Overloading, Copy Constructors and Default Arguments: Function Overloading, Overloading Constructor Functions, Copy Constructors, Finding the Address of an Overloaded Function, Overload Anachronism, Default Arguments, Function Overloading and Ambiguity.

Operator Overloading: Creating Member Operator Function, Overloading Using a Friend Function, Overloading new delete, Overloading Special Operators & Comma Operator

Inheritance: Base-Class Access Control, Inheritance and protected members, Inheriting Multiple Base Classes, Constructors, Destructors and Inheritance, Granting Access, Virtual Base Classes.

UNIT III **12 periods**

Virtual Functions & Polymorphism: Virtual Functions, The Virtual Attribute is inherited, Virtual Functions are Hierarchical, Pure Virtual Functions, Using Virtual Functions, Early Vs Late Binding.

Templates: Generic Functions, Applying Generic Functions, Generic Classes, Typename and export Keywords, Power of Templates.

Exception Handling: Fundamentals, Derived-Class Exceptions, Options, Terminate() and unexpected(), uncaught_exception(), exception and bad_exception Classes, Applying Exception Handling.

UNIT IV **12 periods**

The C++ I/O System Basics: Old Vs. Modern C++ I/O, Streams, Stream Classes, Formatted I/O, Overloading << and >>, Creating Manipulators.
C++ File I/O: File Classes, Opening and Closing a File, Text Files, Unformatted Binary I/O, get(), Getline() functions, Detecting EOF ,Random Access

Namespaces, Conversion Functions and other Advanced Topics: Namespaces, Thestd Namespace, Creating Conversion Functions, const Member Functions and mutable, Volatile Member Functions, Explicit Constructors, Differences between C and C++.

Introducing Standard Template Library: An Overview of STL

Learning Resources:

Text Book:

1. The Complete Reference - C++ - Herbert Schieldt, 4/e, Tata McGraw Hill.

Reference Books:

1. Bjarne Stroustrup, "The C++ Programming Language", Special Edition, Pearson Education.
2. C++ - How to Program – Dietel & Dietel
3. Programming in C++ - Barkakati
4. Mastering C++ by Venugopal

CSSL1(c)	PHP Programming	L	P	C
	Skill Oriented Course – I	1	2	2

Course Objectives:

At the end of the course, the students will understand

1. usage of PHP for developing web applications.
2. PHP Browser Handling Power.
3. accessing web form data at the server
4. creation of database driven web applications.

Course Outcomes:

At the end of the course, the student will be able to

1. Apply basic concepts of PHP programming.
2. Design and Develop server side programs using PHP Technologies.
3. Assess the principles of object oriented development using PHP.
4. Develop Database Connectivity using MYSQL.

Course Content:

UNIT I **10 periods**

Essential PHP, Operators and Flow Control, String Arrays, Creating Functions

UNIT II **10 periods**

Reading Data in Web Pages and PHP Browser- PHP server variables, getting the user's browser type, Performing data validation using Regular expressions.

UNIT III **10 periods**

Object-oriented Programming- Creating Classes, Creating Objects, Setting Access to Properties and Methods, Using constructors to initialize objects, using destructors to clean up after objects, Basing one class on another with inheritance, Overriding methods, Overloading methods.

File handling -Opening files using fopen, Reading text from a file using fgets, Closing file, Reading from a file character by character with fgetc, Reading a whole file at once with file_get_contents.

UNIT IV **10 periods**

Working with Databases- Creating a MySQL database, Accessing the Database in PHP.

Sessions, Cookies- Setting a Cookie, reading a Cookie, Setting Cookies Expiration, Deleting Cookies.

Learning Resources:

Text Book:

1. PHP: The Complete Reference By Steven Holzner, TATA McGraw Hill.

Reference Books:

1. Beginning PHP and MySQL: From Novice to Professional, By by W. Jason Gilmore, Apress.
2. PHP 6 and MySQL 6 Bible, By Steve Suehring, Tim Converse, Joyce Park, Wiley Publishing, Inc.

CS/ITMC3	Design Thinking & Product Innovation	L	P	C
		2	0	0

Course Objectives:

1. Identify the design thinking principles and practices in today's industry.
2. Learn the Planning of research activities to gather and empathize from a user's viewpoint.
3. Study the Ideate techniques to help arrive at the best solution and evaluation.
4. Knowledge to Identify design thinking approaches for business challenges.

Course Outcomes:

1. Interpret the concepts of Design thinking to real-world activities.
2. Investigate a problem to determine its root cause in terms of Design Thinking perspective.
3. Apply group thinking methods and experiment with different solutions to a given problem.
4. Develop innovative thinking and creative problem solving abilities.

Course Content:

UNIT I [Text Book 1 & 2] 12 Periods

Introduction to Design Thinking – Origin of Design Thinking, Features & Principles of Design Thinking, Applications of Design Thinking, Role of Research in Design Thinking.

UNIT II [Text Book 3] 12 Periods

Modules of Design Thinking – Inspiration – methods & tools used in Explore and Empathize phases of Design Thinking, Case study-activity.

UNIT III [Text Book 3] 12 Periods

Modules of Design Thinking – Ideation & Implementation – methods & tools used in Experiment, Engage and Evolve phases of Design Thinking, Case study-activity.

UNIT IV [Text Book 4] 12 Periods

Design Thinking applied in Business & Strategic Innovation – Ten Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization, Creative Culture, Strategy & Organization – Design Thinking approaches.

Learning Resources:

Text Book(S):

1. "Design Thinking for Entrepreneurs and Small Businesses" by Beverly Rudkin Ingle, Apress. [UNIT -1]
2. "Change by design", Tim Brown, Harper Collins, 2009 [UNIT -1]
3. "Design Thinking- The Guide Book" – Facilitated by the Royal Civil Service Commission, Bhutan. [UNIT –II & III]
4. IdrisMootee, "Design Thinking for Strategic Innovation", John Wiley & Sons (2013). [UNIT -IV]

Reference Book(S):

1. "Design Thinking Business Innovation", Rio de Janeiro – 2012 1st edition, MJV press.
2. "Design Thinking- Understanding How Designers Think and Work" by Nigel Cross, Berg publishers.

Web Reference:

1. IDEO: Design Thinking for Educators toolkit https://designthinkingforeducators.com/.
2. https://dschool.stanford.edu/resources/a-virtual-crash-course-in-design-thinking
3. https://dschool-old.stanford.edu/groups/designresources/wiki/4dbb2/ (wallet Project)

Semester - IV (Second Year)

CS/IT221	Computational Statistics	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. The knowledge to understand the concepts of linear statistical and ANOVA models and draw the conclusions.
2. The idea to develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
3. To understand the key technologies in data science and business analytics such as data mining, machine learning, visualization techniques and predictive modelling.
4. The knowledge to apply principles of data science to analyze and to effectively visualize the data.

Course Outcomes:

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

1. CO1: Remember the basic concepts of linear statistical models
2. CO2: Interpret the results of Multivariate Regression models
3. CO3: Estimate the discriminate function to segregate and allot the item to the subgroup.
4. CO4: Data reduction and visualize the data for interpretation.

Course Content:

UNIT I **14 periods**

Linear Statistical Models: Scatter diagram, linear regression and correlation, least squares methods, rank correlation, multiple correlation.

Analysis of Variance (ANOVA): Analysis of Variance (one-way classification), Analysis of Variance (two-way classification).

UNIT II **14 periods**

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Multiple Linear Regression Model: Standard multiple regression models with emphasis on collinearity, outliers, non-normality and auto correlation, validation of model assumptions.

UNIT III **14 periods**

Multivariate Regression: Assumptions of multivariate regression models, Parameter estimation, multivariate analysis of variance and co-variance.

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT IV **14 periods**

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Factor Analysis: Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

Learning Resources:

Text Book:

1. Richard. A. Johnson and Dean.W. Wichern "Applied Multivariate Statistical Analysis" Pearson Prentice Hall, 6th Edition, 2007

Reference Books:

1. ALVIN C. RENCHER, "Methods of Multivariate Analysis", John Wiley & Sons Publication, 3rd Edition
2. T.W. Anderson, "An Introduction to Multivariate Statistical Analysis", Wiley, 3rd Edition, 2003.

CS/IT222	Database Management Systems	L	P	C
		3	0	3

Course Objectives

The main objectives of this course are to:

1. Fundamental concepts and architectures of database system
2. Features and design of conceptual and relational data models
3. Formal relational Languages and SQL to query, update, and manage a database
4. The concepts and protocols related to transaction processing, concurrency control and recovery

Course Outcomes

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

1. Discuss the fundamental concepts and architecture of database systems.
2. Query the database using relational algebra and SQL.
3. Explain the concepts of relational data model and design database using normalization process.
4. Develop conceptual database schema for a given specification.
5. Describe the role of transaction processing, concurrency control and recovery in a multi user database system.

Course Content:

UNIT I **11 Periods**

Introduction to Databases and Database Management System: Database system Applications, Advantages of DBMS over File System, Data Models, Instances and schema, View of Data, Database Languages –DDL, DML, DCL, Database Users and Administrator, Database System Architecture

Introduction to the Relational Model: Structure of RDBMS, Database Schema, Keys, Relational Query Languages, Relational Operations

UNIT II **15 Periods**

Formal Relational Query Languages - The Relational Algebra and Relational Calculus

SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Subqueries, Modification of the Database, Join Expressions, Views, Transaction, Integrity Constraints, SQL Data Types and Schemas, Authorization

UNIT III **12 Periods**

Database Design and the E-R Model - Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas.

Relational Database Design - Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Database-Design Process.

UNIT IV **12 Periods**

Transactions: Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels

Concurrency Control: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols, Multiversion Schemes, Snapshot Isolation

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management

Learning Resources:

Text Book:

1. Database System Concepts by Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition, McGraw Hill Publishers

CS/IT223	Operating Systems	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. To introduce the structure and functions of the operating system
2. To provide the knowledge of how the operating system manages the resources
3. To expose the students to the issues related to executing multiple process in the system.

Course Outcomes:

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

1. Describe the fundamental concepts of an operating system functionality, and processes.
2. Apply the concepts of multithreading and IPC mechanisms.
3. Analyze the performance of CPU scheduling algorithms, page replacement algorithms, and disk scheduling algorithms.
4. Demonstrate the methods to solve critical section problem and deadlock handling in a system.
5. Differentiate the effectiveness and the hardware support required for contiguous, non-contiguous, and virtual memory management schemes.
6. Differentiate the file systems for applying different allocation and access techniques.

Course Content:

UNIT I **(CO1 &CO2)** **12 Periods**

Introduction: What Operating Systems Do, Operating-System Operations, Resource Management, Security and Protection, Virtualization, Distributed Systems, Kernel Data Structures.
Operating System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Operating-System Structure.
Processes: Process Concept, Process Scheduling, Operations on Processes, inter process Communication, IPC in shared-memory Systems, IPC in Message-passing Systems.

UNIT II **(CO2,CO3&CO4)** **14 Periods**

Threads and Concurrency: Overview, Multicore Programming, Multithreading Models, Implicit Threading, Threading Issues.

CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Synchronization: Background, The Critical-Section Problem, Peterson 's solution, Hardware support for Synchronization, Mutex Locks, Semaphores, Monitors. Classic Problems of Synchronization.

UNIT III **(CO4 &CO5)** **14 Periods**

Dead Locks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Main Memory: Background, Contiguous Memory Allocation, Paging, Structure of the Page Table, Swapping.
Virtual-Memory: Background, Demand Paging, Page Replacement, allocation of frames, Thrashing - Memory Compression, Other considerations.

UNIT IV **(CO6)** **10 Periods**

Mass-Storage Structure: Overview of Mass-Storage Structure, HDD Scheduling.

Files System Interface: File Concept, Access Methods, Directory Structure, Protection, Memory –mapped files.

File-Systems Implementation: File-System Structure, File-System operations, Directory Implementation, Allocation Methods, and Free-Space Management.

Learning Resources:

Text Book(s):

1. Operating System Concepts-Abraham Silberchatz, Peter B Galvin, Greg Gange Tenth Edition, WILEY.

Reference Books:

1. Operating Systems, Internal and Design Principles, Stallings, 8th Edition-2015, Pearson education/PHI.
2. Operating system, A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tenenbaum 4th Edition Pearson/PHI.
4. An Introduction to Operating Systems, Concepts and Practice, 4th Edition, PHI, 2013-Pramod Chandra P. Bhatt.
5. Operating Systems- A concept based approach –DM Dhamdhere -3rd Edition TMH.

CS/IT224	Software Engineering	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Acquire knowledge on the principles and process models for software development.
2. Explain the specific requirements for a given software project
3. Acquire knowledge on design concepts and user interface principles for Software development
4. Examine various testing techniques and metrics applicable to a Software project

Course Outcomes:

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

1. Describe the software engineering process model required to create a software system.
2. Discuss the software requirements and analyze a model for a software project.
3. Design and specify software components for real-world problems.
4. Evaluate various software testing techniques and metrics.

Course Content:

UNIT I **(CO1,CO2)** **12 Periods**

Software and Software engineering: The Nature of Software, Defining Software, Software Application Domains, Legacy Software, The software Process.

The Software Process: Process Models: A Generic Process Model, defining a Framework Activity, identifying a task set, Process Assessment and Improvement, Prescriptive Process Models: The waterfall model, Prototyping Process model, Evolutionary process model, The Unified Process.

Agile Development: What Is Agility? What Is an Agile Process? Scrum Other Agile Process Models, Scrum, Other Agile Frameworks- The XP Framework.

UNIT II **(CO3)** **13 Periods**

Understanding Requirements: Requirements Engineering, Establishing the Groundwork, Requirements gathering, developing use cases, Building the Analysis Model, Negotiating Requirements, Requirements monitoring, Validating Requirements.

Requirements Modelling: Requirements Analysis, Scenario-Based Modeling, Class-Based Modeling, Functional Modelling, Behavioural Modelling.

Design Concepts: Design within the Context of Software Engineering, the Design Process, Design Concepts, the Design Model.

UNIT III **(CO4)** **13 Periods**

Architectural Design: Software Architecture, Agility and Architecture, Architectural Styles, Architectural Design, Assessing Alternative Architectural Designs, Architectural Reviews.

Modeling Component-Level Design: What Is a Component? Designing Class-Based Components, Conducting Component Level Design.

User Experience Design: User Experience Design Elements, The Golden Rules, User Interface Analysis and Design, Interface Analysis and Design Models, The process.

UNIT IV **(CO5, CO6)** **12 Periods**

Software Testing –Component Level: A Strategic Approach to Software Testing, Planning and Record keeping, Test case design, White box testing, Black-Box-Testing.

Software-Testing Integration level: Software Testing Fundamentals, Integration testing, Validation Testing, Testing Patterns.

Software Metrics and Analytics: Software Measurement, Software Analytics, Product Metrics, Metrics for Testing, Metrics for maintenance, Process and Project Metrics, Metrics for Quality.

Learning Resources:

Textbook(s):

1. Roger Pressman and Bruce Maxim "Software Engineering- A Practitioner's Approach", 9th edition, Tata McGraw-Hill International.

Reference Books:

1. Ian Somerville, Software Engineering. 6 ed, Pearson Education.
2. Carlo Ghezzi, Mehdi Jazayeri and Dino Mandrioli, Fundamentals of Software Engineering.2 ed, PHI.
3. RajibMall, Fundamentals of Software Engineering. 2 ed, PHI.

Web Resources:

1. http://nptel.ac.in/courses/106101061/2
2. http://nptel.ac.in/courses/106101061/5

CS/IT 225	Web Technologies	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Basic technologies to develop web documents.
2. Dynamic HTML Pages and Event handling mechanism.
3. XML, Web Servers, Servlet technologies.
4. Java Server Page Technologies.

Course Outcomes:

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

1. Create web pages with HTML, CSS, and JavaScript.
2. Design dynamic web pages using client side scripting.
3. Create XML documents, work with Web Servers and develop Web applications with Servlets.
4. Design and develop server side programs with Java Server Pages.

Course Content:

UNIT I **12 Periods**

Introduction to HTML5 Part - I & II. Cascading Style Sheets (CSS) Part - I & II.
JavaScript: Introduction to Scripting, Control Statements Part - I & II.

UNIT II **14 Periods**

JavaScript: Functions, Arrays, Objects. DOM Objects and Collections. JavaScript Event Handling

UNIT III **12 Periods**

XML: XML Basics, XML Namespaces, DTD, XML Schema, MathML, XSL & XSLT.
Web Servers (IIS and Apache).
Introduction to Servlets: Common Gateway Interface (CGI), Lifecycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

UNIT IV **12 Periods**

Introduction to JSP:JSP& Servlet as Web Components, Servlets vs. JSP, JSP Lifecycle, JSP Page Lifecycle Phases, General Rules of Syntax, JSP syntactic elements, JSP element syntax, Template content. JSP elements-directives, declarations, expressions, scriptlets, actions. JSP Standard Actions: jsp: useBean, jsp: getProperty, jsp: setProperty, jsp: include, jsp: forward, jsp: plugin, jsp: param.

Learning Resources:

Text Book:

1. Harvey M. Deitel and Paul J.Deitel, "Internet & World Wide Web How to Program", 4/3, Pearson Education.(UNIT I, UNIT II and UNIT III).
2. SubrahmanyamAllamaraju and Cedric Buest, "Professional Java Server Programming: J2EE" (UNIT III and UNIT IV (Servlets and JSP)

Reference Books:

1. Jason Cranford Teague "Visual Quick Start Guide CSS, DHTML & AJAX", 4/ e, "Pearson Education".
2. Tom NerinoDoli Smith "JavaScript & AJAX for the Web" Pearson Education, 2007.
3. Bill Dudney, Johathan Lehr, Bill Willies, Lery Mattingly "Mastering Java Server Faces" Willey India, 2006.
4. Web Technology - UttamK.Roy, Oxford University Press, 2010.

Web References:

1. www.deitel.com
2. www.w3schools.com
3. www.tutorialspot.com

CS/IT261	Computational Statistics Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. The knowledge to understand the concepts of linear statistical and ANOVA models and draw the conclusions.
2. The idea to develop a sound understanding of current, modern computational statistical approaches and their application to a variety of datasets.
3. To understand the key technologies in data science and business analytics such as data mining, machine learning, visualization techniques and predictive modelling.
4. The knowledge to apply principles of data science to analyse and to effectively visualize the data.

Course Outcomes:

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

1. Explain the basic concepts of linear statistical models
2. Interpret the results of Multivariate Regression models
3. Estimate the discriminate function to segregate and allot the item to the subgroup.
4. Implement Multi-Variate Statistical Analysis techniques using Python.
5. Apply data reduction and visualization techniques.

Lab Programs to implement

WEEK 1	Simple Linear Regression
WEEK 2	Correlation methods
WEEK 3	Multiple Regression
WEEK 4	Multivariate Regression
WEEK 5	Multivariate analysis of variance and co-variance
WEEK 6	Analysis of Variance (one-way classification),
WEEK 7	Analysis of Variance (two-way classification)
WEEK 8	Multivariate Normal Distribution
WEEK 9	Linear discriminant analysis for multivariate data
WEEK 10	Principle component analysis for multivariate data
WEEK 11	Factor Analysis for multivariate data
WEEK 12	Cluster analysis for multivariate data

Learning Resources:

Text Books:

1. Richard. A. Johnson and Dean. Wichern "Applied Multivariate Statistical Analysis" Pearson/Prentice Hall, 6th Edition, 2007
2. Daniel J. Denis "Applied Univariate, Bivariate, and Multivariate Statistics Using Python: A Beginner's Guide to Advanced Data Analysis", Daniel J. Wiley.
3. Alejandro Garcia, "Applied Multivariate Analysis with Python"

Reference Books:

1. Regression Diagnostics , Identifying Influential Data and Sources of Collinearity, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.

CS/IT262	Database Management Systems Lab	L	P	C
		0	3	1.5

Course Objectives:
The main objectives of this course are to:

1. Syntax and usage of DDL, DML, DCL, and TCL statements, asserting database integrity constraints during database creation.
2. Semantics of SQL for implementing the user queries on a relational database.
3. Block structured PL / SQL programming concepts.

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

1. Define, manipulate and control data using Structured Query Language (SQL).
2. Identify various database integrity constraints during database creation.
3. Construct SQL statements for satisfying end user queries by utilizing functions, set operations, joins, and subqueries.
4. Develop various applications using various PL/SQL data object like Database cursors, Functions, Stored Procedures, Packages, and Triggers.

Week 1

Practice DDL and DML statements for creating a sample database without integrity constraints.

Week 2

Practice DDL and DML statements for refining a sample database including integrity constraints.

Week 3

Query the sample database using simple select statements retrieving:

1. Small-large number of attributes
2. Distinct output values
3. By Renaming attributes
4. Computed attributes
5. By using Simple-complex conditions (AND, OR, NOT)
6. By using Partial Matching operators (LIKE, %, _, *,?)
7. Sorted records
8. By checking for Nulls

Week 4-6

Query the sample database using joins, nested queries, aggregate functions and set oriented operations

Week 7 Query the sample database using built-in single row functions
Week 8 Implement PL/SQL named and unnamed blocks
Week 9 Implement PL/SQL Implicit and Explicit Cursors
Week 10 Implement PL/SQL pre-defined and user defined exceptions
Week 11 Implement PL/SQL stored procedures, functions and packages
Week 12 Implement PL/SQL database triggers

CS/IT263	Web Technologies Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. Basic technologies to develop web documents.
2. Dynamic HTML Pages and Event handling mechanism.
3. XML, Web Servers, Java Servlet technologies.
4. Java Server Page Technologies

Course Outcomes:

After successful completion of the course, the students are able to

1. Create web pages with HTML, CSS, and JavaScript.
2. Design dynamic web pages using client side scripting.
3. Create XML documents using XML Technologies
4. Develop Server side web applications with Java Servlets.
5. Design server side programs with Java Server Pages.

LAB CYCLE –I

1.
   a. Create a web page having the background in green and title "My First Page".
   b. Create a web page of pink colour and display a moving message in red colour.
   c. Design a web page containing text, in form of paragraphs giving suitable heading style
2.
   a. Create a web page which displays WELCOME text using heading tags(h1 to h6)
   b. Create a web page which displays WELCOME text using <b> tag
   c. Create a web page which displays h2o and x2+y2 using <sup> tag and <sub> tag
3.
   a. Create a web page to show different attributes of Font tag.
   b. Create a web page to show different attributes: italics, bold, underline.
   c. Design a web page having background colour yellow and giving text colour red
4.
   a. Create a web page using href attribute of anchor tag & the attribute: alink, vlink etc.
   b. Create links on the words e.g. —Wi-Fi and —LAN‖ to link them to Wikipedia pages.
   c. Create a web page with appropriate content and insert an image towards the left hand side of the page. When user clicks on the image, it should open another Web page.
5.
   a. Create a web page, showing an ordered list of the names of five of your friends.
   b. Create a web page containing a nested list showing the content page of any book
   c. Create a web page, showing an unordered list of names of five of your friends
6.
   a. Create a table to show your class timetable using rowspan and colspan attributes.
   b. Use tables to provide layout to your HTML page describing your college infrastructure.
   c. Create a web page in the following table fields

Name of train	place	Destination	Train No	Time		Fare
				Arrival	Departure	

7.

a. Develop a web page having two frames that divide the Web page into two equal rows.
b. Develop a web page having two frames that divide the Web page into two equal rows and then divide the second row into two equal columns.
c. Develop a web page having frames as described in the above web page and then fill each frame with a different background colour

8.

a. Create your bio-data form on a web page using all input types
b. Create a web page having radio buttons labeled as name of colours. Clicking on each radio button should change the colour of the Web page
c. Embed Audio and Video into your web page

9.

a. Create a webpage which displays the class time table and apply the following effects on the table:
b. For the table header apply blue as the background colour and white for the colour of the text in the table header. b. Display days in a week (Mon, Tue etc...) in bold format with the first letter in the day name in uppercase.
c. Display lunch slightly in bigger font other than the remaining text.

10.

a. Create a webpage which displays "Hello World" with font size 20 pixels, bold format, in "Times New Roman" font and green in colour using inline CSS, embedded CSS and external CSS.
b. Create a web page containing two images, where one image overlaps another image by using the z-index CSS property.
c. Demonstrate the usage of CSS Inheritance and Specificity with an example.

