Vel Tech Multi Tech
Dr.Rangarajan Dr.Sagunthala Engineering College
An Autonomous Institution

B.Tech - COMPUTER SCIENCE AND BUSINESS SYSTEMS

CURRICULUM SYLLABUS–Regulation 2019

SEMESTER I

Course Code	Name of the Course	Category	L	T	P	Credits
191MA101	Engineering Mathematics – I	BS	2	2	0	3
191PH101	Engineering Physics	BS	3	0	0	3
191CH101	Engineering Chemistry	BS	3	0	0	3
191HS102	Business Communication & Value Science - I	HSS	3	0	0	3
191RA111	Basic Engineering Science	ES	3	0	0	3
191CS111	Introduction to Programming in C	ES	3	0	0	3
191PH10A	**Physics Laboratory**	**BS**	**0**	**0**	**2**	**1**
191CH10A	**Chemistry Laboratory**	**BS**	**0**	**0**	**2**	**1**
191CS11A	**Programming in C Laboratory**	**ES**	**0**	**0**	**2**	**1**
Total			17	2	6	21

SEMESTER II

Course Code	Name of the Course	Category	L	T	P	Credits
191MA203	Discrete Mathematics	BS	2	2	0	3
191HS202	Business Communication & Value Science – II	HSS	3	0	0	3
191HS201	Environmental Science and Engineering	HSS	3	0	0	3
191ME211	Engineering Graphics	ES	2	2	0	3
191CS221	Problem Solving and Python Programming	PC	3	0	0	3
191CB221	Fundamentals of Design Thinking	PC	3	0	0	3
191ME21A	**Engineering Practice Lab**	**ES**	**0**	**0**	**4**	**2**
191CS22A	**Problem Solving and Python Programming Laboratory**	**PC**	**0**	**0**	**2**	**1**
	தமிழர்மரபு / Scientific Thoughts in Tamil	HSS	0	0	1	1
Total			16	4	7	22

SEMESTER III

Course Code	Name of the Course	Category	L	T	P	Credits
191MA303	Probability and Statistics	BS	2	2	0	3
191AI321	Data Structures	PC	3	0	0	3
191CS322	Computer Architecture	PC	3	0	0	3
191CS323	Object Oriented Programming	PC	3	0	0	3
191CS324	Software Engineering	PC	3	0	0	3
191CB321	Basic Economics for Engineers	PC	3	0	0	3
191AI32A	**Data Structures Laboratory**	**PC**	**0**	**0**	**2**	**1**
191CS32B	**Object Oriented Programming Laboratory**	**PC**	**0**	**0**	**2**	**1**
191HS30A	**Advanced Reading and Writing skills Laboratory**	**HSS**	**0**	**0**	**2**	**1**
	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	ES	**0**	**0**	**2**	**2**
Total			**17**	**2**	**8**	**23**

SEMESTER IV

Course Code	Name of the Course	Category	L	T	P	Credits
191MA405	Linear Algebra and Numerical Methods	BS	2	2	0	3
191CS424	Computer Networks	PC	3	0	0	3
191CS422	Database Management Systems	PC	3	0	0	3
191CB421	Innovation Management, Entrepreneurship and IPR	PC	3	0	0	3
191CS423	Operating Systems	PC	3	0	0	3
191CB422	Software Design and Modeling	PC	3	0	0	3
191CS42A	**Database Management Systems Laboratory**	PC	0	0	2	1
191CS42C	**Networks Laboratory**	PC	0	0	2	1
191CS42B	**Operating Systems Laboratory**	PC	0	0	2	1
191MC46A	**Internship / Training-I**	MC	0	0	0	**
Total			**17**	**2**	**6**	**21**

SEMESTER V

Course Code	Name of the Course	Category	L	T	P	Credits
191MA503	Operations Research	ES	2	2	0	3
191CB521	Compiler Design	PC	3	0	0	3
191AI521	Design and Analysis of Algorithms	PC	3	0	0	3
	Professional Elective - I	PE	3	0	0	3
	Professional Elective - II	PE	3	0	0	3
	Open Elective – I	OE	3	0	0	3
191HS50A	**Professional Communication**	HSS	0	0	2	1
191CB52A	**Compiler Design Laboratory**	PC	0	0	2	1
191AI52A	**Design and Analysis of Algorithms Laboratory**	PC	0	0	2	1
191MC56A	**Technical Seminar**	MC	0	0	0	**
Total			**17**	**2**	**6**	**2**

SEMESTER VI

Course Code	Name of the Course	Category	L	T	P	Credits
191HS601	Business Communication & Value Science - III	HSS	3	0	0	3
191CS622	Internet Programming	PC	3	0	0	3
191CB621	Machine Learning Techniques	PC	3	0	0	3
	Professional Elective – III	PE	3	0	0	3
	Open Elective – II	OE	3	0	0	3
191CS62B	Internet Programming Lab	PC	0	0	2	1
191CB62A	Machine Learning Techniques Laboratory	PC	0	0	2	1
191CB67A	**Mini Project**	PROJ	0	0	4	2
191MC66A	**Internship / Training – II**	MC	0	0	0	**
Total			**15**	**0**	**8**	**19**

SEMESTER VII

Course Code	Name of the Course	Category	L	T	P	Credits
191CS722	Cryptography and Network Security	PC	3	0	0	3
191CB721	Marketing Research and Management	PC	3	0	0	3
	Professional Elective – VI	PE	3	0	0	3
	Professional Elective – V	PE	3	0	0	3
	Open Elective – III	OE	3	0	0	3
191CS72B	Security Laboratory	PC	0	0	2	1
191CB72A	Statistical Package for Social Sciences Laboratory	PC	0	0	2	1
191CB77A	**Project Work - Phase I**	PROJ	0	0	2	2
Total			**15**	**0**	**6**	**19**

SEMESTER VIII

Course Code	Name of the Course	Category	L	T	P	Credits
191AI821	Blockchain Technology	PC	3	0	0	3
	Professional Elective – VI	PE	3	0	0	3
191CB87A	**Project Work - Phase II**	PROJ	0	0	24	12
Total			**6**	**0**	**24**	**18**
Total Credits						**161**

VERTICALS

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
I ARTIFICIAL INTELLIGENCE	I	191ITV11	App Development	PE	2	0	2	3
	II	191ITV12	Bio-Inspired Optimization Techniques	PE	3	0	0	3
	III	191ITV13	Business Analytics	PE	2	0	2	3
	IV	191ITV14	Cognitive Science	PE	2	0	2	3
	V	191ITV15	Computer Vision	PE	2	0	2	3
	VI	191ITV16	Ethics and AI	PE	2	0	2	3
	VII	191ITV17	Knowledge Engineering	PE	2	0	2	3
	VIII	191ITV18	Soft Computing	PE	2	0	2	3
			TOTAL		**17**	**0**	**14**	**24**
II CLOUD COMPUTING	I	191ITV21	Cloud Services Management	PE	2	0	2	3
	II	191ITV22	Data Warehousing	PE	2	0	2	3
	III	191ITV23	Principles of Cloud Computing	PE	2	0	2	3
	IV	191ITV24	Security and Privacy in Cloud	PE	2	0	2	3
	V	191ITV25	Software Defined Networks	PE	2	0	2	3
	VI	191ITV26	Storage Technologies	PE	3	0	0	3
	VII	191ITV27	Stream Processing	PE	2	0	2	3
	VIII	191ITV28	Virtualization	PE	2	0	2	3
			TOTAL		**17**	**0**	**14**	**24**
III CYBER SECURITY	I	191ITV31	Cryptocurrency and Blockchain Technologies	PE	2	0	2	3
	II	191ITV32	Cryptography and Cyber Security	PE	3	0	0	3
	III	191ITV33	Digital and Mobile Forensics	PE	2	0	2	3
	IV	191ITV34	Ethical Hacking	PE	2	0	2	3
	V	191ITV35	Modern Cryptography	PE	2	0	2	3
	VI	191ITV36	Network Security	PE	2	0	2	3
	VII	191ITV37	Security and Privacy in Cloud	PE	2	0	2	3
	VIII	191ITV38	Social Network Security	PE	2	0	2	3
			TOTAL		**17**	**0**	**14**	**24**
IV CREATIVE MEDIA	I	191ITV41	Augmented Reality / Virtual Reality	PE	2	0	2	3
	II	191ITV42	Digital marketing	PE	2	0	2	3
	III	191ITV43	Game Development	PE	2	0	2	3
	IV	191ITV44	Multimedia and Animation	PE	2	0	2	3
	V	191ITV45	Multimedia Data Compression and Storage	PE	2	0	2	3
	VI	191ITV46	UI and UX Design	PE	2	0	2	3
	VII	191ITV47	Video Creation and Editing	PE	2	0	2	3
	VIII	191ITV48	Visual Effects	PE	2	0	2	3
			TOTAL		**16**	**0**	**16**	**24**

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
V QUANTUM COMPUTING	I	191ITV51	Physics to Quantum Computing	PE	3	0	0	3
	II	191ITV52	Quantum Circuits	PE	3	0	0	3
	III	191ITV53	Quantum Computer Systems design	PE	3	0	0	3
	IV	191ITV54	Quantum Computing Architecture and Algorithms	PE	3	0	0	3
	V	191ITV55 -	Quantum Information	PE	3	0	0	3
	VI	191ITV56	Quantum Internet	PE	3	0	0	3
	VII	191ITV57	Quantum machanics and atoms	PE	3	0	0	3
	VIII	191ITV58	Quantum ML	PE	3	0	0	3
			TOTAL		**24**	**0**	**0**	**24**
VI DATA SCIENCE	I	191ITV61	Business Analytics	PE	2	0	2	3
	II	191ITV62	Computer Vision	PE	2	0	2	3
	III	191ITV63	Exploratory Data Analysis	PE	2	0	2	3
	IV	191ITV64	Image and Video Analytics	PE	2	0	2	3
	V	191ITV65	Network Security	PE	2	0	2	3
	VI	191ITV66	Neural Networks and Deep Learning	PE	2	0	2	3
	VII	191ITV67	Recommender Systems	PE	2	0	2	3
	VIII	191ITV68	Text and Speech Analysis	PE	2	0	2	3
			TOTAL		**16**	**0**	**16**	**24**
VII MACHINE LEARNING	I	191ITV71	Cognitive Science	PE	2	0	2	3
	II	191ITV72	Data Exploration and Visualization	PE	2	0	2	3
	III	191ITV73	Game Theory	PE	2	0	2	3
	IV	191ITV74	Machine Learning for Signal Processing	PE	3	0	0	3
	V	191ITV75	Machine Learning with Big data	PE	3	0	0	3
	VI	191ITV76	Machine Learning with Python	PE	2	0	2	3
	VII	191ITV77	Neural Networks and Deep Learning	PE	2	0	2	3
	VIII	191ITV78	Text and Speech Analysis	PE	2	0	2	3
			TOTAL		**18**	**0**	**12**	**24**
VII MANAGEMENT	I	191ITV81	Behavioral Economics	PE	3	0	0	3
	II	191ITV82	Customer Relation Management	PE	3	0	0	3
	III	191ITV83	Entrepreneurship Development	PE	2	0	2	3
	IV	191ITV84	Financial Management	PE	3	0	0	3
	V	191ITV85	Fundamentals of Management	PE	3	0	0	3
	VI	191ITV86	Human Resource Management for Entrepreneurs	PE	3	0	0	3
	VII	191ITV87	IT Project Management	PE	3	0	0	3
	VIII	191ITV88	Supply Chain Management	PE	3	0	0	3
			TOTAL		**23**	**0**	**2**	**24**

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
IX MARKETING	I	191ITV91	Conversational Systems	PE	3	0	0	3
	II	191ITV92	Digital Marketing	PE	2	0	2	3
	III	191ITV93	Enterprise Security	PE	3	0	0	3
	IV	191ITV94	Financial Analytics	PE	3	0	0	3
	V	191ITV95	Marketing Research and Marketing Management	PE	3	0	0	3
	VI	191ITV96	Recommender Systems	PE	2	0	2	3
	VII	191ITV97	Risk Analytics	PE	3	0	0	3
	VIII	191ITV98	Social Text and Media Analytics	PE	3	0	0	3
			TOTAL		**22**	**0**	**4**	**24**

SEMESTER I

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSE TITLE		191MA101 /ENGINEERING MATHEMATICS–I		2	2	0	3

COURSEOBJECTIVES
✓ To develop greater knowledge and understanding of mathematics and to attain the skills necessary for success in the study of higher mathematics.

SYLLABUS	
UNIT-I	**MATRICES**	9

Characteristic equation–Eigen values and Eigen vectors of areal matrix – Properties of Eigen values Clayey Hamilton theorem-Orthogonal reduction of asymmetric matrix to diagonal form–Reduction of quadratic form by orthogonal transformation-Applications.

UNIT-II	**GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS**	9

Curvature–CartesianandPolarcoordinates–Centreofcurvature,Circleofcurvature–EvolutesandEnvelopes-Applications

UNIT-III	FUNCTIONS OF SEVERAL VARIABLES	9

Function of two variables – Partial derivatives – Total derivative – Change of Variables – Jacobians- Taylor's expansion – Maxima and Minima – Constrained Maxima and Minima by Lagrangian Multiplier method-Applications

UNIT-IV	ORDINARY DIFFERENTIAL EQUATIONS	9

Linear differential equations of second and higher order with constant coefficients – Method of variation of parameters – Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation and Legendre's linear equation–Simultaneous linear equations with constant coefficients -Applications.

	COURSEOUTCOMES
	On completion of the course, students will be able to
CO1	Analyze the characteristics equation of a linear system with Eigen values and vectors for practical application.
CO2	Determine the bending of family of curves using differential calculus which deals in various disciplines.
CO3	Apply partial derivatives in various engineering problems.
CO4	Identify and solve the real time problems using higher order differential equations.

TEXT BOOKS
1. Kreyszig.E,"Advanced Engineering Mathematics",JohnWiley & Sons.Singapore,10th edition,2012
2. Grewal.B.S,Higher Engineering Mathematics,Khanna Publications,42nd Edition,2012

REFERENCES
✓ Veerarajan.T,"Engineering MathematicsI", Tata Mc Graw Hill Publishing Co,New Delhi,5th edition,2006
✓ Kandasamy.Pet.al."Engineering Mathematics",Vol.I(4th revisededition),S.Chand&Co,NewDelhi,2000

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSETITLE		**191PH101 /ENGINEERING PHYSICS**		3	0	0	3

COURSE OBJECTIVES
✓ The course aims to equip engineering undergraduates with principles of Physics in a broader sense with a view to lay foundation for the various engineering courses

SYLLABUS		
UNIT-I	**PROPERTIES OF SOLIDS**	**9**

Elasticity- Hooke's law – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- Young's modulus by non-uniform bending(Theory and Experiment) - Tensional stress and twisting couple- Tensional Pendulum ((Theory and Experiment) I-shaped girders

UNIT-II	**PRINCIPLES OF LASERS**	**9**

Properties of laser radiation and their significance-wavelength, power, monochromaticity, coherence. Types of lasers working media and their radiation characteristics-Power, wavelength and operational modes of He-Ne,Carbon-dioxide. Physical principles of Laser beam delivery systems. Applications-Industry and Medical. Selection of lasers for various applications

UNIT-III	**OPTICAL FIBRE SYSTEMS**	**9**

Optical Fibres- Propagation mechanism -Critical Angle- Snell's Law-Total Internal Reflection- Acceptance cone-Numerical aperture- Types of fibers- Attenuation-Active and passive fibre sensors(Temperature and Displacement)-Applications (Industry and Medical) – communication in optical fiber- Endoscope

UNIT-IV	**WAVE NATURE OF PARTICLES**	**9**

Introduction to Quantum mechanics, Black body radiation- Planck's Hypothesis-Compton Effect (Theory and Experiment) -Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Schrodinger equation for one dimensional problems–particle in a box-SEM and TEM

UNIT-V	**SOLID STATE PHYSICS**	**9**

Crystalline and non crystalline materials-Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – Expression for interplanar spacing-Bragg'slaw –Diffraction of X-rays by crystal planes-Co-ordination number. Atomic packing factors (SC, FCC, BCC and HCP structures) – Diamond and graphite structures (qualitativetreatment)-Crystalgrowthtechniques(BridgmanandCzochralski)

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate the proficiency on the properties of matter and its applications
CO2	Describe the working principles of Laser and its developments in industrial and medical applications
CO3	Explain the propagation of waves in optical fibres and their applications
CO4	Apply the theory of wave nature of particles in various microscopic applications
CO5	Analyze the structure of materials and its crystal growth techniques

TEXT BOOKS
1. 'Engineering Physics', R.K. Gaur and S.L. Gupta, Dhanpat Rai Publications (P) Ltd., 8th Edition. **New Delhi (2001).** 2. Introduction to Solid State Physics, 7th Edition, Charles Kittel, Wiley, Delhi 2007. 3. Halliday, D., Resnick, R. & Walker, J. —Principles of Physics‖. Wiley, 2015.

REFERENCES
✓ Laser Fundamentals, WilliamT.Silfvast, 2ndEdition, CambridgeUniversitypress, NewYork, 2004. ✓ Fundamentals of Physics, 6thEdition, D. Holliday, R.ResnickandJ.Walker, John Wiley and Sons, NewYork2001. ✓ E.Hecht, Optics, Pearson Education,2008

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

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSETITLE		191CH101/ENGINEERING CHEMISTRY		3	0	0	3

COURSE OBJECTIVES

- ✓ To acquaint the students with the development of microscopic chemistry in terms of atomic, molecular and intermolecular forces and acquires the knowledge of water treatment. The students will be able to analyze the properties and applications of polymer and advanced materials

SYLLABUS

UNIT-I	CHEMICAL BONDING	9

Types of chemical bonds - bond polarity- dipole moment – partial ionic character - consequences. Weak Interactions – Hydrogen bonding, vander Waals forces - influence on properties of matter. Metallic bond – free electron theory, MO treatment- band theory- metals, semiconductors and insulators. Non stoichiometric semiconductors, chalgogen semiconductors. Defect structures of crystals– Schottky and Frenkel defects

UNIT-II	WATER CHEMISTRY	9

Hardness - determination (EDTA method). Water softening - zeolite and demineralization processes. Desalination by electro-dialysis and reverse osmosis. Water analysis by fluoride ion, Water quality parameters, Instrumental methods for water analysis- AAS, flame emission spectroscopy,ICP-MS and photocolorimetry

UNIT-III	ELECTROCHEMISTRY	9

Electrode potential – standard and reference electrodes, Nernst equation, emf series – applications. Galvanic and concentration cells. Applications of potential measurements– glasselectrode-Ph measurement, acid-basetitration, redoxtitration. Conductance measurement–applications–conductometric titrations.

UNIT-IV	POLYMERS	9

Classification, degree of polymerization, molecular weight – Mn and Mw. Polymerization reactions. Glass transition temperature – factors affecting Tg - determination by DSC. Polymer processing - compounding, outlineof moulding techniques compression, injection, extrusion and blow moulding. Charge transport in conjugated polymers- doped conjugated polymers- glucose biosensor. Polymers for LED and LCD displays.

UNIT-V	ADVANCED MATERIALS	9

Carbon nanotubes and carbon fibres, graphene and polymer nano-composites-properties and applications - morphological studies by SEM and TEM. Solid oxide materials and polymer electrolytes -energy storingapplications. Polymer blends and alloys, photo and electroluminescence materials, insulating materials, photopolymer sand photoresists for electronics, polymer photo voltaics.

COURSEOUTCOMES

On completion of the course, students will be able to

CO1	Analyze microscopic chemistry in terms of atomic, molecular and Intermolecular forces for real time applications of semiconductors.
CO2	Investigate the various water treatment and softening methods.
CO3	Appraise the types and mechanism of electrochemical reaction in batteries and fuel cells.
CO4	Explain the basic principle, types and mechanism of polymerization process and techniques.
CO5	Assess the properties, characterization and applications of advanced materials for energy storage.

TEXTBOOKS

1. Mary Jane Shultz,-"Engineering Chemistry", Cengage Learning, USA, 2009.
2. PalannaO. G.,-"Engineering Chemistry", Tata McGraw Hill Education Pvt.Ltd. NewDelhi, 2009.

REFERENCES

✓ GesserH.D.-"AppliedChemistry-ATextbookforEngineersandTechnologies", Springer, NewYork, 2008.
✓ GowarikarV.R.ViswanathanN.VandJayadevSreedhar,-"PolymerScience",   NewAgeInternational (P) Ltd., NewDelhi, 2011.
✓ VijayamohananK.PillaiandMeeraParthasarathy.–"FunctionalMaterials- AChemist'sPerspective"UniversitiesPress, India, 2012.
✓ ShashiChawla,-"ATextbookofEngineeringChemistry",DhanpatRai&Co,NewDelhi,2005

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	2	2	-	-	-	-	2
CO2	3	3	2	2	-	2	2	-	-	-	-	2
CO3	3	3	2	2	-	2	2	-	-	-	-	2
CO4	3	3	2	2	-	2	2	-	-	-	-	2
CO5	3	3	2	2	-	2	2	-	-	-	-	2
CO	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE / COURSE TITLE	**191HS101 / BUSINESS COMMUNICATION & VALUE SCIENCE -I**			3	0	0	3

COURSE OBJECTIVES

- ✓ Understand what life skills are and their importance in leading a happy and well-adjusted life
- ✓ Motivate students to look within and create a better version of self
- ✓ Introduce them to key concepts of values, life skills and business communication
- ✓ Understand the basic skills in Business Communication
- ✓ Apply the learnt techniques in the business world.

SYLLABUS		
UNIT-I	**OVERVIEW OF LEADERSHIP ORIENTED LEARNING**	**9**

Overview of Leadership Oriented Learning (LOL)-Theory and Practice-Activity on introducing Self- Introducing self and SWOT-Class activity – presentation on favorite cricket captain in IPL-The skills and values they demonstrate-Self-work with immersion – interview a maid, watchman and Sweeper and narrate what you think are the values that drive them-Report on interview-Self-work with immersion – interview a cab driver, beggar and narrate what you think are the values that drive them-Report on interview-Overview of business communication-Types and techniques-Activity: Write a newspaper report on an IPL match-Compare the report with friends Activity: Record a conversation between a celebrity and an interviewer -Stress Management-To overcome stress-Essential Grammar – I: Parts of Speech-Tenses: Applications of tenses in Functional Grammar-Sentence formation (general & Technical), Common errors, Voices.