11.

a. Create a div element with a width and height of 500px. Create a diagonal linear gradient using the colors of the rainbow—Red, Orange, Yellow, Green, Blue, Indigo, Violet. (Linear Gradient)
b. Create a div element with a width and height of 500px. Create a radial gradient with three colors. Start the gradient in the bottom-left corner with the colors changing as they move along the gradient line to the right. (Radial Gradient)
c. Create an infinite animation of an element moving in a square pattern. (Animation)

LAB CYCLE –II
JAVA SCRIPT

1. Write a java scripts to
   a) find the given year is leap year or not
   b) compute the biggest of three numbers
   c) perform the arithmetic operations using switch statement

2. Write a java script to
   a) calculate the sum of the digits of a give number
   b) reverse of a given number
   c) print the first 10 natural numbers except 5

3. Write a java script to
   a) functions (GCD, reverse, random numbers)
   b)recursive function(factorial, Fibonacci , power)
   c) image generator

4. a) Write a java script to
   a) sort the array element using bubble sort technique
   b)search a given element in the given set of given elements using binary search technique.
   c) compute i) addition of two matrices ii) multiplication of two matrices

5. a) Write a java script to
   a) implement string operations using String object
   b) implement the mathematical operations using Math object
   c) display Greeting messages using Date object

5. demonstrate collect objects
   a) All collection
   b) Children collection
   c) Anchor collection

6. Demonstrate event model
   a) Form events(onchange, onfocus ,onblur)
   b) Mouse events (onclick, onmouesedown,onmoueseup,onmouesemove,onmoueseover)
   c) Event bubbling

LAB CYCLE –III

7. Write a valid XML document using DTD
8. Write a servlet program to validate a user
9. Write a web application using servlet and JDBC.
10. Write a JSP program on Implicit objects
11. Write a JSP program on Action tags.
12. Demonstrate cookies and session information using JSP

CSSL2(a)	3D- Computer Animation	L	P	C
	Skill Oriented Course – II	1	2	2

Course Objectives:

The main objectives of this course are to:

1. This course introduces students to all the major features of Maya.
2. To train the students to acquire skills and mastery in the use of Maya software.

Course Outcomes:

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

1. Design, model and texture 3D objects.
2. Create expressive movement with 3D objects and rigs.
3. Create intentional lighting within a 3D scene.

Course Content:

CSSL2(b)	Linux Programming	L	P	C
	Skill Oriented Course – II	1	2	2

Course Objectives:

The main objectives of this course are to:

1. Introduce the architecture of Unix and shell programming.
2. Impart knowledge on Unix internals.

Course Outcomes:

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

1. Use Unix commands and shell scripts to interact with operating system.
2. Demonstrate AWK for pattern scanning and processing.
3. Demonstrate file and process management using system calls.
4. Create applications using signals and IPC mechanisms.

Course Content:

UNIT I **8 Periods**

Introduction to UNIX: Unix architecture, Features of Unix, Vi editor.

Unix Utilities: Directory Related utilities- pwd, mkdir, ls, cd ,rmdir. File Handling and Text Processing - cp, mv, rm, ln, unlink, lp, cat, more, pg , head, tail, sort ,nl, grep, egrep, fgrep, cut, paste, join, tee, w ,chgrp, chmod, chown, find, cmp, diff, uniq, tr.Disk utilities, Backup and other utilities- du, df, mount, unmount, umask, ulimit, tar, cpio, dump , who, mail, compress, uncompress, gzip, gunzip, crypt, sed, tty.

UNITII **12 Periods**

Programmable text processing: awk - awk programs, accessing individual fields, Begin and end, operators, variables, control structures, extended regular expressions, condition Ranges, field separators, Built – in functions.

Bourne Shell programming: Shell, functions of the shell , Meta characters, Input redirection, Output redirection, pipes, shell as programming language, shell variables, predefined local variables, predefined environment variables, Arithmetic, conditional expressions, control structures, positional parameters, passing command line arguments, Built – in Shell commands and shell programs.

UNIT III **14 Periods**

File management system calls : Regular file management system calls – open( ), read( ), write( ), lseek( ), Close(),unlink( ),stat( ), getdents( ). Miscellaneous file management system calls – chown( ) and fchown( ), chmod( ) and fchmod( ), dup( ) and dup2( ), fcntl( ), ioctl( ), link( ), mknod( ), sync( ), truncate( ) and ftruncate( ).

Process Management: Creating a new process – fork( ),orphan processes, terminating a process – exit( ), zombie processes, waiting for child – wait( ), Differentiating a process – exec( ), changing directories – chdir( ), changing priorities- nice( ), Accessing user and Group ID's.

UNIT IV **14 Periods**

Signals: The defined signals, A list of signals, terminal signals, Requesting on Alarm signal – alarm( ), handling signals – signal( ), protecting critical code and chaining interrupt handlers, sending signals – kill( ), Death of children, suspending and Resuming processes, process Group's and control terminals.

Inter process communication: Pipes, Sockets, shared memory, semaphores.

Learning Resources:

Text Book:

1. "Unix for programmers and users" 3rd edition by Graham Glass, King Ables, Pearson education.

Reference Books:

1. "Advanced programming in the unix environment" w- Richard Stevens 2nd Edition Pearson education
2. "Unix programming environment", Kernighan and pike, Pearson education.
3. "Your Unix the ultimate guide" Sumitabha Das, TMH 2nd edition.
4. "Advanced Unix programming" by Marc J. Rochkind, 2nd edition Pearson Educatio

List of Experiments

LABCYCLE I: (Using Commands and Shell Programming)

1. Working with different Unix commands.
2. Program on built in functions of awk programming.
3. Write Shell Programs for the following:

a) Display all the words which are entered as command line arguments.

b) Changes Permissions of files in PWD as rwx for users.

c) To print the list of all sub directories in the current directory.

d) Program which receives any year from the keyboard and determine whether the year is leap year or not. If no argument is supplied the current year should be assumed.

e) Program which takes two file names as arguments, if their contents are same then delete the second file.

4. Write shell scripts for the following

   a) To print the given numbers in the reversed order.

   b) To print the given numbers in sorted order.

   c) To print first 25 Fibonacci numbers.

   d) To print the Prime numbers between the specified range.

   e) To print the first 50 Prime numbers.

5. Write shell scripts for the following:

   a) To delete all lines containing the word 'unix' in the files supplied as arguments.

   b) Menu driven program which has the following options. i) contents of /etc/passwd ii) list of users who have currently logged in. iii) present working directory. iv) exit.

   c) For sorting, searching and insertion, deletion of elements in the list.

LABCYCLE II : (Using System Calls)

1. Program to transfer the data from one file to another file by using un-buffered I/O.
2. Write a C program for demonstrating dup () and dup2() system calls.
3. Write a C program to demonstrate PERROR () function.
4. Program to create two processes to run a loop in which one process adds all even numbers and the other adds all the odd numbers. (use fork ()).
5. Program to create process 'i' and sends data to process 'j', prints the same after receiving it.
6. Program to demonstrate orphan process.
7. Program to demonstrate how to create a zombie process and to avoid Zombie using wait ().
8. Write a C program for Requesting an alarm signal to execute user defined alarm handler.
9. Write a C program to demonstrate Suspending and Resuming Processes.
10. Program on Inter process communication using pipes.
11. Program on Inter process communication using shared memory and semaphores.
12. Program on Client/Server Socket communication.

CSSL2 (c)	Mobile Application Development	L	P	C
	Skill Oriented Course – II	1	2	2

Course Objectives:

The main objectives of this course are to:

1. Provide knowledge on tools required for Mobile Application Development using Android.
2. Create applications on Android User Interface using Views, Pictures and Menus.
3. Build apps using Notifications and Data Persistence.
4. Make the student to use Communication mechanisms in Android.

Course Outcomes:

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

1. Create an Environment to develop Android applications.
2. Design user Interfaces using Views and Menus.
3. Implement backend Android App using SQLite.
4. Develop application using Messaging and Mailing services in Android.

Course Content:

UNIT I **CO1** **12Periods**

Android Programming: What Is Android? Obtaining the Required Tools, Creating Your First Android Application.
Android studio for Application development: Exploring IDE, using code completion, debugging your Application, Generating a signed APK.
Activities, Fragments, and Intents: Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.

UNIT II **CO2** **12Periods**

Android User Interface: Components of a Screen, Adapting To Display Orientation, Managing Changes to Screen Orientation, Utilizing the Action Bar, Creating the User Interface Programmatically.
User Interface with Views: Using Basic Views, Using Picker Views, Using List Views To Display Long Lists, Understanding Specialized Fragments.

UNIT III **CO3** **10 Periods**

Pictures and Menus with Views: Using Image Views to Display Pictures, Using Menus with Views, Using Web View.
Notifications –Creating and Displaying notifications, Displaying Toasts.
Data Persistence: Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.

UNIT IV **CO4** **10 Periods**

Content Providers: Using a Content Provider, Creating Your Own Content Providers.
Messaging: SMS Messaging, Sending E-Mail.

Learning Resources:

Text Book:

1. Beginning Android Programming with Android Studio, J.F.DiMarzio, Wiley India (Wrox), 2017.

Reference Books:

1. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2012.
2. Reto Meier, Professional Android 4 Application Development, Wiley India, (Wrox), 2012.
3. James C Sheusi, Android Application Development for Java Programmers, CengageLearning, 2013.

CSSL2 – (Skill Oriented Course-II)

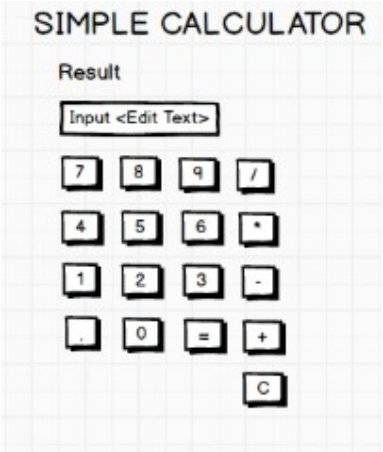
Mobile Application Development Lab

List of Experiments:

1. Create an application to design a visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and website address is to be displayed. Insert a horizontal line between the job title and the phone number.

2. Create an Application that takes the Student data (Name ,Regdno, Number, Email and Mobile Number) from the user and display the same when user clicks the OK Button.

3. Develop an Android application using controls like Button, TextView, EditText for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and division.



4. Create a SIGN-Up activity with Username and Password. Validation of password should happen based on the following rules:

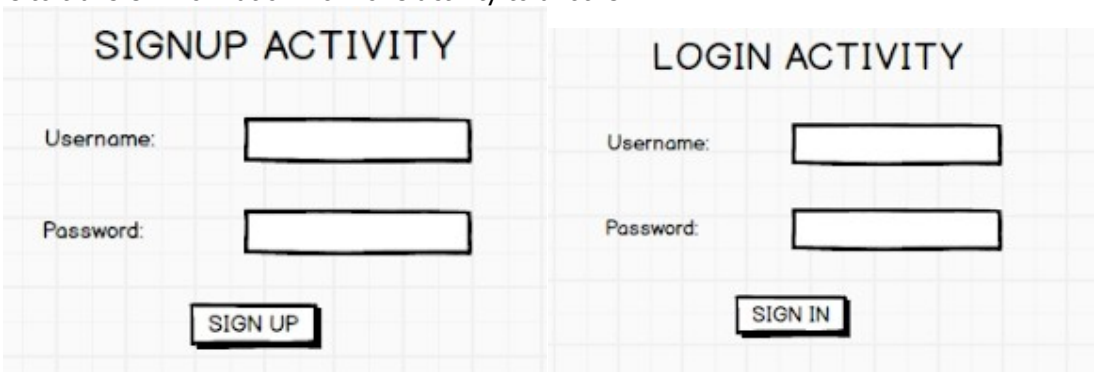
Password should contain uppercase and lowercase letters.·

Password should contain letters and numbers.·

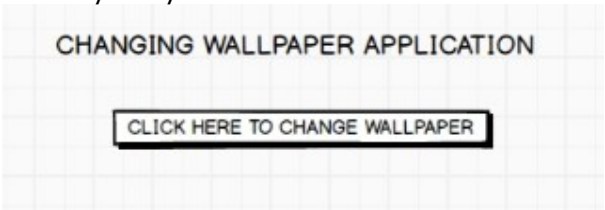
Password should contain special characters.·

Minimum length of the password (the default value is 8).·

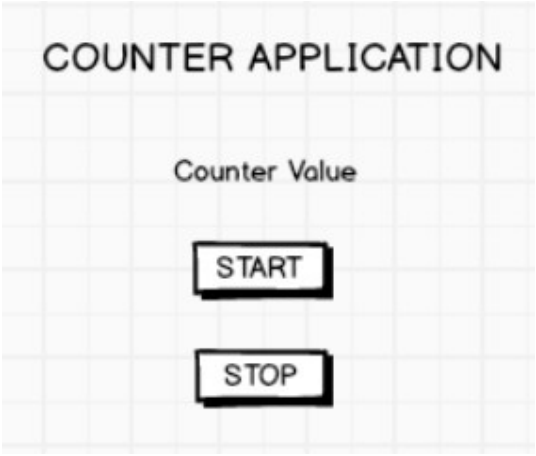
On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during the signup activity. If the Username and Password are matched then navigate to the next activity which displays a message saying "Successful Login" or else display a toast message saying "Login Failed". The user is given only two attempts and after that displays a toast message saying "Failed Login Attempts" and disable the SIGN IN button. Use Bundle to transfer information from one activity to another.



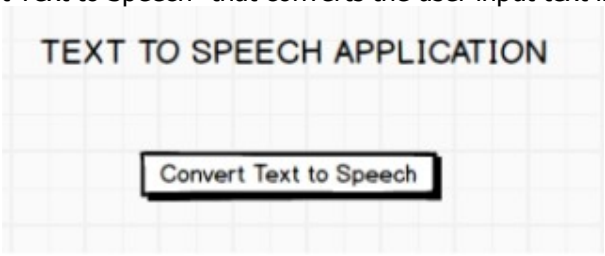
5. Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.



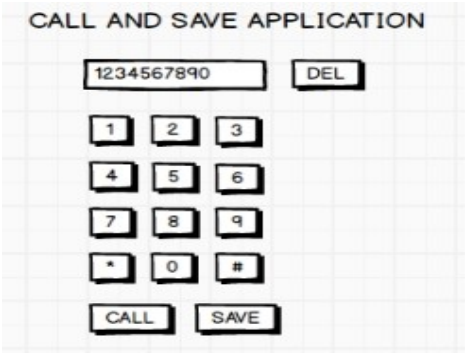
6. Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextView control.



7.Develop a simple application with one EditText so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice.



8. Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.



9. Create an application to demonstrate a basic media player Application.

10. Create a user Registration Application that stores the user details in the Database table.

List of Apps:

1. Medicine Reminder
2. Language Translator
3. Simple Music Player
4. Budget Manager
5. Eye Test App
6. Ludo App
7. College News
8. India in Detail
9. Quiz Application
10. Smart Farm
11. Student Attendance and Marks Application
12. To-Do List
13. COM-RATE
14. Blood Bank
15. Food Donation Application
16. Hotel Review
17. Weather App.
18. Book Listing
19. Tax and EMI calculator App.
20. Text Encryption

CS/ITMC4	Ethics & Human Values	L	P	C
		2	0	0

Course Objectives:

The main objectives of this course are to:

1. To create awareness to specific set of morals, values and ethics the professional must know and abide by, including work ethics, integrity and commitment etc.
2. To realize the importance of moral autonomy, professional ideals and Ethical theories
3. To study safety/risk aspects, welfare of the public and about employee rights
4. Know about the global issues and code of ethics of professional bodies

Course Outcomes:

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

1. Have basic understanding of how a prospective engineer should behave in his chosen field and society.
2. Realize the importance of moral autonomy, professional ideals and Ethical theories.
3. Know about the safety/ risk, welfare of the public and employee rights
4. Gain exposure to global issues and codes of some professional bodies

Course Content:

UNIT I **15 Periods**

Human Values: Morals, Values and Ethics - Integrity- Work Ethics- Service Learning - Civic Virtue Respect for Others - Living Peacefully - Caring - Sharing - Honesty - Courage - Valuing Time -Co-Operation - Commitment - Empathy - Self-Confidence – Stress Management-Character - Spirituality.

UNIT II **15 Periods**

Engineering Ethics: Senses of Engineering Ethics- Variety of Moral Issues - Types of Inquiry - Moral Dilemmas - Moral Autonomy - Kohlberg's Theory - Gillian-s Theory - Consensus and Controversy.

Professions and Professionalism: The nature and characteristics of Professions, Professionalism, the foundation and norms of Professional ethics, the need for separate code of conduct for Professionals, Professional Rights, Theories about Right Action, Uses of Ethical Theories. Case studies like The Space Shuttle Challenger, Bhopal gas tragedy, Chernobyl disaster etc.

UNIT III **15 Periods**

Engineering as Social Experimentation: Engineering as Experimentation - Engineers as Responsible Experimenters Safety.

Responsibilities and Rights: Safety and Risk - Assessment of Safety and Risk,Risk Benefit Analysis and Reducing Risk. Collegiality and Loyalty - Respect for Authority –Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Employee Rights – Intellectual Property Rights (IPR) - Discrimination.

UNIT IV **15 Periods**

Multinational Corporations - Environmental Ethics - Computer Ethics - Business ethics - Engineers As Managers - Consulting Engineers - Engineers As Expert Witnesses and Advisors - Codes Of Ethics -Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management Etc.,

Learning Resources:

Text Books:

1. Mike martin and Ronald Schinzinger, "Ethics in Engineering" McGraw-Hill, New York 1996
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., "Engineering Ethics", PHI, New Delhi
3. Bayles.M. D, Professional ethics, California, Wards worth publishing company,1981
4. Koehn.D, The ground of Professional Ethics, Routledges, 1995

Reference Books:

1. Charles D,Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint)
2. Charles E Harris, Michael S.Protchard and Michael J Rabins, "Engineering Ethics - Concepts and Cases" Wadsworth Thompson Learning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the conduct of business" Pearson, New Delhi, 2003.
4. Edmund G.Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers" Oxford University Press, Oxford, 2001.

Semester- V (Third Year)

CS/IT311	Automata Theory & Formal Languages	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Introduce the types of Finite Automata and properties of Regular Expressions.
2. Explain Context-Free Grammars and Push Down Automata
3. Introduce the Turing Machine and explain undecidability concept.

Course Outcomes:

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

1. Explain the fundamental concepts of Automata and Formal languages. L2
2. Apply the knowledge of Automata Theory, Formal languages, Grammars & Regular Expressions for solving various problems. L3
3. Design PDAs for various languages. L4
4. Design Turing machines to solve problems. L4

Course Content:

UNIT I **(CO-1,2)** **12 periods**

Automata: Introduction to Automata, The central concepts of automata theory - Alphabets, Strings, Languages.
Finite Automata: An Informal picture of finite automata, Deterministic finite automata (DFA) - Definition of DFA, DFA processing strings, Notations for DFA, Extended transition function, the language of DFA, Non deterministic finite automata (NFA) – Definition of NFA, Extended transition function, the language of NFA, Equivalence of DFA and NFA Finite.
Automata with $\in$ transitions: Use of $\in$ - transition, notation for an $\in$ - NFA, Epsilon closures, extended transitions and languages, Applications.

UNITII **(CO-1,2)** **12 periods**

Regular Expressions and Languages: Regular expressions, finite automata and regular expressions, Algebraic laws of regular expressions.
Properties of Regular Languages: Proving languages are not regular – Pumping lemma for regular languages, Applications of the pumping lemma, Closure Properties of Regular Languages, Equivalence and minimization of automata – Minimization of DFA

UNIT III **(CO-1,2,3)** **12 periods**

(Construction based treatment & proofs are excluded)
Context Free Grammars: Context Free Grammars, Parse Trees, Constructing parse trees, derivations and parse trees, ambiguous grammars.
Pushdown Automata: Definition of the Pushdown automata, the languages of PDA, Equivalences of PDA's and CFG's.
Context free languages: Normal form's for context- Free grammars, the pumping lemma for context free languages.

UNIT IV **(CO-1,2,4)** **12 periods**

Properties of Context free languages: closure properties for context free languages, Decision properties for CFL's.
Introduction to Turing Machines: The Turing Machine, programming techniques for Turing machines.
Undecidability: A language that is not recursively enumerable, an undecidable problem that is RE, Undecidability problems about TM, Post's Correspondence problem.

Learning Resources:

Textbook:

1. John.E.Hopcroft, R.Motwani, &Jeffery.D Ullman, "Introduction to Automata Theory,Languages and Computations", Second Edition, Pearson Education, 2003

Reference Books:

1. Daniel I.A.Cohen, 'Computer Theory',
2. KLP Mishra &N.Chandrasekharan, 'Theory of Computation', PHI.
3. MichealSipser, "Introduction of the Theory and Computation", Thomson Brokecole, 1997.
4. R.K.Ragade, "Automata and Theoretical Computer Science", First Edition, Pearson Education, 2004.
5. John E Hopcroft& Jeffery D Ullman' 'Introduction to Automata Theory & Languages and Computation', Narosa Publishing House.

CS/IT312	Computer Networks	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamental concepts and layered architectures of networks.
2. Impart knowledge on functionalities, design issues, protocols and mechanisms used in different layers of network stack.

Course Outcomes:

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

1. Describe the layered architectures of computer networks.
2. Explain the fundamental concepts of data communications.
3. Illustrate the data link layer protocols and the mechanisms used for accessing a channel.
4. Exemplifyoptimal routing algorithms and QoS mechanisms used for networks.
5. Explain reliable and unreliable protocols used for end to end connectivity.
6. Discuss the application layer protocols.

Course Content:

UNIT I **12 Periods**

Introduction: Network Hardware, Network Software, Reference Models.

Physical Layer: The theoretical basis for data communication, Guided media, digital modulation and multiplexing, switching.

UNIT II **13 Periods**

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.

The Medium Access Control Sub-layer: Multiple Access Protocols- ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Ethernet, Data Link Layer Switching.

UNIT III **14 Periods**

The Network Layer: Network Layer Design Issues, Routing Algorithms-Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast routing, multicast routing, Congestion control algorithms, Quality of Service-Application Requirements, Traffic Shaping, Packet Scheduling, Admission Control, Internetworking, The Network Layer in the Internet-The IP version 4.0 protocol, IP Addresses, IP Version 6.0, Internet Control Protocols.

UNIT IV **11 Periods**

The Transport Layer: The Transport Service: Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols – addressing: Connection Establishment,

Connection Release, Error Control and Flow Control, Congestion control-Desirable Bandwidth allocation, Regulating the sending rate, The Internet Transport Protocols: Introduction to UDP, Remote procedure call, Real-Time transport protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

The Application Layer: DNS- The Domain Name System, Electronic mail.

Learning Resources:

Text Book(s):

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Fifth Edition, Pearson Education.

References:

1. James F. Kurose, Keith W. Ross, Computer Networking, Third Edition, Pearson Education.
2. Behrouz A Forouzan, Data Communications and Networking, Fourth Edition, TMH (2007).
3. Kurose & Ross, COMPUTER NETWORKS, A Top-down approach featuring the Internet, Pearson Education, Alberto Leon, Garciak.

CS/IT313	Design & Analysis of Algorithms	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Impart knowledge on algorithm design strategies and performance analysis of algorithms.
2. Introduce pattern matching algorithms and NP-Completeness

Course Outcomes

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

1. Analyze the performance of algorithms based on time and space complexities.
2. Apply algorithm design strategies to solve the real world problems.
3. Use string matching algorithms to solve given problems.
4. Differentiate P and NP class problems.

Course Content:

UNIT I **10 Periods**

Introduction- What is an Algorithm? Algorithm Specification, Performance Analysis, Randomized Algorithms – Identifying the repeated element, primality testing, advantages and disadvantages.

Divide and Conquer: General Method, Merge Sort, Quick sort, Divide and Conquer Run Time Recurrence Relations.

UNIT II **15 Periods**

Greedy Programming: General Method, Knapsack problem, Job Sequencing with Dead Lines, Minimum Spanning Tree - Prim's and Kruskal's algorithms, Single Source Shortest-Paths-Dijkstra's.