UNIT-II	**COMMUNICATION SKILLS**	**9**

Communication Skills: Overview of Communication Skills Barriers of communication, Effective communication-Business communication-Types of communication- verbal and non – verbal – Role- play based learning-Importance of Questioning-Listening Skills: Law of nature- Importance of listening skills, Difference between listening and Hearing, Types of listening-Listening activity-Expressing self On stage activity-Connecting with emotions-Best moments Visualizing-Visual Activity-Experiencing Purpose Discussion-Activity: Skit based on communication skills-Activity: Skit 2 based on communication skills-Evaluation on Listening skills – listen to recording and answer questions based onthem-Evaluate audio clip-Email writing: Formal and informal emails, activity Paper and web based

UNIT-III	**VERBAL COMMUNICATION**	**9**

Verbal communication: clarity of speech-Pronunciation-Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related tothe field of technology, phrases, idioms, significant abbreviations formal business vocabulary- Group discussion using words learnt-Practice: Toastmaster style Table Topics speech with evaluation- Activity Written Communication: Summary writing, story writing: Various scenario-Build your CV – writing comprehensive CV-Activity Life skill: Stress management-Causes of stress-Life skill: workingwith rhythm-activity.

UNIT-IV	GROUP DISCUSSION	9

Group Discussion-Understanding Life Skills: Movie based learning – Pursuit of Happiness. What are the skills and values identified, what it can be related to?-Post discussion-Introduction to life skills What are the critical life skills-Current trend-Multiple Intelligences Embracing diversity – Activity on appreciation of diversity-Post activity discussion- Presentation-techniques involved in presentation, types etc., Life skill: Community service–work with an NGO and make a Presentation.

UNIT-V	LIFE SKILLS	9

Life skill: Join a trek – Values to be learned: Leadership qualities-Types and styles-Team Work -Dealing with ambiguity-Values to be learned: Managing stress-Need for Yoga -Motivating people-Intrinsic and extrinsic-Creativity-understanding Result Orientation Assessment-Creativity –importance of being creative-Painting-Activity: Adzap.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe the need for life skills and values
CO2	Explain their own strengths and opportunities
CO3	Apply the basic tenets of communication
CO4	Analyze the basic communication practices in different types of communication
CO5	Apply the life skills to different situations

TEXT BOOKS
1. APAART: Speak Well 1 (English language and communication)   2. APAART: Speak Well 2 (Soft Skills).

REFERENCES

- ✓ 1.Alan McCarthy and O'Dell – English Vocabulary in Use – Third Edition – Cambridge University Press 2017
- ✓ 2.Dr. Saroj Hiremath – Business Communication – Nirali Prakashan

- ✓ Web References:
  Train your mind to perform under pressure- Simon sinek https://curiosity.com/ videos/simon-sinek-on-training-your-mind-to-perform-under-pressure-captureyour-flag/
- ✓ Brilliant way one CEO rallied his team in the middle of layoffs https://www.inc.com/ video/simon-sinek-explains-why-you-should-put-peoplebefore-numbers.html
- ✓ Will Smith's Top Ten rules for success https://www.youtube.com/ watch? v=bBsT9omTeh0

											CO-PO Mapping	
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	-	-	3	3	3	-	2
CO2	3	3	2	2	-	-	-	3	3	3	-	2
CO3	3	3	2	2	-	-	-	3	3	3	-	2
CO4	3	3	2	2	-	-	-	3	3	3	-	2
CO5	3	3	2	2	-	-	-	3	3	3	-	2
CO	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**2**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSE TITLE	\multicolumn{3}{c}{**191RA111 /BASIC ENGINEERING SCIENCE**}		3	0	0	3

COURSEOBJECTIVES
✓ To gain knowledge in fundamental concepts of Electrical and Electronics Engineering ✓ To gain knowledge in fundamental concepts Civil and Mechanical Engineering ✓ To understand the architecture level concepts of Computer Science Engineering

\multicolumn{3}{c}{SYLLABUS}
UNIT-I	**INTRODUCTION TO ELECTRICAL CONCEPTS**	**9**
\multicolumn{3}{l}{Basic principles involved in Power Generation, Transmission and Distribution - Wiring Systems - Classification of light sources- Tari- Electrical Safety Practices- Applications-Emerging Trends.}
UNIT-II	**INTRODUCTION TO ELECTRONIC CONCEPTS**	**9**
\multicolumn{3}{l}{Basic Electronic Devices-Number Systems-Electronic Instruments-Introduction to Analog and Digital Electronics-Applications-Emerging Trends.}
UNIT-III	**OVERVIEW OF COMPUTER ARCHITECTURE**	**9**
\multicolumn{3}{l}{Introduction- Structure and Function - Data Processing - Data Storage - Data Movement -Structural Components: Memory and Processing Units. Bus Interconnections - Multiple Bus Hierarchies - Elements of Bus Design – Desktop and Server Systems}
UNIT-IV	**SCOPE OF CIVIL ENGINEERING**	**9**
\multicolumn{3}{l}{Overview of Civil Engineering -Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering -Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering.}
UNIT-V	**INTRODUCTION TO MECHANICAL ENGINEERING**	**9**
\multicolumn{3}{l}{Manufacturing Methods-Design Considerations-Limits, Fits and Standardization-Zeroth law of Thermodynamics-Concept of Temperature and Heat-Classification of IC Engines-Types of Power Plants.}

COURSEOUTCOMES

On completion of the course, students will b enable to

CO1	Describe the basic Electrical Circuits
CO2	Explain the basics of Electronic Circuits
CO3	Demonstrate the basic structure of Computer Architecture
CO4	Analyze the basics of Civil Engineering
CO5	Define the basics of Mechanical Engineering

TEXTBOOKS

1. Thereja.B.L.,\Fundamentals of Electrical Engineering and Electronics", S. Chand& Co.Ltd.,2008
2. William Stallings, "Computer Organization and Architecture", Pearson, Tenth Edition, 2016.
3. Shanmugam.G and Palanichamy MS, \Basic Civil and Mechanical engineering", Tata Mc Graw Hill Publishing Co., NewDelhi, 1996.

REFERENCES

- ✓ Leonard's Bo brow,\Foundations of Electrical Engineering", OxfordUniversityPress,2013
- ✓ Ramamrutham S., \Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd.1999.
- ✓ N.N. Bhargava, D.C .Kulshreshtha ,S.C .Gupta, "Basic Electronics and Linear Circuits",NITTTR,Chandigarh2017

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	1	-	-	-	1	1
CO2	3	2	1	1	-	1	1	-	-	1	1	1
CO3	3	3	2	2	1	1	1	-	-	1	1	1
CO4	2	1	1	1	-	-	1	-	-	-	1	1
CO5	2	1	1	1	-	-	1	-	-	-	1	1
CO	3	2	1	1	1	1	1	-	-	1	1	1

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSE TITLE		**191CS111/ INTRODUCTION TO PROGRAMMING IN C**		3	0	0	3

COURSEOBJECTIVES
✓ Learn the organization of a digital computer. ✓ Be exposed to the number systems. ✓ Learn to think logically and write pseudo code or draw flow charts for problems. ✓ Be exposed to the syntax of C. ✓ Be familiar with programming in C. ✓ Learn to use arrays, strings, functions, pointers, structures and unions in C

SYLLABUS	
UNIT-I — **INTRODUCTION**	**9**
Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flowchart.	
UNIT-II — **C PROGRAMMING BASICS**	**9**
Problem formulation – Problem Solving - Introduction to ' C' programming –fundamentals – structure of a 'C'program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.	
UNIT-III — **ARRAYS AND STRINGS**	**9**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String - String operations – StringArrays.Simple programs-sorting- searching–matrix operations	
UNIT-IV — **FUNCTIONS AND POINTERS**	**9**
Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers-Definition–Initialization–Pointers arithmetic – Pointers and arrays-Example Problems	
UNIT-V — **STRUCTURES AND UNIONS**	**9**
Introduction–need for structure data type– structure definition– Structure declaration–Structure within a structure-Union-Programs using structures and Unions–Storage classes, Pre-processor directives.	

COURSEOUTCOMES	
Oncompletionofthecourse,students will be able to	
CO1	Describe the basic concepts of C programming for problem-solving.
CO2	Write simple applications using basic programming constructs.
CO3	Develop applications using arrays and strings to solve different problems.
CO4	Apply the concepts of function modules and memory allocation using Pointers.
CO5	Implement the concept of structures for developing applications.

TEXTBOOKS
1. Anita Goel and Ajay Mittal, "Computer Fundamental sand Programming in C", Dorling Kindersley (India) Pvt.Ltd. Pearson Education in SouthAsia, 2011.   2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, OxfordUniversityPress, 2009.   3. Yashavant P.Kanetkar."Let Us C", BPB Publications, 2011.

REFERENCES
✓ Byron's Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.   ✓ Dormer R.G., "How to Solve it by Computer", P earson Education, FourthReprint, 2007.   ✓ Kernighan .Wand Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	1	-	-	-	-	-	-	-	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1
CO5	2	2	1	-	-	-	-	1	-	-	-	1
CO	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSE TITLE		**191PH10A/ PHYSICS LABORATORY**		0	0	2	1

COURSE OBJECTIVES
✓ Students will be able to demonstrate an understanding of the scientific method, so that they may use the training beneficial in their higher pursuits.

LIST OF EXPERIMENT	
1	Determination of Rigidity modulus – Torsion pendulum.
2	Determination of Young's modulus by non-uniform bending method.
3	Determination of Planck's Constant and work function of materials using photo electric effect experiment.
4	Determination of wavelength, and particle size using Laser.
5	Determination of acceptance angle in an optical fiber.

DEMONSTRATION	
1	Determination of wavelength of mercury spectrum – spectrometer grating.
2	Demonstration of Crystal Growth Technique.
3	Determination of fiber thickness – Air Wedge method.

COURSEOUTCOMES	
On completion of the course, students willbeableto	
CO1	Apply the principles of properties of matter in determining the various elastic properties
CO2	Attains the practical knowledge, to apply principles of optics for various engineering applications
CO3	Demonstrate the technical knowledge on Quantum Mechanical concepts

REFERENCES
WilsonJ.D.andHernandezC.A.,-"PhysicsLaboratoryExperiments",HoughtonMifflinCompany,NewYork2005.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	2	2	2	2	-	-	2
CO2	3	3	2	2	-	2	2	2	2	-	-	2
CO3	3	3	2	2	-	2	2	2	2	-	-	2
CO	3	3	2	2	-	2	2	2	2	-	-	2

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSETITLE	\multicolumn{3}{c}{**191CH10A/CHEMISTRY LABORATORY**}		0	0	2	1

COURSE OBJECTIVES
✓ To furnish the conceptual understanding of the basic principles involved in chemical analysis.   ✓ To attain the analytical knowledge of students by conducting various experiments.

**LIST OF EXPERIMENTS**
1	Determination of total, permanent, temporary, calcium and magnesium hardness of water by EDTA method.
2	Conductometric titration - determination of strength of an acid.
3	Estimation of iron by potentiometry.
4	Determination of molecular weight of polymer by viscosity average method.
5	Determination of dissolved oxygen in a water sample by Winkler's method.
6	Determination of Na / K in water sample by Flame photometry (Demonstration).
7	Estimation of Copper in ore.
8	Estimation of nickel in steel.
9	Determination of total alkalinity and acidity of a water sample.
10	Determination of rate of corrosion by weight loss method.

**COURSEOUTCOMES**
On completion of the course, students will be able to
CO1	Acquire knowledge on quantitative chemical analysis by instrumentation and volumetric method.
CO2	Analyse the water sample for hardness, chloride, sodium /potassium content, dissolved oxygen etc.
CO3	Solve analytical problems in spectrometer and flame photometer for the identification and quantification.

REFERENCES
Vogel's Textbook of quantitative chemical Analysis (8th edition, 2014).

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	2	2	2	2	-	-	2
CO2	3	3	2	2	-	2	2	2	2	-	-	2
CO3	3	3	2	2	-	2	2	2	2	-	-	2
CO	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**-**	**-**	**2**

YEAR	I	SEMESTER	I	L	T	P	C
COURSE CODE /COURSETITLE	\multicolumn{3}{|c|}{191CS11A/ PROGRAMMING IN C LABORATORY}		0	0	2	1

COURSE OBJECTIVES

✓ To develop programs in C using basic constructs.
✓ To develop applications in C using strings, pointers, functions, structures.
✓ To develop applications in C using file processing.

SYLLABUS

LIST OFEXPERIMENTS

1. Programs using I/O statements and expressions.

2. Programs using decision-making constructs.

3. Write a program to find whether the given year is leap year or Not?

4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.

5. Check whether a given number is Arm strong number or not?

6. Populate an array with height of persons and find how many persons are above the average height.

7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.

8. Given a string―a$bcd. /fg‖ find its reverse without changing the position of special characters.

9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.

10. From a given paragraph perform the following using built-in functions:

    a. Find the total number of words.
    b. Capitalize the first word of each sentence.
    c. Replace a given word with another word.

11. Solve towers of Hanoi using recursion.

12. Sort the list of numbers using pass by reference.

13. Generate salary slip of employees using structures and pointers.

14. Compute internal marks of students for five different subjects using structures and functions

Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

15. Programs using I/O statements and expressions.

16. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

Miniprojects:

17. Create—Railway reservation system with the following modules
    Booking
    Availability checking
    Cancellation
    Prepare chart

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Write C programs for simple applications making use of basic constructs, arrays and strings.
CO2	Develop C programs involving functions, recursion, pointers, and structures
CO3	Design applications using sequential and random access file processing

Requirements for a batch of 30students (3students per batch)

S.No	Description of Equipment	Quantity required	Quantity available(A)	Deficiency(R-A)
1	Desktop PCs with Linux Operating System	30	30	Nil
2	GNU compiler	30	30	Nil

CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	1	-	-	-	2
CO2	3	2	2	2	2	-	-	1	-	-	-	2
CO3	3	2	2	2	2	-	-	1	-	-	-	2
CO	3	2	2	2	2	-	-	1	-	-	-	2

SEMESTER II

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSETITLE	\multicolumn{3}{c	}{**191MA203/ DISCRETE MATHEMATICS**}		2	2	0	3

COURSE OBJECTIVES
✓ To extend student's logical and mathematical maturity and ability to deal with abstraction.
✓ To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
✓ To understand the basic concepts of combinatory and graph theory.
✓ To familiarize the applications of algebraic structures.
✓ To understand the concepts and significance of lattices and Boolean algebra

\multicolumn{3}{c}{SYLLABUS}
UNIT-I	**LOGIC AND PROOFS**	**12**
\multicolumn{3}{l}{Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference}
UNIT-II	**COMBINATORICS**	**12**
\multicolumn{3}{l}{Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications}
UNIT-III	**GRAPHS**	**12**
\multicolumn{3}{l}{Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.}
UNIT-IV	**ALGEBRAIC STRUCTURES**	**12**
\multicolumn{3}{l}{Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem}
UNIT-V	**LATTICES AND BOOLEAN ALGEBRA**	**12**
\multicolumn{3}{l}{Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.}

COURSEOUTCOMES
On completion of the course ,students will be able to

CO1	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers and apply it in their fields.
CO2	Apply counting principles and estimate probabilities and also to analyze algorithms and programs by recurrence relation.
CO3	Analyze the different types of graphs and hence know about the application of graph theory in their field.
CO4	Analyze the algebraic structures and their application
CO5	Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra.

TEXTBOOKS

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES

- ✓ . Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
- ✓ Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
- ✓ Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.

CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	-	-	-	-	-	-	-	2
CO2	3	3	1	2	-	-	-	-	-	-	-	2
CO3	3	3	1	2	-	-	-	-	-	-	-	2
CO4	3	3	1	2	-	-	-	-	-	-	-	2
CO5	3	3	1	2	-	-	-	-	-	-	-	2
CO	3	3	1	2	-	-	-	-	-	-	-	2

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSETITLE	191HS202/BUSINESS COMMUNICATION & VALUE SCIENCE –II			3	0	0	3

COURSE OBJECTIVES

- ✓ Develop effective writing, reading, presentation and group discussion skills
- ✓ Help students identify personality traits and evolve as a better team player.
- ✓ Introduce them to key concepts of a) Morality b) Behavior and beliefs c) Diversity & Inclusion

SYLLABUS

UNIT-I	MAGAZINE	9

Icebreaker-Individual identification of social issues-Group discussion and Power Point Presentation on the social cause –Writing an Article-Good and Bad Writing. Common errors, punctuation rules, use of words. Plan and design an E Magazine. Writing an article to the magazine, Lucid Writing, Activity: Contributing an article to the magazine.

UNIT-II	PRESENTATION SKILL	9

Creation of Vision, Mission, Value statement, tagline and Design a logo for NGO. Introduction to basic presentation skills & ORAI app Theory and video Groups-individual write up for E- magazine Sharing of learning, written Practical and formative evaluation-Group activity to share findings from the recording. Speed Reading session: Introduction to skimming and scanning. SATORI – Join the dots- Brain Storming session- Discuss and explore the means Of articulating and amplifying the social issue of NGO-Design a skit- script writing-articulating the message of their respective NGOs. Activity: preparing a script for a play

UNIT-III	TEAM PLAYER	9

Play writing: Techniques, review writing-Views, observations and experiences of working in a team- 5personality traits- 8team player -identify individual personality traits with 8 team player styles Practical based learning followed by a presentation- working in teams- Ten minutes General Talk about Changes that affects the society. Activity: taking part in a ten minutes talk.

UNIT-IV	INTERVIEWS TECHNIQUES	9

Speech-Direct and Indirect-Narrative Techniques, Narration of a story in first person-Practical Research on a book, incident or film based on the topic of a NGO. Write a review in a blog on the topics they are covering in their research. Types of interviews: Preparation of interviews of people from diverse groups .Debate: Practical Debate on the topic of diversity with an angle of ethics, morality and Respect for individual. Activity: debate

UNIT-V	NGO	9

Project- 1) Each team to look for an NGO/ social group in the city which is working on the issue their college group is supporting.2) Spend a day with the NGO/ social group to understand exactly how they work and the challenges they face.3) Render voluntary service to the group for one day4) Invite the NGO/ social group to address with students for couple of hours. Plan the suitable venue in the college, gather audience, invite faculty members etc.(they need to get their plan ratified their professor). Outcome--Host an interactive session with the NGO spokesperson 5) The groups to present their experience of a day with the NGO and inspire students to work for the cause, Field work: Formative Evaluation

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Apply the tools of structured written communication
CO2	Design the basics of presentation.
CO3	Apply the basic concept of speed reading, skimming and scanning
CO4	Identify individual personality types and role in a team
CO5	Recognize the concepts of outward behavior and internal behavior

TEXTBOOKS

1. Dr. A.P.J Abdul Kalam , Arun Tiwari,"Guiding Souls : Dialogues on the purpose of life",2005.
2. Dr. A.P.J Abdul Kalam , Acharya Mahapragya ,"The Family and the Nation", 2015.
3. Dr. A.P.J Abdul Kalam, Y.S.Rajan," The Scientific India: A twenty First Century Guide to the World around Us",2011.
4. Dr. A.P.J Abdul Kalam ,"Forge Your Future: Candid, Forthright, Inspiring" ,2014
5. Peter H. Diamandis and Steven Kotler ,"Abundance: The Future is Better Than You Think", 2012.
6. Simon Sinek ,"Start With Why: How Great Leaders Inspire Everyone to Take Action", Penguin,2011.
7. Sandra Moriarty, Nancy D. Mitchell, William D. Wells," Advertising & IMC: Principles and Practice",Pearson Education India,2016

REFERENCES

✓ ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
✓ A Framework for Making Ethical Decisions https://www.brown.edu/academics/science-and-technology-studies/framework-makingethical-decisions
✓ Five Basic Approaches to Ethical Decisionhttp://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

CO-PO Mapping

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

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSETITLE	191HS201/ENVIRONMENTAL SCIENCE AND ENGINEERING			3	0	0	3

COURSE OBJECTIVES
✓ This course provides the basic knowledge of structure and function of ecosystem and better understanding of natural resources, biodiversity and their conservation practices.   ✓ It describes the need to lead more sustainable lifestyles, to use resources more equitably.   ✓ It helps to create a concern for our environment that will trigger pro-environmental action, including activities we can do in our daily life to protect it.   ✓ Furthermore, it deals the social issues and ethics to develop quality engineer in our country..

SYLLABUS		
UNIT-I	ENVIRONMENT-ANOVERVIEW	9
	Ecosystem-concept-structure-function-types. Energy flow in ecosystem. Biodiversity and its conservation- values of biodiversity-threats to biodiversity conservation of biodiversity. Natural resources-types ,uses.	
UNIT-II	ENVIRONMENTAL IMPACT OF ENERGY SOURCES	9
	Sources of primary energy-present and future consumption of energy-environmental impacts of energy development-oil, natural gas, coal, hydroelectric, nuclear power, windmill and solar panels-Urban problems related to energy-case studies.	
UNIT-III	CLIMATIC CHANGE AND SOLID WASTE MANAGEMENT	9
	Environmental pollution- air, water, soil, marine and noise pollution-green house gases- causes, effects- global warming, ozone layer depletion, acid rain-sources and effects. Pollution control strategies- preventive measures-green technologies-green building concepts- standards and regulations- role of individuals. Sustainable development .Hazardous wastes-e-waste-source-effect, management. Nuclear waste-sources ,effects ,management. Recycling of waste. Future challenges.	
UNIT-IV	HUMAN POPULATION AND THE ENVIRONMENT	9
	Population growth, variation among nations – population explosion – family welfare programmer – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and humanhealth–Casestudies.	
UNIT-V	ENVIRONMENTAL LAWS AND ETHICS	9
	Legal provision in India-environmental acts-air, water, forest, soil and wildlife. Environmental ethics-theories and codes-resource consumption patterns, equity-disparity, urban-rural equity issues, need for gender equity , preserving resource for future generation, right of animals, ethical basis of environment education and awareness, ethical problem solving- changing attitude, conservation ethics and traditional value systems of India. Effect of social media on the adolescent.	

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Interpret the concept of ecosystem, biodiversity and its conservation.
CO2	Demonstrate the environmental impacts of energy development.
CO3	Categorize the various environmental pollutions and select suitable preventive measures.
CO4	Perceive the environmental effects of human population and the implementation of welfare programs.
CO5	Recall the environmental ethics and legal provisions.

TEXTBOOKS
1. Erach Bharucha,"Text book for Environmental sciences for Undergraduate courses", UGC, 2004   2. Kaushik,A &Kaushik, CP, Environmental Science and engineering ",3rdEdition ,New Age International(P) Limited, NewDelhi, 2009.   3. Henry,JG &Heinke, GW ,"Environmental Science and Engineering", 2ndEdition, PHILearning Private limited,NewDelhi,2011.

REFERENCES
✓ Masters, GM & Ela,WP, "Introduction to Environmental Engineering and Science " , 3rdEdition ,PHILearning Private limited, NewDelhi, 2009.   ✓ Encyclopaedia of environmental ethics and philosophy. Available at www.gmu.ac.ir/download/booklibrary/e-library/Encyclopaedia of Environmental Ethics and philosophy.pdf

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	2	3	3	-	-	-	2
CO2	3	3	2	2	-	2	3	-	-	-	-	2
CO3	3	3	2	2	-	2	3	-	-	-	-	2
CO4	3	3	2	2	-	2	3	-	-	-	-	2
CO5	3	3	2	2	-	2	3	3	-	-	-	2
CO	**3**	**3**	**2**	**2**	**-**	**2**	**3**	**3**	**-**	**-**	**-**	**2**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSE TITLE	\multicolumn{3}{c	}{**191ME211/ENGINEERING GRAPHICS**}		2	2	0	3

COURSEOBJECTIVES

- ✓ To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
- ✓ To expose them to existing national standards related to technical drawings.

**SYLLABUS**	
UNIT-I	**CURVES AND PICTORIAL VIEWS TOORTHOGRAPHIC VIEWS**	**8+4**

Geometrical Constructions like bisection of a straight line, division of a straight line into n equal parts, bisection of angles, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Free hand sketching of multiple orthographic views from single pictorial view of objects.

UNIT-II	**PROJECTION OF POINTS, LINES AND PLANES URFACES**	**8+2**

Orthographic projections - Introduction - Principles -Principal planes-First angle projection. Projection of points located in all quadrants. Projection of straight lines inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method, traces. Projection of planes (regular polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT-III	**PROJECTION OF SOLIDS**	**8+2**

Projection of regular solids by rotating object method when the axis is inclined to one of the principal planes.

UNIT-IV	**SECTION OF SOLIDS & DEVELOPMENT OF LATERAL SURFACES OF SOLIDS**	**8+4**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of the section. Development of lateral surfaces of regular and sectioned solids.

UNIT-V	**ISOMETRIC AND PERSPECTIVE PROJECTIONS**	**8+4**

Principles of isometric projection – Isometric scale – Isometric View– Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones– combination of two solid objects in simple vertical positions. Perspective projection of simple solids–Prisms, pyramids and cylinders by visual ray method.

COURSEOUTCOMES	
On completion of the course, students will be able to	
CO1	Draw engineering curves and apply the concepts of free hand sketching
CO2	Draw orthographic views of points, lines and surfaces
CO3	Draw visualizations of simple solid objects as per orthographic projections
CO4	Draw sections and developments made in drawing
CO5	Draw pictorial drawings of simple objects

TEXTBOOKS

1. N.D.Bhatt, Engineering Drawing, 49thedition, Charotar Publishing House, 2006.

REFERENCES

✓ NatarajanK.V.,"A text book of Engineering Graphics",Dhanalakshmi Publishers, Chennai,2009

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	-	2	1	-	-	-	1	1	1
CO2	3	3	3	-	2	1	-	-	-	1	1	1
CO3	3	3	3	-	2	1	-	-	-	1	1	1
CO4	3	3	3	-	2	1	-	-	-	1	1	1
CO5	3	3	3	-	2	1	-	-	-	1	1	1
CO	**3**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**1**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSE TITLE	**191CS221 / PROBLEM SOLVING AND PYTHON PROGRAMMING**			**3**	**0**	**0**	**3**

COURSEOBJECTIVES
✓ To know the basics of algorithmic problem solving.   ✓ To read and write simple Python programs.   ✓ To develop Python program swith conditionals and loops.   ✓ To define Python functions and call them.   ✓ To use Python data structures–lists, tuples, dictionaries.   ✓ To do input/output with files in Python.

SYLLABUS		
UNIT-I	**ALGORITHMIC PROBLEM SOLVING**	**9**
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion) Illustrative problems: find minimum in a list, insert acardinalist of sorted cards, Guessan integer number in a range, Towers of Hanoi.		
UNIT-II	**DATA, EXPRESSIONS, STATEMENTS**	**9**
Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuples assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution , parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.		
UNIT-III	**CONTROL FLOW, FUNCTIONS**	**9**
Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
UNIT-IV	**LISTS, TUPLES, DICTIONARIES**	**9**
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuples assignment, tuples as return value; Dictionaries: operations and methods; advanced list processing -list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.		
UNIT-V	**FILES,MODULES,PACKAGES**	**9**
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.		

	COURSEOUTCOMES
	On completion of the course, students will be able to
CO1	Describe the algorithmic solutions for simple computational problems.
CO2	Identity the various data ,expression,statatements in python programming
CO3	Use control flow and function for solving problems.
CO4	Distinguish list, tuples and dictionary in python programming.
CO5	Develop simple programs using files, modules and packages in python.

TEXTBOOKS
1. AllenB.Downey,``ThinkPython:HowtoThinkLikeaComputerScientist''',2ndedition,UpdatedforPython 3,Shroff/O'Reilly Publishers,2016 (http://greenteapress.com/wp/thinkpython/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python3.2,NetworkTheoryLtd.,2011.

REFERENCES
✓ John V Guttag,"Introduction to Computation and Programming Using Python'',Revised and expanded Edition,MITPress,2013
✓ Robert Sedgewick, Kevin Wayne, Robert Dondero,"Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education ServicesPvt.Ltd.,2016.
✓ TimothyA. Budd,"Exploring Python",Mc-GrawHillEducation(India)PrivateLtd.,,2015.
✓ KennethA.Lambert,"Fundamentals of Python:FirstPrograms",CENGAGELearning,2012.
✓ Charles Dierbach,"Introduction to Computer Science using Python: A Computational Problem-Solving Focus,Wiley India Edition,2013.
✓ Paul Gries,Jennifer Campbell and Jason Montojo, Practical Programming: An Introduction to Computer Science using Python3",Second edition,Pragmatic Programmers,LLC,2013.

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	1	-	-	-	1	-	-	-	1
CO	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSE TITLE		191CB221 / FUNDAMENTALS OF DESIGN THINKING		3	0	0	3

COURSEOBJECTIVES
✓ Learn the introduction to the basic concepts and techniques of engineering and reverse engineering   ✓ Know the process of design   ✓ Develop analytical thinking and ideas, basics and development of engineering drawing   ✓ Be familiar with application of engineering drawing with computer aide

SYLLABUS		
UNIT-I	**PROCESS OF DESIGN**	9
	Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step - Five Step - Twelve Step - Creativity and Innovation in Design Process - Design limitation	
UNIT-II	**GENERATING AND DEVELOPING IDEAS**	9
	Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Analogies – Brainstorming - Mind mapping - National Group Technique – Synectics - Development of work - Analytical Thinking - Group Activities Recommended.	
UNIT-III	**REVERSE ENGINEERING**	9
	Introduction - Reverse Engineering Leads to New Understanding about Products - Reasons for Reverse Engineering - Reverse Engineering Process - Step by Step - Case Study.	
UNIT-IV	**BASICS OF DRAWING TO DEVELOP DESIGN IDEAS**	9
	Introduction - Many Uses of Drawing - Communication through Drawing - Drawing Basis – Line - Shape/ Form – Value – Colour – Texture - Practice using Auto CAD recommended	
UNIT-V	**DATA SCIENCE INBUSINESS APPLICATIONS**	9
	Introduction - Perspective Drawing - One Point Perspective - Two Point Perspective - Isometric Drawing - Orthographic Drawing - Sectional Views - Practice using Auto CAD recommended	

	COURSEOUTCOMES
	On completion of the course, students will be able to
CO1	Apply various design process procedure.
CO2	Design new ideas through different technique.
CO3	Identify the significance of Reverse Engineering to design products.
CO4	Plot technical drawing for design ideas.
CO5	Develop technical drawing for innovative design.

TEXTBOOKS
1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013

REFERENCES
✓ Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	1	-	1	1	1	-	1
CO2	3	3	2	2	2	1	-	1	1	1	-	1
CO3	3	3	2	2	2	-	-	1	1	1	1	1
CO4	3	2	2	2	2	1	-	1	1	-	-	1
CO5	3	2	2	2	2	1	-	1	1	-	-	-
CO	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**1**	**1**	**1**	**1**	**1**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSETITLE		**191ME21A/ENGINEERING PRACTICE LABORATORY**		0	0	4	2
COURSEOBJECTIVES							

- ✓ To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL&MECHANICAL)

I CIVIL ENGINEERING PRACTICE	13

Buildings:
(a)Study of plumbing and carpentry components of residential and industrial buildings, Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in House holds fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise: Basic pipe connections–Mixed pipe material connection– Pipe connections with Different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

II MECHANICAL ENGINEERING PRACTICE	18

Welding:
(a) Preparation of butt joints, lap joints and T-joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a)Forming Bending: (b) Model making– Traysandfunnels.(c) Differenttypeofjoints. Machine

Assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example–Exercise–
Production of hexagonal headed bolt.
(b) Foundry operation slike mould preparation forger and step cone pulley.
Fitting–Exercises–Preparation of square fitting and V–fitting models

GROUP B (ELECTRICAL&ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE	**13**

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Staircase wiring
4. Measurement of electrical quantities–voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance o earth of an electrical equipment.

IV ELECTRONICS ENGINEERING PRACTICE	**16**

1. Study of Electronic components and equipments–Resistor, color coding measurement f AC signal parameter (peak-peak, rmsperiod, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice–Components Devices and Circuits–Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL	60Periods

LIST OF EQUIPMENTS
Requirements for a batch of 30 students

S.NO	Description of the Equipment	Quantity Required
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15sets
2	Carpentry vice(fittedtoworkbench)	15Nos.
3	Standard wood working tools	15sets
4	Model so findustrial trusses, door joints, furniture joints	5 Each
5	Power Tools: a) Rotary Hammer b) Demolition Hammer c) Circular Saw d) Planer e) Hand Drilling Machine	2Nos 2Nos 2Nos. 2Nos. 2Nos. 2Nos.
	f) Jigsaw	
	MECHANICAL	
1	Arc welding transformer with cables and holders	5Nos
2	Welding booth with exhaust facility	5Nos
3	Welding accessories like welding shield, chipping hammer, Wire brush,etc.	5Nos
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2Nos
5	Centre lathe	2Nos
6	Hearth furnace, anvil and smithy tools	2Nos
7	Moulding table, foundry tools	2Nos
8	Power Tool: Angle Grinder	2Nos
9	Study-purpose items: centrifugal pump, air-conditioner	One Each
	ELECTRICAL	
1	Assorted electrical components for house wiring	15Nos
2	Electrical measuring instruments	10Nos
3	Study purpose items: Iron box, fan and regulator, emergency Lamp	1 No
4	Megger (250V/500V)	1 No
5	Power Tools: (a) Range Finder	2Nos

	(b) Digital Live-wire detector	2Nos
	ELECTRONICS	
1	Soldering guns	10Nos
2	Assorted electronic components for making circuits	50Nos
3	Small PCBs	10Nos
4	Multimeters	10Nos
5	Study purpose items: Telephone ,FM radio, low-voltage power supply	

	COURSEOUTCOMES
	On completion of the course, students will be able to
CO1	Use mechanical and civil engineering equipments to join the structures and perform basic machining operations and fabricate models in sheet meta
CO2	Use electrical and electronics engineering equipments to test the respective electrical and electronic parameters

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	2	-	-	-	1	1	1
CO2	3	3	3	2	2	2	-	-	-	1	1	1
CO	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**1**

YEAR	I	SEMESTER	II	L	T	P	C
COURSE CODE /COURSE TITLE	191CS22A / PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY			0	0	2	1

COURSEOBJECTIVES

- ✓ Write, test, and debug simple Python programs.
- ✓ Implement Python programs with conditional sand loops.
- ✓ Use functions for structuring Python programs.
- ✓ Represent compound data using Python lists, tuples, and dictionaries.
- ✓ Read and write data from/ to files in Python...

SYLLABUS
LIST OFEXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (powerofanumber)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame.
14. Python versions, advancements and applications of python- Case Study.
15. Mini project

PLATFORMNEEDEDPython3 interpreter for Windows/Linux

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Solve problems using conditionals and loops in Python.
CO2	Develop Python programs by defining functions.
CO3	Use lists, Tuples and dictionaries for solving complex problems in python programming
CO4	Develop Python programs using files.

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1
CO3	3	2	1	1	-	-	-	-	-	-	-	1
CO4	3	2	1	1	-	-	-	-	-	-	-	1
CO	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

SEMESTER III

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191MA303 / PROBABILITY AND STATISTICS			2	2	0	3

COURSE OBJECTIVES
1. Introduced to the notion of sampling distributions and have acquired knowledge of statisticaltechniques useful in making rational decision in management problems. 2. Exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

SYLLABUS		
UNIT-I	PROBABILITY AND RANDOM VARIABLES	9
Probability -Axioms of probability – Conditional probability – Baye's theorem - Random variable - Probability mass function - Probability density function - Cumulative distribution function - Moments - Moment generating functions.		
UNIT-II	STANDARD DISTRIBUTIONS	9
Discrete distributions - Binomial, Poisson, Geometric distributions - Continuous distributions- Uniform - Exponential and Normal distributions.		
UNIT-III	TWO DIMENSIONAL RANDOM VARIABLES	9
Random variables - One and two dimensional random variables-Joint distributions - Marginal and conditional distributions – Covariance - Correlation and regression.		
UNIT-IV	TESTING OF HYPOTHESIS	9
Sampling distributions- Large sample test: Tests for mean- Small sample tests: Tests for mean (t test), F- test- Chi-square test for Goodness of fit and Independence of attributes.		
UNIT-V	DESIGN OF EXPERIMENTS	9
Analysis of Variance - One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate and apply the basic probability axioms and concepts in their core areas.
CO2	Analyze the concepts of probability distributions in an appropriate place of science and Engineering.
CO3	Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
CO4	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO5	Identify the classification of design of experiment in their respective fields.

TEXT BOOKS

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Peebles. P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.

REFERENCES

- ✓ Yates. R.D. and Goodman. D.J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
- ✓ Stark. H., and Woods. J.W., "Probability and Random Processes with Applications to Signal Processing", 3rd Edition,Pearson Education, Asia, 2002.
- ✓ Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
- ✓ Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

CO- PO MAPPING												
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1
CO	3	3	2	2	1	-	-	-	-	-	-	1

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE		191AI321 / DATA STRUCTURES		3	0	0	3

COURSE OBJECTIVES
✓ Define the basic concepts of ADTs used in python   ✓ Design the linear data structures – lists, stacks, and queues using python   ✓ Analyze the various sorting, searching and hashing algorithms   ✓ Tree and Graph structures

SYLLABUS		
UNIT-I	ABSTRACT DATA TYPES	9
Abstract Data Types (ADTs) – ADTs and classes – introduction to OOP – classes in Python – inheritance – namespaces – shallow and deep copying Introduction to analysis of algorithms – asymptotic notations – recursion – analyzing recursive algorithms		
UNIT-II	LINEAR STRUCTURES	9
List ADT – array-based implementations – linked list implementations – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Stack ADT – Queue ADT – double ended queues		
UNIT-III	SORTING AND SEARCHING	9
Bubble sort – selection sort – insertion sort – merge sort – quick sort – linear search – binary search – hashing – hash functions – collision handling – load factors, rehashing, and efficiency		
UNIT-IV	TREE STRUCTURES	9
Tree ADT – Binary Tree ADT – tree traversals – binary search trees – AVL trees –**B tree -B+ tree** - heaps – multi- waysearch trees-Application of trees		
UNIT-V	GRAPH STRUCTURES	9
Graph ADT – representations of graph – graph traversals – DAG – topological ordering – shortest paths – minimum spanning trees		

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Demonstrate the concepts of ADT and explain the list data structures and its applications
CO2	Analyze, design linear data structures-Stacks & queues using array and pointer implementations
CO3	Evaluate sorting, searching and hashing algorithms
CO4	Design and develop tree data structures and its traversal algorithms
CO5	Analyze, design and develop various nonlinear tree data structures

TEXT BOOKS

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", John Wiley & Sons Inc., 2013
2. Lee, Kent D., Hubbard, Steve, "Data Structures and Algorithms with Python" Springer Edition 2015

REFERENCES

- ✓ Rance D. Necaise, "Data Structures and Algorithms Using Python", John Wiley & Sons, 2011
- ✓ Aho, Hopcroft, and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
- ✓ Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
- ✓ Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2014

CO- PO MAPPING												
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	2	-	-	-	-	-	1
CO2	3	3	3	2	2	2	-	-	-	-	-	1
CO3	3	3	3	2	2	1	-	-	-	-	-	1
CO4	3	3	3	2	2	2	-	-	-	-	-	1
CO5	3	3	3	2	2	1	-	-	1	-	-	1
CO	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE							

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS322 / COMPUTER ARCHITECTURE**			3	0	0	3

COURSE OBJECTIVES

- ✓ To conceptualize the basic structure and operations of a computer.
- ✓ To study the basic working principles of arithmetic and logic unit and implement fixed-point and floating point arithmetic algorithms.
- ✓ To learn the basics of pipelined execution.
- ✓ To understand parallelism and multi-core processors.
- ✓ To describe the concepts of memory hierarchies, cache memories and virtual memories

SYLLABUS	

UNIT-I	BASIC STRUCTURE OF A COMPUTER SYSTEM	9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing

UNIT-II	ARITHMETIC FOR COMPUTERS	9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Sub word Parallelism.

UNIT-III	PROCESSOR AND CONTROL UNIT	9

A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelineddata path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT-IV	PARALLELISIM	9

Parallel processing challenges – Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT-V	MEMORY & I/O SYSTEMS	9

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB, Case Study- PARAM Siddhi **-** AI**.**

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define the basics concepts of fundamental component, architecture; register organization and performance metrics of a computer.
CO2	Illustrate the efficient algorithm for binary arithmetic operations.
CO3	Construct an efficient data path for an instruction format for a given architecture.
CO4	Categorize various parallel processors.
CO5	Analyze the memory, I/O devices and cache structures for processor.

TEXT BOOKS

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
3. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach‖, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	1	1	1	1	1	-	-
CO2	3	3	2	2	1	1	1	1	1	1	-	-
CO3	3	3	2	2	1	1	1	-	1	-	1	1
CO4	3	3	2	2	1	1	-	1	1	-	1	1
CO5	3	3	2	2	1	1	1	1	1	1	1	1
CO	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	191CS323/ OBJECT ORIENTED PROGRAMMING			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand Object Oriented Programming concepts and basic characteristics of Java.
- ✓ To know the principles of packages, inheritance and interfaces.
- ✓ To define exceptions and use I/O streams.
- ✓ To develop a java application with threads and generics classes.
- ✓ To design and build simple Graphical User Interfaces.

SYLLABUS

UNIT-I	INTRODUCTION TO OOP AND JAVA BASICS	9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment **-** Java Source File -Structure – Compilation.
Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifies - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages – Java Doccomments.

UNIT-II	INHERITANCE AND INTERFACES	9

Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class –abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, Array Lists – Strings.

UNIT-III	EXCEPTION HANDLING AND I/O	9

Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT-IV	MULTITHREADING AND GENERIC PROGRAMMING	9

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads,Inter-thread communication, Thread priorities, daemon threads, thread groups, .Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.

UNIT-V	EVENT DRIVEN PROGRAMMING	9

Applets: Basics, Applet class, Applet Architecture, Applet skeleton. Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Acquire knowledge in OOPS concept and define the structure of Java programs.
CO2	Identify the concept of inheritance, interfaces and illustrate the Java Programs.
CO3	Develop Java applications using Exceptions and I/O streams
CO4	Analyze and evaluate the concept of threads and generic classes to develop Java applications
CO5	Create interactive Java programs using AWT and Swings

TEXT BOOKS

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education.2010.
2. Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamental‖, 9th Edition, Prentice Hall, 2013.

REFERENCES

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers‖", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book‖",Dreamtech press, 2011.
3. Timothy Budd,"Understanding Object-oriented programming with Java‖", Updated Edition, Pearson Education, 2000.

CO-PO MAPPING

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

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE							

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS324 / SOFTWARE ENGINEERING**			3	0	0	3

OURSE OBJECTIVES

- ✓ To learn the phases in a software project
- ✓ To understand fundamental concepts of requirements engineering and Analysis Modeling.
- ✓ To study the various software design methodologies
- ✓ To explore various testing and maintenance measures

SYLLABUS

UNIT-I	SOFTWARE PROCESS AND AGILE DEVELOPMENT	9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility – Agile process – Extreme programming-XP Process

UNIT-II	REQUIREMENTS ANALYSIS AND SPECIFICATION	9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary

UNIT-III	SOFTWARE DESIGN	9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- Design Patterns-Types-User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components-.

UNIT-IV	TESTING AND MAINTENANCE	9

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software Implementation Techniques: Coding practices-Refactoring- Maintenance and Reengineering-BPR model- Reengineering process model-Reverse and Forward Engineering –Testing the documentation

UNIT-V	PROJECT MANAGEMENT	9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process-Critical Path (CRM) Method- RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan-CASE TOOLS

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember the key activities in managing a software project
CO2	Identify different process models and the approach adopted in gathering requirements
CO3	Apply systematic procedure for software design and deployment.
CO4	Analyze , Compare and contrast the various testing and maintenance.
CO5	Evaluate the Management project schedule, estimate project cost and effort required

TEXT BOOKS

1. Roger S. Pressman, —Software Engineering – A Practitioner's Approach‖, Seventh Edition, McGraw-Hill International Edition, 2010.
2. Ian Sommerville, —Software Engineering‖, 9th Edition, Pearson Education Asia, 2011.

REFERENCES

- ✓ Rajib Mall, —Fundamentals of Software Engineering‖, Third Edition, PHI Learning Private Limited, 2009.
- ✓ PankajJalote, —Software Engineering, A Precise Approach‖, Wiley India, 2010.
- ✓ Kelkar S.A., —Software Engineering‖, Prentice Hall of India Pvt Ltd, 2007.
- ✓ Stephen R.Schach, —Software Engineering‖, Tata McGraw-Hill Publishing Company Limited,2007.
  - o http://nptel.ac.in/.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	3	1	1	-	-	-	2
CO2	3	2	2	1	-	2	1	1	-	-	-	2
CO3	3	2	2	1	-	2	1	1	-	-	-	2
CO4	3	2	1	1	-	3	1	1	-	-	-	2
CO5	3	2	2	1	-	2	1	1	-	-	-	2
CO	**3**	**2**	**2**	**1**	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**2**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE							

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CB321 / BASIC ECONOMICS FOR ENGINEERS**			3	0	0	3

COURSE OBJECTIVES

- ✓ Introduce various basic concepts and terminology of the subject of economics.
- ✓ Study the nuances of optimizing conditions of consumer and producer behavior.
- ✓ Understand various features concepts used in macroeconomic decision-making.
- ✓ Perform basic knowledge of monetary and fiscal policy and external sector economics
- ✓ Explore role of government in economic decision making at micro economic and macroeconomiclevel.