Dynamic Programming: General Method, Multi Stage Graph, All Pairs Shortest Paths, Single Source Shortest Paths-general Weights, Optimal Binary Search Trees, 0/1 Knapsack, Traveling Salesman Problem.

UNIT III **13 Periods**

Back tracking: General Method, 8-queen problem, Hamiltonian Cycles, 0/1 Knapsack.

Branch and Bound: Control Abstraction for LC Search, Bounding, FIFO branch and bound, LC branch and bound, 0/1 Knapsack problem, Traveling Salesman Problem.

UNIT IV **12 Periods**

String Matching – The Naïve String Matching Algorithm, The Rabin-Karp Algorithm, String Matching with Finite Automata, The KMP Algorithm.

NP-Completeness- Polynomial Time, Polynomial Time verification, NP Completeness and reducibility, NP Complete Problems.

Approximation Algorithms - The Travelling Sales Person Problem.

Learning Resources:

Text Book:

1. E. Horowitz, S. Sahni and S.Rajasekaran, "Fundamentals of Computer Algorithms", Galgotia Publication. (Unit I, II, III).

2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer Algorithm", PHI. (Unit IV).

Reference Book(s):

1. Sara Basse, A.V. Gelder, "Computer Algorithms", Addison Wesley.

CS314 **PROFESSIONAL ELECTIVE - I**

CSEL01	**Digital Image Processing**	**L**	**P**	**C**
	CS314 (CSEL01) Elective - I	**3**	**0**	**3**

Course objectives:
The main objectives of this course are to:

1. To create basic understanding of fundamental concepts in digital image processing and enhancement in the spatial domain.
2. To demonstrate the approaches used in enhancement in the frequency domain and image segmentation.
3. To teach image restoration and image compression techniques.
4. To analyse morphological transformations, and image representation of real world objects

Course outcomes:

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

1. Define image processing systems and develop algorithms for image enhancement techniques in the spatial domain.
2. Implement enhancement techniques in the frequency domain and image segmentation
3. Develop image restoration, and image compression techniques.
4. Analyse morphological transformation algorithms, and select various descriptors for image representation.

Course Content:

UNITI **[CO1]** **12 Periods**

Introduction: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.
Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters.

UNIT II **[CO2]** **12 Periods**

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency domain Filters, Sharpening frequency-domain Filters, Holomorphic Filtering, Implementation.

Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

UNIT III **[CO3]** **12 Periods**

Image Restoration: A Model of the Image Degradation/Restoration Process, Linear, Position-Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering.

Image Compression: Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards.

UNIT IV **[CO4]** **12 Periods**

Morphological Image Processing: Dilation and Erosion, The Hit-or-Miss Transformation, Some basic Morphological Algorithms, Extension to Gray-Scale Images.

Representation and Description: Representation, Boundary Descriptors, Regional Descriptors.

Learning Resources:

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods, 'Digital Image Processing' Addison Wesley Pubs (Second Edition).

Reference Books:

1. " Image Processing. Analysis, and Machine Vision ", Milan Sonka, Vaclav Hlavac, Roger Boyle (Second Edition).
2. A.K.Jain, 'Fundamentals of Digital Image Processing' PHI.

CSEL02	Information Retrieval	L	P	C
	CS314 (CSEL02) Elective - I	3	0	3

Course Objectives:

The main objectives of the course are:

1. To introduce the basic concepts and techniques used for information retrieval
2. To introduce models for scoring and evaluating information Retrieval Systems
3. To impart knowledge on text classification and clustering.

Course Outcomes:

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

1. CO1 – Illustrate the basic concepts and techniques used in Information Retrieval.
2. CO2 – Exemplify index construction and compression techniques.
3. CO3 – Explain scoring and computing scores in vector space model.
4. CO4 – Explain evaluation of retrieved documents and the support of feedback.
5. CO5 - Explain probabilistic information retrieval and text classification.
6. CO6 – Explain vector space classification and clustering techniques.

Course Content:

UNIT I **[CO1]** **12 Periods**

Boolean retrieval: An example information retrieval problem, A first take at building an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval.

The term vocabulary and postings lists: Document delineation and character sequence decoding, Determiningthe vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings and phrase queries.

Dictionaries and tolerant retrieval: Search structures for dictionaries, Wildcard queries, Spelling correction, Phonetic correction.

UNIT II **[CO2,CO3]** **12 Periods**

Index construction: Hardware basics, blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing. **[CO2]**

Index compression: Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.**[CO2]**

Scoring, term weighting and the vector space model: Parametric and zone indexes, Term frequency and weighting, The vector space model for scoring, Variant tf-idf functions. **[CO3]**

Computing scores in a complete search system: Efficient scoring and ranking, Components of an information retrieval system, Vector space scoring and query operator interaction. **[CO3]**

UNIT III [CO4,CO5] 12 Periods

Evaluation in information retrieval: Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance. **[CO4]**

Relevance feedback and query expansion: Relevance feedback and pseudo relevance feedback, Global methods for query reformulation. **[CO4]**

Probabilistic information retrieval: The Probability Ranking Principle, The Binary Independence Model. **[CO5]**

Text classification and Naïve Bayes: The text classification problem, Naïve Bayes text classification, The Bernoulli model, properties of Naïve Bayes, Evaluation of text classification. **[CO5]**

UNIT IV [CO6] 12 Periods

Vector space classification: Document representations and measures of relatedness in vector spaces, Rocchio classification, k nearest neighbor.

Flat clustering: Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means.

Hierarchical clustering: Hierarchical agglomerative clustering, Single – link and completelink clustering.

Learning Resources:

Text Book:

1. "An Introduction to Information Retrieval" by Christopher D. Manning, PrabhakarRaghavan&HinrichSchütze, Cambridge University Press Cambridge, England

Reference Books:

1. Modern Information Retrieval, Baeza – Yates Ricardo and Berthier Ribeiro – Net, 2nd edition, Addison Wesley.
2. Information Retrieval : Implementing and Evaluating Search Engines, Stefan butcher, Charlie Clarke, Gordon Cormack, MIT Press, 2010.
3. Search Engines: Information Retrieval in Practice, Bruce Croft, Donald Metzler, and Trevor Strohman, Pearson Education.

CSEL03	Data Engineering	L	P	C
		3	0	3

Course Objectives:

The main objectives of the course are:

1. To introduce basics of data warehousing and data mining.
2. To impart knowledge on data mining techniques.
3. To introducemining on complex data objects.

Course Outcomes:

After successful completion of the course, the student will be able to**:**

1. Explain the concepts of data warehousing and data mining.
2. Apply data preprocessing techniques for given data set.
3. Extract association rules from transactional databases.
4. Build a classifier for a given data set.
5. Apply various clustering and outlier detection techniques for a given data set.
6. Describe the concepts of mining on complex data objects.

Course Content:

UNIT I [CO1, CO2] 13 Periods

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts- Data Warehouse Modeling: Data Cube and OLAP-Data Warehouse Design and Usage- Data Warehouse Implementation.

Getting to know Your Data: Data Objects and Attribute Types- Basic Statistical Descriptions of Data- Measuring Data Similarity and Dissimilarity.

Data Preprocessing: An overview of Data Preprocessing**-** Data cleaning- Data Integration- Data Reduction- Data Transformation and Data Discretization.

UNIT II [CO1, CO3] 12 Periods

Introduction - Data Mining: Why Data Mining- What is Data Mining? -What Kinds of Data can be mined? - What Kinds of Patterns can be mined? - Which Technologies are used? - Major Issues in Data Mining.

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts- Frequent Item set Mining Methods: Apriori Algorithm, Generating Association Rules, Improving the efficiency of Apriori, FP Growth Approach for Mining Frequent Item Sets, Mining Frequent Item Sets using Vertical Data Format Method.

UNIT III [CO4] 13 Periods

Classification: Basic Concepts- Decision tree induction- Bayes Classification Methods- Rule-Based Classification- Model Evaluation and Selection- Techniques to Improve Classification Accuracy.

Advanced Methods in Classification: Bayesian Belief Networks-Classification by Backpropagation-Classification by Support Vector Machines-Lazy Learners.

UNIT IV **[CO5, CO6]** **12 Periods**

Cluster Analysis: Introduction to cluster analysis- partitioning methods- Hierarchical methods- Density-Based Methods: DBSCAN, Outliers and Outlier Analysis- Outlier Detection Methods.
Data Mining Trends: Mining Sequence Data- Mining Graphs and Networks- Mining Other Kinds of Data- Data Mining Applications.

Learning Resources

Text Book:

1. Data Mining Concepts & Techniques, Jiawei Han, MichelineKamber, and Jian Pei, 3/e, Morgan Kaufmann Publishers.

Reference Books*:*

1. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, Addison Wesley.
2. Data Warehouse Toolkit, Ralph Kimball, John Wiley Publishers.

CS315	Open Elective /Job Oriented Course- I	L	P	C
		3	0	3

CSOL01 Programming with Java

Course Objectives:

The main objectives of this course are to:

1. To make the students learn the basic concepts and fundamentals of platform independent object oriented language.
2. To elucidate the concepts of exception handling techniques and multithreading.
3. To create awareness on user interface design techniques and event handling mechanisms.

Course Outcomes:

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

1. Use the syntax and semantics of java programming language and basic concepts of OOP.
2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
4. Design event driven GUI and web related applications which mimic the real world scenarios.

Course Content:

UNIT I [CO1, CO2] 12 Periods

Introduction: Introduction to java, java buzzword, data types, dynamic initialization, scope and life time, operators, control statements, arrays, type conversion and casting, finals & blank finals.
Classes and Objects: Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes.
Inheritance: Basic concepts, access specifiers, usage of super key word, method overriding, final methods and classes, abstract classes, dynamic method dispatch, Object class.

UNIT II [CO2, CO3] 12 Periods

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.
Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.
Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

UNIT III [CO3] 12 Periods

Strings: Exploring the String class, String buffer class, Command-line arguments.
Library: Date class, Wrapper classes.

Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks.

I/O Streams: Streams, Byte Streams, Character Streams, File class, File Streams.

UNIT IV [CO4] 12 Periods

Applets: Concepts of Applets, life cycle of an applet, creating applets, passing parameters to applets, accessing remote applet, Color class and Graphics
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.
AWT: AWT Components, windows, canvas, panel, File Dialog boxes, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar.

Learning Resources:

Text Book:

1. Java The Complete Reference 12th Edition, Herbert Schildt, Mc Graw Hill Education (India) Private Limited, New Delhi.

Reference Books:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.DanielLiang,Pearson Publication.

CSOL02 Relational Database Management Systems

Course Objectives:

The main objectives of this course are to:

1. To learn the fundamental concepts of Data Base Management Systems.
2. To make the students learn how to retrieve the data from database using SQL
3. To understand the concepts of transaction processing, concurrency control.

Course Outcomes:

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

1. Describe the basic concepts of database systems.
2. Explain various data models and database system architectures.
3. Write queries to access database using SQL.
4. Describe the process of refining data base design using normalization.
5. Explain the concepts of transaction Processing and concurrency control.

Course Content:

UNIT I **12 Periods**

Databases and Database Users: Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs.

UNIT II **12 Periods**

Data Modeling Using the Entity-Relationship (ER) Model: Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types.

The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT III **12 Periods**

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL - More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT IV **12 Periods**

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions -Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

Learning Resources:

Text Book:

1. Fundamentals of Database Systems, RamezElmasri and SHamKanthB.NavatePearson Education, 5th edition.

Reference Books:

1. Introduction to Database Systems, C.J.Date Pearson Education.
2. Data Base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rdEdition.
3. Data base System Concepts, Abraham Silberschatz, Henry.F.Korth, McGraw hill, 5th edition.

CS/IT351	Design & Analysis of Algorithms Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. Provide foundations to deal with variety of computational problems
2. To demonstrate the use of algorithm design and pattern matching techniques for solving given problems.

Course Outcomes:

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

1. Solve the given problems using suitable algorithm design strategies.
2. Implement algorithms using high level language.
3. Use string matching algorithms to solve string editing problems.

List of Experiments to implement:

1. Problems related to Divide and Conquer strategy
2. Problems related to Greedy Strategy
3. Graph Related Problems using Greedy Strategy
4. Problems related to Dynamic Programming
5. Graph Related Problems using Dynamic Programming
6. Problems related to Backtracking Strategy
7. Problems related to Branch and Bound
8. String Matching Problems

CS352	Data Analysis Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of the course are to:

1. Introduce Python libraries used for data manipulation and visualization
2. Create awareness on data cleaning, wrangling and various operations on data
3. Impart knowledge on visualizing the data using various plots

Course Outcomes:

On successful completion of the course, students will be able to:

1. Solve the problems using Numpy features
2. Perform operations on data using Pandas
3. Visualize data using the tool Matplotlib
4. Perform operations on time series data

Course Content:

UNIT-I

NumPy Basics: Arrays and VectorizedComputation : TheNumPyndarray: A Multidimensional Array Object, Universal Functions: Fast Element-wise Array Functions,Data Processing Using Arrays.

Pandas Data Structure: Introduction to pandas Data Structure, Essential Functionality,Summarizing and Computing Descriptive Statistics.

UNIT-II

Data Loading, Storage, and File Formats: Reading and Writing Data in Text Format, Binary Data Formats, Interacting with Web APIs, Interacting with Databases.

Data Cleaning and Preparation: Handling Missing Data, Data Transformation, Extension Data Types, String Manipulation, Categorical Data

UNIT-III

Data Wrangling: Join, Combine, and Reshape: Hierarchical Indexing, Combining and Merging Datasets, Reshaping and Pivoting

Plotting and Visualization: A Brief matplotlib API Primer, Plotting with pandas and seaborn, Other Python Visualization Tools

UNIT-IV

Data Aggregation and Group Operations: How to think about Group Operations, Data Aggregation, Apply: General split-apply-combine, Group Transforms and "Unwrapped" GroupBys, Pivot Tables and Cross-Tabulation.

Time Series: Date and Time Data Types and Tools, Time Series Basics, Date Ranges, Frequencies, and Shifting, Time Zone Handling, Periods and Period Arithmetic, Resampling and Frequency Conversion, Moving Window Functions

Learning Resources:

Textbook(s):

1. Wes McKinney, "Python for Data Analysis", THIRD EDITION, O`REILLY

References:

1. David Ascher and Mark Lutz, Learning Python, Publisher O'Reilly Media.
2. ReemaThareja, "Python Programming using Problem Solving approach",Oxford University press
3. Allen Downey ,JeffreyElkner ,Chris Meyers,: Learning with Python, Dreamtech Press
4. David Taieb ,"Data Analysis with Python: A Modern Approach " 1st Edition, Packt Publishing

List of Experiments:

1. NumPyndarray creation and arithmetic operations.
2. Indexing and slicing on NumPyndarray.
3. Universal Functions on data in ndarrays .
4. Array_Oriented Programming with Arrays.
5. Pandas Data structures.
6. Mechanics of interacting with the data contained in a Series or DataFrame.
7. Mathematical and statistical methods of pandas object.
8. Reading and Writing Data in Text Format
9. Handling Missing Data
10. Data Transformation operations using Pandas.
11. String Manipulation and Regular Expressions using Pandas.
12. Combining and Merging Datasets using Pandas.
13. Reshaping and Pivoting using Pandas.
14. GroupBy (split – apply – combine) Mechanics using Pandas.
15. Data Aggregation using GroupBy methods with Pandas
16. Indexing, Selection, Subsetting of Time Series data using Pandas.
17. Visualization using matplotlib
    - Bar graph
    - Pie chart
    - Box plot
    - Histogram
    - Line chart and subplots
    - Scatter plot

Content Beyond the syllabus:

Visualisation using Tableau

Learning Resources:

1. Wes McKinney, Python for Data Analysis - Data Wrangling with Pandas, NumPy, and IPython 2nd Edition. O'Reilly/SPD

2. Jake VanderPlas, Python Data Science Handbook Essential Tools for Working with Data. O'Reilly/SPD

CS353	SUMMER INTERNSHIP / MINI PROJECT	L	P	C
		-	-	1.5

Semester- VI (Third Year)

CS/IT321	Artificial Intelligence	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Introduce fundamental concepts of artificial intelligence.
2. Impart knowledge on problem solving using uninformed, informed, local and adversarial search strategies.
3. Create awareness on formalization of knowledge and reasoning.

Course Outcomes:

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

1. Explain the fundamental concepts of artificial intelligence
2. Apply search strategies for solving real world problems
3. Utilize game playing strategies for solving problems
4. Infer knowledge using propositional and predicate logic
5. Discuss knowledge representation of the real world using Ontologies
6. Summarize the algorithms for classical planning

Course Content:

UNIT I **CO1, CO2** **10 Periods**

Introduction to AI: What Is AI?, The Foundations of AI, The History of AI, The State of the Art.
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.
Problem Solving by Search: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

UNIT II **CO2,CO3** **14 Periods**

Beyond Classical Search: Local Search Algorithms and Optimization Problems, Searching with Non-Deterministic Actions.
Adversarial Search: Games, Optimal Decisions in Games, Alpha–Beta Pruning.
Constraint Satisfaction Problems: Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

UNIT III **CO4** **12 Periods**

Logical Agents: Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic, Effective Propositional Model Checking, Agents Based on Propositional Logic.
First-Order Logic: Representation Revisited, Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic.
Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT IV **CO5,CO6** **14 Periods**

Knowledge Representation: Ontological Engineering, Categories and Objects, Events. Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information.
Automated Planning: Definition of Classical Planning, Algorithms for Classical Planning
Planning and Acting in the RealWorld: Time, Schedules and Resources, Hierarchical Planning.

Learning Resources:

Text Books:

1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, Fourth Edition, Pearson Education

References:

1. Artificial Intelligence, E. Rich and K. Knight,3rd Edn.,(TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, 3rd Edn., Pearson Education.
3. A First Course in Artificial Intelligence, Deepak Khemani, Tata Mc-Grah Hill.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.
5. Artificial Intelligence, SarojKaushik, CENGAGE Learning

CS/IT322	Cryptography & Network Security	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Describe the architecture of network security.
2. Explain design principles of symmetric and asymmetric encryption techniques.
3. Discuss various authentication protocols. Describe the web security and network security applications.

Course Outcomes

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

1. Identify common network security vulnerabilities/ attacks, classical and symmetric encryption schemes.
2. Analyze the concepts of public key encryption and key management schemes.
3. Design MAC and Hashing techniques needed for authentication.
4. Discuss the authentication applications, Web and E-Mail security mechanisms.

Course Content:

UNIT I **CO1** **13 Periods**

Introduction: Computer Security Concepts, The OSI security architecture, Security Attacks, Security Services, Security Mechanisms, A model for Network Security .
Number Theory: Prime Numbers, Fermat's and Euler's theorem, testing for primality, The Chinese remainder theorem, Discrete logarithms.
Classical Encryption techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Steganography.

UNIT II **CO1,CO2** **13 Periods**

Block Ciphers & Data Encryption Standard: Traditional Block Cipher Structure, Data Encryption Standard, Strength of DES, Block Cipher Design Principles.
Advanced Encryption Standard(AES): AES structure, AES Transformation functions, AES key expansion.
Block Cipher operations:
Public key cryptography and RSA: Principles of public key crypto-systems,The RSA Algorithm.
Other Public Key Crypto Systems: Diffie Hellman Key exchange, Elgamal Cryptographic System.

UNIT III **CO2,CO3** **12 Periods**

Cryptographic Hash Functions: Applications of cryptographic hash functions, Hash function based on cipher block chaining, SHA 512, SHA-3.
Message Authentication codes: Message Authentication requirements, Message Authentication functions, MAC Based on Hash functions: HMAC
Digital signatures: Digital Signatures, ELGamal Digital Signature Scheme.

Key management and Distribution: Symmetric key distribution using Symmetric Encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 Certificates.

UNIT IV **CO4** **12 Periods**

User authentication: Kerberos.
Transport Level Security: Web security Considerations, Transport Layer Security(TLS), Secure Shell(SSH).
E-Mail Security: S/MIME, Pretty Good Privacy (PGP).
IP Security: Overview, IP Security Policy, Encapsulating Security Payload.

Learning Resources:

Text Book:

1 Cryptography and Network Security Principles and Practice WilliamStallings,7thEdition, PearsonEducation.

Reference Books:

1 BehrouzA.Ferouzan,"Cryptography&NetworkSecurity",TataMcGrawHill,2007.
2 Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications,2003.
3 CharlesPfleeger,"SecurityinComputing",4thEdition,PrenticeHallofIndia,2006.
4 Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.

CS/IT323	Machine Learning	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Basic concepts and applications of machine learning.
2. Supervised learning and its applications
3. Unsupervised learning and its applications
4. Multilayer perceptions and kernel tricks

Course Outcomes:

After successful completion of the course, the students are able to:

1. Apply the machine learning concepts in real life problems
2. Design solutions for supervised learning problems
3. Use rule sets and reinforcement learning to solve real world problems
4. Discuss the issues in dimensionality reduction and unsupervised learning algorithms.

Course Content:

UNIT I **CO1** **12Periods**

Introduction: Well posed learning problems, Designing a Learning System, Perspectives and Issues in machine learning.
Concept Learning and general to specific ordering: concept learning Task , Concept learning as a search, Finding a Maximally Specific Hypothesis , Version Spaces and Candidate Elimination Algorithm, Remarks on Version space and candidate elimination. **Bayesian Learning:** Bayes Theorem, Maximum Likelihood and Least Square Error Hypotheses, Bayes Optimal Classifier, Naïve-Bayes Classifier, Bayesian Belief Network.

UNIT II **CO2** **12 Periods**

Decision Tree Learning : Decision Tree Representation, appropriate problems for decision tree, the basic decision tree Algorithm, Issues in decision tree learning. **Artificial Neural Networks:** Introduction, Neural Network Representation, appropriate problems for neural network, Perceptrons , Multilayer Networks and the Back Propagation Algorithm. **Instance Based Learning:** Introduction, KNN Learning, Locally Weighted Regression , Radial Bias Functions, Case-Based Reasoning.

UNIT III **CO3** **12 Periods**

Learning Sets of Rules: Sequential Covering Algorithm , Learning Rule Sets: summary , Learning First Order Rules, Learning set of first order rules: FOIL. **Reinforcement Learning:** Introduction, the Learning Task , Q Learning , Non Deterministic Rewards and Actions , Temporal Difference Learning , Generalizing from Examples , Relationship to Dynamic Programming.

UNIT IV **CO4** **12 Periods**

Dimensionality Reduction : Introduction, subset selection, Principal component analysis, Feature Embedding, Factor analysis, Singular Value Decomposition and Matrix factorization, Multidimensional Scaling, Linear Discriminant analysis, Canonical correlation analysis. **Clustering:** Introduction,Mixture Densities, K-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Spectral Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

Learning Resources:

Text Books:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013. (UNIT I , UNIT II, and UNIT III)
2. EthemAlpaydin, Introduction to Machine Learning , MIT Press, Prentice Hall of India, Third Edition 2014. (UNIT IV)

Reference Books:

1. Stephen Marsland, —Machine learning: An Algorithmic Perspective‖, CRC Press, 2009
2. Machine Learning: a Probabilistic Perspective, Kevin P. Murphy, MIT Press, 2012
3. Foundations of Machine Learning, MehryarMohri, AfshinRostamizadeh and Ameet Talwalkar, MIT Press, 2012.
4. Machine Learning -The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge

CS324	PROFESSIONAL ELECTIVE –II	L	P	C
		3	0	3

III/IV B.Tech. (VIthSem)				
CS324				
1.	CSEL04	Compiler Design	3-0-0	3
2.	CSEL05	Distributed Systems	3-0-0	3
3.	CSEL06	Principles of Cloud Computing	3-0-0	3
4.	*CSEL07	Industry Recommended Course(IRC)*	3-0-0	3

CSEL04	Compiler Design	L	P	C
	CS324 (CSEL04) Elective - II	3	0	3

Course Objectives:

The main objectives of this course are to

1. To discuss the phases of compiler.
2. To demonstrate parsing techniques and syntax direct translation schemes.
3. To explain run-Times to rageallocations strategies and Symbol Table implementation.
4. To teach the intermediate code forms and code generation.