SYLLABUS		
UNIT-I	**DEMAND AND SUPPLY**	**9**

Principles of Demand and Supply — Supply Curves of Firms — Elasticity of Supply; Demand Curves of Households—Elasticity of Demand; Equilibrium and Comparative Statics(Shift of a Curve and Movement along the Curve)-Micro Economics

UNIT-II	**CONSUMER ANALYSIS**	**9**

Welfare Analysis — Consumers' and Producers' Surplus — Price Ceilings and Price Floors; Consumer Behavior — Axioms of Choice — Budget Constraints and Indifference Curves; Consumer's Equilibrium Effects of a Price Change, Income and Substitution Effects - Demand Curve Derivation.

UNIT-III	**COST AND ITS APPLICATION**	**9**

Applications — Tax and Subsidies — Inter-temporal Consumption — Suppliers' Income Effect; Theory of Production — Production Function and Iso-quants — Cost Minimization; Cost Curves — Total, Average and Marginal Costs — Long Run and Short Run Costs; Equilibrium of a Firm under Perfect Competition; Monopoly and Monopolistic Competition-Cost Analysis-Traditional costing approach

UNIT-IV	**COMSUMPTION AND INVESTMENT**	**9**

National Income and its Components — GNP, NNP, GDP, NDP; Consumption Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian Multiplier; Government Sector — Taxes and Subsidies

UNIT-V	**DEMAND AND ITS APPLICATIONS**	**9**

External Sector — Exports and Imports; Money — Definitions; Demand for Money —Transactionary and Speculative Demand; Supply of Money — Bank's Credit Creation Multiplier; Integrating Money and Commodity Markets—IS, LM Model; Business Cycles and Stabilization—Monetary and Fiscal Policy— Central Bank and the Government; The Classical Paradigm — Price and Wage Rigidities — Voluntary and Involuntary Unemployment-Case Study.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember basic knowledge of terminology and fundamental concepts of economics.
CO2	Identify and understanding of decision making behavior of consumers.
CO3	Apply the detailed insightful knowledge of producer optimization conditions and equilibrium.
CO4	Analyze the critical role played by various variables in determination of macroeconomic aggregates.
CO5	Evaluate substantial understanding of the role played by policy making in determining various outcomes in an economy.

TEXT BOOKS

1. Pindyck, Robert S., and Daniel L. Rubinfeld , Microeconomics,7/e,Pearson,2009.
2. Dornbusch, Fischer and Startz , Macroeconomics, 12/e, McGraw Hill Education,27 August 2018.
3. Paul Anthony Samuelson, William D. Nordhaus, Economics,20/e, McGraw-Hill, 28 October 2019.

REFERENCES

1. Intermediate Microeconomics: A Modern Approach, Hal R,Varian,2019.
2. Principles of Macroeconomics, N. GregoryMankiw,2012.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	3	1	1	-	-	-	2
CO2	3	2	2	1	-	2	1	1	-	-	-	2
CO3	3	2	2	1	-	2	1	1	-	-	-	2
CO4	3	2	1	1	-	3	1	1	-	-	-	2
CO5	3	2	2	1	-	2	1	1	-	-	-	2
CO	3	2	2	1	-	2	1	1	-	-	-	2

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191AI32A / DATA STRUCTURES LABORATORY**			0	0	2	1

COURSE OBJECTIVES
✓ Implement ADTs in Python   ✓ Design and implement linear data structures-lists, stacks, and queues.   ✓ Implement sorting, searching and hashing algorithms.   ✓ Solve problems using trees and graph structures.

LIST OF EXPERIMENTS	
1	Implement simple ASTs as Python classes.
2	Implement recursive algorithms in Python
3	Implement List ADT using Python arrays
4	Linked list implementations of List
5	Implementation of Stack and Queue ADTs
6	Applications of List, Stack and Queue ADTs
7	Implementation of sorting and searching algorithms
8	Implementation of Hash tables
9	Tree Representation and traversal algorithms
10	Implementation of Binary Search Trees
11	Implementation of Heaps
12	Graph representation and Traversal algorithms
13	Implementation of single source shortest path algorithm
14	Implementation of minimum spanning tree algorithm

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate the concepts of ADT and explain the list data structures and its applications
CO2	Analyze, design linear data structures-Stacks & queues using array and pointer implementations
CO3	Evaluate sorting, searching and hashing algorithms
CO4	Design and develop tree data structures and its traversal algorithms
CO5	Analyze, design and develop various nonlinear tree data structures

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	1	1	1	1	2	-	3
CO2	3	3	3	2	-	1	1	1	1	2	-	3
CO3	3	3	3	2	-	1	1	1	1	2	-	3
CO4	3	3	3	2	-	1	1	1	1	2	-	3
CO5	3	3	3	2	-	1	1	1	1	2	-	3
CO	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**1**	**2**	**-**	**3**

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS32B / OBJECT ORIENTED PROGRAMMING LABORATORY**			0	0	2	1

COURSE OBJECTIVES
➢ Develop applications using Object Oriented Programming Concepts   ➢ Develop and implement Java programs principles of packages, inheritance and interfaces   ➢ Develop and implement Java programs for simple applications that make use of classes, packages and interfaces.   ➢ Develop and implement Java programs with array list, exception handling and multithreading.   ➢ Design applications using file processing, generic programming and event handling.

LIST OF EXPERIMENTS	
1	Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff. If the type of the EB connection is domestic, calculate the amount to be paid as follows: • First 100 units - Rs. 1 per unit • 101-200 units - Rs. 2.50 per unit • 201 -500 units - Rs. 4 per unit • > 501 units - Rs. 6 per unit If the type of the EB connection is commercial, calculate the amount to be paid as follows: • First 100 units - Rs. 2 per unit • 101-200 units - Rs. 4.50 per unit • 201 -500 units - Rs. 6 per unit • > 501 units - Rs. 7 per unit
2	Develop a java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
3	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, and Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
4	Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.
5	Write a program to perform string operations using Array List. Write functions for the following a. Append - add at end b. Insert – add at particular index

	c. Search
	d. List all string starts with given letter
6	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
7	Write a Java program to implement user defined exception handling.
8	Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
9	Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
10	Write a java program to find the maximum value from the given type of elements using a generic function.
11	Design a calculator using event-driven programming paradigm of Java with the following options. a. Decimal manipulations b. Scientific manipulations
12	Applet program implementing Graphics Applications
13	Develop a mini project for any application using Java concepts.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
CO2	Analyze the concept of function overloading, operator overloading, virtual functions and polymorphism.
CO3	Implement Java programs for simple applications that make use of classes, packages and interfaces.
CO4	Develop and implement Java programs with array list, exception handling and multithreading.
CO5	Design applications using file processing, generic programming and event handling.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	1	1	1	1	2	3	3
CO2	3	3	3	2	3	1	1	1	1	2	3	3
CO3	3	3	3	2	3	1	1	1	1	2	3	3
CO4	3	3	3	2	3	1	1	1	1	2	3	3
CO5	3	3	3	2	3	1	1	1	1	2	3	3
CO	3	3	3	2	3	1	1	1	1	2	3	3

YEAR	II	SEMESTER	III	L	T	P	C
COURSE CODE/COURSE TITLE	191HS30A / ADVANCED READING AND WRITING SKILLS LABORATORY			0	0	2	1

COURSE OBJECTIVES

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

SYLLABUS	
UNIT-I	**12**

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title **Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

UNIT-II	

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in **writing**– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT-III	**12**

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques-**Writing**– Elements of good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT-IV	**12**

Reading– Genre and Organization of Ideas- **Writing**– Email writing- visumes – Job application- project writing-writing convincing proposals.

UNIT-V	**12**

Reading– Critical reading and thinking- understanding how the text positions the reader- identify **Writing**– Statement of Purpose- letter of recommendation- Vision statement

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate understanding of elements of writing such as brainstorming for generating topic sentence, central ideas, supporting ideas, organization patterns, editing and drafting different types of paragraphs and essays.
CO2	Understand the strategies of skimming and scanning to read a text analytically and critically respond to it.
CO3	Apply critical thinking skills and infer a text logically in relation to various professional concerns.

TEXT BOOKS
1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011.
2. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011.

REFERENCES
✓ Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
✓ E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012.
✓ Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004.
✓ Goatly, Andrew. Critical Reading and Writing. Routledge: United States of America, 2000.
✓ Petelin, Roslyn and Marsh Durham. The Professional Writing Guide: Knowing Well and Knowing Why. Business & Professional Publishing: Australia, 2004.

CO- PO MAPPING												
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	3	3	2	2
CO2	3	-	-	-	-	-	-	-	3	3	2	2
CO3	3	-	-	-	-	-	-	-	3	3	2	2
CO	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**2**

YEAR	II	2019-R SEMESTER	III	L	T	P	C
COURSE TITLE		தமிழரும் தொழில்நுட்பமும்		1	0	0	1

COURSE OBJECTIVES

SYLLABUS	

அலகு I	**நெசவு மற்றும் பானைத் தொழில்நுட்பம்:**	3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II	**வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:**	3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III	**உற்பத்தித் தொழில் நுட்பம்**	3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV	**வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:**	3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V	**அறிவியல் தமிழ் மற்றும் கணித்தமிழ்**	3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

SEMESTER IV

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191MA405 / LINEAR ALGEBRA AND NUMERICAL METHODS**			2	2	0	3

COURSE OBJECTIVES
- Introduce the basic notions of groups, rings, fields which will then be used to solve related problems.   - Understand the concepts of vector space, linear transformations.   - Apply the concept of inner product spaces in orthogonalization.   - Analyze the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

SYLLABUS		
UNIT-I	**VECTOR SPACES**	**9**
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.		
UNIT-II	**LINEAR TRANSFORMATION**	**9**
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations		
UNIT-III	**INNER PRODUCT SPACES**	**12**
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation		
UNIT-IV	**SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS**	**12**
Iterative method Newton - Raphson method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss –Jordan method. Eigen value of a matrix by power and Jacobi methods.		
UNIT-V	**INTERPOLATION**	**12**
Newton forward and backward difference formulae - Lagrange's Interpolation – Newton's divided difference fomula- Stirling's Bessel's central difference formulae.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2	Analyze accurate and efficient use of advanced algebraic techniques.
CO3	Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
CO4	Compare the basic solutions of equations and Eigen value problems.
CO5	Acquire skills in handling situations involving first and second order differential equations.

TEXT BOOKS
1. Grewal B.S., ―Higher Engineering Mathematics‖, Khanna Publishers, New Delhi, 43rd Edition, 2014.   2. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra, Prentice Hall of India, New Delhi, 2004.   3. Datta, "Numerical Methods for Linear Control Systems" CBS Publishers. Chennai 2005

REFERENCES
✓ James, G. ―Advanced Modern Engineering Mathematics‖, Pearson Education, 2007.   ✓ Kolman, B. Hill, D.R., ―Introductory Linear Algebra‖, Pearson Education, New Delhi, First Reprint, 2009.   ✓ Lay, D.C., ―Linear Algebra and its Applications‖, 5th Edition, Pearson Education, 2015.   ✓ O'Neil, P.V., ―Advanced Engineering Mathematics‖, Cengage Learning, 2007.   ✓ Srinivasan, "Numerical Methods for Engineering" CBS Publishers.Chennai.1994.   ✓ Yang, "Applied Numerical Methods Using MATLAB" CBS Publishers. Chennai 2005   ✓ Burden, R.L. and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.   ✓ Balagurusamy: Numerical Methods, Scitech.   ✓ Baburam: Numerical Methods, Pearson Education.   ✓ N. Dutta: Computer Programming & Numerical Analysis, Universities Press.   ✓ SoumenGuha& Rajesh Srivastava: Numerical Methods, OUP

CO-PO Mapping											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1
CO	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS422 / DATABASE MANAGEMENT SYSTEMS**			3	0	0	3

COURSE OBJECTIVES

- ✓ Learn the fundamentals of data models and to represent a database system using ER diagrams.
- ✓ Study SQL and relational database design.
- ✓ Understand the internal storage structures using different file and indexing techniques which will helpin physical DB design.
- ✓ Apply the fundamental concepts of transaction processing- concurrency control techniques andrecovery procedures.
- ✓ Evaluate an introductory knowledge about the Storage and Query processing Techniques.

SYLLABUS	
UNIT-I **RELATIONAL DATABASES**	**10**

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL.

UNIT-II **DATABASE DESIGN**	**8**

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT-III **TRANSACTIONS**	**9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT-IV **IMPLEMENTATION TECHNIQUES**	**9**

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

UNIT-V **ADVANCED TOPICS**	**9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models, Queries in IR systems-Case Study on application to get discount during festival times, to list the Stock Clearance.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember the modern and futuristic database applications based on size and complexity
CO2	Identify and Map ER model to Relational model to perform database design effectively
CO3	Apply queries using normalization criteria and optimize queries
CO4	Analyze contrast various indexing strategies in different database systems
CO5	Evaluate how advanced databases differ from traditional databases

TEXT BOOKS
1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, ―Database System Concepts‖, Sixth Edition, Tata McGraw Hill, 2011.   2. RamezElmasri, Shamkant B. Navathe, ―Fundamentals of Database Systems‖, Sixth Edition, Pearson Education, 2011.

REFERENCES
✓ C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.   ✓ RaghuRamakrishnan, ―Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.   ✓ G.K.Gupta,"Database Management Systems‖, Tata McGraw Hill, 2011.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	1	1	-	1	1	-	-	1
CO2	3	2	2	1	-	1	1	1	1	-	-	2
CO3	3	2	2	1	2	1	1	1	-	-	-	1
CO4	3	2	2	2	2	1	1	-	-	-	-	2
CO5	3	3	2	2	1	2	2	1	2	2	2	2
CO	**3**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	191CS423 / OPERATING SYSTEMS			3	0	0	3

COURSE OBJECTIVES

- To understand the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks..
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

SYLLABUS

UNIT-I	PROCESSES AND THREADS	9

Operating system overview-objectives and functions, Evolution of Operating System -operating system structures – system calls – system programs – system structure – virtual machines. Processes: Process concept – Process scheduling – Operations on processes –Cooperating processes – Inter process communication – Communication in client-server systems-Threads: Multi-threading models – Threading issues.

UNIT-II	PROCESS SCHEDULING AND SYNCHRONIZATION	9

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Algorithm Evaluation- Process Synchronization: The critical-section problem –Synchronization hardware – Semaphores – Classic problems of synchronization – critical regions – Monitors. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance –Deadlock detection – Recovery from deadlock, Distributed Operating System concepts, Real time OS, Mobile OS

UNIT-III	STORAGE MANAGEMENT	9

Memory Management: Background – Swapping – Contiguous memory allocation –Paging – Segmentation – Segmentation with paging. Virtual Memory: Background –Demand paging – Process creation – Page replacement – Allocation of frames –Thrashing.

UNIT-IV	FILE SYSTEMS AND I/O SYSTEMS	9

Mass-Storage Structure: Disk scheduling – Disk management –Swap-space management-File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File-System Implementation : Directory implementation –Allocation methods – Free-space management – efficiency and performance – recovery. I/O Systems– I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance

UNIT-V	CASE STUDY	9

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Describe the Basic Concepts and functions of OS and Process.
CO2	Compare various scheduling algorithms and Understand deadlock, prevention and avoidance algorithms.
CO3	Distinguish the various memory management schemes.
CO4	Analyze the functionality of file systems
CO5	Review the administrative tasks on Linux Servers and to Compare iOS and Android Operating Systems

TEXT BOOKS

Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012

REFERENCES

1. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.
2. Andrew S. Tanenbaum, ―Modern Operating Systems‖, Second Edition, Pearson Education, 2004..
3. Achyut S.Godbole, Atul Kahate, ―Operating Systems‖, McGraw Hill Education, 2016.
4 Gary Nutt, ―Operating Systems‖, Third Edition, Pearson Education, 2004.
5. Daniel P Bovet and Marco Cesati, ―Understanding the Linux kernel‖, 3rd edition, O'Reilly, 2005
6. http://nptel.ac.in/.
7. Neil Smyth, ―iPhone iOS 4 Development Essentials – Xcode‖, Fourth Edition, Payload media, 2011.

CO-PO MAPPING

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

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE				3	0	0	3

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS424 / COMPUTER NETWORKS**			3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the division of network functionalities into layers.
- ✓ To be familiar with the components required to build different types of networks.
- ✓ To be exposed to the required functionality at each layer.
- ✓ To learn the flow control and congestion control algorithms.

SYLLABUS		
UNIT-I	**FUNDAMENTALS & LINK LAYER**	**9**
Building a network, Requirements, Layering and protocols, Internet Architecture, Network software, Performance; Link layer Services, Framing, Error Detection, Flow control.		
UNIT-II	**MEDIA ACCESS & INTERNETWORKING**	**9**
Media access control, Ethernet (802.3), Wireless LANs, 802.11, Bluetooth, Switching and bridging, Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP).		
UNIT-III	**ROUTING**	**9**
Routing (RIP, OSPF, metrics), Switch basics, Global Internet (Areas, BGP, IPv6), Multicast, addresses, multicast routing (DVMRP, PIM).		
UNIT-IV	**TRANSPORT LAYER**	**9**
Introduction, Transport Layer Protocols, Services, Port Numbers, User Datagram Protocol, Transmission Control Protocol, SCTP.		
UNIT-V	**APPLICATION LAYER**	**9**
WWW and HTTP, FTP, Email, Telnet, SSH, DNS, SNMP.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify the basic layers and its functions in Computer networks and the working of various application layer protocols.
CO2	Compare the performance of a network.
CO3	Discuss the basics of how data flows from one node to another.
CO4	Analyze and design routing algorithms.
CO5	Design protocols for various functions in the network.

TEXT BOOKS

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A System Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011.
2. Belhrouz A. Forouzan, "Data Communications and Networking", Fifth Edition TMH, 2013.

REFERENCES

- ✓ 1.James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009.
- ✓ 2.Nader. F. Mir, "Computer and Communications Networks", Pearson Prentice Hall Publishers, 2010.
- ✓ 3.William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013.
- ✓ 4.Ying -Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
- ✓ Behrouz A. Forouzan, "Data Communication and Networking", Fourth Edition, Tata McGraw Hill, 2011.

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	1	1	-	-	-	-	1	1
CO2	3	2	2	1	1	-	-	-	-	-	1	1
CO3	3	2	2	1	1	1	-	-	-	-	1	1
CO4	3	2	2	1	-	1	-	-	-	-	1	1
CO5	3	2	2	2	-	2	1	-	1	-	1	1
CO	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**1**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	\multicolumn{3}{l}{191CB421 / INNOVATION MANAGEMENT, ENTREPRENEURSHIP AND IPR}		3	0	0	3

COURSE OBJECTIVES

- To learn creative and innovative thinking styles.
- To provide the deep knowledge about Entrepreneurship
- To understand about various types of IPR to protect competitive advantage

SYLLABUS

UNIT-I	INNOVATION WHAT AND WHY?	9

Innovation as core business process – Sources of Innovation – Knowledge Pull vs. Need Pull Innovation.Case study: Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT-II	BUILDING AN INNOVATIVE ORGANIZATION	9

Creating new products and services - Exploiting open innovation and collaboration - Use of innovation for starting a new ventureCase study: Class Discussion - Innovation: Co-operating across networks vs. 'go-it-alone' approach

UNIT-III	ENTREPRENEURSHIP	9

Opportunity recognition and entry strategies- Entrepreneurship as a Style of Management- Maintaining Competitive Advantage- Use of IPR to protect Innovation.Entrepreneurship Financial Planning – Financial Projections and Valuation- Stages of financing- Debt, Venture Capital and other forms of Financing

UNIT-IV	INTELLECTUAL PROPERTY RIGHTS	9

Introduction and the economics behind development of IPR: Business Perspective- IPR in India – Genesis and Development - International Context - Concept of IP Management, Use in marketing

UNIT-V	TYPES OF IPR	9

Patent- Procedure, Licensing and Assignment, Infringement and Penalty - Trademark- Use in marketing, example of trademarks- Domain name - Geographical Indications- What is GI, Why protect them? – Copyright- What is copyright- Industrial Designs- What is design? How to protect? Case study: Class Discussion - Major Court battles regarding violation of patents between corporate companies

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Define familiar with creative and innovative thinking styles
CO2	Plan the process of founding a startup
CO3	Design the needs for resources as well as obstacles in the early stages of the development of a business
CO4	Describe the fundamentals of intellectual property rights and legislation, particularly in the biotech industry.
CO5	Evaluate various types of IPR to protect competitive advantage

TEXT BOOKS

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change 2007
2. Case Study Materials: To be distributed for class discussion 2003

CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	1	-	1	2	3	2	1
CO2	3	3	3	2	1	1	-	1	2	3	2	1
CO3	3	3	3	2	1	1	-	1	2	3	2	1
CO4	3	3	3	2	1	1	-	1	2	3	2	1
CO5	3	3	3	2	1	1	-	1	2	3	2	1
CO	3	3	3	2	1	1	-	1	2	3	2	1

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CB422 / SOFTWARE DESIGN AND MODELLING**			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn UML notation and symbols
- ✓ To analyze and design systems and software solutions in the object-oriented approach
- ✓ To Employ the UML notation to create effective and efficient system designs
- ✓ To learn various types of testing

SYLLABUS

UNIT-I	INTRODUCTION	9

Introduction to software design, design methods- procedural / structural and object oriented, Requirement Vs Analysis Vs Architecture Vs Design Vs Development 4+1 Architecture, case study of transferring requirement to design, UP, COMET use case based software life cycle, Introduction to UML -Basic building blocks, Reusability, Use case modeling, Use case template Case study – Transferring requirements into design using advanced tool

UNIT-II	STATIC MODELING	9

Analysis Vs Design, Class diagram- Analysis - Object & classes finding analysis & Design- design classes, refining analysis relationships, Inheritance & polymorphism, Object diagram, Component diagram- Interfaces & components, deployment diagram, Package diagram

UNIT-III	DYNAMIC MODELING	9

Interaction & Interaction overview diagram, sequence diagram, Timing diagram, Communication diagram, Advanced state machine diagram, Activity diagram

UNIT-IV	ARCHITECTURE DESIGN AND PATTERNS	9

Introduction to Architectural design, overview of software architecture, Object oriented software architecture, Client server Architecture, Service oriented Architecture, and Component based Architecture, Real time software Architecture. Introduction to Creational design pattern – singleton, Factory ,Structural design pattern- Proxy design pattern, Adapter design pattern, Behavioral – Iterator design pattern, Observer design pattern

UNIT-V	TESTING	9

Introduction to testing, Error, Faults, Failures, verification and validation, Whit Box Testing, Black Box Testing, Unit testing, Integration testing, GUI testing, User acceptance Validation testing, integration testing, scenario testing, performance testing. Test cases and test plan. Case studies expected for developing usability test plans and test cases.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Define the basics of UML
CO2	Express the software design concepts with UML diagram
CO3	Apply the software design concepts with dynamic UML diagrams
CO4	Categorize UML based software design into pattern based design using design patterns.
CO5	Construct the various testing methodologies

TEXT BOOKS

1. Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Pearson Education, 2005
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML 2 Toolkit", WILEY-Dreamtech India Pvt. Ltd, 2003

REFERENCES

✓ Meilir Page-Jones, "Fundamentals of Object Oriented Design in UML", Pearson Education, 2002
✓ Atul Kahate, "Object Oriented Analysis & Design", The McGraw-Hill, 2004
✓ Mark Priestley; "Practical Object-Oriented Design with UML", TATA McGrawHill, 2005
✓ Craig Larman, "Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process", Pearson Education, 1997

CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	-	-	-	-	-	-
CO2	3	2	2	1	1	1	1	-	-	-	-	-
CO3	3	2	2	1	1	1	1	1	-	-	-	-
CO4	3	2	2	1	1	1	1	1	1	1	1	1
CO5	3	2	2	1	1	1	1	1	1	1	1	1
CO	3	2	2	1	1	1	1	1	1	1	1	1

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS42A / DATA BASE MANAGEMENT SYSTEMS LABORATORY**			0	0	2	1

COURSE OBJECTIVES

- ✓ To learn the data definitions and data manipulation commands.
- ✓ To understand the uses of nested and join queries.
- ✓ To apply functions, procedures and procedural extensions of data bases.
- ✓ To explore the uses of front end tool.
- ✓ To implement the typical database applications.

SYLLABUS

LIST OF EXPERIMENTS

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.

2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.

3. Views, Sequences, Synonyms.

4. Create a imaginary view table using views

5. Database Programming: Implicit and Explicit Cursors.

6. Stored Procedures and Functions.

7. Triggers

8. Write a query to demonstrate any on type of triggers

9. Exception Handling.

10. Database Design using ER modeling, normalization and Implementation for any application.

11. Database Connectivity with Front End Tools.

12. Case Study using real life database applications

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember typical data definitions and manipulation commands.
CO2	Identify the design applications to test Nested and Join Queries.
CO3	Apply simple applications that use Views.
CO4	Analyze applications that require a Front-end Tool.
CO5	Evaluate and analyze the use of Tables, Views, Functions and Procedures.

Requirements for a batch of 30 students

Sl. No	Description of Equipment	Quantity required	Quantity available (A)	efficiency (R-A)
1	Systems with MySql	30	30	Nil
2	Visual Studio	30	30	Nil
3	Server	1	1	Nil

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	-	1	-	-	-	-	1	3
CO2	3	2	2	1	-	1	-	-	-	-	1	3
CO3	3	2	2	2	-	1	-	-	-	-	1	3
CO4	3	2	2	2	2	2	-	-	-	-	1	3
CO5	3	2	2	2	2	2	-	-	-	-	1	3
CO	**3**	**2**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**3**

YEAR	II	SEMESTER		IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS42B / OPERATING SYSTEMS LABORATORY**				0	0	2	1

COURSE OBJECTIVES
✓ To learn Unix commands and shell programming.   ✓ To implement various CPU Scheduling Algorithms.   ✓ To implement Process Creation and Inter Process Communication.   ✓ To implement Deadlock Avoidance and Deadlock Detection Algorithms.   ✓ To implement Page Replacement Algorithms.   ✓ To implement File Organization and File Allocation Strategies.

LIST OF EXPERIMENTS	
1	Basics of UNIX commands.
2	Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
3	Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4	Shell Programming.
5	Write C programs to implement the various CPU Scheduling Algorithms.
6	Implementation of Semaphores.
7	Implementation of Shared memory and IPC.
8	Bankers Algorithm for Deadlock Avoidance.
9	Implementation of Deadlock Detection Algorithm.
10	Write C program to implement Threading & Synchronization Applications.
11	Implementation of the following Memory Allocation Methods for fixed partition, a) First Fit b) Worst Fit c) Best Fit
12	Implementation of Paging Technique of Memory Management.
13	Implementation of the following Page Replacement Algorithms, a) FIFO b) LRU c) LFU
14	Implementation of the various File Organization Techniques.
15	Implementation of the following File Allocation Strategies, a) Sequential b) Indexed c) Linked

16	Android OS / iOS Family – Case study.
17	VMware Workstation – Case study.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Compare the performance of various CPU Scheduling Algorithms.
CO2	Implement Deadlock avoidance and Detection Algorithms.
CO3	Demonstrate Semaphores.
CO4	Create processes and implement IPC.
CO5	Analyze the performance of the various Page Replacement Algorithms and Implement File Organization and File Allocation Strategies

REQUIREMENTS FOR A BATCH OF 30 STUDENTS

SI NO	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED	QUANTITY AVAILABLE(A)	DEFICIENCY(R-A)
1	SYSTEMS WITH LINUX OS AND GNU COMPUTER	30	30	NIL

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	2	2	2	2
CO2	3	3	3	2	2	2	2	2	2	2	2	2
CO3	3	3	3	2	2	2	2	2	2	2	2	2
CO4	3	3	3	2	2	2	2	2	2	2	2	2
CO5	3	3	3	2	2	2	2	2	2	2	2	2
CO	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS42C / NETWORK LABORATORY**			0	0	2	1

COURSE OBJECTIVES
✓ To learn network commands. ✓ To learn socket programming. ✓ To implement and analyze various network protocols. ✓ To learn and use simulation tools. ✓ To use simulation tools to analyze the performance of various network protocols.

LIST OF EXPERIMENTS	
1	Implementations of Stop and Wait Protocol and Sliding Window Protocol.
2	Study of Socket Programming and Client-Server model.
3	Write a code simulating ARP/RARP protocols.
4	Write a code simulating PING and TRACEROUTE commands
5	Create a socket for HTTP for web page upload and download.
6	Applications using TCP Sockets like: a. Echo client and Echo server b. Chat c. File Transfer
7	Simulation of DNS using UDP sockets.
8	Study of Network Simulator (NS) and Simulation of Congestion Control Algorithms using NS.
9	Study of TCP/UDP performance using simulation tool.
10	Study of Distance vector/Link State routing algorithm using NS.
11	Write a code simulating Go Back N ARQ.
12	Simulation of Error Correction Code (CRC).
13	MINI PROJECT

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify various protocols using TCP and UDP.
CO2	Compare the performance of different transport layer protocols.
CO3	Use simulation tools to measure the performance of various network protocols.
CO4	Implement various routing algorithms.
CO5	Interpret error correction codes.

	REQUIREMENTS FOR A BATCH OF 30 STUDENTS			
SI NO	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED	QUANTITY AVAILABLE(A)	DEFICIENCY(R-A)
1	STANDALONE DESKTOPS	30	30	NIL
2	C / C++ / Java / Python / Equivalent Compiler Network Simulator like NS2 / Glomosim / OPNEt / Packet Tracer / Equivalent	30	30	NIL

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	-	1	1	1	1
CO2	3	3	3	3	2	2	2	-	1	1	1	1
CO3	3	3	3	3	3	2	1	-	1	1	1	1
CO4	3	3	3	3	3	2	2	-	1	1	1	1
CO5	3	3	3	3	3	1	2	-	1	1	1	1
CO	3	3	3	3	3	2	2	-	1	1	1	1

YEAR	II	SEMESTER	IV	L	T	P	C
COURSE CODE / COURSE TITLE	**191MC46A - INTERNSHIP / TRAINING - I**			0	0	0	0

COURSE OBJECTIVES
✓ Get connected with reputed industry/ laboratory/academia / research institute ✓ Get practical knowledge on Product Development / Services and operations / Software ✓ Design and Development / Testing / Analytics/ research/ startups/ professionalism / business processes and insights / domain knowledge/ Industry Practices/ and other related aspects and develop skills to solve related problems ✓ Develop technical, soft, team skills to cater to the needs of the industry / academia / businesses / research / organizations in the core aspects of Automation, Digitalization

EVALUATION
The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within 15 days from the commencement of next semester. The students will be evaluated as per the Regulations. ✓ Internship offer letter or mail should be collected and check the company before sending the students for training. ✓ After completing the internship, report has to be submitted with necessary details to the coordinator. ✓ Internship certificate should be produced for verification along with internship report. ✓ PPT should be explained by the students about their company and the nature of training. ✓ Based on the performance, company and report the marks should be graded.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Industry Practices, Processes, Techniques, technology, automation and other core aspects of software industry
CO2	Analyze, Design solutions to complex business problems
CO3	Preparation of Technical reports and presentation

	CO-PO MAPPING												PSO's		
CO	**PO 1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO 10**	**PO 11**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	2	2	2	1	1	1	-	1	-	1	-	2	2	1	1
CO 2	2	2	2	1	1	1	-	-	-	-	-	2	2	1	1
CO 3	2	2	2	1	1	1	-	1	-	1	-	2	2	1	1
CO	**2**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**

SEMESTER V

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		191MA503/ OPERATIONS RESEARCH		3	0	0	3

COURSE OBJECTIVES
• Define the linear programming problems with formulations.   • Identify the appropiate techniques for optimization.   • Plan to analyze and solve integer programming and network models arising from a wide range of applications.   • Demnstrate the procedures and interpret results and solutions in simulation.

SYLLABUS		
UNIT-I	LINEAR PROGRAMMING	9
	Linear programming problems - Mathematical formulation, graphical method of solution, simplex method.	
UNIT-II	TRANSPORATION PROBLEM	9
	Duality in linear programming problems, dual simplex method, sensitivity analysis, transportation and assignment problems, Traveling salesman Problem.	
UNIT-III	THEORY OF GAMES	9
	Game theory Introduction, two-person zero-sum games, some basic terms, the maxmini minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property. CPM & PERT- project scheduling, critical path calculations, Crashing.	
UNIT-IV	QUEUING MODELS	9
	Queueing theory -basic structure of queuing systems, roles of the Poisson and exponential distributions, classification of queues basic results of M/M/1: FIFO systems, extension to multi-server queues.	
UNIT-V	SIMULATION	9
	Simulation: simulation concepts, simulation of a queuing system using event list, pseudo random numbers, multiplication congruential algorithm, inverse transformation method, basic ideas of Monte-Carlo simulation.	

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Solve the optimization problems using mathematical formulas.
CO2	Summarize the model and the solving technique, analyses the results.
CO3	Demonstrate the techniques for game theory.
CO4	Design the Queuing models to the systems.
CO5	Construct the mathematical software to solve the proposed simulation model.

TEXT BOOKS

1. Taha.H.A ,operation Research : An Introduction, McMilan publishing Co., 7 th ed,1982.
2. Ravindran A, Philips D.T & Solbery.J.J, Operations Research: Principles and practice, John Wiley & Sons, New York, 1987.

REFERENCES

1. Frank S. Budnick, Dennis Mcleavey and Richard Mojena, Principles of Operations Research for Management. All India Traveler Book seller, Delhi, 1989.
2. Gillet.B.E., Introduction to Operations Research - A Computer oriented algorithmic approach, McGraw Hill, 1987.
3. Joseph.G.Ecker & Michael Kupper Schimd, Introduction to operations Research, John Wiley & Sons, 1988.
4. Hillier.F.S & Liberman.G.J, operation Research, Second Edition, Holden Day Inc, 1974.
5. Kanti Swarup, Gupta.P.K. & Man Mohan, operations Research, S.Chand & Sons,2000.

CO-PO MAPPING

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

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE		**191CB521 / COMPILER DESIGN**		3	0	0	3

COURSE OBJECTIVES
✓ Describe the various phases of compiler.   ✓ Organize the various parsing techniques.   ✓ Justify the intermediate code generation and run-time environment.   ✓ Summarize the front-end of the compiler.   ✓ Measure how to implement code generator.

SYLLABUS		
UNIT-I	**INTRODUCTION TO COMPILERS**	9
Structure of a compiler, Lexical Analysis, Role of Lexical Analyzer, Input Buffering , Specification of Tokens , Recognition of Tokens, Lex, Finite Automata, NFA, Regular Expressions to Automata, Minimizing DFA.		
UNIT-II	**SYNTAX ANALYSIS**	12
Role of Parser, Grammars, Error Handling, Context-free grammars , Writing a grammar, Top Down Parsing , General Strategies Recursive Descent Parser Predictive Parser, LL(1) Parser, Shift Reduce Parser, LR Parser, LR (0)Item Construction of SLR Parsing Table, Introduction to LALR Parser, CLR(1) Parser, Error Handling and Recovery in Syntax Analyzer, YACC.		
UNIT-III	**INTERMEDIATE CODE GENERATION**	8
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.		
UNIT-IV	**RUN-TIME ENVIRONMENT AND CODE GENERATION**	8
Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation , Design of a simple Code Generator.		
UNIT-V	**CODE OPTIMIZATION**	8
Principal Sources of Optimization, Peep-hole optimization, DAG, Optimization of Basic Blocks, Global Data Flow Analysis, Efficient Data Flow Algorithm, Minimal List GNU for windows.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Acquire knowledge in different phases and passes of Compiler, and specifying different types of tokens by lexical analyzer.
CO2	Illustrate the translation of regular expression into parse tree using syntax analyzer and use the Compiler tools.
CO3	Practice about the top-down parsing and bottom-up parsing and able to construct parse table.
CO4	Able to translate the statement and implement the storage allocation strategies.
CO5	Analyze the various optimization techniques.

TEXT BOOKS

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers : Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.

REFERENCES

- ✓ Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
- ✓ Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
- ✓ Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
- ✓ V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
- ✓ Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	2
CO2	3	3	3	2	2	2	2	-	-	-	-	
CO3	3	3	3	2	2	2	2	-	-	2	1	
CO4	3	3	2	2	-	-	-	1	-	-	-	-
CO5	3	3	3	2	2	2	2	1	-	1	1	2
CO	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**-**	**1**	**1**	**2**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191AI521 / DESIGN AND ANALYSIS OF ALGORITHMS**			3	0	0	3

COURSE OBJECTIVES

- ✓ To learn and apply the algorithm analysis techniques.
- ✓ To understand the efficiency of alternative algorithmic solutions for the same Problem
- ✓ To apply the different algorithm design techniques.
- ✓ To analyze the limitations of Algorithmic power

SYLLABUS	

UNIT-I	INTRODUCTION	9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Visualization

UNIT-II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9

Brute Force – Computing a^n – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort -Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

UNIT-III	DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE	9

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd's algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

UNIT-IV	ITERATIVE IMPROVEMENT	9

The Simplex Method - The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs, Stable marriage Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem

UNIT-V	COPING WITH THE LIMITATIONS OF ALGORITHM POWER	9

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Remember the fundamental needs of algorithms in problem solving
CO2	Identify the Design algorithm for various computing problems
CO3	Apply the different algorithm design techniques for a given problem
CO4	Analyze the existing algorithm to improve efficiency
CO5	Evaluate the time and space complexity of various algorithms

TEXT BOOKS

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", Second Edition, Universities Press, 2007.
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, ―Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.

REFERENCES

✓ Sudhakar, A. Shyammohan, "Circuits and Network", Third Edition, Tata McGraw Hill, 2006.
✓ Kelkar, Pandit, "Linear Network Theory", Pratibha Publication,Third Edition,2006.
✓ "Introduction to Network Synthesis", Valkenburg, PHI Pbs, Third Edition,2006.
✓ "Network Analysis And Synthesis", Wadhwa, New Age Pbs, Third Edition,2006.

CO-PO MAPPING												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	2	1	1
CO4	3	3	2	2	-	-	1	-	-	2	1	1
CO5	2	2	1	1	-	-	1	-	-	2	2	1
CO	3	3	2	1	-	-	1	-	-	2	1	1

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191AI52A / DESIGN AND ANALYSIS OF ALGORITHMS LAB**			0	0	2	1

COURSE OBJECTIVES

- ✓ To learn the problems using divide and conquer strategy.
- ✓ To understand the problems using backtracking strategy.
- ✓ To implement problems using greedy and dynamic programming techniques.
- ✓ To perform Optimal Binary Search

LIST OF EXPERIMENTS

1. Write a java program to implement Bubble sort algorithm for sorting a list of integers in ascending order
2. Write a java program to implement Quick sort algorithm for sorting a list of integers in ascending order
3. Write a java program to implement Merge sort algorithm for sorting a list of integers in ascending order.
4. Write a java program to implement the dfs algorithm for a graph.
5. Write a java program to implement the bfs algorithm for a graph.
6. Write a java programs to implement backtracking algorithm for the N-queens problem.
7. Write a java program to implement the backtracking algorithm for the sum of subsets problem.
8. Write a java program to implement the backtracking algorithm for the Hamiltonian Circuits problem.
9. Write a java program to implement greedy algorithm for job sequencing with deadlines.
10. Write a java program to implement Dijkstra's algorithm for the Single source shortest path problem.
11. Write a java program that implements Prim's algorithm to generate minimum cost spanning tree.
12. Write a java program that implements Kruskal's algorithm to generate minimum cost spanning tree
13. Write a java program to implement Floyd's algorithm for the all pairs shortest path problem.
14. Write a java program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
15. Write a java program to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem.
16. Write a java program to implement Greedy algorithm for the Knapsack problem.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Remember how to analyze a problem and design the solution for the problem.
CO2	Identify design and implement efficient algorithms for a specified application.
CO3	Apply Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.
CO4	Evaluate the design algorithm for various computing problems

TEXT BOOKS
1. Levitin A, "Introduction to the Design And Analysis of Algorithms", Pearson Education, 2008.
2. Goodrich M.T.,R Tomassia, "Algorithm Design foundations Analysis and Internet Examples", John Wileyn and Sons, 2006.
3. Base Sara, Allen Van Gelder ," Computer Algorithms Introduction to Design and Analysis", Pearson, 3 rd Edition, 1999.

REFERENCES
1. http://www.personal.kent.edu/~rmuhamma/Algorithms/algorithm.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://www.facweb.iitkgp.ernet.in/~sourav/daa.html

CO-PO MAPPING											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	-	-	-	1	-	-	-	1
CO2	3	3	2	2	-	-	-	1	-	-	-	1
CO3	3	2	2	1	-	-	-	1	-	-	-	1
CO4	3	3	2	2	-	-	-	1	-	-	-	1
CO	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**1**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191CB52A / COMPILER DESIGN LABORATORY**			0	0	2	1

COURSE OBJECTIVES

- ➢ Build using different compiler writing tools.
- ➢ Diagnose how to implement the different Phases of compiler
- ➢ Express the familiarities how to use the control flow and data flow analysis
- ➢ Design the simple optimization techniques

LIST OF EXPERIMENTS

1	Implementation of Symbol Table
2	Develop a lexical analyzer to recognize a few patterns in C.
3	Implementation of Lexical Analyzer using Lex Tool
4	Generate YACC specification for a few syntactic categories
5	Program to recognize a valid arithmetic expression that uses operator +, - , *
6	Program to recognize a valid variable which starts with a letter followed by any number of letters or digits
7	Implementation of Calculator using LEX and YACC
8	Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree
9	Implement type checking
10	Implement control flow analysis and Data flow Analysis
11	Implement any one storage allocation strategies(Heap,Stack,Static)
12	Construction of DAG

13	Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler.
14	Implementation of Simple Code Optimization Techniques
15	Implementation Of Shift-Reduced Parsing Algorithms
16	Construction Of LR -Parsing Table.
17	Construction of CLR –Parsing Table.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Analyze the different compiler writing tools to implement the different Phases.
CO2	Design the data flow and control flow.
CO3	Develop the intermediate representation.
CO4	Construct the back end of a compiler for 8086 assembler.
CO5	Compare various code optimization techniques.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	3	3	2	1	-	-	-	-	1
CO2	3	3	3	3	2	1	-	-	-	-	-	1
CO3	3	3	3	3	2	1	-	-	-	-	-	1
CO4	3	3	3	3	3	1	-	-	1	-	-	1
CO5	3	3	3	3	2	1	1	-	-	-		1
CO	3	3	3	3	2	1	1	-	1	-	-	1

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191HS50A / PROFESSIONAL COMMUNICATION LAB**			0	0	2	1

COURSE OBJECTIVES
➢ Develop their communicative competence in English with specific reference to Speaking and listening.   ➢ Enhance their ability to communicate effectively in interviews.   ➢ Strengthen their prospects of success in competitive examinations.

LIST OF EXPERIMENTS	

1	Letter Writing
	    i. Formal letter
	    ii. Informal letter

2	Report Writing
	    i. Event report
	    ii. Project report

3	Resume Writing
4	Non-Technical Presentation
5	Technical Presentation
6	Interview Skills
7	Group Discussion
8	Listening Comprehension
9	Reading Comprehension
10	Common Errors in English
11	Familiarize different Genres of texts.
12	Different types of speeches, debates and Model UN.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	➢ Equip students with technology driven language skills required for successful undertaking of academic studies with primary emphasis on academic speaking and listening and to prepare students for competitive exams.
CO2	➢ Identify different genres of reading and writing, and be able to reflect and respond critically on formal communication such as letters, reports and memos.
CO3	➢ Learn to understand the role of multiple intelligences and incorporate them in communication in a diverse team.

CO- PO MAPPING												
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	-	-	-	-	-	3	3	2	2
CO2	3								3	3	2	2
CO3	3	-	-	-	-	-	-	-	3	3	2	2
CO	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**2**	**2**

YEAR	III	SEMESTER	V	L	T	P	C
COURSE CODE / COURSE TITLE	**191MC56A / TECHNICAL SEMINAR**			**0**	**0**	**0**	**0**

COURSE OBJECTIVES

- ✓ To encourage the students to study advanced engineering developments
- ✓ To prepare and present technical reports.
- ✓ To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

EVALUATION

- ➢ During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 15 minutes.
- ➢ In a session of two periods per week, around 10 students are expected to present the seminar.
- ➢ Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- ➢ At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report.
- ➢ A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- ➢ Evaluation is 100% internal.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Ability to review, prepare and present technological developments
CO2	Survey the changes in the technologies relevant to the topic selected
CO3	Compile report of the study and present to the audience, following the ethics also ability to face the placement interviews

CO-PO Mapping												PSO's		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	-	-	-	2	1	1	1	2	-	1	2	1	1
CO2	2	-	-	-	-	2	1	1	1	2	-	1	2	1	1
CO3	2	-	-	-	-	2	1	1	1	2	-	1	2	1	1
CO	2	-	-	-	-	2	1	1	1	2	-	1	2	1	1

SEMESTER VI

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191CB621 / MACHINE LEARNING**		3	0	0	3

COURSE OBJECTIVES

- ✓ To understand the need for machine learning for various problem solving.
- ✓ To study the various supervised, semi-supervised and unsupervised learning algorithm in machine learning.
- ✓ To understand the latent trends in machine learning.
- ✓ To design appropriate machine learning algorithms for problem solving.