Course Outcomes:

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

1. Demonstrate through knowledge on the phases of compiler.
2. Implement Parsers and SDT schemes.
3. Specify various intermediate code forms for compiler construction.
4. Design code generator through optimized intermediate code forms
5. Apply the various code optimization methods, and run time allocation strategies.

CourseContent:

UNIT I **CO 1** **12 Periods**

Introduction to Compiling: Compilers - Analysis of the source program - Phases of acompiler-Cousins of the Compiler –Grouping of Phases – Compiler construction tools.

Lexical Analysis: Role of Lexical Analyzer - Input Buffering - Specification of Tokens-Recognition of tokens- a language for specifying lexical analyzers- Finite Automata-From Regular expressions to NFA.

UNIT II **CO 2** **12 Periods**

Syntax Analysis: Role of the parser- Top-Down parsing- Recursive Descent Parsing, Predictive parsing, LL(1)Parser.

Bottom-upparsing-Shift Reduce Parsing, Operator Precedence Parser–Operator precedence parsing, Operator Precedence functions, Error recovery in operator precedence parsing, LR Parsers –SLR Parser, Canonical LR Parser, and LALR Parser-Parser Generators.

UNIT III **CO 2 & CO 3** **12 Periods**

Syntax Directed Translation: Syntax Directed definition-construction of syntax trees , Bottom-up evaluation of S-attribute Definitions-L-attribute Definitions.

Intermediate Code Generation: Intermediate languages – SDT scheme for Assignment Statements - SDT scheme for Case Statements-SDT scheme for Boolean Expressions, SDT scheme for Flow of control constructs-SDT scheme for Procedure calls.

UNIT IV **CO4 & CO5** **12 Periods**

Code Generation: Issues in the design of code generator - The target machine – Runtime Storage management-Basic Blocks and Flow Graphs – Next – use Information-A simple Code generator-DAG representation of Basic Blocks.

Code Optimization: Introduction- Principal Sources of Optimization - Optimization of basic Blocks-Peephole Optimization.

Learning Resources:

TextBook(s):

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools",PearsonEducation Asia, 2007.

ReferenceBooks:

1. AlfredV. Aho, JeffreyD. Ullman, Principles of Compiler Design, Narosapublishing,2002.
2. Lex & Yacc - JohnR. Levine, Tony Mason, Doug Brown,2ndEdition, O'Reilly
3. Engineering a Compiler -Keith Cooper & LindaTorezon, 2ndEdition Elsevier.

CSEL05	Distributed Systems	L	P	C
	CS324 (CSEL05) Elective - II	3	0	3

Course Objectives:

The main objectives of this course are to:

1. To learn the principles underlying the function in of distributed systems
2. To understand the major technical challenges in distributed systems design and implementation
3. To get exposure to current technology and the software used in distributed systems
4. To understand the implementation of typical algorithms used in distributed systems
5. To know the research issues in the field of distributed systems.

Course Outcomes:

1. Ability to list the principles involved in distributed systems
2. Knowledge of the technical challenges in distributed systems design and implementation
3. Knowledge of current techniques used to solve the technical challenges
4. Ability to design algorithms for various concepts of distributed systems
5. Ability to do research in distributed systems
6. Ability to develop simple distributed applications.

Course Content:

UNIT-I **12 periods**

Introduction: Definition of a Distributed System, Goals, Hardware Concepts, Software Concepts, The Client-Server Model.

Communication: Remote Procedure Call-Basic RPC Operation, Parameter Passing, Extended RPC Models, Remote Object Invocation –Distributed Objects, Binding a Client to an Object, Static versus Dynamic Remote Method Invocations, Parameter assing.

Message-Oriented Communication:-Persistence and Synchronicity in Communication, Message Oriented Transient and Persistent Communication.

UNIT-II **18 periods**

Processes:-Threads, Clients, Servers, Code Migration, Software Agents

Naming: Naming Entities -Names, Identifiers and Addresses, Name Resolution, The Implementation of a Name Space. Locating Mobile Entities, Removing Unreferenced Entities

UNIT-III **18 periods**

Synchronization: Clock Synchronization. Logical Clocks, Election Algorithms, Mutual Exclusion. Distributed Transactions.

Consistency and Replication: Introduction, Data-Centric Consistency Models, Client–Centric Consistency Models, Distribution Protocols, Consistency Protocols.

UNIT-IV: **12 periods**

Fault tolerance:-Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed Commit, Recovery.

Distributed OBJECTS-BASED SYSTEMS: CORBA

Distributed File Systems:-Sun Network File System

Learning Resources:

Text Book:

1. Tanenbaum, Maarten VanSteen "Distributed Systems: Principles and Paradigms", 2002, Pearson Education/PHI.

Reference Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg,"DistributedSystems-ConceptsandDesign"3rd edition,PearsonEducation.
2. MukeshSinghal&NiranjanG.Shivaratri,"AdvancedConceptsinOperatingSystems",TMH.
3. PradeepKumarSinha,"DistributedOperatingSystem–ConceptsandDesign",PHI.A

CSEL06	Principles Of Cloud Computing	L	P	C
	CS324 (CSEL06) Elective - II	3	0	3

Course Objectives:

The main objectives of this course are to:

1. To Explain different Cloud Deploy Models & Service Models in an enterprise cloud environment.
2. To teach Cloud Virtual Machines Migration and cloud enhancing service.
3. To create awareness Cloud Data security issues, workflow engines and SLA management for clouds.

Course Outcomes:

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

1. Analyze the Integrate Enterprise cloud Environments, Cloud Deployment & Service Models.
2. Identify the use of Cloud Virtual Machines and cloud enhancing service.
3. Evaluate the Secure Distributed Data Storage and workflow engines for clouds.
4. Describe Data security and SLA Management.

Course Content:

UNIT I **12 Periods**

Introduction to cloud computing: Cloud Computing, in a Nutshell, roots of Cloud Computing, Layers and Types of Clouds, Desired Features of Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers.

Migration into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud.

Enriching the 'Integration as a Service' Paradigm for the Cloud Era: An Introduction, The Onset of Knowledge Era, The Evolution of SaaS, The challenges of SaaS paradigm, New integration scenarios, The integration methodologies, Saas integration products and platforms, SaaS Integration Services, Business to Business Integration(B2Bi) Services, A Framework of Sensor-Cloud Integration.

UNIT II **12 Periods**

The Enterprise Cloud Computing Paradigm: Relevant deployment models for enterprise cloud computing, Issues for Enterprise Applications on the Cloud, Transition Challenges, Business Drivers toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain.

Virtual Machines Provisioning and Migration Services: Virtualization Technology overview, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context.

Enhancing Cloud Computing Environments Using a Cluster as a Service: Introduction, Related Work, RVWS Design, Cluster as a Service: The Logical Design, Proof of Concept.

UNIT III **12 Periods**

Secure Distributed Data Storage in Cloud Computing: Introduction, Cloud Storage: from LANs TO WANs, Technologies for Data Security in Cloud Computing Open Questions and Challenges.
Workflow Engine for Clouds: Introduction, Workflow Management Systems and Clouds, Architecture of Workflow Management Systems, Utilizing Clouds for Workflow Execution.

UNIT IV **12 Periods**

SLA Management in Cloud Computing: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.

Data Security in the Cloud: An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud, Homo Sapiens and Digital Information, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security—Pros and Cons.

Learning Resources:

Text Book:

1. RajkumarBuyya, James Broberg, AndrZejGoscinski**,** Cloud Computing Principles and Paradigms, Wiley Publications.

Reference Books:

1. Michael Miller, Cloud Computing – Web-Based Application That Change the Way You Work
2. and Collaborate Online Pearson Publications.
3. Thomas Erl, ZaighamMahmood, & Ricardo Puttini, Cloud Computing**-** Concepts, Technology&
4. Architecture Pearson Publications.
5. Enterprise Cloud Computing - Technology, Architecture, Applications, GautamShroff,
6. Cambridge University Press, 2010.
7. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010.
8. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, R.
9. Kai Hwang, Geoffrey C.Fox. Jack J. Dongarra, Distributed and Cloud Computing **–** From
10. Parallel Processing to the Internet of Things, ELSEVIER Publications.

CS324(CSEL07-IRC*) (Professional Elective-VI)	Secure Software Engineering	L	P	C
		3	0	3

Course Objectives:

The main objectives of this course are to:

1. Identify the fundamental concepts in security aspects to be included in software systems
2. Explain the approaches used in secure software development methodologies.
3. Describe concepts in Secure Coding and Security Testing techniques.
4. Analyze Resources, code, protection and security mechanisms in software

Course Outcomes :

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

CO1: Apply the secure concepts to the issues related to software development.
CO2: Explain the required improvements to ensure a secure development methodology
CO3: Design the most appropriate approach to develop secure software.
CO4: Demonstrate a thorough understanding of secure coding principles and practices.
CO5: Describe the effects and implications of security technologies and validating software.

Course Content:

UNIT I [CO1] [Text Book1] 12 Periods

Introduction &Motivation: Hacker vs. Cracker, Historical Background, Mode of Ethical Hacking, Hacker Motive, Gathering Information, Secure Software, Compliance Requirements, C-Level Language, Assets, Threats and Risks, Security Requirements, Confidentiality, Integrity, Availability.

Secure Software Development Methodologies: Secure Software Development Lifecycle (SSDLC), Guidelines for Secure Software, SD-3 Principles, Security Practices, Secure coding standards, OWASP, ISO15408, Common Criteria (CC), build-insecurity Requirements Engineering: Availability, Authenticity, Confidentiality, Efficiency, Integrity, Maintainability, Portability, Reliability,

UNIT II [CO2] [CO3] [Text Book 1] [Text Book2] 12 Periods

Requirements Engineering for Secure Software: Introduction, Misuse and Abuse cases, The SQUARE Process model, SQUARE Sample outputs, Requirements Engineering: Requirements Elicitation, Requirements Prioritization.

Secure Architectural Design: Threat Modelling, Asset, Threat, Attack, Data flow Diagram (DFD), Threat Tree (Attack Tree), STRIDE, DREAD. Security Architecture, Software Attack Surface, Secure, Mandatory Access Control (MAC), Discretionary Access Control (DAC), Role-based Access Control (RBAC), Access Matrix.

UNIT III **[CO4] [Text Book1]** **12 Periods**

Considerations for Secure Coding and Testing: Introduction, code analysis, static analytical tools, examples, coding practices, Software security testing, Software security testing considerations throughout SDLC Examples.
Security and Complexity: SystemAssembly and Challenges: Introduction, Security Failures,Functionaland Attacker Perspectives for Security Analysis:Two examples: System complexity and drivers and security.

UNIT IV **[CO5] [Text Book2]** **12 Periods**

Defensive Tactics and Technologies: Tactics and Technologies for Mitigating Threats, Authentication: Mitigating Spoofing, Integrity: Mitigating Tampering, Non-Repudiation: Mitigating Repudiation, Confidentiality: Mitigating Information Disclosure, Availability: Mitigating Denial of Service, Authorization: Mitigating Elevation of Privilege, Tactic and Technology Traps.
Validating That Threats Are Addressed: Testing Threat Mitigations, How to Test a mitigation, Black box testing, White box testing, Penetration Testing

Learning Resources:

Text Books:

1. "Software Security Engineering: A Guide for Project Managers" byJulia H. Allen, Sean Barnum, Robert J. Ellison, Gary McGraw and Nancy Mead. Addison-Wesley (2008) **(UNIT I, II, III)**
2. "Threat Modelling: Designing for Security" by Adam Shostack, John Wiley and Sons Inc, (2014).**(UNIT II- Chapter 3, 4, 5and UNITIV- Chapter8, 10)**

Reference Books:

1. **"**Software Security: Building Security "by Gary McGraw, Addison-Wesley (2006)
2. **"**7 Qualities of Highly Secure Software" by Mano Paul, Taylor and Francis, CRC Press.

Web Resources:

1. https://home.engineering.iastate.edu/~othmanel/CPRE562.html
2. http://player.slideplayer.com/download/22/6355598/GLChELIc45VZQLdcyZPJSg/1686627364/6355598.ppt4 (For Topics in Unit III and Unit IV)

CS325	Open / Job Oriented Elective – II	L	P	C
		3	0	3

JOEL01 Big data Processing

JOEL02 Full Stack Development

Course Objectives:

The main objectives of this course are to:

1. To Explore theNode.js-to-Angular Stack.
2. To make the students understand the MonoDB databases
3. To Develop Dynamic custom web applications using Mean Full Stack Web Framework

Course Outcomes:

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

1. Discuss Node.js-to-Angular Stack Components
2. Design Front-end Applications using Angular JS Framework components
3. Implement Applications using Node.jscomponents such as packages, events, listeners, etc.
4. Explain backend programming by using Mongo DB.

Course Content:

UNIT I (CO – 1) 12 periods

Introducing the Node.js-to-Angular Stack: Understanding the Basic Web Development Framework, Understanding the Node.js-to-Angular StackComponents

Getting Started with Node.js: Understanding Node.js, Installing Node.js, Working with Node Packages, Creating a Node.js Application, Writing Data to the Console

Angular.js: Getting Started with Angular, Why Angular?, Understanding Angular, Separation of Responsibilities, Adding Angular to Your Environment, Using the Angular CLI, Creating a Basic Angular Application, Understanding and Using NgModule,

UNITII (CO – 2) 13 periods

Angular Components: Component Configuration, Building a Template, Using Constructors, Using External Templates, Injecting Directives.

Expressions: Using Expressions, Using Pipes.

Data Binding: Understanding Data Binding.

Built-in Directives: Understanding Directives, Using Built-in Directives

UNIT III (CO – 3) 13 periods

Using Events, Listeners, Timers, and Callbacks in Node.js: Node.js Event Model, Adding Work to the Event Queue, Implementing Callbacks

Implementing HTTP Services in Node.js :Processing URLs, Understanding Request, Response, and Server Objects, Implementing HTTP Clients and Servers in Node.js, Implementing HTTPS Servers and Clients

Implementing Express in Node.js: Getting Started with Express, Configuring Routes, Using Request/Responses Objects

UNIT IV (CO – 4) 12 periods

Understanding No SQL and MongoDB: Why No SQL?, Understanding MongoDB, MongoDB Data Types;

Getting Started with MongoDB andNode.js: Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, the Objects Used in the MongoDB Node.js Driver,Accessing and Manipulating Databases.

Learning Resources:

Text Book(s):

1. **Node.js, MongoDB andAngular WebDevelopment**(Second Edition), Brad Dayley,Brendan DayleyCaleb Dayley, byPearson Education,Inc.**(Chapters 1, 3, 21-25, 4, 7,11-12, 18)**

References:

1. Getting MEAN with Mongo, Express, Angular,and Node, Manning Publications,by Simon Holmes, Clive Herber,ISBN-10 : 1617294756,
2. Beginning Node.js, Express & MongoDB Development,by Greg Lim (Author) ,ISBN-10 : 9811480281,
3. Beginning Node.js, Basarat Syed, APress, ISBN-10: 9781484201886

CS/IT361	Artificial Intelligence lab	L	P	C
		0	3	1.5

Course Objectives:

1. Develop various applications in AI
2. Formulate and implement real-world problems as state space problems, optimization problems or constraint satisfaction problems
3. Select and apply AI techniques to solve complex problems.
4. To learn about various Python packages that are used for solving AI problems

Course Outcomes:

1. Analyze artificial intelligence techniques
2. Solve problems using different uninformed search techniques
3. Solve problems using different heuristic search techniques
4. Implement the algorithms for game playing
5. Solve the given problems using logic.

List of Programs:

1. Implement Exhaustive search techniques using
    a. BFS
    b. DFS
    c. Uniform Cost Search
    d. Depth-First Iterative Deepening
    e. Bidirectional
2. Implement water jug problem with Search tree generation using
    a. BFS b. DFS
3. Implement Missionaries and Cannibals problem with Search tree generation using
    a. BFS b. DFS
4. Implement Vacuum World problem with Search tree generation using
    a. BFS b. DFS
5. Implement the following
    a. Greedy Best First Search
    b. A* algorithm
6. Implement 8-puzzle problemusing A* algorithm
7. Implement AO* algorithm forGeneral graph problem
8. Implement Game trees using
    a. MINIMAX algorithm
    b. Alpha-Beta pruning
9. Implement Crypt arithmetic problems.
10. Program to implement Logic.

Additional Programs:

1. Implementation of Tic-Tac-Toe Problem
2. Implementation of 8- Queens problem

CS362	Machine Learning Lab	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. Demonstrate the basic concepts and techniques of Machine Learning.
2. Develop skills of using recent machine learning software for solving practical problems.
3. Provide experience of doing independent study and research.

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

1. Implement supervised learning techniques.
2. Write Programs to solve Instance based learning problems.
3. Develop solutions to the problems using unsupervised learning.

Lab Programs:

1. Implement and demonstrate the FIND-S algorithm to finding the most specific hypothesis based on a given set of data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test datasets.
4. Assuming a set of documents that need to be classified, use the naïve Bayesian classifier model to perform this task. Built-in Java classes /API can be used to write the program. Calculate the accuracy precision and recall for your data set.
5. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis the of heart patients using standard heart disease data set. You can use Java or Python ML Library classes /API.
6. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
7. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate datasets.
8. Write a program to implement k-Nearest Neighbor algorithm to classify there is dataset. Print both correct and wrong predictions. Java /Python MLlibrary classes can be used for this problem.
9. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set your experiment and draw graphs.
10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using K-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java / Python ML library classes/API in the program.

CS/IT363	Term Paper	L	P	C
		0	3	1.5

Course Objectives:

The main objectives of this course are to:

1. To build Confidence in understanding the current state of the art technology.
2. Identification of the field of interest.
3. To develop the ability to select are search paper from International Journals.
4. To identifying the technology used and to extend the work in various applications.
5. Develop presentation skills.

Course Outcomes:

After the successful completion of the course, student will be able to:

1. Submit reporting IEEE format.
2. Gain more knowledge in the relevant subject.
3. Improved Preparation skills.
4. Understand latest technologies.

It is aimed as a precursor to the project work done in the second semester of thefinal year B.Tech. It should help the students to identify their research area / topic and should form the ground work and preliminary research required for the project work.

The batches formed for pursuing the Project Work in the Final Year shall select some research article published in the latest journals of IEEE, ACM and other referred journals. The batch must gain an understanding of the research tools used and the related material, available both in printed and digital formats. Each individual of the project batch must make the presentation for two rounds on the same research article about their understanding, conclusion and if possible propose the extensions for the work.

At the end of the Semester, the batch must submit a report in IEEE format, on the work they have pursued through out the Semester containing.

The aim and objective of the study.
The Rationale behind the study.
The work already done in the field and identified.
Hypothesis, experiment ation and discussion .
Conclusion and further work possible.
Appendices consisting of Illustrations,Tables, Graphsetc.,
Evaluation is to be done for the two presentations made and the report submitted.

CSSL4	Skill Oriented Course – IV	L	P	C
		1	2	2

Advanced skill Oriented courses

S.NO	COURSE NAME
a.	Automation Testing
b.	Object Oriented Modeling and Design
c.	Socket Programming

CSSL4(a)	Automation Testing	L	P	C
	Skill Oriented Course – IV	1	2	2

Course Objectives:

1. **Distributed Systems:** Introduce basic concepts of automated software testing
2. Understand white box, black box, object oriented, web based testing
3. Know in details automation testing and selenium testing tool used for automation testing
4. Understand the importance of automation testing development.

Course Outcomes:

After the successful completion of the course, student will be able to:

1. Describe the fundamental concepts in software testing such as manual testing, automation testing
2. Design and develop a project test plan, design test cases, test data, and conduct test operations
3. Apply recent selenium automation tool for testing web application using java
4. Explain different approaches to automated testing using selenium

Course Contents :

UNIT I **10 Periods**

Introduction: Introduction to Selenium Structure Objectives What is Selenium?; Introducing Selenium, Brief History of The Selenium Project, Selenium's Tool Suite, Selenium IDEF, Selenium RC, Selenium Web driver, Selenium Grid, Test Design Considerations

Preparing System and Application Under Test: Structure Objectives Setting eclipse Create new Java project Adding Selenium jars Set browser drivers Walkthrough of BPB application Other applications

UNIT II **10 Periods**

Web Driver, Web Element, and By Structure Objectives Web Driver and its purpose Set browser drivers Methods of Web Driver The Web Element interface Generic structure of Web Element Methods of Web Elements Exception with Web Elements About By class Methods in By class Understanding locators Exception with the By class
Working with Web Elements—Form, Table, and Dropdown Structure Objectives Working with form elements working with Web Tables Working with dropdown

UNIT III **10 Periods**

Working with Web Element—Alert, Frame, IFrame, and Window Structure Objectives Working with JavaScript alerts Working with Frame and IFrame Working with HTML window
Extra Concepts— Actions, Screenshot, Web Driver Manager Introduction Structure Objectives Actions Screenshot Web Driver Manager

UNIT IV **10 Periods**

What is Test NG Structure Objectives Introduction, Installation Structure Assertions in Test NG Result and reporting in Test NG Design Test NG test passing data in Test NG test
Concept of Page Object Model Structure Objectives Page object model Implementing page object model Implementing page factory Structure Objectives Managing data using CSV Managing data using Excel Reading data from Excel file Using Excel reading function

Learning Resources:

Text Book:

1. Web Browser Automation for Testing Using Selenium with Java" by Pallavi S, BPB Publications.

References:

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903
2. SrinivasanDesikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X
3. NareshChauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
4. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086

Web References:

1. https://www.selenium.dev/documentation/webdriver/
2. https://testng.org/doc/index.html

CSSL4 (b)	Object Oriented Modeling and Design	L	P	C
	Skill Oriented Course – IV	1	2	2

Course objectives:
At the end of the course, the student will understand

1. The basic concepts in Object-Oriented modeling and their benefits.
2. The basic concept of use-case model, sequence model and state chart model for a given problem.
3. How Translate the requirements into implementation for Object Oriented design.
4. Choose an appropriate design pattern to facilitate development procedure.

Course outcomes: At the end of the course, the student will be able to

1. Describe the concepts of object-oriented and basic class modelling.
2. Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
3. Analyze and specify software requirements.
4. Choose and apply a befitting design pattern for the given problem

Course Content:

UNIT I **10 Periods**

Introduction, Modeling Concepts and Class Modeling: What is Object orientation? What is OO development? Evidence for usefulness of OO development; OO modeling history.

Modeling as Design technique: Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model.

UNIT II **10 Periods**

Use Case Modeling and Detailed Requirements: Overview; Detailed object-oriented Requirements definitions; System Processes-A use case/Scenario view; Identifying Input and outputs-The System sequence diagram; Identifying Object Behavior-The state chart Diagram; Integrated Object-oriented Models.

UNIT III **10 Periods**

ADVANCED STATE MODELING, INTERACTION MODELING: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model;

Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships.

UNITIV **10 Periods**

Design Patterns: Introduction; what is a design pattern? Describing design patterns, the catalogue of design patterns, Organizing the catalogue, How design patterns solve design problems, how to select a design patterns, how to use a design pattern; Creational patterns: prototype and singleton (only); structural patterns adaptor and proxy (only).

Learning Resources:

Text Books:

1. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML,2nd Edition, Pearson Education,2005
2. Satzinger, Jackson and Burd: Object-Oriented Analysis & Design with the Unified Process, Cengage Learning,2005.
3. Erich Gamma, Richard Helm, Ralph Johnson and john Vlissides: Design Patterns – Elements of Reusable Object-Oriented Software, Pearson Education,2007.

Reference Books:

1. Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3 rd Edition, Pearson Education, 2007.
2. Brahma Dathan, SarnathRamnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
3. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley-Dreamtech India, 2004.
4. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2 nd Edition, Tata McGraw-Hill, 2002.

CSLL4(C)	Socket Programming	L	P	C
	Skill Oriented Course – IV	1	2	2

Course Objectives:

The main objectives of this course are :

1. To introduce the client/server programming design issues and protocols.
2. To discuss the elementary TCP/UDP system calls.
3. To demonstrate the performance of server process using threads.

Course Outcomes:

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

1. Explain the basics of network programming.
2. Implement client/server applications using elementary socket functions.
3. Develop concurrent client/server programs using multiplexing and threads.
4. Demonize various client/server processes.

Course Content:

UNIT I **10 periods**

Introduction:
Data in client, Error Handling, Data in Server, Client Server examples, OSI model, Unix Standards, 64 bit architectures.