SYLLABUS		
UNIT-I	**INTRODUCTION**	**9**

Introduction to Artificial Intelligence-Application of AI-Machine Learning-Machine Learning Life Cycle-applications-Types of machine learning Learning Problems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Eliminations, Inductive Bias, Decision Tree Learning, Representation, Algorithm, Heuristic Space Search.

UNIT-II	**NEURAL NETWORKS AND GENETIC ALGORITHMS**	**9**

Basics of Neural Networks-Neural network representation, History and cognitive basis of neural computation Neural Network Representation, Problem, Perceptrons, Multilayer Networks and Back Propagation Algorithms, Advanced Topics, Genetic Algorithms, Hypothesis Space Search, Genetic Programming, Models of Evaluation and Learning.

UNIT-III	**BAYESIAN AND COMPUTATIONAL LEARNING**	**9**

Bayes Theorem, Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier, Bayesian Belief Network, EM Algorithm, Probability Learning, Sample Complexity, Finite and Infinite Hypothesis, Mistake Bound Model.

UNIT-IV	**INSTANT BASED LEARNING**	**9**

K-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Function, Case Based Learning

UNIT-V	ADVANCED LEARNING	9

Learning Set of Rules, Sequential Covering Algorithm, Learning Rule Set, First Order Rules, Sets of First Order Rules, Induction on Inverted Deduction, Inverting Resolution, Analytical Learning, Perfect Domain Theories, Explanation Base Learning, FOCL Algorithm, Reinforcement Learning, Task, Q-Learning, Temporal Difference Learning, Deep Neural Networks.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Recall the learning techniques with this basic knowledge.
CO2	Define effectively neural network and genetic algorithm for appropriate applications.
CO3	Apply Bayesian techniques and derive effectively learning rules.
CO4	Analyze the different machine learning techniques.
CO5	Differentiate reinforcement and analytical learning techniques.

TEXT BOOKS

1.Tom M.Mitchell,"Machine Learning",McGraw-Hill Education(Indian Ed,2013.

REFERENCES

1. Ethem Alpaydin, " Intd. to Machine Learning", PHI Learning Pvt.Ltd.,2013.
2. T.Hastic, R. Tibshirani, J.H. Friedman, " The Elements of Statistical Learning",Springer,1st Edition,2001.

CO-PO MAPPING

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

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE	\multicolumn{3}{c|}{191HS601 / BUSINESS COMMUNICATION & VALUESCIENCE – III}		3	0	0	3

COURSE OBJECTIVES
• Recognize the importance of diversity in workplace   • Recognize the best practices of communicative writing   • Understand the importance of emotional intelligence in personal and professional lives   • Apply emotional intelligence in real life scenarios   • Understand the importance of corporate social responsibility (CSR) and corporate etiquettes   • Practice corporate etiquettes in real life scenarios

SYLLABUS		
UNIT-I	DIVERSITY AND INCLUSION AT WORKPLACE	9
\multicolumn{3}{l|}{Recapitulation activity of Satori, Introduce the concept of Diversity in corporate environments through an activity. Understand the importance of diversity and inclusion at workplace, Diversity and inclusion matter at workplace.}		
UNIT-II	COMMUNICATIVE WRITING AND EMOTIONAL INTELLIGENCE	9
\multicolumn{3}{l|}{Communicative writing, Application of communicative writing in real life scenarios , Use of charts and graphs in communicative writing, The best practices of communicative writing what is emotional intelligence?, Emotional intelligence in personal and professional lives its importance need and application, public speaking at workplace, Importance , need and ways, The best practices of public speaking, Apply public speaking in real life scenarios}		
UNIT-III	CORPORATE SOCIAL RESPONSIBILITY	9
\multicolumn{3}{l|}{Corporate social responsibility (CSR) its importance and need, Stalwarts in CSR, the attributes needed to function and grow in a corporate environment, the best practices to share and receive feedback for CSR}		
UNIT-IV	INTELLIGENCES AND LEARNING STYLES IN INTERPERSONAL INTERACTIONS	9
\multicolumn{3}{l|}{Application of emotional intelligence in real life scenarios, intelligences and learning styles in interpersonal interactions, the impact of conflicts, Basic guidelines required to manage conflicts}		

UNIT-V	CORPORATE ETIQUETTE, STRESS & TIME MANAGEMENT	9

The key features of corporate etiquette, Application of the business idioms and corporate terms, the impact of stress in life and work, the best practices to manage stress, the importance of time management, the best time management practices

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Understand the ways and means of working effectively within the diversified social environment
CO2	Engage even with the personalities of high social profiles effectively with respect to the sophisticated communication under the balancing emotional intelligence
CO3	Quite aware of the best practices and so understands the significance of individual responsibility in the corporate environment
CO4	Become efficient in conflict management and so he would be able to establish amicable interpersonal relations.
CO5	Learn the corporate etiquette and so becomes expertise in terms of managing time and stress.

REFERENCES

- ✓ Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman
- ✓ Putting Emotional Intelligence To Work by Ryback David
- ✓ How to Develop Self Confidence and Improve Public Speaking – Time – Tested Methods of Persuasion by Dale Carnegie
- ✓ TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations
- ✓ Diversity, Inclusion and Engagement 3rd Edition by Mervyn Hyde Lorelei Carpenter , Shelley Dole

CO-PO MAPPING

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

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191CS622 / INTERNET PROGRAMMING		3	0	0	3

COURSE OBJECTIVES
✓ To understand different Internet Technologies.   ✓ To create the client-side Programming   ✓ To learn server side Programming   ✓ To Develop php programming and Xml   ✓ To determine java-specific web services architecture

SYLLABUS	
UNIT-I	**WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0** 9

Web Essentials: Clients, Servers and Communication, The Internet, Basic Internet protocols, World wide web, HTTP Request Message, HTTP Response Message, Web Clients, Web Server, HTML5: Tables, Lists, Image, HTML5 control elements, Semantic elements, Drag and Drop, Audio, Video controls, CSS3: Inline, embedded and external style sheets, Rule cascading, Inheritance, Backgrounds, Border Images , Colors , Shadows , Text, Transformations, Transitions, Animations .Creating Canvas.

UNIT-II	**CLIENT SIDE PROGRAMMING** 9

Java Script: An introduction to JavaScript, JavaScript DOM Model, Date and Objects, Regular Expressions, Exception Handling, Validation, Built-in objects, Event Handling, DHTML with JavaScript, JSON introduction, Syntax, Function Files, Http Request, SQL.Arrays

UNIT-III	**SERVER SIDE PROGRAMMING** 9

Servlets: Java Servlet Architecture, Servlet Life Cycle, Form GET and POST actions, Session Handling, Understanding Cookies, Installing and Configuring Apache Tomcat Web Server, DATABASE CONNECTIVITY : JDBC perspectives, JDBC program example , JSP: Understanding Java Server Pages, JSP Standard Tag Library (JSTL), Creating HTML forms by embedding JSP code. Mixing Scriplets and HTML

UNIT-IV	**PHP and XML** 9

An introduction to PHP: PHP, Using PHP, Variables, Program control, Built-in functions, Form Validation, Regular Expressions, File handling, Cookies, Connecting to Database. XML: Basic XML- Document Type Definition, XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).XMLXlink,Xpath Axes

UNIT-V	INTRODUCTION TO AJAX and WEB SERVICES	9

AJAX: Ajax Client Server Architecture, XML Http Request Object, Call Back Methods; Web Services: Introduction, Java web services Basics, Creating, Publishing, Testing and Describing a Web services (WSDL), Consuming a web service, Database Driven web service from an application, SOAP. Higher order AJAX ASP Example

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Describe the basic web essential terms.
CO2	Discuss dynamic web page using Java Script objects.
CO3	Create server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and represent data in XML format.
CO5	Develop AJAX, web services and various interactive web applications.

TEXT BOOKS
1. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program" , Prentice Hall, 5th Edition, 2011.

REFERENCES
1. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition,1999. 2. Chris Bates, Web Programming , "Building Intranet Applications", 3rd Edition, Wiley Publications, 2009. 3. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011. 4. Gopalan N.P. and Akilandeswari J, "Web Technology" , Prentice Hall of India, 2011. 5. UttamK.Roy, "Web Technologies", Oxford University Press, 2011.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	1	-	-	-	3	3	3	-	3
CO2	3	3	3	1	-	-	-	3	3	3	-	3
CO3	3	3	3	1	-	-	-	3	3	3	-	3
CO4	3	3	3	1	-	-	-	3	3	3	-	3
CO5	3	3	3	1	-	-	-	3	3	3	-	3
CO	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**-**	**3**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		191CS62B / INTERNET PROGRAMMING LABORATORY		0	0	2	1

COURSE OBJECTIVES

- ✓ To be familiar with Web page design using HTML/XML and style sheets.
- ✓ To learn to create dynamic web pages using server side scripting.
- ✓ To write Client Server applications.
- ✓ To be familiar with the PHP programming.
- ✓ To be exposed to creating applications with AJAX.and Spring

LIST OF EXPERIMENTS	
1	Create a web page with the following using HTML a. To embed a map in a web page b. To fix the hot spots in that map c. Show all the related information when the hot spots are clicked.
2	Create a web page with the following. a. Cascading style sheets. b. Embedded style sheets. c. Inline style sheets. Use our college information for the web pages.
3	Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.
4	Write programs in Java using Servlets: a. To invoke servlets from HTML forms b. Session tracking using hidden form fields and Session tracking for a hit count
5	Write programs in Java to create three-tier applications using servlets for conducting online examination for displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
6	Install TOMCAT web server. Convert the static web pages of programs into dynamic web pages using servlets (or JSP) and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml. Each user should have a separate Shopping Cart.
7	Redo the previous task using JSP by converting the static web pages into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database.

8	Create and save an XML document at the server, which contains 10 users Information. Write a Program, which takes user Id as an input and returns the User details by taking the user information from the XML document.
9	a. Validate the form using PHP regular expression. b. PHP stores a form data into database.
10	Write a web service for finding what people think by asking 500 people's opinion for any consumer product.
11	Create a Spring MVC application. The application should handle form validation, file upload, session tracking

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Explain the basic web essential terms.
CO2	Discuss the creation of dynamic web page using Java Script objects.
CO3	Create server side programs using Servlets and JSP.
CO4	Construct simple web pages in PHP and represent data in XML format.
CO5	Develop AJAX, web services and various interactive web applications.

SOFTWARE REQUIRED
Dream Weaver or Equivalent, MySql or Equivalent, Apache Server, WAMP/XAMPP.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	3	2	2	3	3	3	3	3
CO2	3	2	2	2	3	2	2	3	3	3	3	3
CO3	3	2	2	2	3	2	2	3	3	3	3	3
CO4	3	2	2	2	3	2	2	3	3	3	3	3
CO5	3	2	2	2	3	2	2	3	3	3	3	3
CO	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191CB62A / MACHINE LEARNING LAB**		**3**	**0**	**0**	**3**

COURSE OBJECTIVES

- ✓ Make use of Data sets in implementing the machine learning algorithms
- ✓ Implement the machine learning concepts and algorithms in any suitable language of choice. Description

LIST OF EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training 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 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.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. 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 data sets.
6. 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.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. 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.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
11. Apply instance based learning for a set using FOCL algorithm.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Recall the procedures for the machine learning algorithms.
CO2	Design Java/Python programs for various Learning algorithms.
CO3	Apply appropriate data sets to the Machine Learning algorithms.
CO4	Analyze and apply Machine Learning algorithms to solve real world problems
CO5	Implement the procedures of NN in Learning algorithm

CO-PO Mapping												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	2	-	-	-	1	-	-	1
CO2	3	3	3	2	2	-	-	-	1	-	-	1
CO3	3	3	3	2	2	-	-	-	1	-	-	1
CO4	3	3	3	2	2	-	-	-	1	-	-	1
CO5	3	3	3	2	2	-	-	-	1	-	-	1
CO	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**

YEAR	III	SEMESTER	VI	L	T	P	C
COURSE CODE / COURSE TITLE		**191MC66A / INTERNSHIP/TRAINING - II**		0	0	0	0

COURSE OBJECTIVES

- ✓ To train the students
- ✓ For gaining domain knowledge, and technical skills to solve potential business / research problems
- ✓ Gather requirements and design suitable software solutions and evaluate alternatives
- ✓ To work in small teams and understand the processes and practices in the 'industry.
- ✓ Implement, Test and deploy solutions for target platforms
- ✓ Preparing reports and presentation

EVALUATION

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

- ✓ Internship offer letter or mail should be collected and check the company before sending the students for training.
- ✓ After completing the internship, report has to be submitted with necessary details to the coordinator.
- ✓ Internship certificate should be produced for verification along with internship report.
- ✓ PPT should be explained by the students about their company and the nature of training.
- ✓ Based on the performance, company and report the marks should be graded.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Gain Domain knowledge and technical skill set required for solving industry / research problems
CO2	Develop communication, interpersonal and other critical skills in the job interview process.
CO3	Prepare detailed technical report, demonstrate and present the work

CO-PO MAPPING												PSO's		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	1	1	1	1	-	1	-	1	-	2	3	1	1
CO 2	2	2	1	1	1	1	-	-	-	-	-	2	3	1	1
CO 3	2	2	1	1	1	1	-	1	-	1	-	2	3	1	1
CO	2	2	1	1	1	1	-	1	-	1	-	2	3	1	1

SEMESTER VII

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS722 / CRYPTOGRAPHY AND NETWORK SECURITY**			3	0	0	3

COURSE OBJECTIVES
✓ To understand Cryptography Theories, Algorithms and Systems. ✓ To implement necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.

SYLLABUS		
UNIT-I	**INTRODUCTION**	**9**
Security trends , Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies, Model of network security, Security attacks, services and mechanisms, OSI security architecture, Mathematical Tools for Cryptography: Substitutions and Permutations Classical encryption techniques : substitution techniques, transposition techniques, steganography, Foundations of modern cryptography: perfect security, information theory, product cryptosystem , cryptanalysis.		
UNIT-II	**SYMMETRIC KEY CRYPTOGRAPHY**	**9**
MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY : Algebraic structures , Modular arithmetic, Euclid's algorithm, Congruence and matrices, Groups, Rings, Fields, Finite fields, Chinese remainder theorem- SYMMETRIC KEY CIPHERS: SDES, Block cipher Principles of DES, Strength of 80 DES, Differential and linear cryptanalysis, Block cipher design principles, Block cipher mode of operation, Evaluation criteria for AES, Advanced Encryption Standard, IDEA ,RC4, Key distribution.		
UNIT-III	**PUBLIC KEY CRYPTOGRAPHY**	**9**
MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY : Primes, Primality Testing, Factorization, Euler's totient function, Fermat's and Euler's Theorem, Chinese Remainder Theorem , Exponentiation and logarithm, ASYMMETRIC KEY CIPHERS : RSA cryptosystem, Key distribution, Key management , Diffie Hellman key exchange, ElGamal cryptosystem , Elliptic curve arithmetic, Elliptic curve cryptography, Aggregation and Inference Direct Attacks.		
UNIT-IV	**MESSAGE AUTHENTICATION AND INTEGRITY**	**9**
Authentication requirement, Authentication function , MAC , Hash function, Security of hash function and MAC, SHA, Digital signature and authentication protocols, DSS, Entity Authentication: Biometrics, Passwords, Challenge Response protocols, Authentication applications , Kerberos, X.509 ,P2P and Overlay Systems.		

UNIT-V	SECURITY PRACTICE AND SYSTEM SECURITY	9

Electronic Mail security, PGP, S/MIME, IP security, Web Security, SYSTEM SECURITY : Intruders, Malicious software, viruses, Firewalls, Network Anomaly Detection and Routing Security.

COURSE OUTCOMES

On completion of the course, students will be able to

CO1	Interpret the fundamentals of networks security, security architecture, threats and vulnerabilities.
CO2	Analyze the different cryptographic operations of symmetric cryptographic algorithms.
CO3	Identify the commonly used cryptographic operations of public key cryptography.
CO4	Demonstrate the various Authentication schemes to simulate different applications.
CO5	Articulate various Security practices and System security standards.

TEXT BOOKS

1. William Stallings, " Cryptography and Network Security : Principles and Practice", PHI 3rd Edition, 2006.

REFERENCES

1. C K Shyamala, N Harini and Dr. T R Padmanabhan," Cryptography and Network Security", Wiley India Pvt.Ltd 2012.
2. BehrouzA.Foruzan, "Cryptography and Network Security", Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a public World", Prentice Hall, ISBN 0-13-046019-2.

CO-PO MAPPING											
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	-	-	-	-	-	-	1	-
CO2	2	2	2	1	-	-	-	-	-	-	-	1
CO3	3	2	2	2	-	-	-	-	-	-	1	-
CO4	3	3	2	1	-	-	-	-	-	-	2	2
CO5	3	2	2	1	-	-	-	-	-	-	2	1
CO	3	2	2	1	-	-	-	-	-	-	2	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CB721 / MARKETING RESEARCH AND MARKETINGMANAGEMENT			3	0	0	3

COURSE OBJECTIVES
✓ To learn the basics of marketing ✓ To understand the product life cycle ✓ To study the various pricing, promotion and distribution strategies ✓ To learn about Internet marketing in detail

SYLLABUS		
UNIT-I	**MARKETING CONCEPTS AND APPLICATIONS**	**9**
Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector. Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, and Technical & Social. Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior. Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning.		
UNIT-II	**PRODUCT MANAGEMENT**	**9**
Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging		
UNIT-III	**PRICING, PROMOTION AND DISTRIBUTION STRATEGY**	**9**
Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.		
UNIT-IV	**MARKETING RESEARCH AND DATA ANALYSIS**	**9**
Introduction, Type of Market Research, Scope, Objectives & Limitations, Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminate Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis.		
UNIT-V	**INTERNET MARKETING**	**9**
Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing.		

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	State the basic marketing concepts
CO2	Summarize the concept of Product Life cycle and Product development.
CO3	Apply the basic knowledge on Pricing, Promotion and Distribution Strategy.
CO4	Analyze the dynamics of marketing and analyze how its various components interact with each other in the real world.
CO5	Evaluate the marketing concepts for effective Internet Marketing.

TEXT BOOKS

1. Philip Kotler , "Marketing Management (Analysis, Planning, Implementation & Control)", Pearson Education, 8th edition, 1993
2. William J. Stanton, "Fundamentals of Marketing", McGraw-Hill Inc.,US; 8th edition, 1986
3. Rajendra Nargundkar, "Marketing Research", McGraw Hill Education; 3rd edition, 2017
4. V.S. Ramaswamy and S. Namakumari, "Marketing Management", McGraw Hill Education; 5th edition, 2017
5. G.C. Beri, "Market Research", McGraw Hill Education; Fifth edition, 2013

REFERENCES

1. Rajan Saxena, "Marketing Management", McGraw Hill Education; 4th edition 2009
2. S.A. Sherlekar, "Marketing Management", Himalaya Publishing House, 2010
3. S.M. Zha, "Service Marketing", Himalaya Publishing House, 2002
4. David M. Levine, David F. Stephan, Kathryn A. Szabat, P.K. Viswanatha, "Business Statistics - A First Course" Pearson Education, 2017

CO-PO Mapping												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	-
CO2	3	3	2	2	1	1	-	-	-	-	-	-
CO3	3	3	2	2	1	1	1	1	-	-	-	-
CO4	3	2	2	1	1	1	1	1	1	1	1	-
CO5	3	2	2	1	1	1	1	1	1	1	1	1
CO	3	3	2	2	1	1	1	1	1	1	1	1

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191CS72B / CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY**			0	0	2	1

COURSE OBJECTIVES
✓ To learn different cipher techniques ✓ To implement the algorithms DES, RSA,MD5,SHA-1 ✓ To use network security tools and vulnerability assessment tools

LIST OF EXPERIMENTS	

1	Perform encryption, decryption using the following substitution techniques
	   i. Ceaser cipher,
	   ii. playfair cipher,
	   iii. Hill Cipher,
	   iv. Vigenere cipher

2	Perform encryption and decryption using following transposition techniques
	   i. Rail fence
	   ii. Row & Column Transformation

3	Apply DES algorithm for practical applications.
4	Apply AES algorithm for practical applications.
5	Implement RSA Algorithm using HTML and JavaScript.
6	Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7	Calculate the message digest of a text using the SHA-1 algorithm.
8	Implement the SIGNATURE SCHEME - Digital Signature Standard.
9	Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
10	Automated Attack and Penetration Tools, Exploring N-Stalker, a Vulnerability Assessment Tool

11	Defeating Malware
	   i) Building Trojans
	   ii) Rootkit Hunter

12	Implement Block cipher using any one of the tool eg. Snort or any other s/w.
13	Case study: Electronic Mail security

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Identify the use of programming languages to implement Symmetric cryptography
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.
CO3	Construct code for authentication algorithms.
CO4	Develop a signature scheme using Digital signature standard.
CO5	Demonstrate the network security system using open source tools.

REFERENCES
✓ " Build Your Own Security Lab", Michael Gregg, Wiley India 2013.

REQUIREMENTS FOR A BATCH OF 30 STUDENTS

SI NO	DESCRIPTION OF EQUIPMENT	QUANTITY REQUIRED	QUANTITY AVAILABLE(A)	DEFICIENCY(R-A)
	SOFTWARE			
1	C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent	30	30	NIL
	HARDWARE			
2	Standalone desktops or server supporting 30 terminal or more	30	30	NIL

CO-PO MAPPING

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

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	191CB72A / STATISTICAL PACKAGE FOR SOCIAL SCIENCESLAB			0	0	2	1

COURSE OBJECTIVES
✓ To enable the students to understand the basic concepts involved in the statistical analyses.