The Transport Layer:
Introduction, User datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP), TCP Connection Establishment and Termination, TIME_WAIT State, Port Numbers, TCP Port Numbers and Concurrent Servers.

Sockets Introduction:
Introduction, Socket Address structures, Value-Result Arguments, Byte Ordering Functions, inet_aton, inet_addr,andinet_ntoa Functions, inet_pton and inet_ntop Functions, readn, writen and readline Functions.

UNIT II **10 periods**

Elementary TCP Sockets:
Introduction, socket Function, connect Function, bind function, listen function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions.

TCP Client-Server Example:
Introduction, TCP Echo Server: main Function, TCP Echo Server: str_echo Function, TCP Echo Client: main Function, TCP Echo Client: str_cli Function, Normal Startup, Normal Termination, POSIX Signal Handling, Handling SIGCHLD Signals, wait and waitpid Functions, Connection Abort before accept Returns, Termination of Server Process, SIGPIPE Signal, Crashing of Server Host, Crashing and rebooting of Server Host.

UNIT III **8 periods**

Elementary UDP Sockets:
Introduction, recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server:dg_echo Function, UDP Echo Client: main Function, UDP Echo Client:dg_cli Function, Lost Datagrams, Verifying Received Response, Server Not Running, connect Function with UDP, dg_cli Function (Revisited), Lack of Flow Control with UDP, Determining Outgoing Interface with UDP,TCP and UDP echo Server Using select.

UNITIV **8 periods**

Daemon Processes and the inetdSuperserver:
Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd Function

Threads:
Introduction, Basic Thread Functions: Creation and Termination, str_cli Function Using Threads, TCP Echo Server Using Threads, Thread-Specific Data, Mutexes: Mutual Exclusion, Condition Variables.

Learning Resources:

Text Book:

1. W.Richard Stevens, Bill Fenner, Andrew M. Rudoff, Unix Network Programming. The Sockets Networking API, Volume 1 , 3rd edition – 2004.

Reference Books:

1. Douglas E.Comer, David L.Stevens, Internetworking With TCP/IP: Design, Implementation and Internals
2. Rochkind, Advanced Unix Programming, 2nd edition

Web References:

1. http://www.pearsoned.co.in/wrichardstevens
2. http://www.iana.org

Semester- VII (Final Year)

S.No	Course Code	Course Title	Hours Per Week		Scheme of Examination			Category
			L	P	Internal Marks	Sem End Exam Marks	Credits	
1	CS411	Humanities and Social Sciences (Elective)	3	0	30	70	3	HS
2	CS412	Professional Elective - III	3	0	30	70	3	PE
3	CS413	Professional Elective - IV	3	0	30	70	3	PE
4	CS414	Professional Elective – V (**MOOCS**)	0	0	-	100	3	PE
5	CS415	Open / Job Oriented Elective - III	3	0	30	70	3	OE
6	CS416	Open / Job Oriented Elective – IV (**MOOCS**)	0	0	-	100	3	HS
7	CS451	Internship / Professional Certification	-	-	100	-	3	PR
8	CSSL5	Skill Oriented Course – V	1	2	100	-	2	SC
TOTAL			**13**	**2**	**320**	**480**	**23**	

CS411-Humanities & Social Sciences Elective for CSE		
S.NO	**COURSE CODE**	**COURSE NAME**
1	HSEL1	Industrial Management and Entrepreneurship
2	HSEL2	Economics for Engineers
3	HSEL3	Introduction to Industrial Management
4	HSEL4	Project Management & Entrepreneurship
5	HSEL5	Human Resources and Organizational Behavior

HSEL1	Industrial Management and Entrepreneurship	L	P	C
		3	0	3

Course Objectives:

1. To enable the student to demonstrate a thorough working knowledge of Management and Organisations.
2. To alert the students in regular business activity on Time values of money and depreciation.
3. To motivate the students on Entrepreneurial Perspectives at present business.
4. To enable the student on the MSME sector and motivate the startup of MSME and support agencies.

Course outcomes:

After successful completion of the course, the students are able to

1. To gain insight into contemporary issues in Management and Business Organisation
2. Ability to identify, analyze and interpret various concepts of time values of money and depreciation.
3. An understanding of the impact of knowledge on Entrepreneurship to enable the student to meet theneeds of Industry
4. Recognition of the needs and ability to MEME and Support Agencies

UNIT I **Text Book - 1 [CO:1]** **10 periods**

Management and Business Organisation: Management concept-Managerial and operational functions ofmanagement-Scientific management-Job Design-Job description and job specification. Sole Proprietorship, Partnership Firm, Limited Liability Partnership (LLP), Joint Stock Company, One Person Company (OPC), Private Company & Public Limited Company form of Organization, Co-Operatives.

UNIT II **Text Book - 1,2 [CO:2]** **10 periods**

Time values of money and depreciation: Simple interest-Compound interest-Present worth factors Future worth factors-Depreciation Concept-Straight-line method of depreciation-Diminishing method of depreciation-Sum of the year digits method of depreciation etc along with problems

UNIT III **Text Book - 3,4 [CO:3]** **10 periods**

Entrepreneur and Entrepreneurship-Concept of Entrepreneur-Characteristics of an Entrepreneur Distinction between an Entrepreneur and Intra preneur and a Manager-Functions of an Entrepreneur-Types of entrepreneurs-Recent Trends of Women Entrepreneurship-Rural Entrepreneurship-Entrepreneurial process -Growth of Entrepreneurship in India

UNIT IV **Text Book – 3,4 [CO:4]** **10 periods**

MSME and Support Agencies: Meaning of MSME-Definitions of MSME, Characteristics of MSME-Relationships of MSME- Certificate of MSME - Make in India concept of MSME-Commercial Banks-financial institutions-(KVIC) Khadi and Village Industries Commission- (SIDO) Small Industries Development Corporation -(NSIC) National Small Industries Corporation-(NPC) National productivity council-(DIC) District Industries Centre-(SFC) State Financial corporation.

Learning Resources:

Text Book(S):

1. KK Ahuja, Industrial Management, Vol. I & II, Dhanpat Rai, 1978.
2. E.PaulDegarmo, John R Chanda, William G Sullivan, Engineering Economy, Mac Millan PublishingCo, 1979.
3. Poornima M Charantimath, Entrepreneurship Development Small business environment, PearsonEducation
4. ShivganeshBhargav, Entrepreneurial Management, Sage Publications, 2008.

Reference Book(s):

1. Gary Dessler, Human Resource Management,11th Edition, 2008.
2. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH, 2004.

HSEL2	Economics for Engineers	L	P	C
		3	0	3

Course objectives:

1. To provide the students with knowledge of basic economic problems and the relationship between engineering technology and economics.
2. To make the students understand the demand determinants and the methods of demand forecasting of a product.
3. The students gain the knowledge about various cost concepts for determining the manufacturing of a product.
4. To sensitize the students about the changing environment of banking scenario and to understand the functions of RBI.

Course outcomes:

After successful completion of the course, the students are able to

1. Understand the basic economic problems and objectives of a firm.
2. Get knowledge about overall functions and concepts of Demand elasticity of the firm and forecasting.
3. Linkage of various cost concepts and to understand how to sustain break even for a business.
4. Know the overview of Liberalization, Privatization and Globalization and their impact on Indian economy.

UNIT I **Text Book - 1,2 [CO:1]** **15 periods**

ENGINEERING ECONOMICS: Economics definition - Functions & Scope of Engineering economics - Basic economic problem - Relationship between Science - Engineering - Technology - Economics.FIRMS OBJECTIVE: Theories of Maximization - Profit Maximization - Wealth Maximization -Growth Maximization - Sales Revenue Maximization - Utility Maximization.

UNIT II **Text Book - 2,3 [CO:2]** **15 periods**

THEORY OF DEMAND: Demand Definition - Nature and Characteristics of Demand - Demand schedule Law of demand - Limitations to the law of demand - Various concepts of Demand Elasticity – Price Elasticity - Income Elasticity - Cross elasticity - Demand Forecasting definition - Factors determining Demand Forecasting - Methods of Demand forecasting.

UNIT III **Text Book - 4 [CO:3]** **15 periods**

COST CONCEPTS: Introduction - Types of costs - Fixed cost - Variable cost - Average cost – Marginal cost - Real cost - Opportunity cost - Accounting cost - Economic cost - Break - Even analysis.

UNIT IV **Text Book - 4 [CO:4]** **15 periods**

INDIAN ECONOMY - AN OVERVIEW: Nature and characteristics of Indian economy – Banking-Structure of Indian Banking- RBI functions - Functions of Commercial banks - Merits and Demerits of Liberalization - Privatization - Globalization(LPG) - Elementary concepts of WTO - GATT- GATS - TRIPs - TRIMs - Monetary Policy - Fiscal Policy.

Learning Resources:

Text Book(s):

1. Riggs, Bedworth and Randhwa, Engineering Economics, McGraw-Hill Education India.
2. S.C.Sharma and T.R.Banga, Industrial Organisation and Engineering Economics, KhannaPublishers.
3. S.K.Misra and V.K.Puri, Economic Environment of Business, Himalaya Publishing House.
4. H.L.Ahuja, Managerial Economics, S.Chand Publishing.

Reference Book(s):

1. Singh A and Sadh A.N., Industrial Economics , Himalaya Publishing House , Bombay
2. R.L.Varshney&K.L.Maheswari, Managerial Economics,S.Chand Publishing ,2003 Edition
3. Datt&Sundharam, Indian Economy ,S.Chand Publishing, 2014 Edition.

HSEL3	Introduction to Industrial Management	L	P	C
		3	0	3

Course objectives:

1. To provide the students a foundation in concepts and skills in management.
2. To make the students understand the concept of interest and evaluation of project alternatives.
3. Prepare the students for facing the changing environment, its implication on human resources and to achieve the corporate excellence.
4. Provide awareness about the materials requirement and procurement, in order to produce good quality products and maintain quality as desired by the consumer.

Course outcomes:

After successful completion of the course, the students are able to

1. become aware of the inference of organization structure and performance of people working inorganizations.
2. get knowledge about time value of money, evaluation of alternatives in the changing economicenvironment.
3. understand the elements of human resource management to acquire competitive advantage.
4. use right sort of material for delivering the right products and services to the market.

UNIT I **[CO:1]** **15 Periods**

GENERAL MANAGEMENT: Management Concept, Managerial levels, Managerial Skills, Manageria llevels v/s skills, Brief treatment of managerial functions, Scientific Management Principles, Administrative Principles of Management. FORMS OF BUSINESS ORGANISATION: Salient features of sole proprietorship. Partnership, JointStock Company, Private limited and Public limited companies.

UNIT II **[CO:2]** **15 Periods**

FINANCIAL MANAGEMENT: Objectives of Financial Management - Concept of money – Equivalent cash flow diagram - Break even analysis-Economic evaluation of alternatives- Basic methods – the annual equivalent method - present worth method - future worth method. DEPRECIATION: Purpose - Definition - types of depreciation - common methods of depreciation – The Straight Line Method - Diminishing Balance Method - the Sum of the Years Digits Method.

UNIT III **[CO:3]** **15 Periods**

HUMAN RESOURCE MANAGEMENT: Functions of Human Resource Management - Job Analysis - Human Resources Planning - Brief treatment of Recruitment - Selection - Placement - Induction &Orientation - Training and Development - Performance Appraisal. SUPPLY CHAIN MANAGEMENT: Introduction, need of supply, Chain management, Elements of Supply chain management, logistics, E-commerce, Steps in creating an effective supply chain, Supplier management.

UNIT IV **[CO:4]** **15 Periods**

MATERIAL MANAGEMENT: Functions of Materials Management - Material Requirement Planning - Purchasing - Objectives of Purchasing - Sources of Selection - Procurement Methods - Vendor Rating -

Inventory Management - EOQ - EPQ - ABC Analysis. MARKETING MANAGEMENT: Functions of Marketing - Marketing Mix - Product life cycle - Channels of distribution - Marketing Segmentation - Advertising & Sales promotion - Market Research.

Learning Resources:

Text Book(s):

1. KK Ahuja, Industrial Management and Organizational Behaviour, Khanna Publishers.
2. Pravin Kumar, Industrial Engineering and Management, Pearson Publications.

Reference Book(s):

1. Philip Kotler, Marketing Management, 11th Edition, Pearson Education.
2. Heinz Weirich and Harold Koontz, Management, 10th Edition, TMH.

HSEL4 Project Management & Entrepreneurship **L P C**
3 0 3

Course objectives:

1. To develop Entrepreneurial creativity and Entrepreneurial initiative, adopting the key steps in the elaboration of business idea.
2. To be aware the growth and development of Entrepreneurial process and the resources needed for the successful development of Entrepreneurial ventures.
3. To grasp the project identification, Planning and execution of the projects.
4. To understand the project analysis, apply appropriate project tools and techniques.

Course Outcomes:
After successful completion of the course, the students are able to
1. utilize the ideas to create value.
2. self-advocacy and problem solving skills and manage strong identity purpose.
3. Understand the conceptual clarity about project identification, formulation and feasibility analysis.
4. Analyse the learning and implementation of the project techniques for project planning, schedulingand execution.

UNIT I **[CO:1]** **15 Periods**
Entrepreneurship: An overview of Entrepreneurship - Characteristics and competencies of Entrepreneur - Entrepreneurial traits - Classification of Entrepreneurs - functions of Entrepreneur - Distinction between Entrepreneur, Intra preneur and Manager - Entrepreneurial decision process

UNIT II **[CO:2]** **15 Periods**
Entrepreneurship growth and Development: Factors affecting Entrepreneurial Development – Economic and Non-Economic factors - Entrepreneurial Development Programs - Need and objectives of EDP -EDP programs in India - Entrepreneurial Motivation - theories of Maslow's and Mc Clelland's– MSMEan introductory framework.

UNIT III **[CO:3]** **15 Periods**
Project Identification and Formulation: Meaning and definition of Project - concepts - Project Life cycle -Project Identification - Project Selection - Source of Finance for a Project - Project appraisal - Technical,Financial, Market appraisal - preparation of detailed project report.

UNIT IV **[CO:4]** **15Periods**
Implementation of project: An overview of Project Planning and Scheduling - Management and Control of Projects - Network Analysis - PERT and CPM.

Learning Resources:
Text Book(s):
1. Dr. S.S Khanka, Entrepreneurial Development, S. Chand and Company limited, New Delhi.
2. H. Nandan, Fundamentals of Entrepreneurship, PHI, New Delhi.
3. Prasanna Chandra, Project Planning, Analysis, Selection, Implementation and Review, Tata McGrawHill.
4. Rao. P.C.K., Project Management & Control, S. Chand, New Delhi.

HSEL5	Human Resources & Organizational Behavior	L	P	C
		3	0	3

Course Objectives:

1. To familiarize the student with the fundamental aspects of various issues associated with Human Resource Management and Organizational Behaviour.
2. This course aims to give a comprehensive overview about Career Planning, theories of Motivationand styles of Leadership.
3. To introduce the basic concept of Individual Behaviour.
4. To enhance the awareness of Group Behaviour.

Course Outcomes:

After successful completion of the course, the students are able to

1. know the Functions of Human Resource Management, Job Description and Job Specification.
2. familiarize with the concepts in Compensation, Motivation and styles of Leadership.
3. understand the Behaviour of people at individual level through the concepts of Perception, Learning
4. and Personality.
5. comprehend the Group and Team Dynamics in an Organization.

UNIT I **[CO:1]** **15 Periods**

Human Resource Management: Nature - significance - functions of HRM - .Job Analysis – Objectives and methods of Job Analysis - Job Description - Job Specification - Job Rotation - Job Enlargement -Job Enrichment - Job Evaluation & its Methods.

UNIT II **[CO:2]** **15 Periods**

Career Planning & Motivation: Career Planning and Development - Career Stages - Compensation - Components of Pay Structure - Wage and Salary administration - Incentives and Employee Benefits -Motivation: Maslow's Theory - Herzberg's Two Factors Theory of Motivation - McGregor's Theory X and Y - Vroom's Expectancy Theory - Leadership: Theories of Leadership and its Styles.

UNIT III **[CO:3]** **15 Periods**

Introduction to Organizational Behavior: Meaning- Importance - Nature & Scope of OB - Contribution of other Disciplines to OB - Need for Development of individual Skills; Perception - Process of Perception -Enhancing Perceptual Skills - Learning - Theories of learning - Personality - Stages of personality Development - Determinants of personality.

UNIT IV **[CO:4]** **15 Periods**

Groups and Teams: Meaning & Definition of Group and Group Dynamics - Dynamics of Group Formation - Reasons for Group Formation - Types of Groups - Concept and Definition of Team - Types of Teams - Work Teams - Cross-functional Teams - Virtual Teams - Group/Team Effectiveness -How to make Teams more Effective - Team Building - Collaboration - Group Leadership.

Learning Resources:

Text Book(s):

1. Aswathappa.K., Human Resource Management, Text and Cases 8th Edition, McGraw Hill, NewDelhi.
2. De Cenzo. & Stephen P. Robbins, Personnel/ Human Resource Management, Pearson Publications.
3. Stephen P. Robbins, Organisational Behavior, PHI, 9th edition
4. Fred Luthans, Organisational Behaviour, Tata McGraw Hill.-12th Edition.

Reference Book(s):

1. VSP Rao, Human Resource and Personnel Management, PHI
2. Edwin B. Flippo, Personnel Management, McGraw-Hill.
3. Aswathappa.K., Organisational Behaviour, Himalaya Publishing House, New Delhi
4. Jai, B.P.Sinha, "Culture and Organisational Behaviour", Sage Publications

Professional Elective Courses					
IV/IV B.Tech.					
CS412					
1.	CSEL08	Devopsy(LBD)	3-0-0	3	
2.	CSEL09	Cyber Security(LBD)	3-0-0	3	
3.	CSEL10	Web and Micro Services (LBD)	3-0-0	3	
CS413					
4.	CSEL11	Internet of Things(LBD)	3-0-0	3	
5.	CSEL12	Visual Programming	3-0-0	3	
6.	CSEL13	Natural Language Processing(LBD)	3-0-0	3	
7.	*CSEL14	Industry Recommended Course(IRC)*	3-0-0	3	

CSEL08	DevOps	L	P	C
	CS412(CSEL08) Elective - III	3	0	3

Course Objectives:

The main objectives of this course are :

Course outcomes:

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

1. Remember the importance of DevOps tools used in software development life cycle
2. Understand the importance of Jenkins to Build, Deploy and Test Software Applications
3. Examine the different Version Control strategies
4. Analyze & Illustrate the Containerization and deployment of applications over Docker
5. Summarize the importance of Software Configuration Management in DevOps
6. Synthesize the provisioning using Ansible.

UNIT I

Introduction to Devops:

What Is Devops ,History of Devops, Devops definition ,DevOps Main Objectives ,DevOps and Software Development Life Cycle ,Waterfall Model ,Agile Model ,Continuous Integration & Deployment ,Jenkins ,Containers and Virtual Development ,Docker ,Vagrant ,Configuration Management Tools ,Ansible

Cloud Computing :What is Cloud, IAAS(Infrastructure as a Service) ,SAAS(Software as a Service) ,PAAS(Platform as a Service) ,Private, Public and Hybrid Cloud ,Public Cloud Amazon Web Services , Microsoft Azure ,Google Cloud Services

UNIT II

Terraform: Introduction to terraform, terraform architecture and its components, terraform life cycle, terraform modules, terraform using aws examples.

Ansible: Introduction to Ansible, Infrastructure Management, YAML Scripts , Host Inventory ,Hosts and Groups , Host Variables ,Group Variables ,Playbooks ,Variables ,Conditionals ,Loops ,Blocks ,Handlers ,Templates ,Modules ,Core Modules ,Ansible Roles

UNIT III

Docker: What is Docker Image, Docker Installation, Working with Docker Containers, What is Container,Docker Engine,Creating Containers with an Image,Working with Images Docker Command Line Interface ,Docker Compose

Version Control-GIT: GITFeatures, 3-TreeArchitecture, GIT–Clone /Commit/Push, GIT Hub Management, GIT Rebase &Merge ,GIT Stash, Reset, Checkout ,GIT Clone, Fetch ,Pull

UNITIV

Continuous Integration–Jenkins: Introduction to Jenkins, Configure Jenkins, Jenkins Management, Scheduling build Job, pollscmMaven Build Scripts , Support for the GIT version

control System ,Different types of Jenkins Jobs, Jenkins Build Pipe Line ,Parent and Child Builds ,Sequential Builds ,Jenkins Master &Slave Node Configuration, Jenkins Workspace Management ,Securing Jenkins ,Authentication ,Authorization, Confidentiality ,Creating Users ,Jenkins Plugins ,Installing Jenkins Plugins , SCM plug in ,Build and test.

Kubernetes: Introduction to kubernetes, components and architecture of kubernetes

Learning Resources:

Text Books:

1. Learning Devops,Mikael krief, packt publishers
2. Ansible from beginner to pro ,Michael heap ,Apress
3. Jenkins the definitive guide ,John ferguson smart,creative commons edition

CSEL09	Cyber Security	L	P	C
	CS412(CSEL09) Elective - III	3	0	3

Course Objectives:

The main objectives of this course are :

1. To introduce the fundamental Information security concepts & Threats.
2. Learn the security standards and policies to be maintained by the organizations.
3. Describe various Security Performance Metrics & Configuration reviews.
4. Discuss the different log management and backup procedures.
5. Use the Vulnerability analysis tools and perform auditing.

Course Outcomes:

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

1. Analyze the Information Security Assets and Threats.
2. Identify the various security standards and policies to be maintained by the organizations.
3. Design and Implement Security Performance Metrics, Configuration reviews, log management.
4. Apply the backup procedures, and Security Audit process using Vulnerability analysis tools.

Course Content:

UNIT I **13 Periods**

Information Security Assets & Threats: Introduction, Role of a security analyst, Threats, Virus, Worms, Trojans, Other Threats, types of Network Attacks, types of Phishing Attack, Types of viruses, Types of worms, types of Trojans. DoS (denial-of-service) attack, Common Vulnerabilities and Exposures (CVE), Bluetooth related attacks.

Fundamentals of Information Security: Elements of information security, Principles and concepts - data security, Types of controls, Discretionary Access Control (DAC), Role-Based Access Control (RBAC).

UNIT II **13 Periods**

Roles and Responsibilities: Information and Data Security Team, CEO or Executive Management, Security Engineer, Systems Administrator, Security Steering Committee, Security Incident Response Team.

Data Leakage: Introduction – Data Leakage, Organizational Data Classification, Location and Pathways, Content Awareness, Content Analysis Techniques, Data Protection, DLP Limitations, DRM-DLP Conundrum,Case studies: SQL Injection using OWASP tool.

Information Security Policies, Procedures, Standards and Guidelines: Information Security Policies, Key Elements of a Security Policy, Security Policy implementation, Security Standards, COSO, COBIT,ISO27001,SANS.

UNIT III **12 Periods**

Information Security Performance Metrics: Introduction –Security Metrics, Types of Security Metrics, Using Security Metrics, Developing the Metrics Process, Metrics and Reporting. **Configuration review:** Configuration Management, Organizational SecCM Policy, Identify CM Tools, Implementing Secure Configurations, case studies.

Log Correlation and Management: Event Log Concepts, Log Management Infrastructure and functions, Log Management - Using Log watch.

UNIT IV **13 Periods**

Data Backup: Types of Backup, Backup Procedures, Types of Storage, Features of a Good Backup Strategy.

Information Security Audit: Information Systems Audit versus Information Security Audit, What is an Information Security Audit, Scope of the Audit, Types of Security Audits, Phases of Information Security Audit, Information Security Audit Methodology, Role of an Auditor, Penetration testing stages.

Vulnerability Analysis: What Is Vulnerability Assessment, Vulnerability Classification, Types of Vulnerability Assessment, Vulnerability Analysis Tools,Case studies.

Learning Resources:

Text Book : NASSCOM Handbook

Study Material Reference Books:

1. Nina Godbole, "Information System Security", Wiley
2. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi.
3. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
4. MarttiLehto, PekkaNeittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015
5. Nelson Phillips and EnfingerSteuart, —Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.

CSEL10	Web and Micro Services	L	P	C
	CS412(CSEL10) Elective - III	3	0	3

Course Objectives:

The main objectives of this course are :

1. Analyze the basic technologies to develop Middleware applications.
2. Design web service applications using SOAP, UDDI and WSDL.
3. Devise message services and microservices.
4. Articulate the development of Micro services with Springbot configuration.
5. Describe the consuming, deploying and testing of a microservice.

Course Outcomes:

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

1. Develop Middleware applications using RMI and CORBA technologies.
2. Explain Restful web services using SOAP, WSDL and JMS.
3. Elucidate the architectural components of microservices.
4. Design microservices web applications using Spring Boot.
5. Discuss consuming, deploying and testing Microservices in Web Applications.

Course Content:

UNIT I **12 Periods**

J2EE Introduction: J2EE Multi-Tier Architecture, JAVA XML: DOM parsers, SAX parsers.

J2EE Interconnectivity: Java Remote Method Invocation (JRMI).

Middleware Technologies: Java Interface Definition Language (JIDL) and CORBA.

UNIT II **12 Periods**

Introduction: RESTful Web Services: SOAP Universal Description, Discovery and Integration(UDDI),

Web Services: Web Services Description Language (WSDL).

Messaging Services: Java Naming and Directory Interface (JNDI)

UNIT III **12 Periods**

Microservices Introduction: Setting Up the Development Environment, Domain-Driven Design and Implementing a Micro service.

A Solution Approach: Introduction: Evolution of microservices: Monolithic Limitation of monolithic architecture versus its solution with microservices architecture overview, Microservices build pipeline.

Deployment: Setting Up the Development Environment, NetBeans IDE installation and setup, Spring Boot configuration, Sample REST program, Domain-Driven Design, and Implementing a Microservice.

UNIT IV **12 Periods**

Domain-driven design fundamentals: Fundamentals of DDD, Artifacts of domain-driven design, Strategic design and principles.

Deployment and Testing: Deployment and Testing of Microservices: Mandatory services for good Microservices, Service discovery and registration

Consuming Services: Consuming Services Using a Micro Service Web Application, AngularJS framework overview, Setting up the web application

LearningResources:

Textbook (s):

1. Jim Keogh, The complete Reference J2EE, Tata McGraw Hill-Paper back, India Edition 2017(Unit – I)
2. Mastering Micro services by SourabhSarma by PacktPublishers(Unit-II ,III,IV)

Reference books:

1. B.V.Kumar, S.Sangeetha, S.V.Subrahmanya, J2EE Architecture, Tata McGraw Hill.
2. James McGovern & Rahim Aditya, J2EE 1.4 Bible, Wiley publications. Justin couch andDaniel H.Steinberg "Java2 Enterprise Edition" J2EE Bible by Hungry minds Publishing.
3. Jonathan Wetherbee, Massimo Nardone, Chirag Rathod, Raghu Kodali "Beginning EJB in Java EE 8" Academic Press, Third edition,2018
4. KamalmeetSingh,MertÇalışkan,OndrejMihályi,PavelPscheidl,Java EE 8 Microservices" Packt Publications,2018

Web References:

1. http://middlewaretutorial.com/
2. https://www.geeksforgeeks.org/microservices-introduction/
3. https://www.tutorialspoint.com/angularjs/index.htm

CSEL11	Internet of Things	L	P	C
	CS413(CSEL11) Elective - IV	3	0	3

Course Objectives:

The main objectives of this course are :

1. Classify the interconnection and integration of the physical world and IoT devices.
2. Interpret the various IoT applications and its infrastructures
3. Relate the concept of setting up IOT Devices with Python.
4. Describe the concepts of interfacing hardware to develop IoT projects.

Course Outcomes:

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

1. Explain the physical and logical design of IoT.
2. Discuss the application areas of IoT.
3. DemonstrateIoT applications using Raspberry Pi.
4. Design an IoT application using sensors, actuators and controllers

Course Content:

UNIT I **9 Periods**

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT,IoT Protocols, IoT communication models, IoT Communication APIs.

IoT enabled Technologies –Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems.

UNIT II **12 Periods**

IoT Levels and Templates Domain Specific IoTs – Home, City, Environment,Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Python Introduction: Variables, Numbers, Strings-python examples,LaunchingPrograms from Python, Troubleshooting Errors, Basic Input andOutput - Using Inputs and Outputs

UNIT III **12 Periods**

Programming Inputs and Outputs with Python: Installing and Testing GPIO in Python, Blinking an LED, Reading a Button.
Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

UNIT IV **12 Periods**

PREPARING IOT PROJECTS:
Creating the actuator project: Hardware - Interfacing the hardware
Creating a controller for IoT project - Representing sensor values - Parsing sensor data - Calculating control states

Creating a camera for IoT project - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera

Learning Resources:

Text Book(s):

1. ArshdeepBahga and Vijay Madisetti, Internet of Things A Hands-on Approach,Universities Press, 2015, ISBN: 9788173719547.
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors OvidiuVermesan

Reference Books:

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 – 2024.
2. Peter Friess,'Internet of Things – From Research and Innovation to Market 4. Deployment', River Publishers, 2014 5. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

Web References:

1. http://postscapes.com/.
2. http://www.theinternetofthings.eu/what-is-the-internet-of-things.
3. https://www.youtube.com/channel/UCfY8sl5Q6VKndz0nLaGygPw.
4. https://www.codeproject.com/Learn/IoT/.

CSEL12	Visual programming	L	P	C
	CS413(CSEL12) Elective - IV	3	0	3

Course Objectives:

The main objectives of this course are :

1. Comprehend the C# language and the .NET Framework.
2. Demonstrate the use of Windows Forms applications with rich, highly responsive user interfaces.
3. Identify the cloud web applications and Services using ASP.NET.
4. Relate the use of Language Integrated Query (LINQ).

Course Outcomes:

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

1. Apply the fundamental concepts of C# programming.
2. Implement advanced OOPS concepts in console applications.
3. Develop and deploy cloud web applications and web services using ASP.NET and AZURE API.
4. Develop database driven applications utilizing XML and LINQ.

Course Content:

UNIT I **12 Periods**

Introducing C#, Writing a C# Program, Variables and Expressions. Flow Control, More About Variables, Functions.

UNIT II **12 Periods**

Debugging and Error Handling, Introduction to Object-Oriented Programming, Defining Classes, Defining Class Members. Collections, Comparisons and Conversions.

UNIT III **14 Periods**

Generics, Additional C# Techniques, Basic Desktop Programming. Advanced Desktop Programming. Advanced Cloud Programming

UNIT IV **12 Periods**

Files, XML and JSON, LINQ, DATABASES

Learning Resources:

Text Book:

1. Karli Watson, Christian Nagel, Jacob Hammer Pedersen, Jon Reid, and Morgan Skinner, BEGINNING VISUAL C# 2015, Wiley Publishing, Inc**.**

Reference Books:

1. Stephen C. Perry, Core C# and .NET, Pearson Education, 2006.
2. Herbert Scheldt, C#: The Complete Reference, TATA McGraw Hill Publishing.
3. Andrew Troelsen, Pro C# and the .NET Platform, A! Press.
4. Kevin Hoffman, Microsoft Visual C# 2005 Unleashed, Sams Pearson India.

Web References:

1. https://en.wikipedia.org/wiki/.NET_Framework
2. www.dotnetjalps.com/.../Dynamic-URL-of-asp-net-web-service

CSEL13	Natural Language Processing	L	P	C
	CS413(CSEL13) Elective - IV	3	0	3

Course Objectives:
The main objectives of this course are :

1. To understand the underlying concepts and techniques required f or natural language processing.
2. To create computational models for enabling effective and natural language processing.

Course Outcomes:

After successful completion of the course, the students are able to:

1. Determine the structural components of sentences for a given Grammar.
2. Produce logical form that represents context-independent meaning of a sentence.
3. Link logical forms with syntactic structures for semantic interpretation of the sentence.
4. Understand the ambiguity in natural language constructs and identify possible interpretations of a sentence.
5. Map the logical form to the Knowledge representation to generate contextual representation.

Course Content:

UNIT I **12 Periods**

Introduction to Natural Language Understanding: Applications of Natural Language Understanding, Evaluating language Understanding Systems, The Different levels of Language Analysis.
Syntactic Processing: Grammars and Parsing, Grammars and Sentence Structure, Top- down parser, Bottom up chart parser, Transition network grammars, Top-down chart parsing, Finite state models and Morphological processing.

Features and Augmented Grammars: Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, A Simple Grammar Using Features, Parsing with Features, Augmented Transition Networks.

UNIT II **12 Periods**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling Questions in Context-Free Grammars.

Toward Efficient Parsing: Human preferences in parsing, Encoding Uncertainty-Shift-Reduce Parsers, A Deterministic Parser.

Ambiguity Resolution: Statistical Methods: Part of Speech tagging, Obtaining lexical probabilities, Probabilistic Context-Free Grammars, Best-First Parsing.

Semantic Interpretation: Semantics and logical Form: Semantics and Logical Form, Word Senses and Ambiguity, The Basic Logical Form Language, Encoding Ambiguity in the Logical Form, Verbs and States in Logical Form.

UNIT III **12 Periods**

Linking Syntax and Semantics: Semantic Interpretation and Compositionality, A Simple grammar and Lexicon with Semantic Interpretation, Prepositional Phrases and Verb Phrases.

Ambiguity Resolution: Selectional Restrictions, Semantic Filtering Using Selectional Restrictions, Statistical Word Sense Disambiguation.

Knowledge Representation and Reasoning: Knowledge representation, A Representation based on FOPC, Frames: representing Stereotypical Information, Handling Natural Language Quantification.

UNIT IV **12 Periods**

Local discourse context and Reference: Defining Local Discourse Context and Discourse Entities, A Simple Model of Anaphora Based on History Lists, pronouns and Centering, Define Descriptions.

Using World Knowledge: Using world knowledge: Establishing Coherence, Matching against Expectations, Reference and Matching Expectations, Using Knowledge about Action and Casualty, Scripts: Understanding Stereotypical Situations

Discourse Structure: The Need for Discourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense and Aspect, Managing the Attentional stack

Learning Resources:

Text Book:

1. James Allen, Natural Language Understanding, Second Edition, Pearson Education.

Reference Books:

1. Daniel Jurafsky, James H.Martin, Speech and Language Processing.
2. Christopher Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, MIT Press.
3. Elaine Rich and Kevin Knight, Artificial Intelligence, Second Edition, Tata McGraw Hill.

JOEL01	**JOEL01-Big Data Processing**	**L**	**P**	**C**
	Job Oriented Elective - III	**3**	**0**	**3**

Course Objectives:

The main objectives of this course are to:

1. To impart the fundamental concepts of big data analytics.
2. To explain the applications using Map Reduce Concepts and NoSQL Databases.
3. To introduce programming tools PIG, HIVE, Hbase, mahout.
4. To introduce Scala programming language for big data.

Course Outcomes:

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

1. Explain data analytics and big data characteristics.
2. Explain and use features of NoSQL databases.
3. Handle big data using Hadoop techniques- HDFS and Map Reduce.
4. Process big data using Hadoop tools – Hive, Pig, HBase, mahout
5. Process data using in-memory computing model spark.

Course Content:

UNIT I **12 Periods**

Understanding Big Data: Concepts and Terminology – Data sets, Data Analysis, Data Analytics, Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Business Analytics, Big Data characteristics – Volume, Velocity, variety, veracity, value. Different Types of Data – structured data, unstructured data, semi-structured data, meta-data.
(**Text Book 2)**
Big Data and Hadoop- - Meeting the Big Data Challenge, The Hadoop Ecosystem: Hadoop Core Components, Hadoop Distributionsi(**Text Book 1)**
HDFS- HDFS Architecture-Using HDFS Files, Hadoop-Specific File Types, HDFS Federation and High Availability, Data Ingestion with Flume and Scoop and Hadoop archives, Hadoop 2(YARN).(**Text Book 1)**

UNIT II **12 Periods**

Map Reduce- Getting to Know MapReduce, Processing data with Map Reduce- Execution Pipeline,Runtime Coordination and Task Management in Map Reduce,Your First MapReduce Application-Designing Map Reduce implementations:Simple Data Processing with Map Reduce,Building Joins with Map Reduce.(**Text Book 1)**
NoSQL: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models: sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, working with Cassandra, Table creation, loading and reading data.(**Text Book 3)**

UNIT III Text Book 1 12 Periods

Pig- Pig on Hadoop, How Pig differs from Map Reduce, Pig's History-Pig's Data Model Introduction to Pig Latin-Input and Output-Relational Operations-User Defined Functions-Advanced
Pig Latin-Advanced Relational Operations-Joining Datasets-Join-Cogroup- Controlling Execution-Pig Latin Pre-processor
HBase-HBase Architecture, HBase schema design
Hive - Hive architecture –Hive in the Hadoop ecosystem — Hive QL – Data Definition-Data Manipulation-Queries
Apache Mahout: Introduction, Environment of mahout, Classification, Clustering

UNIT IV 12 Periods

Spark - What Is Apache Spark, SparkSQL, Spark MLlib,Apache Spark's Distributed Execution:Spark driver,Cluster manager,Spark executor,Deployment modes, distributed data and partitions,Spark **SQL and Datasets:**Single API for Java and Scala,working with Datasets,Transforming Sample Data,Memory Management for Datasets and Data Frames.

Learning Resources:

Text Books:

1. The Hadoop Definitive guide "O`Reilly Media" 4th Edition.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streamswith Advanced Analytics", John Wiley& sons, 2012.
3. ArshdeepBahga and Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach

References:

1. Edward Capriolo,Dean ampler,Jason Rutherglen, "Programming Hive", O'Reilly Media;
2. Tom White,"Hadoop: The Definitive Guide", O'Reilly Media 3rd Edition,May6, 2012
3. Chuck Lam , "Hadoop in Action" ,Manning Publications; 1st Edition ,December, 2010

CSSL5	Skill Oriented Course – V	L	P	C
		1	2	2

S.NO	COURSE NAME
a	AWS cloud
b	User Interface Design with ReactJS
c	OpenMP & MPI
d	Industry Recommended Course (IRC*)

CSSL5(a)	AWS Cloud	L	P	C
	Skill Oriented Course – V	1	2	2

CSSL5(b)	User Interface Design with ReactJS	L	P	C
	Skill Oriented Course – V	1	2	2
CSSL5(d)	Industry Recommended Course (IRC*)	L	P	C
	Skill Oriented Course – V	1	2	2

CSSL5(C)	Open MP & MPI	L	P	C
		1	0	2

Course Objectives:
The main objectives of this course are to:

1. Impart the knowledge of Shared and distributed memory concepts.
2. Introduce the fundamentals of Open MP and MPI Programming languages.
3. Familiarize students with the working of parallel regions and thread synchronization.

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

1. Demonstrate parallel regions and Loop parallelism.
2. Implement basic parallelization and synchronization methods with OpenMP.
3. Explain MPI operations, data types and Functional parallelism.
4. Design and develop MPI programs for Process management and synchronization.

Course Content:

UNIT1 **[CO1]** **8 periods**

Getting started with OpenMP: The OpenMP model, Compiling and running an OpenMP program, first OpenMP program, Thread data, Creating parallelism.
Parallel regions: Creating parallelism with parallel regions, Nested parallelism, Cancel parallel construct.
Loop parallelism: Loop parallelism, An example, Loop schedules, Nested loops, nowait, While loops.

UNIT II **[CO2]** **8 periods**

Open MP Work sharing: Work sharing constructs, Sections, Single/master.
Controlling thread data: Shared data, Private data, Data in dynamic scope, Temporary variables in a loop, Default.
Synchronization: Barrier, Mutual exclusion, Locks, Nested locks, Relaxed memory model

UNIT III **[CO3]** **8 periods**

Getting started with MPI:Distributed memory and message passing,History,Basic model,Making and running an MPI program,Language binding with C.
MPI Functional parallelism:The SPMD model,Starting and running MPI processes,Processor identification,Functional parallelism,Distributed computing and distributed data.
MPI Point-to-point operations:Blocking point-to-point operations,Non-blocking point-to-point operations.

UNIT IV **[CO4]** **8 periods**

MPI Data types: The MPI_Datatype data type, Predefined data types, Derived datatypes, Type maps and type matching.
MPI Process management: Process spawning, Socket-style communications, Sessions.
One-sided communication in MPI: Windows,Active target synchronization: epochs,Put- get - accumulate: halo update, Passive target synchronization,More about window memory:Memory models,Dynamically attached memory.

Learning Resources:

Text Book:
1. Parallel Programming in MPI and OpenMP , Victor Eijkhout, 2nd edition.

Reference Books:
1. Introduction to Parallel Computing by AnanthGrama, Anshul Gupta, George Karypis, VipinKumar,Pearson publication.

Web Resources:
1. **https://tinyurl.com/yle335course**
2. **https://hpc-tutorials.llnl.gov/openmp/**
3. **https://onlinecourses.nptel.ac.in/noc23_cs28/**

CSSL5 Skill Oriented Course-V

OpenMP& MPI Lab

OpenMP

1. Write an OpenMP 'hello world' program, where the print statement is in a parallel region.
2. Extend hello world program and insert the functions *omp_get_num_threads, omp_get_thread_num, omp_get_num_procs* before, in, and after the parallel region.
   - omp_get_num_threadsreports how many threads are currently active, and
   - omp_get_thread_num reports the number of the thread that makes the call.
   - omp_get_num_procs reports the number of available cores before, in, and after the parallel region.
3. Write an OpenMP program to print the scope of a variable.
4. Write an OpenMP program to create team of Threads.
5. Write an OpenMP Program using single pragma limits.
6. Write an OpenMP Program using first and last private.
7. Write an OpenMP Program to show race condition.
8. Write an OpenMP Program to show binning problem.
9. Write an OpenMP program to implement master-worker paradigm.

MPI

1. Write MPI 'parallel hello world' program using 4 processes.
2. Write MPI program to implement ping-pong technique.
3. Write MPI program to implement functional parallelism.
4. Write MPI program to implement prime number factorization.
5. Write MPI program to implement simple blocking point to point communication.
6. Write MPI program to implement simple non-blocking point to point communication.
7. Write MPI program to implement process-spawning.
8. Write MPI program by using put-get-accumulate functions.
9. Write MPI program to implement synchronous communication.

Courses offered for Minor in Computer Science & Engineering

S.NO	COURSE CODE	COURSE NAME	L-T-P	CR
1.	CSMR1	Fundamentals of Data Structures	4-0-0	4
2.	CSMR2	Computer Organization and Architecture	4-0-0	4
3.	CSMR3	Operating System Concepts	4-0-0	4
4.	CSMR4	Relational DataBase Management Systems	4-0-0	4
5.	CSMR5	Programming with JAVA	4-0-0	4
6.	CSMR6	Introduction to Algorithms	4-0-0	4
7.	CSMR7	Principles of Software Engineering	4-0-0	4
8.	CSMR8	Computer Networking Concepts	4-0-0	4
• 2 courses to be done through MOOCs with the acceptance of CSE BoS				

CSMR1	Fundamentals Of Data Structures	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To provide the knowledge of basic linear and non-linear data structures and their implementations.
2. To familiarize searching and sorting techniques.
3. To demonstrate the importance of data structures in developing and implementing efficient algorithms.

Course Outcomes:

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

1. Analyze the efficiency of programs based on time complexity.
2. Implement operations like search, insertion, deletion and traversal etc. on a given data structure.
3. Apply appropriate sorting/searching technique for solving the given problem.
4. Develop computational solutions to given problems using suitable data structures

Course Content:

UNIT I **CO1, CO2** **12 periods**

Time and space complexity, Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, circular linked list implementation, Double linked list implementation, insertion, deletion and searching operations.

UNIT II **CO2, CO4** **12 periods**

Stacks-Operations, array and linked representations of stacks, stack applications-infix to postfix conversion, postfix expression evaluation. Queues-operations, array and linked representations. Circular Queue operations.

UNIT III **CO3** **12 periods**

Searching and Sorting – Sorting- Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Shell Sort, Radix Sort, Searching-Linear and Binary Search Methods, Comparison of Sorting and Searching Methods.

UNIT IV **CO2, CO4** **12 periods**

Trees – Definitions, Tree Representation, Properties of Trees, Binary Tree, Binary Tree Representation, Binary Tree Properties, Binary Tree Traversals, Binary Search Tree Implementation.

Learning Resources:

Text Book(S):

1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

Reference Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson ducation,1983.
3. ReemaThareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011.

CSMR2	Computer Organization And Architecture	L	P	C
		4	0	4

Course Objectives:
The main objectives of this course are to:
1. Impart basic concepts of computer architecture and organization.
2. Familiarize the basic CPU organization.
3. Introduce various memory devices used in a computer system.
4. Facilitate students in learning I/O communication

Course Outcomes:
After successful completion of the course, students will be able to:
1. Discuss the representation of the data employed in arithmetic operations and the binary coding of symbols used in data processing.
2. Explain the organization and design of a basic digital computer
3. Describe the organization, architecture and functionality of the central processing unit
4. Write procedures for implementing addition, subtraction, multiplication and division operations with digital hardware
5. Discuss the techniques that computers use to communicate with input and output devices
6. Describe the organization and architecture of memory unit in a digital computer

Course Content:

UNIT I **12 Periods**

DATA REPRESENTATION – Data Types, Complements, Fixed-point Representation, Floating point Representation, Other Binary Codes, Error Detection Codes
BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output and interrupt.

UNIT II **12 Periods**

CENTRAL PROCESSING UNIT: General Register Organization, Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC)
MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.

UNIT III **12 Periods**

COMPUTER ARITHMETIC- Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.
MEMORY SYSTEM: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual memory.

UNIT IV **12 Periods**

INPUT OUTPUT: Peripheral Devices, I/O interface Asynchronous data Transfer, Modes of transfer, Priority Interrupt, DMA, Serial Communication.

Learning Resources:

Text Book:

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.

Reference Books:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky (2002), Computer Organization, 6th edition, McGraw Hill, New Delhi, India.
2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.
3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,
4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHill

CSMR3	Operating System Concepts	L	P	C
		4	0	4

Course Objectives:
The main objectives of this course are to:
1. Operating system structure, functions and IPC mechanism.
2. Concepts of multithreading, process scheduling and process synchronization.
3. Dead lock handling mechanisms and memory management techniques.
4. Concepts of file management and secondary storage management.

Course Outcomes:
After successful completion of the course, students will be able to:
1. Describe the structure, operations and services provided by the Operating System.
2. Comprehend the features of process & threads, inter-process communication and multi-threading issues.
3. Analyze the performance of CPU scheduling algorithms.
4. Illustrate the problems of synchronization and deadlocks.
5. Differentiate the effectiveness and the hardware support required for contiguous, noncontiguous, and virtual memory management schemes.
6. Explain the function, implementation of file systems.

Course Content:

UNIT I **CO 1, CO2** **12 Periods**

Introduction: What Operating Systems Do, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.
System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls.
Process Concept: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication.

UNIT II **CO2, CO3** **12 Periods**

Multithreaded Programming: Overview of Multithreading, Multi-core Programming, Multithreading Models, Threading Issues.
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms- FCFS, SJF, SRTF, Priority. Round Robin, Multi-Level Queue, and Multi-Level Queue Feedback scheduling.
Synchronization: Background, The Critical-Section Problem, Peterson's solution, Semaphores.

UNIT III **CO4,CO5** **12 Periods**

Dead Locks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.
Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging.

UNIT IV **CO5,CO6** **10 Periods**

Virtual-Memory Management: Background, Demand Paging, Page Replacement algorithms.

Files System: File Concept, Access Methods, Directory and Disk Structure.
Implementing File-Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, and Free-Space Management.

Learning Resources:

Text Books:

1. Operating System Concepts-Abraham Silberchatz, Peter B, Galvin, Greg Gange 9th Edition, John Wiley.

Reference Books:

1. Operating Systems, Internal and Design Principles, Stallings, 8th Edition-2015, Pearson education/PHI.
2. Operating system, A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tenenbaum 4th Edition Pearson/PHI.
4. "An Introduction to Operating Systems, Concepts and Practice", 4th Edition, PHI, 2013-Pramod Chandra P. Bhatt.
5. Operating Systems- A concept based approach –DM Dhamdhere -3rd Edition TMH.