SYLLABUS
LIST OF EXPERIMENTS

1. Mean, Standard deviation, Variance.

2. Bar diagram, Line diagram, Pie chart and Histogram.

3. Co efficient of correlation.

4. Regression equation of X on Y.

5. Regression equation of Y on X.

6. Application of t-test for one sample problem.

7. Application of t-test for two sample problems.

8. Application of t-test for testing the significance of Correlation Coefficient.

9. One-tailed and Two-tailed tests.

10. Application of analysis of variance.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	State and apply the basic probability axioms and concepts in their core areas.
CO2	Estimate the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO4	Analyze the relationship of two dimensional random variables using correlation techniques
CO5	Interpret the classification of various designs of experiments in their respective fields.

CO-PO Mapping											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	1	1	1	1	-	-	-	-	-
CO2	3	3	2	1	1	1	1	-	-	-	-	-
CO3	3	3	2	1	1	1	1	1	1	-	-	-
CO4	3	3	2	1	1	1	1	1	1	1	1	1
CO5	3	3	2	1	1	1	1	1	1	1	1	1
CO	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

YEAR	IV	SEMESTER	VII	L	T	P	C
COURSE CODE / COURSE TITLE	**191CB77A – PROJECT WORK - PHASE I**			0	0	2	2

COURSE OBJECTIVES
✓ To make them understand the concepts of Project Management for planning to execution of projects.   ✓ To develop the capacity of students in correlating theoretical knowledge into practical systems either to perform creative works or to perform analysis and hence to suggest solutions to problems, pertaining to civil engineering domain   ✓ To Develop self-directed inquiry and life-long skills   ✓ To enhance the communication skills of the students by providing opportunities to discussion groups and to present their observations, findings and report in formal reviews both in oral and written format.   ✓ To understand professional and ethical responsibility

EVALUATION
• Start by clarifying the objectives and expected outcomes of Phase 2 for the specific project. Ensure that these objectives align with the course or program's learning outcomes.   • Develop evaluation rubrics and criteria that clearly outline what you'll be assessing. These rubrics should include criteria related to content, presentation, research, teamwork, and other relevant aspects.   • Review any project documentation, reports, or manuals assess the completeness, accuracy, and quality of these materials.   • Evaluate how well the documentation aligns with the project's objectives and scope.   • Assess students' ability to communicate their work effectively, answer questions, and defend their project decisions.   • This may include evaluating the technical aspects, creativity, problem-solving, and attention to detail.   • Evaluate the effectiveness of team collaboration. Consider factors such as communication, delegation of tasks, conflict resolution, and individual contributions.   • Ensure that students have followed any guidelines, instructions, or best practices relevant to their field of study or industry standards.   • Assess the level of innovation, creativity, and critical thinking.   • Provide clear and constructive feedback to students, highlighting their strengths and areas where they can improve.   • Ensure that grading is consistent and aligned with the established rubrics.   • After the evaluation, compile a final report that summarizes the assessment process and provides recommendations for both individual students and the project as a whole.   • Evaluate how well students have applied their knowledge and skills to real-world problem-solving.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate the ability to develop and execute advanced project plans.
CO2	Apply and expand their technical or subject-specific knowledge and skills to solve complex challenges
CO3	Communicate project progress, findings, and outcomes effectively through comprehensive written reports and oral presentations.

CO-PO MAPPING													PSO's		
CO	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO1 2**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO2	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO3	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**3**	**2**

Course Assessment methods:

Direct	**Indirect**
Project Reviews	Course Exit Survey
Project Report	
Project Demonstration	

GUIDELINES
1. Selection of a topic or project title in consultation with a Faculty member.
2. Develop a project planning strategy.
3. If it is an industry – sponsored project, a concurrent letter from industry is required.
4. A maximum of 3/4 students per group will do the project.
5. The project may be done in one of the labs under the supervision of a guide or in the selected industry.
6. Continuous assessment of the project will be done by the project review committee based on four reviews consisting of technical presentation.
7. At the end of the project, a report will be written and a technical presentation along with demonstration will be made by the students.
8. The report, project demonstration and technical presentations will be evaluated by the internal and external examiners.

SEMESTER VIII

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE /COURSETITLE		**191AI821 / BLOCKCHAIN TECHNOLOGY**		3	0	0	3

COURSE OBJECTIVES
✓ To understand the basic concepts of blockchain ✓ To learn about blockchain in Cryptography ✓ To study about Bitcoin ✓ To build smart contracts and Etherum ✓ To develop an application using blockchain development tools and hyperledger tools

SYLLABUS	
UNIT-I	**INTRODUCTTION TO BLOCKCHAIN**	**9**

Block chain: The growth of block chain technology - Distributed systems - The history of block chain and Bit coin - Features of a block chain - Types of block chain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in block chain. Decentralization: Decentralization using block chain - Methods of decentralization - Routes to decentralization- Block chain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT-II	**BLOCKCHAIN IN CRYPTOGRAPHY**	**9**

Introduction - Working with the Open SSL command line – Introduction: Mathematics, Cryptography, Confidentiality, Integrity, Authentication, Non-repudiation, Accountability - Cryptographic primitives: Symmetric cryptography, Data Encryption Standard, Advanced Encryption Standard - Public Key Cryptography - Asymmetric cryptography -Public and private keys - RSA - Encryption and decryption using RSA Discrete algorithm problem in ECC - Encryption and decryption - ECC using OpenSSL - Hash functions -Message Digest- Merkle trees -Patricia trees - Financial markets and trading.

UNIT-III	**BITCOIN**	**9**

Introduction: Bit coin - Private keys in Bit coin, Transactions: The transaction life cycle - The transaction data structure - Types of transactions - Transaction malleabilityBlockchain Mining, Tasks of the miners - Mining rewards Proof of Work (PoW) - The mining algorithm - The hash rate - Mining systems - Mining pools. Bit coin Network and Payments: The Bit coin network – Wallets - Bit coin payments - Innovation in Bit coin. Bit coin Clients and APIs: Bit coin installation. Alternative Coins: Alternatives to Proof of Work -Proof of Stake (PoS) - Proof of Deposit (PoD).

UNIT-IV	SMART CONTRACTS AND ETHEREUM	9

Smart Contracts: Introduction - Ricardian contracts - Deploying smart contracts on a block chain. Ethereum: Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether crypto currency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network.

UNIT-V	BLOCKCHAIN DEVELOPMENT TOOLS AND HYPERLEDGER TOOLS	9

Development Tools and Frameworks: Compilers, Integrated Development Environments (IDEs), Tools and libraries, Contract development and deployment. Solidity language: Types- Literals – Enums - Function types - Reference types - Global variables - Control structures. Hyper ledger: Projects under Hyper ledger - Hyper ledger as a protocol - The reference architecture. Fabric: Hyper ledger Fabric, Membership services, Block chain services, Consensus services, And Distributed ledger, Corda: Architecture - State objects – Transactions – Consensus- Flows and Components.

COURSEOUTCOMES	
On completion of the course, students will be able to	
CO1	Recognize the basic concept of block chain and its types, Consensus theorem , Decentralization
CO2	Interpret how cryptography techniques working in block chain using RSA and other encryption standard
CO3	Apply knowledge of Bit coin techniques, Mining algorithm, PoW, PoS, PoD
CO4	Analyze the concept of Smart Contracts, Ethereum with EVM and development tools
CO5	Formulate knowledge of block chain development tools and hyperledger concepts

TEXTBOOKS

- Imran‖Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart‖contracts‖explained˙, Birmingham – Mumbai: Packt, 2nd Edition, 2018. [Unit 1 to 5]

REFERENCES
✓ Narayanan‖A, Bonneau J, Felten E, Miller A, and Goldfeder S, Bitcoin and Cryptocurrency Technologies – A Comprehensive Introduction˒, Princeton University Press, 2016.

CO-PO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	2	-	2	1	-	2	2
CO2	3	3	3	2	-	2	-	2	1	-	2	2
CO3	3	3	3	2	-	2	-	2	1	-	2	2
CO4	3	3	3	3	2	2	-	2	1	-	2	2
CO5	3	3	3	3	2	2	-	2	1	-	2	2
CO	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**1**	**-**	**2**	**2**

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		**191CB87A - PROJECT PHASE II**		**0**	**0**	**24**	**12**

COURSE OBJECTIVES

- ✓ To further develop and advance the project initiated in Phase 1. This could involve refining the project scope, objectives, and plans.
- ✓ To identify and address any challenges or issues that arise during the project implementation, teaching students problem-solving skills in a real-world context.
- ✓ To integrate the knowledge and skills gained in previous coursework into the practical implementation of the project.
- ✓ To emphasize the importance of documenting project processes, decisions, and outcomes for future reference or analysis.
- ✓ To encourage creative and innovative thinking in finding solutions and approaches to project challenges

EVALUATION

1. Start by clarifying the objectives and work done in Phase 1 for the specific project. Ensure that these objectives align with the course or program's learning outcomes.
2. Develop evaluation rubrics and criteria that clearly outline what you'll be assessing. These rubrics should include criteria related to content, presentation, research, teamwork, and other relevant aspects.
3. Evaluate how well the documentation aligns with the project's objectives and scope.
4. Assess students' ability to communicate their work effectively, answer questions, and defend their project decisions.
5. This may include evaluating the technical aspects, creativity, problem-solving, and attention to detail.
6. Evaluate the effectiveness of team collaboration. Consider factors such as communication, delegation of tasks, conflict resolution, and individual contributions.
7. Ensure that students have followed any guidelines, instructions, or best practices relevant to their field of study or industry standards.
8. Provide clear and constructive feedback to students, highlighting their strengths and areas where they can improve.
9. Design the modules and implement the same.
10. Assess the quality of the modules.
11. Coding should be done in any languages based on the output.
12. Ensure that grading is consistent and aligned with the established rubrics.
13. Project implementation output should be verified manually. After the evaluation, compile a final report that summarizes the assessment process and provides recommendations for both individual students and the project as a whole.

COURSE OUTCOMES
On completion of the course, students will be able to

CO1	Demonstrate the ability to develop and execute advanced project plans.
CO2	Communicate project progress, findings, and outcomes effectively through comprehensive written reports and oral presentations.
CO3	Work collaboratively in teams to address complex project issues, demonstrating strong teamwork.
CO4	Implement quality assurance and control processes to ensure the quality of project work

CO-PO Mapping												PSO's		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO2	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO3	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**3**	**2**

Course Assessment methods:

Direct	**Indirect**
Project Reviews	Course Exit Survey
Project Report	
Project Demonstration	

GUIDELINES

    Project work shall preferably be batchwise, the strength of each batch shall not exceed maximum of four students.
    Viva-voce examination in project work shall be conducted batch-wise.
    The CIE marks in the case of projects in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project guide.
    Students failing to secure a minimum of 50% of the CIE marks in Project work shall not be eligible for the Project examination conducted by the University and they shall be considered as failed in that/those Course/s. However, they can appear for university examinations conducted in other Courses of the same semester and backlog Courses if any. Students after satisfying the prescribed minimum CIE marks in the Course/s when offered during subsequent semester shall appear for SEE.
    Assess the quality of the work.
    Norms of final documentation of the project report are to be provided by the Department.

VERTICALS

VERTICAL 1 - ARTIFICIAL INTELLIGENCE

Verticals			Course Code	Name of the Course	Category	L	T	P	Credits
I ARTIFICIAL INTELLIGENCE	I		191ITV11	App Development		2	0	2	3
	II		191ITV12	Bio-Inspired Optimization Techniques		3	0	0	3
	III		191ITV13	Business Analytics		2	0	2	3
	IV		191ITV14	Cognitive Science		2	0	2	3
	V		191ITV15	Computer Vision		2	0	2	3
	VI		191ITV16	Ethics and AI		2	0	2	3
	VII		191ITV17	Knowledge Engineering		2	0	2	3
	VIII		191ITV18	Soft Computing		2	0	2	3
TOTAL						**17**	**0**	**14**	**24**

COURSE NAME : APP DEVELOPMENT   **L T P C**

COURSE CODE: 191ITV11   **2 0 2 3**

COURSE OBJECTIVES:
- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I   FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT   6
Basics of Web and Mobile application development, Native App, Hybrid App, Cross-platform App, What is Progressive Web App, Responsive Web design

UNIT II   NATIVE APP DEVELOPMENT USING JAVA   6
Native Web App, Benefits of Native App, Scenarios to create Native App, Tools for creating Native App, Cons of Native App, Popular Native App Development Frameworks, Java & Kotlin for Android, Swift & Objective-C for iOS, Basics of React Native, Native Components, JSX, State,Props

UNIT III   HYBRID APP DEVELOPMENT   6
Hybrid Web App, Benefits of Hybrid App, Criteria for creating Native App, Tools for creating Hybrid App, Cons of Hybrid App, Popular Hybrid App Development Frameworks, Ionic, Apache Cordova

UNIT IV   CROSS-PLATFORM APP DEVELOPMENT USING REACT-NATIVE   6
What is Cross-platform App, Benefits of Cross-platform App, Criteria for creating Cross-platform App, Tools for creating Cross-platform App, Cons of Cross-platform App, Popular Cross Platform App Development Frameworks, Flutter, Xamarin, React-Native, Basics of React Native, Native Components, JSX, State, Props

UNIT V   NON-FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS   6
Comparison of different App frameworks, Build Performance, App Performance, Debugging capabilities,Time to Market, Maintainability, Ease of Development, UI/UX, Reusability

                                      30 PERIODS

COURSE OUTCOMES:
CO1:Develop Native applications with GUI Components.
CO2:Develop hybrid applications with basic event handling.
CO3: Implement cross-platform applications with location and data storage capabilities.
CO4:Implement cross platform applications with basic GUI and event handling.
CO5:Develop web applications with cloud database access.

PRACTICAL EXERCISES: **30 PERIODS**

1. Using react native, build a cross platform application for a BMI calculator.
2. Build a cross platform application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expense.
3. Develop a cross platform application to convert units from imperial system to metric system (km to miles,   kg to pounds etc.,)
4. Design and develop a cross platform application for day to day task (to-do) management.
5. Design an android application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout
managers.
6. Design and develop an android application using Apache Cordova to find and display the current location of the user.
7. Write programs using Java to create Android application having Databases
   ● For a simple library application.
   ● For displaying books available, books lend, book reservation. Assume that student information is available in a database which has been stored in a database server.

                              TOTAL:60 PERIODS

TEXT BOOKS
1. Head First Android Development, Dawn Griffiths, O'Reilly, 1st edition
2. Apache Cordova in Action, Raymond K. Camden, Manning. 2015
3. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing

REFERENCES
1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Native Mobile Development by Shaun Lewis, Mike Dunn
3. Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach, Pawan Lingras, Matt Triff, Rucha Lingras
4. Apache Cordova 4 Programming, John M Wargo, 2015
5. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition

COURSE NAME: BIO-INSPIRED OPTIMIZATION TECHNIQUES   L   T   P   C

COURSE CODE:191ITV12   3   0   0   3

COURSE OBJECTIVES:
● To understand fundamental topics in bio-inspired optimization techniques
● To Learn the collective systems such as ACO, PSO, and BCO
● To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
● To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
● To implement the Bio-inspired technique with other traditional algorithms.

UNIT I   INTRODUCTION   9
Optimization Techniques: Introduction to Optimization Problems – Single and Muti- objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

UNIT II   SWARM INTELLIGENCE   9
Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms

UNIT III   NATURAL TO ARTIFICIAL SYSTEMS   9
Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

UNIT IV   SWARM ROBOTICS   9
Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle 165 Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

UNIT V   CASE STUDIES   9
Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Traveling Salesman problem.

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Familiarity with the basics of several biologically inspired optimization techniques.
CO2: Familiarity with the basics of several biologically inspired computing paradigms.
CO3: Ability to select an appropriate bio-inspired computing method and implement it for any application and data set.
CO4: Theoretical understanding of the differences between the major bio-inspired computing methods.
CO5: Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.

TEXT BOOK
 1. A. E. Elben and J. E. Smith, "Introduction to Evolutionary Computing", Springer, 2010.
 2.Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
 3. Leandro Nunes de Castro, " Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Chapman & Hall/ CRC, Taylor and Francis Group, 2007

 REFERENCES
 1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, "Swarm Intelligence: From Natural to Artificial Systems", Oxford University press, 2000.
 2. Christian Blum, Daniel Merkle (Eds.), "Swarm Intelligence: Introduction and Applications", Springer Verlag, 2008.
 3. Leandro N De Castro, Fernando J Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Inc., 2005.
 4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
 5. C. Eberhart et al., "Swarm Intelligence", Morgan Kaufmann, 2001.

COURSE NAME: BUSINESS ANALYTICS	L	T	P	C

COURSE CODE:191ITV13   2   0   2   3

COURSE OBJECTIVES:
- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT I   INTRODUCTION TO BUSINESS ANALYTICS   6
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

UNIT II   BUSINESS INTELLIGENCE   6
Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

UNIT III   BUSINESS FORECASTING   6
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT IV   HR & SUPPLY CHAIN ANALYTICS   6
Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V   MARKETING & SALES ANALYTICS   6
Marketing Strategy, Marketing Mix, Customer Behavior –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behavior in marketing and sales.

30 PERIODS

LIST OF EXPERIMENTS:

Use MS-Excel and Power-BI to perform the following experiments using a Business data set, and make presentations. Students may be encouraged to bring their own real-time socially relevant data set. I Cycle – MS Excel

1. Explore the features of Ms-Excel.
2.(i) Get the input from the user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND)
  ii) Perform data import/export operations for different file formats.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis
4. Perform Z-test, T-test & ANOVA
5. Perform data pre-processing operations
   i) Handling Missing data
   ii) Normalization
6. Perform dimensionality reduction operation using PCA, KPCA & SVD
7. Perform bivariate and multivariate analysis on the dataset.
8. Apply and explore various plotting functions on the data set. II Cycle – Power BI Desktop
9. Explore the features of Power BI Desktop
10. Prepare & Load data
11. Develop the data model
12. Perform DAX calculations
13. Design a report
14. Create a dashboard and perform data analysis
15. Presentation of a case study

30 PERIODS

COURSE OUTCOMES:

CO1: Explain the real world business problems and model with analytical solutions.
CO2: Identify the business processes for extracting Business Intelligence
CO3 : Apply predictive analytics for business fore-casting
CO4: Apply analytics for supply chain and logistics management
CO5: Use analytics for marketing and sales.

TOTAL: 60 PERIODS

TEXT BOOKS

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018

COURSE NAME: COGNITIVE SCIENCE	L	T	P	C

COURSE CODE:191ITV14	2	0	2	3

COURSE OBJECTIVES:
- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I   PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE   6

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II   COMPUTATIONAL INTELLIGENCE   6

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

UNIT III   PROBABILISTIC PROGRAMMING LANGUAGE   6

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations – Enumeration

UNIT IV   INFERENCE MODELS OF COGNITION   6

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V   LEARNING MODELS OF COGNITION   6

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

30 PERIODS

PRACTICAL EXERCISES :
1. Demonstration of Mathematical functions using WebPPL.
2. Implementation of reasoning algorithms.
3. Developing an Application system using generative model.
4. Developing an Application using conditional inference learning model.
5. Application development using hierarchical model. 6. Application development using Mixture model.

30 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1:Understand the underlying theory behind cognition.
CO2:Connect to the cognition elements computationally.
CO3:Implement mathematical functions through WebPPL.
CO4:Develop applications using cognitive inference models.
CO5:Develop applications using cognitive learning models.

TOTAL: 60 PERIODS

TEXT BOOK:
1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",The MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:
1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

COURSE NAME: COMPUTER VISION   **L   T   P   C**

COURSE CODE:191ITV15   **2   0   2   3**

COURSE OBJECTIVES:
- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

UNIT I   INTRODUCTION TO IMAGE FORMATION AND PROCESSING   6
Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II   FEATURE DETECTION, MATCHING AND SEGMENTATION   6
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III   FEATURE-BASED ALIGNMENT & MOTION ESTIMATION   6
 2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV   3D RECONSTRUCTION   6
Shape from X - Active range finding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture maps and albedos

UNIT V   IMAGE-BASED RENDERING AND RECOGNITION   6
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

                                                                          30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

LABORATORY EXPERIMENTS:

Software needed: OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or or equivalent

● OpenCV Installation and working with Python
● Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Blob detection
● Image Annotation – Drawing lines, text circle, rectangle, ellipse on images
● Image Enhancement - Understanding Color spaces, color space conversion, Histogram equalization, Convolution, Image smoothing, Gradients, Edge Detection
● Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment
● Image segmentation using Graph Cut / Grabcut
● Camera Calibration with circular grid
● Pose Estimation
● 3D Reconstruction – Creating Depth map from stereo images
●Object Detection and Tracking using Kalman Filter, Camshift 1. docs.opencv.org 2. https://opencv.org/opencv-free-course/

                                                                           TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1:To understand basic knowledge, theories and methods in image processing and computer vision. CO2:To implement basic and some advanced image processing techniques in OpenCV.

CO3:To apply 2D feature- based image alignment, segmentation and motion estimations.

CO4:To apply 3D image reconstruction techniques

CO5:To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

 REFERENCES:

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

COURSE NAME:ETHICS AND AI	L	T	P	C
COURSE CODE: 191ITV16	2	0	2	3

COURSE OBJECTIVES:
- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

UNIT I   INTRODUCTION   6
Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

UNIT II   ETHICAL INITIATIVES IN AI   6
International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT III   AI STANDARDS AND REGULATION   6
Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV ROBOETHICS:SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 6 Robot-Roboethics-Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society-Harmonization of Principles- Ethics and Professional ResponsibilityRoboethics Taxonomy.

UNIT V   AI AND ETHICS- CHALLENGES AND OPPORTUNITIES   6
Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.
                                                                                          30 PERIODS

PRACTICAL EXERCISES:
1. Recent case study of ethical initiatives in healthcare, autonomous vehicles and defense
2. Exploratory data analysis on a 2 variable linear regression model
3. Experiment the regression model without a bias and with bias
4. Classification of a dataset from UCI repository using a perceptron with and without bias
5. Case study on ontology where ethics is at stake
6. Identification on optimization in AI affecting ethics

30 PERIODS
TOTAL:60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to
CO1:Learn about morality and ethics in AI
CO2:Acquire the knowledge of real time application ethics, issues and its challenges.
CO3:Understand the ethical harms and ethical initiatives in AI
CO4:Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
CO5:Understand the concepts of Roboethics and Morality with professional responsibilities.
CO6:Learn about the societal issues in AI with National and International Strategies on AI

TEXT BOOKS:
1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014
.
REFERENCES:
1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017 2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

WEB LINK:
1.https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2.https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteenchallenges-and-opportunities/
3.https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4. https://sci-hub.mksa.top/10.1159/000492428

COURSE NAME: KNOWLEDGE ENGINEERING	L	T	P	C
COURSE CODE:191ITV17	2	0	2	3

COURSE OBJECTIVES:
● To understand the basics of Knowledge Engineering.
● To discuss methodologies and modeling for Agent Design and Development.
● To design and develop ontologies.
● To apply reasoning with ontologies and rules.
● To understand learning and rule learning

UNIT I   REASONING UNDER UNCERTAINTY   9
Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II   METHODOLOGY AND MODELING   9
Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill- Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III   ONTOLOGIES – DESIGN AND DEVELOPMENT   9
Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as   Feature Values – Ontology Matching. Design and Development Methodologies –   Steps in Ontology Development – Domain Understanding and ConceptElicitation – Modeling-based Ontology Specification.