CSMR4	Relational Database Management Systems	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

4. To learn the fundamental concepts of Data Base Management Systems.
5. To make the students learn how to retrieve the data from database using SQL
6. To understand the concepts of transaction processing, concurrency control.

Course Outcomes:

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

6. Describe the basic concepts of database systems.
7. Explain various data models and database system architectures.
8. Write queries to access database using SQL.
9. Describe the process of refining data base design using normalization.
10. Explain the concepts of transaction Processing and concurrency control.

Course Content:

UNIT I **12 Periods**

Databases and Database Users: Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs.

UNIT II **12 Periods**

Data Modeling Using the Entity-Relationship (ER) Model: Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints - Weak Entity Types.

The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT III **12 Periods**

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL - More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT IV **12 Periods**

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions -Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

Learning Resources:

Text Book:

2. Fundamentals of Database Systems, RamezElmasri and SHamKanthB.NavatePearson Education, 5th edition.

Reference Books:

1. Introduction to Database Systems, C.J.Date Pearson Education.
2. Data Base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill,
3. 3rdEdition.

4. Data base System Concepts, Abraham Silberschatz, Henry.F.Korth, McGraw hill, 5th edition.

Relational Database Management Systems Lab

List of Programs:

1. Creating a sample database using DDL and DML statements without integrity constraints.
2. Refining a sample database using DDL and DML statements including integrity constraints.
3. Simple queries: selection, projection, sorting on a simple table
   i. Distinct output values
   ii. Renaming attributes
   iii. Computed attributes
   iv. Simple-complex conditions (AND, OR, NOT)
   v. Partial Matching operators (LIKE, %, _)
   vi. ASC-DESC ordering combinations
   vii. Checking for Nulls
4. Multi-table queries (JOIN OPERATIONS)
   i. Simple joins (no INNER JOIN)
   ii. Inner-joins (two and more (different) tables)
   iii. Inner-recursive-joins (joining to itself)
   iv. Outer-joins (restrictions as part of the WHERE and ON clauses)
5. Multi-table queries (JOIN OPERATIONS)
   v. Simple joins (no INNER JOIN)
   vi. Inner-joins (two and more (different) tables)
   vii. Inner-recursive-joins (joining to itself)
   viii. Outer-joins (restrictions as part of the WHERE and ON clauses)
6. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
7. Nested queries
   i. In, Not In
   ii. Exists, Not Exists
8. Set Oriented Operations
   i. Union
   ii. Difference
   iii. Intersection

CSMR5 **Programming with Java**

L	P	C
4	0	4

Course Objectives:
The main objectives of this course are to:

4. To make the students learn the basic concepts and fundamentals of platform independent object oriented language.
5. To elucidate the concepts of exception handling techniques and multithreading.
6. To create awareness on user interface design techniques and event handling mechanisms.

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

5. Use the syntax and semantics of java programming language and basic concepts of OOP.
6. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
7. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
8. Design event driven GUI and web related applications which mimic the real world scenarios.

Course Content:

UNIT I **[CO1, CO2]** **12 Periods**

Introduction: Introduction to java, java buzzword, data types, dynamic initialization, scope and life time, operators, control statements, arrays, type conversion and casting, finals & blank finals.
Classes and Objects: Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameter passing mechanisms, nested classes and inner classes.
Inheritance: Basic concepts, access specifiers, usage of super key word, method overriding, final methods and classes, abstract classes, dynamic method dispatch, Object class.

UNIT II **[CO2, CO3]** **12 Periods**

Interfaces: Differences between classes and interfaces, defining an interface, implementing interface, variables in interface and extending interfaces.
Packages: Creating a Package, setting CLASSPATH, Access control protection, importing packages.
Exception Handling: Concepts of Exception handling, types of exceptions, usage of try, catch, throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

UNIT III **[CO3]** **12 Periods**

Strings: Exploring the String class, String buffer class, Command-line arguments.
Library: Date class, Wrapper classes.

Multithreading: Concepts of Multithreading, differences between process and thread, thread life cycle, Thread class, Runnable interface, creating multiple threads, Synchronization, thread priorities, inter thread communication, daemon threads, deadlocks.

I/O Streams: Streams, Byte Streams, Character Streams, File class, File Streams.

UNIT IV **[CO4]** **12 Periods**

Applets: Concepts of Applets, life cycle of an applet, creating applets, passing parameters to applets, accessing remote applet, Color class and Graphics
Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.
AWT: AWT Components, windows, canvas, panel, File Dialog boxes, Layout Managers, Event handling model of AWT, Adapter classes, Menu, Menu bar.

Learning Resources:

Text Book:

2. Java The Complete Reference 12th Edition, Herbert Schildt, Mc Graw Hill Education (India) Private Limited, New Delhi.

Reference Books:

3. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
4. Introduction to Java programming, By Y.DanielLiang,Pearson Publication.

CSMR6 **Introduction to Algorithms**

L	P	C
4	0	4

Course Objectives:

The main objectives of this course are to:

1. Analyze asymptotic performance of algorithms.
2. Apply important algorithmic design paradigms and methods of analysis.
3. Demonstrate a familiarity with major graph algorithms
4. Understand how a number of algorithms for fundamental problems in computer science and engineering work and compare with one another

Course Outcomes:

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

1. Analyze running times of algorithms using asymptotic analysis.
2. Propose solutions to the given problems using combinatorial algorithms like merge sort, quick sort, bucket sort and radix sort
3. Solve the computational problems using important algorithmic design paradigms
4. Employ graphs to model engineering problems and solve them using suitable algorithms.
5. Compare different classes of problems

Course Content:

UNIT I **12 Periods**

Algorithm Analysis – Analyzing Algorithms, A Quick Mathematical Review, Amortization
Union-Find Structures - Union-Find and Its Applications, A List-Based Implementation,
Sorting - Merge-Sort, Quick-Sort, Bucket-Sort and Radix-Sort

UNIT II **12 Periods**

Graphs and Traversals-Graph Terminology and Representations Depth-First Search, Breadth-First Search, Directed Graphs, Biconnected Components
Shortest Paths - Single-Source Shortest Paths, Dijkstra's Algorithm, The Bellman-Ford Algorithm, All-Pairs Shortest Paths
Minimum Spanning Trees - Properties of Minimum Spanning Trees, Kruskal's Algorithm, The Prim-Jarnńık Algorithm.

UNIT III **12 Periods**

The Greedy Method - The Fractional Knapsack Problem, Task Scheduling, Text Compression and Huffman Coding
Divide-and-Conquer-Recurrences and the Master Theorem, Integer Multiplication, Matrix Multiplication, The Maxima-Set Problem.

UNIT IV **12 Periods**

Dynamic Programming-Matrix Chain-Products, The General Technique, Telescope Scheduling,

Game Strategies, The Longest Common Subsequence Problem, The 0-1 Knapsack Problem

NP -Completeness - P and NP, NP-Completeness, CNF-SAT and 3SAT

Learning Resources:

Text Book:

1. *Algorithm Design* and. *Applications*, by M. T. Goodrich and R. Tamassia, Wiley, 2015

Reference Books:

1. E. Horowitz, S. Sahni and S.Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia Publication.
2. T. H. Cormen, Leiserson, Rivest and Stein, "Introduction of Computer Algorithm", PHI.
3. Sara Basse, A.V. Gelder, "Computer Algorithms", Addison Wesley.

CSMR7 **Principles of Software Engineering** **L P C**

4 0 4

Course Objectives:

The main objectives of this course are to:

1. Provide an understanding of the working knowledge Software Development
2. Acquaintance on process models, software requirement s, UML diagrams and software design,
3. Knowledge on the software testing techniques for estimation, design, testing
4. Quality management of large software development projects.

Course Outcomes:

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

1. Apply Knowledge to translate end-user requirements into system and software requirements, using e.g. UML, and structure the requirements in a Software Requirements Document (SRD).
2. Apply appropriate software architectures and patterns
3. Discuss high level design of a system and be able to critically compare alternative choices.
4. Explain the importance of software testing and features of a good quality software

Course Content:

UNIT 1 **12 Periods**

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths.
A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models.
Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

UNIT II **12 Periods**

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. System models: Context models, behavioural models, data models, object models, structured methods.

UNIT III **12 Periods**

Design Engineering: Design process and design quality, design concepts, the design model.
Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modelling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging

UNIT IV **12 Periods**

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.
Metrics for Process and Products: Software measurement, metrics for software quality. Risk management: Reactive vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.
Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Learning Resources:

Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The Unified Modelling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.

Reference Books:

1. Software Engineering, an Engineering approach- James F. Peters, WitoldPedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meilerpage-Jones: Pearson Education.

CSMR8	Computer Networking Concepts	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. Fundamental concepts of computer networks.
2. Different error control, flow control techniques and Collision-Free Protocols.
3. Various routing, congestion control algorithms and QoS techniques.
4. Design issues of transport layer and protocols of application layer.

Course Outcomes:

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

1. Compare ISO reference model with TCP/IP and determine various guided media.
2. Verify the transmission errors using error detection and correction methods.
3. Apply various routing algorithms and compare IPv4.0 and IPv6.0.
4. Contrast various transport layer services and apply different application layer protocols.

Course Content:

UNIT I **14 Periods**

Introduction: Network Hardware, Network Software, Reference Models.
Physical Layer: The theoretical basis for data communication, Guided media, digital modulation and multiplexing, switching.

UNIT II **12 Periods**

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols.
The Medium Access Control Sub-layer: Multiple Access Protocols- ALOHA, Carrier Sense Multiple Access Protocols, Ethernet**,** Data Link Layer Switching.

UNIT III **12 Periods**

The Network Layer: Network Layer Design Issues, Routing Algorithms-Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast routing, multicast routing, Congestion control algorithms, Quality of Service: Application Requirements, Traffic Shaping, Packet scheduling, Admission Control, Internetworking, The Network Layer in the Internet-The IP version 4.0 protocol, IP Addresses, IP Version 6.0, Internet Control Protocols.

UNIT IV **12 Periods**

The Transport Layer: The Transport Service-Services Provided to the Upper Layers, Transport Service Primitives, Elements of Transport Protocols –Addressing, Connection Establishment, Connection Release, Error Control and Flow Control.
The Internet Transport Protocols: Introduction to UDP, Remote procedure call, Real-Time transport protocols, Introduction to TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

The Application Layer: DNS- The Domain Name System.

Learning Resources:

Text Book:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Fifth Edition, Pearson Education.

Reference Books:

1. James F. Kurose, Keith W. Ross, Computer Networking, Third Edition, Pearson Education
2. Behrouz A Forouzan, Data Communications and Networking, Fourth Edition, TMH (2007).
3. Kurose & Ross, COMPUTER NETWORKS, A Top-down approach featuring the Internet, Pearson Education, Alberto L

HONORS COURSES

S.NO.	COURSE CODE	COURSE NAME	L-T-P	CR
POOL1				
1	CSH11	Advanced Data Structures	4-0-0	4
2	CSH12	Functional Programming	4-0-0	4
3	CSH13	Fuzzy Logic	4-0-0	4
4	CSH14	Computer Graphics	4-0-0	4
POOL2				
1	CSH21	Advanced Databases	4-0-0	4
2	CSH22	Concurrent Programming	4-0-0	4
3	CSH23	Game Theory	4-0-0	4
4	CSH24	ARM system architecture	4-0-0	4
POOL3				
1	CSH31	GPU Architectures and Programming	4-0-0	4
2	CSH32	Search Engine Internals	4-0-0	4
3	CSH33	Wireless Sensor Networks	4-0-0	4
4	CSH34	Parallel Algorithms	4-0-0	4
POOL4				
1	CSH41	Semantic Web Technologies	4-0-0	4
2	CSH42	Deep Learning	4-0-0	4
3	CSH43	Social Network Analysis	4-0-0	4
4	CSH44	Augmented and Virtual Reality	4-0-0	4
MOOCS				
2 MOOC courses to be done with the acceptance of CSE BoS. **Any of the following two can be opted:** • Knowledge Graphs / Ethical hacking / Digital Forensics / BlockChain Technology. • Courses from Honors Pools not opted by the concerned student & offered by NPTEL				

POOL1

CSH11	Advanced Data Structures	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To illustrate operations of linear and non-linear data structures.
2. To demonstrate computational problems using suitable data structures.
3. To develop algorithms for text processing applications
4. To provide knowledge on the concepts of computational geometry.

Course Outcomes:

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

1. Implement hashing techniques.
2. Explain importance of dictionary and skip list ADTs.
3. Implement the operations of AVL, red black, splay and 2-4 trees.
4. Develop applications by using text processing.
5. Explain the concepts of computational geometry.

Course Content:

UNIT 1 **CO1** **10 Periods**

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Functions, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT II **CO** **12 Periods**

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists.
Search Trees: AVL Trees – Update Operations, Splay Trees – Splaying, When to Splay

UNIT III **CO** **10 Periods**

Bounded-Depth Search Trees - Multi-Way Search Trees, (2, 4) Trees, Red- Black Trees

UNIT IV **CO** **13 Periods**

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, **Text Compression** - The Huffman Coding Algorithm, **Text Similarity Testing** - The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Computational Geometry: One Dimensional Range Searching, Two-Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree.

Learning Resources:

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004. (Unit I)
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002. (Units II - IV)

ReferenceBook(S):

1. A. V. Aho, J. E. Hopcroft, And J. D. Ullman, Data Structures and Algorithms, Pearson Education, First Edition Reprint 2003.
2. R. F. Gilberg, B. A. Forouzan, Data Structures, Second Edition, Thomson India Edition, 2005
3. Jean-Paul Tremblay, Paul g. Sorenson, An Introduction to Data Structures with Applications, Tata Mc Graw hill Edition – Second Edition.
4. Seymour Lipschutz, Theory and Problems of Data Structures, Mc Graw hill Edition

Web References:

1. https://en.wikipedia.org/wiki/Data Structures
2. nptel.ac.in/courses/106103069/
3. www.tutorialspoint.com/cplusplus/cpp_data_structures.htm

Advanced Data Structures Lab:
List of Programs

1. Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client 's telephone number. Use a collision resolution strategy of your choice.
2. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Use any data structure of your choice for implementation.
3. Implement the locator-based method before(l) as well as the closest Before(l) in a dictionary realized using an ordered sequence. Use a skip list to implement the solution.
4. Beginning with an empty tree, construct a height balanced binary search tree by inserting the values in the order given. After constructing the tree
   a. Insert new node
   b. Find number of nodes in longest path
   c. Minimum data value found in the tree
   d. Search a value
   e. Visit the nodes of the tree following pre-order traversal
5. Implement the following operations on a splay tree.
   a. Insert
   b. Delete
   c. Search
   d. Pre-order Traversal
6. Implement an optimal pattern matching algorithm for the given input text and pattern. The time complexity of the solution must be O(m+n), where n is the size of input text and m is the size of pattern.
7. Develop an application to compute the longest common subsequence between two input strings with a polynomial time complexity.
8. Develop an application that produces Huffman codes for the given text.

CSH12	Functional Programming	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. Introduce to the student the fundamentals of Functional Programming.
2. To make the students to understand the Lists, Infinite lists
3. To create Monads and Parsing in functional Programming.

Course Outcomes:

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

1. Apply Basic Constructs of Functional Programming.
2. Use Lists and examples of lists to build functional Programming .
3. Create Infinite lists and abstract data types,etc.
4. Apply Monads and parsing in text processing.

Course Content:

UNIT 1 **CO** **12 Periods**

Fundamental concepts: Sessions and scripts, Evaluation, values, Functions, Definitions, types and specifications.

Simple Data Types: Boolean, Characters, Enumerations, tuples, other types, type synonyms, strings.

Numbers: Natural numbers, Induction, fold function, Haskell numbers, examples, Church numbers.

UNIT II **CO** **12 Periods**

Lists: List Notations, List operations, Map and filter, Zip, fold function, Laws of fold

Examples: Converting numbers to words, producing a class list, Printing a Calendar, Text Processing

Efficency: Lazy Evaluation, Asymtotic analysis, Acumlating parameters, Tupling, Controlling space, fusion, finite deferencing and deforestation.

UNIT III **CO** **12 Periods**

Abstract Data types: Basic concepts, Modules, sets,

Infinite lists: Review, Infinite lists and limits, Properties of Infinite lists, cyclic structures, example, stream based interaction.

UNIT IV **CO** **12 Periods**

Monads: Monadic Interaction, variations an evaluator, Monads and laws, combining Monads.

Parsing: Sequencing, alternation, repetitions, efficiency

An Automatic Calculator: Basic consideration, expressions, Matching and substitution, sub expressions and rewriting, testing the calculator.

Learning resources:

Text Book:

1. Introduction to Functional Programming using Haskell, Second Edition By Richard Bird, University of Oxford.

Reference Books:

1. **Thinking Functionally with Haskell , Second Edition by Richard Bird ,University of Oxford.**
2. Programming in Haskell, ByGraham Hutton ,Cambridge University Press, ISBN 978-1316626221; Kindle: ASIN B01JGMEA3U

CSH13	Fuzzy Logic	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To introduce the fundamental concepts of Classical sets, Fuzzy sets, Classical relations, and Fuzzy relations.
2. To provide knowledge on the fuzzification, and the defuzzification.
3. To impart knowledge on logic and Fuzzy systems, decision making, and Fuzzy classification.

Course Outcomes:

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

1. Explain the fundamental concepts of classical sets, fuzzy sets.
2. Explain the basic concepts of classical relations, and fuzzy relations.
3. Explain the fuzzification of scalar variables and the defuzzification of membership functions.
4. Design a fuzzy rule based system.
5. Demonstrate various fuzzy decision making methods.
6. Explain different fuzzy classification, and pattern recognition methods.

CourseContent:

UNIT 1 **CO** **12 Periods**

Introduction: The Case for Imprecision ,A Historical Perspective ,The Utility of Fuzzy Systems ,Limitations of Fuzzy Systems ,The Illusion: Ignoring Uncertainty and Accuracy ,Uncertainty and Information ,Fuzzy Sets and Membership ,Chance versus Fuzziness ,Intuition of Uncertainty: Fuzzy versus Probability ,Sets as Points in Hyper cubes .
Classical Sets and Fuzzy Sets: Classical Sets, Fuzzy Sets

UNIT II **CO** **12 Periods**

Classical Relations and Fuzzy Relations: Cartesian Product, Crisp Relations, Fuzzy Relations, Tolerance and Equivalence Relations, Fuzzy Tolerance and Equivalence Relations, Value Assignments , Other Forms of the Composition Operation.
Properties of Membership Functions, Fuzzification, and Defuzzification: Features of the Membership Function, Various Forms, Fuzzification, Defuzzification to Crisp Sets, λ-Cuts for Fuzzy Relations, Defuzzification to Scalars.

UNIT III **CO** **12 Periods**

Logic and Fuzzy Systems: Logic: Classical Logic, Fuzzy Logic, Fuzzy Systems
Decision Making with Fuzzy Information: Fuzzy Synthetic Evaluation, Fuzzy Ordering, Non-transitive Ranking, Preference and Consensus, Multi objective Decision Making, Fuzzy Bayesian Decision Method, Decision Making under Fuzzy States and Fuzzy Actions.

UNIT IV **CO** **12 Periods**

Fuzzy Classification and Pattern Recognition: Fuzzy Classification, Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, *c*-Means Clustering , Hard *c*-Means (HCM) , Fuzzy *c*-Means (FCM), Classification Metric , Hardening the Fuzzy *c*-Partition, Similarity Relations from Clustering, Fuzzy Pattern Recognition, Single-Sample Identification, Multi feature Pattern Recognition.,

Applications of Fuzzy Systems Using Miscellaneous Models: Fuzzy Optimization, Fuzzy Cognitive Mapping, Agent-Based Models, Fuzzy Arithmetic and the Extension Principle, Fuzzy Algebra, Data Fusion.

Learning Resources:

Text Book(s):

1. Timothy J.Ross - Fuzzy logic with engineering applications, 4th edition, Wiley, 2016.
2. George J.Klir,Bo Yuan - Fuzzy sets and Fuzzy logic theory and Applications, PHI, New Delhi,1995.

Reference Book(S):

1. S. Rajasekaran, G. A. Vijayalakshmi - Neural Networks and Fuzzy logic and Genetic Algorithms, Synthesis and Applications, PHI, New Delhi,2003.

CSH14	Computer Graphics	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. Identify the functions and operations of display hardware and associated devices.
2. Interpret the algorithms for drawing 2D primitives.
3. Classify and implement geometric transformations of 2D objects.
4. Classify and implement geometric transformations of 3D objects.
5. Recognize the concepts related to Computer Animation.

Course Outcomes:

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

1. Examine the functions and operations of display hardware and associated devices.
2. Evaluate the algorithms related to 2D primitives.
3. Analyze and formulate the transformations of 2D objects.
4. Analyze and formulate the transformations of 2D objects.
5. Possess the knowledge on Computer Animation.

Course Content:

UNIT 1 **CO** **15 Periods**

Output primitives: Points and lines, line drawing algorithms - DDA, Bresenham's, mid-point circle and ellipse algorithms, Filled area primitives - Scan line polygon fill algorithm, inside-outside tests, boundary-fill and flood-fill algorithms, character generation and Antialiasing.

UNIT II **CO** **15 Periods**

2-D geometrical transforms: Translation, scaling, rotation, reflection and shear transformation, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems.

2-D viewing: The viewing pipeline, viewing coordinate reference frame, window to view-port coordinate transformation, viewing functions, Cohen-Sutherland and Liang-Barsky line clipping algorithms, Sutherland - Hodgeman polygon clipping algorithm.

UNIT III **CO** **15 Periods**

Three Dimensional Concepts: 3-D Object representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-spline curves, Bezier and B-spline surfaces, sweep representations, octrees BSP Trees.

3-D Geometric transformations: Translation, rotation, scaling, reflection and shear transform actions, composite transformations.

UNIT IV **CO** **15 Periods**

viewing: Viewing pipeline, viewing coordinates, projections, view volume and generalprojection transforms and clipping.

Computer animation: Design of animation sequence, general computer animation functions, raster animation, computer animation languages, key frame systems, motion specifications.

Learning Resources

Text Book:

1. "Computer Graphics C version", Donald Hearn and M.Pauline Baker, Pearson Education 2nd Edition.

Reference Books:

1. "Computer Graphics Principles & Practice", Second Edition in C, James.D.Foley, AndriesVanDam, Steven K.Feiner and Hughes, Pearson Education.
2. Computer Graphics, Steven Harrington, TMH
3. "Computer Graphics Second edition", Zhigand Xiang, Roy Plastock, Schaum's outlines, Tata Mc- Graw Hill edition.
4. Procedural elements for Computer Graphics, David F Rogers, Tata Mc Graw Hill, 2nd edition.
5. "Principles of Interactive Computer Graphics", Willam.M.Neuman and Robert.F.Sproul, TMH.
6. Principles of Computer Graphics, ShaliniGovil, Pai, 2005, Springer.

Web References:

1. http://kat.ph/hearn-baker-computer-graphics-c-version-2nd-edt3295235.html
2. http://users.abo.fi/jawester/compgraph/
3. http://research.cs.wisc.edu/graphics/Courses/559-s2002/cs559.html
4. http://www.cs.umd.edu/~mount/427/Lects/427lects.pdf

POOL-2

CSH21	Advanced Databases	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To learn multi-user DBMS architectures and emerging developments in Web services and service- oriented architectures (SOA) in the context of database field.
2. To realize the importance of query processing and optimization.
3. To understand the basic concepts and architectures of advanced database systems like distributed, object oriented, cloud and multimedia databases.

Course Outcomes:

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

1. Discuss the concepts of middleware, web services and service-oriented architectures that can be used to provide new types of business services in the database field.
2. Choose an optimal query processing strategy for a given user query
3. Describe the concepts of distributed DBMSs and replication servers as an alternative to distributed DBMSs
4. Discuss the issues associated with mobile databases
5. Compare and contrast the features of relational data model with object-oriented data model.

Course Content:

UNIT1 **CO** **10 Periods**

Database Architectures and the Web - Multi-user DBMS Architectures, Web Services and Service-Oriented Architectures, Distributed DBMSs, Data Warehousing, Cloud Computing, Components of a DBMS .

UNIT II **CO** **15 Periods**

Query Processing - Overview of Query Processing, Query Decomposition, Heuristical Approach to Query Optimization, Cost Estimation for the Relational Algebra Operations, Enumeration of Alternative Execution Strategies, Query Processing and Optimization .

UNIT III **CO** **12 Periods**

Distributed DBMSs—Concepts and Design – Introduction, Functions and Architectures of a DDBMS, Distributed Relational Database Design, Transparencies in a DDBMS, Distributed Transaction Management, Distributed Concurrency Control, Distributed Deadlock Management, Distributed Database Recovery Replication and Mobile Databases - Introduction to Data Replication, Replication Architecture, Replication Schemes, Introduction to Mobile Databases.

UNIT IV **CO** **13 Periods**

Object-Relational DBMSs - Advanced Database Applications, Weaknesses of RDBMSs, Storing Objects in a Relational Database, Introduction to Object-Relational Database Systems Object-Oriented DBMSs—Concepts and Design - Next-Generation Database Systems, Introduction to OODBMSs, Persistence in OODBMSs, Issues in OODBMSs, Advantages and Disadvantages of OODBMSs, Comparison of ORDBMS and OODBMS.

Learning Resources:

Text Book:

1. Text Book Thomas M. Connolly and Carolyn E. Begg, Database Systems: A Practical Approach to Design, Implementation, and Management, Sixth Edition, Pearson Education, 2015

CSH22	Concurrent Programming	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. Impart principles for programming secure, reliable and robust software in a multi-threaded or multi-process environment.
2. Introduce the fundamental concepts of concurrency using shared memory architectures.
3. To provide knowledge on how to implement , and analyse the performance of multiprocessor algorithms.

Course Outcomes:

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

1. Explain the fundamental concepts of concurrent programming.
2. Discuss the behavior based on all notions of correctness for concurrent objects.
3. Discuss the synchronization primitives needed to implement highly concurrent data structures.
4. Explain various types of locks used to achieve synchronization of concurrent objects.
5. Apply various synchronization techniques on linked lists.
6. Analyze the performance of sequential and multiprocessor algorithms used for multiprocessor programming.

Course Content:

UNIT 1 **[CO1, CO2]** **12 Periods**

Introduction-Shared Objects and Synchronization, A Fable, The Producer-Consumer Problem, the Readers-Writers Problem, The Harsh Realities of Parallelization, Parallel Programming.
Mutual Exclusion- Time**,** Critical Sections, Thread Solutions, The Filter Lock, Fairness, Lamport's Bakery algorithm, Bounded Timestamps, Lower Bounds on the Number of locations.
Concurrent Objects –Concurrency and Correctness, Sequential Objects, Quiescent Consistency, Sequential Consistency, Linearizability, Formal Definitions, Progress Conditions, the Java Memory Model.

UNIT II **[CO2, CO3]** **13 Periods**

Foundation of Shared Memory- The Space of Registers, Register Constructions, Atomic Snapshots.
The Relative Power of Primitive Synchronization Operations- Consensus Numbers, Atomic Registers, Consensus Protocols, FIFO Queues, Read-Modify-Write Operations,Common2 RMW Operations, The compareAndSet() Operation.
Universality of Consensus-Introduction, Universality, A Lock-Free Universal Construction, A Wait-Free Universal Construction.

UNIT III **[CO4, CO5]** **12 Periods**

Spin Locks and Contention- Test-And-Set Locks, TAS –Based Spin Locks Revisited, Exponential Back off, Queue Locks, A Queue Lock with Timeouts, A Composite Lock, Hierarchical Locks, One Lock To Rule them All.
Monitors and Blocking Synchronization- Introduction, Monitor Locks and Conditions, Readers-Writers Locks, Our Own Reentrant Lock, Semaphores.
Linked Lists: The Role of Locking- Introduction, List-Based Sets, Concurrent Reasoning, Coarse-Grained Synchronization, Fine –Grained Synchronization, Optimistic Syncronization, Lazy synchronization, on-Blocking Synchronization.

UNIT IV **[CO6]** **12 Periods**

Concurrent Queues and the ABA Problem-Introduction, Queues, A Bounded Partial Queue, An Unbounded Total Queue, An Unbounded Lock-Free Queue, Memory Reclamation and the ABA Problem, Dual Data Structures
Concurrent Stacks and Elimination-Introduction, An Unbounded Lock-Free Stack, Elimination, the Elimination Back off Stack.
Counting, Sorting and Distributed Coordination-Introduction, Shared Counting, Software Combining, Counting Networks, Parallel Sorting, Sorting Networks, Sample Sorting, Distributed Coordination.

Learning Resources:

Text Books:

1. Maurice Herlihy and NirShavit, **"The Art of Multiprocessor Programming",**Revised First Edition, Elsevier, 2012.

Reference Books:

1. Java Concurrency in Practice by Brian Goetz, Tim Peierls, Joshua Block, Joseph Bowbeer, David Holmes and Doug Lea, Addison Wesley, 1st Edition, 2006.
2. Concurrent Programming in Java™: Design Principles and Patterns, Second Edition by Doug Lea, Publisher: Addison Wesley, Pub Date: October 01, 1999.

CSH23	Game Theory	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

Course Outcomes:

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

Course Content:

UNIT I **CO** **12 Periods**

Combinatorial games: Impartial games- Nim, Bouton's solution of Nim, Other impartial games, Partisan games- The game of Hex, Topology and Hex: A path of arrows, Hex and Y, More general boards, Other partisan games played on graphs.

Two-person zero-sum games: Examples, Definitions, The Minimax Theorem and its meaning, Simplifying and solving zero-sum games - Simplifying and solving zero-sum games - Pure optimal strategies: Saddle points, Equalizing payoffs, The technique of domination, Using symmetry, Nash equilibria, equalizing payoffs, and optimal strategies.

UNIT II **CO** **12 Periods**

Zero-sum games on graphs: Games in series and in parallel, Resistor networks and troll games, Hide and Seek games - Maximum matching and minimum covers, A pursuit-evasion game: Hunter and Rabbit, Towards optimal strategies, The hunter's strategy, The rabbit's strategy, The Bomber and Battleship game.

General-sum games: Nash equilibria, General-sum games with more than two players- Symmetric games, Potential games- The general notion, Games with infinite strategy spaces, The market for lemons.

UNIT III **CO** **12 Periods**

Games in extensive form: Introduction, Games of imperfect information, Games of incomplete information - Bayesian games, Signaling, Zero-sum games of incomplete information, Repeated games – Repetition with discounting, The Folk Theorem for average payoffs.

Random-turn games: Examples, Optimal strategy for random-turn selection games, Win-or-lose selection games - Length of play for random-turn Recursive Majority.

UNIT IV **CO** **12 Periods**

Fair division: Cake cutting, Cake cutting via Sperner's Lemma, Bankruptcy.

Cooperative games: Transferable utility games, The core, The Shapley value, Shapley's axioms, Shapley's Theorem, Examples, Nash bargaining.

LearningResources:

Text Book:

1. Anna R. Karlin, Tuval Peres, "Game Theory, Alive", American Mathematical Society.

Reference Books:

2. DeVos and Kent, "Game Theory: A Playful Introduction",American Mathematical Society.
3. Thomas S. Ferguson, Class notes

CSH24	Arm System Architecture	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To introduce the fundamental concepts of ARM architecture and programming.
2. To provide knowledge on various types of ARM instructions, memory maps, memory access, stacks , and ARM pipeline and CPU evaluation.

Course Outcomes:

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

1. Explain the ARM architecture and fundamental concepts of ARM programming.
2. Develop solutions using various types of instructions.
3. Explain the concepts of signed numbers and IEEE 754 floating point standards.
4. Explain ARM memory maps and memory access, and addressing modes.
5. Discuss the ARM pipeline and CPU evaluation

Course Content:

UNIT I **CO1** **14 Periods**

The History of ARM and Microcontrollers: Introduction to Microcontrollers, The ARM Family History
ARM Architecture and Assembly Language Programming: The General Purpose Registers in the ARM, The ARM Memory Map, Load and Store Instructions in ARM, ARM CPSR, ARM Data Format and Directives. Introduction to ARM Assembly Programming, Assembling an ARM Program, The Program Counter and Program ROM Space in the ARM, Some ARM Addressing Modes, RISC Architecture in ARM, Viewing Registers and Memory with ARM Keil IDE.

UNIT II **CO2** **10 Periods**

Arithmetic and Logic Instructions and Programs: Arithmetic Instructions, Logic Instructions, Rotate and Barrel Shifter, Shift and Rotate Instructions in ARM Cortex,

BCD and ASCII Conversion: Branch, Call, and Looping in ARM: Looping and Branch Instructions, Calling Subroutine with BL, ARM Time Delay and Instruction Pipeline, Conditional Execution.

UNIT III **CO3, CO4** **14 Periods**

Signed Numbers and IEEE 754 Floating Point: Signed Numbers Concept, Signed Number Instructions and Operations, IEEE 754 Floating-Point Standards
ARM Memory Map, Memory Access, and Stack: ARM Memory Map and Memory Access, Stack and Stack Usage in ARM, ARM Bit-Addressable Memory Region, Advanced Indexed Addressing Mode, ADR, LDR, and PC Relative Addressing.

UNIT IV **CO5** **10 Periods**

ARM Pipeline and CPU Evolution, ARM Pipeline Evolution, Other CPU Enhancements.

Learning Resources:

Text Book:

1. Muhammed Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Janice Mazidi, "ARM Assembly language Programming & Architecture, Pearson Education.

Reference Book:

1. ARM Assembly Language Programming By Pete Cockerell, Computer Concepts Ltd.

Web References:

1. https://azeria-labs.com/writing-arm-assembly-part-1/
2. https://www.hackster.io/news/do-you-want-to-learn-arm-assembly-43213cdf3178

POOL3

		L	P	C
CSH31	GPU ARCHITECTURES AND PROGRAMMING	4	0	4

Course Objectives:

Course Outcomes:

Course Content:

UNIT-1	CO1	15
UNIT-2	CO1	15
UNIT-3	CO1	12
UNIT-4	CO1	12

Learning Resources:

Text Books:

Reference Books:

Online Resources:

-

CSH32	Search Engine Internals	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To provide knowledge on the implementation of search engines.
2. To expose the students about existing retrieval models.
3. To provide knowledge on the evaluation of search engines.

Course Outcomes:

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

1. Discuss the fundamentals of search engine and it's architecture.
2. Explain the working of web crawlers,feeds, and text processing.
3. Implement the ranking algorithm torank the retrieved web documents.
4. Create the interfaces for querying the text.
5. Analyze various retrieval models.
6. Evaluate the search engine using effectiveness and efficiency metrics.

Course Content:

UNIT I **CO** **10 periods**

Search Engines and Information Retrieval: What is Information Retrieval, The Big Issues, Search Engines, Search Engineers.
Architecture of a Search Engineers: What is an Architecture? Basic Building blocks, Breaking It Down.

UNIT II **CO** **14 Periods**

Crawls and Feeds: Deciding what to search, crawling the web, crawling documents and Email, Document feeds, The conversion problem, Storing the documents, Detecting Duplicates, Removing Noise.
Processing Text: From words to Terms, Text statistics, Document Passing, Document Structure and Mark up, Link Analysis, Information Extraction, Internationalization

UNIT III **CO** **12 Periods**

Ranking with Indexes: Abstract Model of Ranking, Inverted Indexes Compression, Auxiliary structures, Index construction, query processing.
Quires and Interfaces: Information Needs and Quires, Query Transformation and Refinement, showing the results.

UNIT IV **CO** **13 Periods**

Retrieval Models: Overview of Retrieval models, Probabilistic models, Ranking based on Language Models, Complex queries and combining Evidence, Web search, Machine Learning and Information retrieval, Application-Based Models.
Evaluating Search Engines: Why Evaluate? The evaluation corpus, Logging Effectiveness Metrics, Efficiency metrics, Training, Testing, and Statistics.

Learning Resources:

Text Book:

1. Search Engines: Information Retrieval in Practice**,** W.Bruce Croft, Donald Metzler, Trevor Strohman., Addison Wesley-2010.

CSH33	Wireless Sensor Networks	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. To introduce the fundamental concepts of Sensor networks and it's architecture, applications
2. To provide knowledge on Fundamental MAC protocols, routing protocols, network topologies, Quality services, and Security issues of sensor networks.

Course Outcomes:

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

1. Describe the challenges and applications of sensor networks.
2. Implement the design principles of WSN.
3. Use the specific MAC protocol for sensor networks.
4. Design various routing protocol for different applications.
5. Analyze the network security mechanism and QoS metric.

Course Content:

UNIT I **CO** **12 Periods**

Introduction and Overview of Wireless Sensor Networks: Background of Sensor Network Technology, Application of Sensor Networks, Challenges for Wireless Sensor Networks, Mobile Adhoc NET works (MANETs) and WSN, Enabling Technologies for WSN.
Single node Architecture: Hardware Components, Energy Consumption of sensor nodes.

UNIT II **CO** **12 Periods**

Network Architecture: Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs, Service Interfaces of WSNs, Gateway Concepts.
MAC for Wireless Sensor Networks: Fundamental MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, IEEE 802.15.4 MAC protocol.

UNIT III **CO** **12 Periods**

Topology Control: Motivation and basic ideas, Hierarchical networks by clustering, combining hierarchical topologies and power control.
Routing Protocols: Energy-efficient unicast, Broadcast and multicast, Geographic Routing.

UNIT IV **CO** **12 Periods**

Data-centric and content-based networking: Data-centric routing, Data aggregation.
QoS and Security in WSN: QoS in WSN, Reliable data transport, Single packet delivery, Block delivery, Security.

Learning Resources:

Text Book:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

References Books:

1. Ian F. Akyildiz, and Mehmet Can Vuran, "Wireless Sensor Networks", 2011, First Edition, John Wiley & Sons, New Jersey.
2. Kazem Sohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks, Technology, Protocols, and Applications", 2012, First Edition, John Wiley & Sons, New Jersey.
3. Anna Hac, "Wireless Sensor Network Designs", 2013, First Edition, John Wiley &Sons, New Jersey.
4. Elink:http://nptel.ac.in/courses/106105160/22.

CSH34	Parallel Algorithms	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:

1. Realize the use basic sequential algorithms and Describe about basic parallel algorithms.
2. Describe and use basic data structures; know about the existence of advanced data structures.
3. Describe and use the main design techniques for sequential algorithms.
4. Analyze message-passing based parallel algorithms in C using the MPI library.

Course Outcomes:

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

1. Elucidate the parallel computing models, and differentiate between sequential and parallel algorithms.
2. Analyze the parallel algorithms for CRCW, CREW, EREW models.
3. Identify the correctness and analyze the computational complexity of sequential algorithms.
4. Differentiate among several algorithms solving the same problem under different conditions.

Course Content:

UNIT I **CO** **13 Periods**

Introduction to Parallel Algorithms: Models of Computation – Analyzing Algorithms, Selection-The Problem and a lower Bound, A Sequential algorithm, Desirable Properties of Parallel algorithm, An algorithm for parallel Selection.
Merging: A Network for Merging, Merging on the CREW and EREW Models – A better Algorithm for the EREW model.

UNIT II **CO** **12 Periods**

Sorting: A network for Sorting, sorting on a Linear Array, Sorting on CRCW, CREW, EREW Models
Searching: Searching a Sorted Sequence – Searching a Random Sequence, Searching on a tree, searching on Mesh.

UNIT III **CO** **12 Periods**

Generating Permutations and Combinations: Sequential Algorithms, generating permutations in Parallel, generating combinations in Parallel.
Matrix Operations: Transpositions, Matrix by Matrix Multiplications, Matrix by Vector multiplication.

UNIT IV **CO** **13 Periods**

Graph Theory: Computing the Connectivity Matrix, Finding Connected Components, All Pairs Shortest Paths, Computing Minimum Spanning Trees.
Applications: Job Sequencing with Deadlines, Knapsack Problem.

Learning Resources:

Text Book:

1. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice Hall, New Jersey, 1989.

Reference Books:

1.Michael J. Quinn, Parallel Computing: Theory & Practice, Tata McGraw Hill Edition, 2003.
2.Justin R. Smith, the Design and Analysis of Parallel Algorithms, Oxford University Press, USA, 1993.
3.Joseph JaJa, Introduction to Parallel Algorithms, Addison-Wesley, 1992.

POOL4

CSH41	Semantic Web Technologies	L	P	C
		4	0	4

Course Objectives:

The main objectives of this course are to:
1. To provide the knowledge of semantic web layers design and vision.
2. To demonstrate the development of ontology creation and applications

Course Outcomes:

After successful completion of the course, students will be able to:
1. Explain the fundamentals of semantic web and its layers.
2. Represent the datamodel using RDF, RDF Schema, and OWL.
3. Query the semantic web using SPARQL.
4. Explain the benefits of the Semantic Web for various application domains.
5. Construct ontology for the given domain.
6. Describe the key issues in the development of ontology based systems for the web.

Course Content:

UNIT I **12 Periods**

Semantic Web Vision: Introduction, Semantic web technologies, Alayered approach.
Describing Web Resources: RDF- Introduction, RDF: Data Model. RDF Syntaxes, RDFS: Adding Semantics, RDF Schema: The Language, RDF and RDF Schema in RDF Schema, An Axiomatic Semantics for RDF and RDF Schema, A Direct Inference System for RDF and RDFS, adding information with SPARQL update.

UNIT II **13 Periods**

Querying the Semantic Web: SPARQL Infrastructure, Basics: Matching patterns, Filters, Constructs for dealing with an open world, Organizing Result Sets, Other forms of SPARQL Queries, Querying schemas.
Web Ontology Language: Introduction, Requirements for Ontology Languages, Compatibility of OWL2 with RDF/RDFS, The OWL Language, OWL2 Profile.

13 Periods

UNIT III

Logic and Inference: Rules Introduction, Example of Rules: Family Relationships, Monotonic Rules: Syntax, Monotonic Rules: Semantics, OWL2 RL: Description Logic Meets Rules, Rule Interchange Format: RIF, Sematic Web Rules language, Rules in SPARQL, No monotonic rules: Motivation &syntax, Rule Markup language (Rule ML).
Applications: Introduction, Good Relations, BBC Artists, BBC World cup 2010 website, Government Data, New York Times, Sig.ma and Sindice, OpenCalais.

UNIT IV **11 Periods**

Ontology Engineering: Introduction, Constructing ontologies Manually, Reusing existing ontologies, Semi-automatic ontology Acquisition. Ontology mapping, Exposing relational databases, semantic web application architecture.

Learning Resources:

Text Book:

1. A Semantic web Primer: Grigoris Antoniou and Frank Van Hermelen, 3rd Edition, MIT Press

Reference Book(s):

1. Foundations of Semantic Web Technologies, Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, CRC Press

CSH42	Deep Learning	L	P	C
		4	0	4

Course Objective:

The main objectives of this course are to:

1. Introduce different neural network models for deep learning.
2. Explain parameters used for regularizing the deep learning.
3. Define challenges in optimization of a network.

Course Outcomes:

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

1. Describe deep learning algorithms which are suitable for learning tasks in different domains.
2. Discuss different parameters used in deep neural networks.
3. Compare learning and optimization methods for training a model.
4. Implement deep learning algorithms for solving real-world applications.

Course Contents:

UNIT-I **10 Periods**

Deep Feedforward Networks: Example: Learning XOR, Gradient-Based Learning, Hidden Units,Architecture Design, Back-Propagation and Other Differentiation Algorithms, Historical Notes

UNIT-II **12 Periods**

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as ConstrainedOptimization, Regularization and Under-Constrained Problems, Dataset Augmentation, NoiseRobustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training,Tangent Distance, Tangent Prop, and Manifold Tangent classifier.

UNIT-III **12 periods**

Optimization for Training Deep Models, How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and MetaAlgorithms

UNIT-IV **14 Periods**

Convolutional Networks: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuro-scientific Basis for Convolutional Networks, Convolutional Networks and the History of Deep Learning.

Applications: Large-Scale Deep Learning, Computer Vision, Natural Language Processing.

Text Book:

1. Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning (Adaptive Computation andMachine Learning series), MIT Press.

Reference Books:

1. Li Deng and Dong Yu, Deep Learning Methods and Applications, Foundations and Trends®in Signal Processing Volume 7 Issues 3-4, ISSN: 1932-8346.
2. Dr. N.D. Lewis, Deep Learning Made Easy with R A Gentle Introduction for Data Science.Create Space Independent Publishing Platform (January 10, 2016)
3. François Chollet, JJ Allaire, MEAP Edition Manning Early Access Program Deep Learningwith R Version 1, Copyright 2017 Manning Publications

CSH43	Social Network Analysis	L	P	C
		4	0	4

Course objectives:

The main objectives of this course are to:

1. To introduce the current Web development and emergence of SocialWeb.
2. To provide the knowledge of modeling, aggregating, and knowledge representation of semantic web.
3. To expose the students extraction and mining tools, web personalization and web visualization of Social networks

Course Outcomes:

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

1. Apply the knowledge for current Web development in the era of Social Web.
2. Model the knowledge representation of the semantic web using ontology languages.
3. Explain the extraction and mining tools required for social networks.
4. Develop personalized web sites and visualization for Social networks.
5. Design Web personalization and Visualization for Social networks.

Course Content:

UNIT I **12 Periods**

Introduction To Social Network Analysis: Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web - 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.

UNIT II **13 Periods**

Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation - Ontology languages for the Semantic Web – RDF and OWL - Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations.

UNIT III **12 Periods**

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 & Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities.

UNIT IV **13 Periods**

Understanding and Predicting Human Behavior 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 - Combining Trust and Reputation.

Learning Resources:

References:

1. Peter Mika, —Social networks and the Semantic Web‖, Springer, 1st edition 2007.
2. BorkoFurht, —Handbook of Social Network Technologies and Applications‖, Springer, 1st edition, 2010.
3. GuandongXu ,Yanchun Zhang and Lin Li, —Web Mining and Social Networking Techniques and applications‖, Springer, 1st edition, 2011.

E-Resources:

1. https://en.wikipedia.org/wiki/Social_network_analysis.
2. https://www.slideshare.net/pkaviya/cs6010-social-network-analysis-unit-iii
3. https://www.slideshare.net/socialmediadna/visualization-of-social-networks.

CSH44	Augmented and Virtual Reality	L	P	C
		3	0	4

Course Objectives:

The main objectives of this course are to:

1. Recognize the basic components of Virtual Reality technology.
2. Acquire Knowledge on Computing Architecture and Modeling concepts of Virtual Reality.
3. Distinguish the factors that influence the system performance in virtual reality.
4. Relate the Virtual Realty Applications in various domains.

Course Outcomes:

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

1. Distinguish the fundamental technologies and equipment used in virtual reality;
2. Investigate the theoretical contexts relevant to computing and modeling features in VR development.
3. Analyze the current generation systems for creating VR environments.
4. Identify the current VR technologies and next generation applications across all fields.

Course Content:

UNIT I **CO** **12 Periods**

Introduction: The Three I's Virtual Reality, A short History of Early Virtual Reality, Early commercial VR Technology, VR Becomes an Industry, The five classic Components of a VR system.

Input Devices: Trackers, Navigation and Gesture Interfaces: Three- Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces.

Output Devices: Graphics, Three-Dimensional Sound and Haptic Displays: Graphics Displays Sound Displays, Haptic Feedback.

UNIT II **CO** **14 Periods**

Computing Architectures for VR: The Rendering Pipeline Rendering, PC Graphics Architecture Workstation-Based Architectures, Distributed VR Architectures.

Modeling: Geometric modeling, Kinematics Modeling, Physical Modeling, Behavior Modeling, Model Management.

UNIT III **CO** **12 Periods**

VR Programming: Toolkits and Scene Graphs, WorldToolkit, JAVA3D, General Haptics Open Software Toolkit,, People shop.

Human Factors in VR: Methodology and Terminology, User Performance Studies, VR Health and Safety Issues, VR and Society.

UNIT IV **CO** **12 Periods**

Traditional VR Applications: Medical Applications of VR, Education, Arts and Entertainment, Military VR Applications.

Emerging Applications of VR : VR Applications in Manufacturing, Applications of VR in Robotics, Information Visualization.

Learning Resources:

Text Book:

1. GrigoreC.Burdea, Philippe Coiffet. "Virtual Reality" Second Edition, Wiley India.