UNIT IV   REASONING WITH ONTOLOGIES AND RULES   9
Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V   LEARNING AND RULE LEARNING   9
Machine Learning – Concepts – Generalization and Specialization Rules –Types – Formal definition of Generalization. Modeling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and   Analysis – Hypothesis Learning.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
1. Perform operations with Evidence Based Reasoning.
2. Perform Evidence based Analysis.
3. Perform operations on Probability Based Reasoning.
4. Perform Believability Analysis.
5. Implement Rule Learning and refinement.
6. Perform analysis based on learned patterns.
7. Construction of Ontology for a given domain.   **TOTAL: 45 PERIODS**

COURSE OUTCOMES:
At the end of the semester the students can be able to:
CO1 Understand the basics of Knowledge Engineering.
CO2 Apply methodologies and modeling for Agent Design and Development.
CO3 Design and develop ontologies.
CO4 Apply reasoning with ontologies and rules.
CO5 Understand learning and rule learning.

TEXT BOOK:
1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8,

REFERENCES:
1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition,2001.

COURSE NAME: SOFT COMPUTING	L	T	P	C

COURSE CODE:191ITV18	2	0	2	3

COURSE OBJECTIVES:
- To introduce the ideas of fuzzy sets, fuzzy logic and the use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing

UNIT 1   INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC   6
Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems

UNIT II   NEURAL NETWORKS   6
Supervised Learning Neural Networks – Perceptrons - Back Propagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III   GENETIC ALGORITHMS   6
Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Crossover – Mutation - Fitness Function – Maximizing function

UNIT IV   NEURO FUZZY MODELING   6
ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability

UNIT V   APPLICATIONS   6
Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing forColor Recipe Prediction.

30 PERIODS

COURSE OUTCOMES:
CO1: Understand the fundamentals of fuzzy logic operators and inference mechanisms
CO2: Understand neural network architecture for AI applications such as classification and clustering
CO3: Learn the functionality of Genetic Algorithms in Optimization problems
CO4: Use hybrid techniques involving Neural networks and Fuzzy logic
CO5: Apply soft computing techniques in real world applications

PRACTICAL EXERCISES   **30 PERIODS**
1. Implementation of fuzzy control/ inference system
2. Programming exercise on classification with a discrete perceptron
3. Implementation of XOR with backpropagation algorithm
4. Implementation of self organizing maps for a specific application
5. Programming exercises on maximizing a function using Genetic algorithm
6. Implementation of two input sine function
7. Implementation of three input nonlinear function

TOTAL:60 PERIODS

TEXT BOOKS:
1. SaJANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing:A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python
3. With Case Studies and Applications from the Industry, Apress, 2020

REFERENCES
1. roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques andApplications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms",PHI, 2003.
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1999

VERTICAL II - CLOUD COMPUTING

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
II CLOUD COMPUTING	I	191ITV21	Cloud Services Management		2	0	2	3
	II	191ITV22	Data Warehousing		2	0	2	3
	III	191ITV23	Principles of Cloud Computing		2	0	2	3
	IV	191ITV24	Security and Privacy in Cloud		2	0	2	3
	V	191ITV25	Software Defined Networks		2	0	2	3
	VI	191ITV26	Storage Technologies		3	0	0	3
	VII	191ITV27	Stream Processing		2	0	2	3
	VIII	191ITV28	Virtualization		2	0	2	3
			TOTAL		**17**	**0**	**14**	**24**

COURSE NAME : CLOUD SERVICES AND MANAGEMENT   L   T   P   C

COURSE CODE:191ITV21   2   0   2   3

COURSE OBJECTIVES:
- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Select appropriate structures for designing, deploying and running cloud-based services in a business Environment
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

UNIT I   CLOUD SERVICE MANAGEMENT FUNDAMENTALS   6
Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

UNIT II   CLOUD SERVICES STRATEGY   6
Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture

UNIT III   CLOUD SERVICE MANAGEMENT   6
Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management

UNIT IV   CLOUD SERVICE ECONOMICS   6
Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models

UNIT V   CLOUD SERVICE GOVERNANCE & VALUE   6   IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership

30 PERIODS

COURSE OUTCOMES:
CO1:Exhibit cloud-design skills to build and automate business solutions using cloud technologies.
CO2: Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services
CO3: Solve the real world problems using Cloud services and technologies

PRACTICAL EXERCISES: **30 PERIODS**
 1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack, Eucalyptus, OpenNebula with Role-based access control
 2. Create a Cost-model for a web application using various services and do Cost-benefit analysis
 3. Create alerts for usage of Cloud resources
 4. Create Billing alerts for your Cloud Organization
 5. Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best one
TOTAL: 60 PERIODS

TEXT BOOKS
1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
 2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

REFERENCES
 1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
 2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian   Vechhiola, S. Thamarai Selvi

COURSE NAME:DATA WAREHOUSING	L	T	P	C

COURSE CODE:191ITV22	2	0	2	3

COURSE OBJECTIVES:
- To know the details of data warehouse Architecture
- To understand the OLAP Technology
- To understand the partitioning strategy
- To differentiate various schema
- To understand the roles of process manager & system manager

UNIT I   INTRODUCTION TO DATA WAREHOUSE   5

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse

UNIT II   ETL AND OLAP TECHNOLOGY   6

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III   METADATA, DATA MART AND PARTITION STRATEGY   7

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition

UNIT IV   DIMENSIONAL MODELING AND SCHEMA   6

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Database Parallelism – Data Warehouse Tools

UNIT V   SYSTEM & PROCESS MANAGERS   6

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Data exploration and integration with WEKA
2. Apply weka tool for data validation
3. Plan the architecture for real time application
4. Write the query for schema definition
5. Design data warehouse for real time applications
6. Analyze the dimensional Modeling
7. Case study using OLAP
8. Case study using OLTP
 9. Implementation of warehouse testing.

COURSE OUTCOMES:
At the end of the course the students should be able to
CO1: Design data warehouse architecture for various Problems
CO2: Apply the OLAP Technology
CO3: Analyze the partitioning strategy
CO4: Critically analyze the differentiation of various schema for given problem
CO5: Frame roles of process manager & system manager
                                                                              TOTAL: 60 PERIODS
TEXT BOOKS
1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Ralph Kimball, "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", Third edition, 2013.

REFERENCES
1. Paul Raj Ponniah, "Data warehousing fundamentals for IT Professionals", 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay ``Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.

COURSE NAME: PRINCIPLES OF CLOUD COMPUTING   **L   T   P   C**

COURSE CODE:191ITV23   2   0   2   3

COURSE OBJECTIVES
- To understand the basic concepts and architecture of Cloud Computing.
- To understand virtualization and Data Storage in cloud computing.
- To introduce the various levels of services that can be achieved by cloud and security in cloud computing
- To analyze the various tools and technologies in the Cloud.
- To implement the applications in the Cloud.

UNIT I   CLOUD COMPUTING FOUNDATION AND ARCHITECTURE   6
Foundations: Introduction to Cloud Computing – Move to Cloud Computing – Types of Cloud – Working of Cloud Computing – Architecture: Cloud computing Technology – Cloud Architecture – Cloud Modeling and Design.

UNIT II   VIRTUALIZATION AND DATA STORAGE IN CLOUD COMPUTING   6 Virtualization:
Foundation – Grid, Cloud and Virtualization – Virtualization and Cloud Computing – Storage: Data Storage – Cloud Storage – Cloud Storage from LANs and WANs.

UNIT III   CLOUD COMPUTING SERVICES AND SECURITY   6
Cloud Computing Services: Cloud Computing Elements – Understanding Services and Applications by Type - Cloud Services – Cloud Computing at Work – Security: Risks in Cloud Computing – Data Security in Cloud – Cloud Security Services.

UNIT IV   CLOUD COMPUTING TOOLS   6
Cloud Computing Tools: Tools and Technologies for Cloud – Cloud Mashaps – Apache Hadoop – Cloud Tools.

UNIT V   CLOUD APPLICATIONS   6
Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services – Cloud Applications.

30 PERIODS

PRACTICAL EXERCISES   30 PERIODS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like word count.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub   **TOTAL:60 PERIODS**

COURSE OUTCOMES:
CO   Course Outcomes Statements
CO1   Describe the basic concept and architecture of cloud computing
CO2   Identify the virtualization and data storage in cloud computing
CO3   Categorize varies levels of services can be achieved by cloud and cloud computing security
CO4   Analyze the various tools and technologies in Cloud
CO5   Develop the implementation of applications in Cloud

TEXT BOOKS:
1. A.Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications 2014.
REFERENCES:
1. Kai Hwang, Geoffrey C.Fox, Jack G.Dongarra, "Distributed and Cloud Computing, from Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rajkumar Buyya, James Broberg, Andrzej , "Cloud Computing: Principles and Paradigms", Wiley India Publications 2011.
3. Kumar Saurabh, " Cloud Computing, Architecting Next – Gen Transformation Paradigms", Wiley India Publications, Fourth Edition, 2018.

COURSE NAME: SECURITY AND PRIVACY IN CLOUD   L   T   P   C

COURSE CODE:191ITV24   2   0   2   3

COURSE OBJECTIVES:
- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I   FUNDAMENTALS OF CLOUD SECURITY CONCEPTS   7
Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation,
Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II   SECURITY DESIGN AND ARCHITECTURE FOR CLOUD   6
Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III   ACCESS CONTROL AND IDENTITY MANAGEMENT   6
Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV   CLOUD SECURITY DESIGN PATTERNS   6
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V   MONITORING, AUDITING AND MANAGEMENT   5
Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

                                            30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. simulate resource management using cloud sim
3. simulate log forensics using cloud sim
4. simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization,etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario
9. implement an attribute-based access control mechanism based on a particular scenario
10. Develop a log monitoring system with incident management in the cloud

COURSE OUTCOMES:
CO1: Understand the cloud concepts and fundamentals.
CO2: Explain the security challenges in the cloud.
CO3: Define cloud policy and Identity and Access Management.
CO4: Understand various risks and audit and monitoring mechanisms in the cloud.
CO5: Define the various architectural and design considerations for security in the cloud.
                                                                  TOTAL:60 PERIODS
TEXTBOOKS
1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ―Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ―Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ―Cloud Security and Privacy‖, O'REILLYSSSSS 2011
REFERENCES
1. Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011
2. Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

COURSE NAME:SOFTWARE DEFINED NETWORKS   **L   T   P   C**

COURSE CODE:191ITV25 2 0 2 3

COURSE OBJECTIVES:
- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I SDN: INTRODUCTION 6

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane , Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 6

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - South bound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS 6

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION 6

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY 6

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1) Setup your own virtual SDN lab
i) Virtualbox/Mininet Environment for SDN - http://mininet.org
ii) https://www.kathara.org
iii) GNS3
2) Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc.
3) Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.
4) Create a simple end-to-end network service with two VNFs using vim-emu https://github.com/containernet/vim-emu
5) Install OSM and onboard and orchestrate network service.

COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
CO1: Describe the motivation behind SDN
CO2: Identify the functions of the data plane and control plane
CO3: Design and develop network applications using SDN
CO4: Orchestrate network services using NFV
CO5: Explain various use cases of SDN and NFV

TOTAL :60 PERIODS

TEXTBOOKS:
1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud",
Pearson Education, 1st Edition, 2015.

REFERENCES:
1. Ken Gray, Thomas D. Nadeau, "Network Function Virtualization", Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", 1st Edition, CRCPress, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A ComprehensiveApproach", 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", 2nd Edition, O'Reilly Media, 2017.

COURSE NAME:STORAGE TECHNOLOGIES L T P C

COURSE CODE:191ITV26 3 0 0 3

COURSE OBJECTIVES:
- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I   STORAGE SYSTEMS   9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II   INTELLIGENT STORAGE SYSTEMS AND RAID   5

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scaleout storage Architecture.

UNIT III   STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION   13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol,
connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture
.
UNIT IV   BACKUP, ARCHIVE AND REPLICATION   12

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service(DRaaS).

UNIT V   SECURING STORAGE INFRASTRUCTURE   6   Information
security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

COURSE OUTCOMES:

CO1: Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment

CO2: Illustrate the usage of advanced intelligent storage systems and RAID

CO3: Interpret various storage networking architectures - SAN, including storage subsystems and virtualization

CO4: Examine the different role in providing disaster recovery and remote replication technologies

CO5: Infer the security needs and security measures to be employed in information storage management

TOTAL:45 PERIODS

TEXTBOOKS

1. EMC Corporation, Information Storage and Management, Wiley, India

2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017

3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

COURSE NAME:STREAM PROCESSING	L	T	P	C
COURSE CODE:191ITV27	2	0	2	3

COURSE OBJECTIVES:
- Introduce Data Processing terminology, definition & concepts
- Define different types of Data Processing
- Explain the concepts of Real-time Data processing
- Select appropriate structures for designing and running real-time data services in a business environment
- Illustrate the benefits and drive the adoption of real-time data services to solve real world problems

UNIT I   FOUNDATIONS OF DATA SYSTEMS   6

Introduction to Data Processing, Stages of Data processing, Data Analytics, Batch Processing, Stream processing, Data Migration, Transactional Data processing, Data Mining, Data Management Strategy, Storage, Processing, Integration, Analytics, Benefits of Data as a Service, Challenges

UNIT II   REAL-TIME DATA PROCESSING   6

Introduction to Big data, Big data infrastructure, Real-time Analytics, Near real-time solution, Lambda architecture, Kappa Architecture, Stream Processing, Understanding Data Streams, Message Broker, Stream Processor, Batch & Real-time ETL tools, Streaming Data Storage

UNIT III   DATA MODELS AND QUERY LANGUAGES   6

Relational Model, Document Model, Key-Value Pairs, NoSQL, Object-Relational Mismatch, Manyto- One and Many-to-Many Relationships, Network data models, Schema Flexibility, Structured Query Language, Data Locality for Queries, Declarative Queries, Graph Data models, Cypher Query Language, Graph Queries in SQL, The Semantic Web, CODASYL, SPARQL

UNIT IV   EVENT PROCESSING WITH APACHE KAFKA   6

Apache Kafka, Kafka as Event Streaming platform, Events, Producers, Consumers, Topics, Partitions, Brokers, Kafka APIs, Admin API, Producer API, Consumer API, Kafka Streams API, Kafka Connect API

UNIT V REAL-TIME PROCESSING USING SPARK STREAMING 6

Structured Streaming, Basic Concepts, Handling Event-time and Late Data, Fault-tolerant Semantics, Exactly-once Semantics, Creating Streaming Datasets, Schema Inference, Partitioning of Streaming datasets, Operations on Streaming Data, Selection, Aggregation, Projection, Watermarking, Window operations, Types of Time windows, Join Operations, Deduplication

30 PERIODS

PRACTICAL EXERCISES   **30 PERIODS**
1. Install MongoDB
2. Design and Implement Simple application using MongoDB
3. Query the designed system using MongoDB
4. Create a Event Stream with Apache Kafka
5. Create a Real-time Stream processing application using Spark Streaming
6. Build a Micro-batch application
7. Real-time Fraud and Anomaly Detection,
8. Real-time personalization, Marketing, Advertising

COURSE OUTCOMES:
CO1:Understand the applicability and utility of different streaming algorithms.
CO2:Describe and apply current research trends in data-stream processing.
CO3:Analyze the suitability of stream mining algorithms for data stream systems.
CO4:Program and build stream processing systems, services and applications.
CO5:Solve problems in real-world applications that process data streams.

                                         TOTAL:60 PERIODS

TEXT BOOKS
1. Streaming Systems: The What, Where, When and How of Large-Scale Data Processing by Tyler Akidau, Slava Chemyak, Reuven Lax, O'Reilly publication
2. Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly Media
3. Practical Real-time Data Processing and Analytics : Distributed Computing and Event Processing using Apache Spark, Flink, Storm and Kafka, Packt Publishing

REFERENCES
1. https://spark.apache.org/docs/latest/streaming-programming-guide.html
2. Kafka.apache.org

COURSE NAME:VIRTUALIZATION	L	T	P	C

COURSE CODE:191ITV28	2	0	2	3

COURSE OBJECTIVES:
- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To Experiment the virtualization platforms

UNIT I   INTRODUCTION TO VIRTUALIZATION   7

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT II   SERVER AND DESKTOP VIRTUALIZATION   6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform- Desktop Virtualization-Types of Desktop Virtualization

UNIT III   NETWORK VIRTUALIZATION   6

Introduction to Network Virtualization-Advantages- Functions-Tools for Network Virtualization-VLAN-WAN Architecture- WAN Virtualization

UNIT IV   STORAGE VIRTUALIZATION   5

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT V   VIRTUALIZATION TOOLS   6

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

                                                                                30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1.Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memory and storage space as per requirement. Install Guest OS on that VMWARE.
2.a.Shrink and extend virtual disk
  b. Create, Manage, Configure and schedule snapshots
  c. Create Spanned, Mirrored and Striped volume
  d. Create RAID 5 volume
3.a.Desktop Virtualization using VNC
  b.Desktop Virtualization using Chrome Remote Desktop
4.Create type 2 virtualization on ESXI 6.5 server
5.Create a VLAN in CISCO packet tracer
6.Install KVM in Linux
7.Create Nested Virtual Machine(VM under another VM)

COURSE OUTCOMES:

CO1: Analyze the virtualization concepts and Hypervisor
CO2: Apply the Virtualization for real-world applications
CO3: Install & Configure the different VM platforms
CO4: Experiment with the VM with various software

TOTAL :60 PERIODS

TEXT BOOKS

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach
4. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", APress, 2005.
5. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
6. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

VERTICALS III - CYBER SECURITY

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
III CYBER SECURITY	I	191ITV31	Cryptocurrency and Blockchain Technologies		2	0	2	3
	II	191ITV32	Cryptography and Cyber Security		3	0	0	3
	III	191ITV33	Digital and Mobile Forensics		2	0	2	3
	IV	191ITV34	Ethical Hacking		2	0	2	3
	V	191ITV35	Modern Cryptography		2	0	2	3
	VI	191ITV36	Network Security		2	0	2	3
	VII	191ITV37	Security and Privacy in Cloud		2	0	2	3
	VIII	191ITV38	Social Network Security		2	0	2	3
			TOTAL		**17**	**0**	**14**	**24**

COURSE NAME:CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES L   T   P   C

COURSE CODE:191ITV31   **2   0   2   3**

COURSE OBJECTIVES:
● To understand the basics of Blockchain
● To learn Different protocols and consensus algorithms in Blockchain
● To learn the Blockchain implementation frameworks
● To understand the Blockchain Applications
● To experiment the Hyperledger Fabric, Ethereum networks

UNIT I INTRODUCTION TO BLOCKCHAIN   7
Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain
and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of
a hash function-Hash pointer and Merkle tree

UNIT II   BITCOIN AND CRYPTOCURRENCY   6
A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for
Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block
propagation and block relay

UNIT III   BITCOIN CONSENSUS   6
Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem-
Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-
Permissioned model and use cases.

UNIT IV   HYPERLEDGER FABRIC & ETHEREUM   5
Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist
Browser, Ether, Gas, Solidity.

UNIT V   BLOCKCHAIN APPLICATIONS   6
Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management,
Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

30 PERIODS

COURSE OUTCOMES:
CO1: Understand emerging abstract models for Blockchain Technology
CO2: Identify major research challenges and technical gaps existing between theory and practice in the   crypto
currency domain.
CO3: It provides conceptual understanding of the function of Blockchain as a method of securing   distributed
ledgers, how consensus on their contents is achieved, and the new applications that they are enabled.
CO4: Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application.

PRACTICAL EXERCISES   **30 PERIODS**

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
3. Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan

TOTAL: 60 PERIODS

TEXT BOOKS
1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly 2014.

REFERENCES:
1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

COURSE NAME:CRYPTOGRAPHY AND CYBER SECURITY	L	T	P	C

COURSE CODE:191ITV32	3	0	0	3

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

UNIT I   INTRODUCTION TO SECURITY   9

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

UNIT II   SYMMETRIC CIPHERS   9

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

UNIT III   ASYMMETRIC CRYPTOGRAPHY   9

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

UNIT IV   INTEGRITY AND AUTHENTICATION ALGORITHMS   9

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

UNIT V CYBER CRIMES AND CYBER SECURITY 9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications.

CO5: Understand various cyber crimes and cyber security.

TEXT BOOKS

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

.
REFERENCES

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

COURSE NAME: DIGITAL AND MOBILE FORENSIC	L	T	P	C
COURSE CODE:191ITV33	2	0	2	3

COURSE OBJECTIVES:
- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

UNIT I   INTRODUCTION TO DIGITAL FORENSICS   6
Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II   DIGITAL CRIME AND INVESTIGATION   6
Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods forCollecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III DIGITAL FORENSIC READINESS   6
Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS   6
Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System –Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – OxygenForensics – MobilEdit – iCloud

UNIT V   ANDROID FORENSICS   6
Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

30 PERIODS

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

CO1: Have knowledge on digital forensics.
CO2: Know about digital crime and investigations.
CO3: Be forensic ready.
CO4: Investigate, identify and extract digital evidence from iOS devices.
CO5: Investigate, identify and extract digital evidence from Android devices.

LAB EXPERIMENTS: **30 PERIODS**

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

TOTAL : 60 PERIODS

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

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

COURSE CODE:191ITV34   2   0   2   3

COURSE OBJECTIVES:
- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I   INTRODUCTION   6
Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II   FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS   6
Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III   ENUMERATION AND VULNERABILITY ANALYSIS   6
Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Os

UNIT IV   SYSTEM HACKING   6
Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade -

UNIT V   NETWORK PROTECTION SYSTEMS   6
Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis   Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network- Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expand the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage
FOCA : http://www.informatica64.com/foca.aspx.
Nessus : http://www.tenable.com/products/nessus.
Wireshark : http://www.wireshark.org.
Armitage : http://www.fastandeasyhacking.com/.
Kali or Backtrack Linux, Metasploitable, Windows XP

COURSE OUTCOMES:
At the end of this course, the students will be able:
CO1: To express knowledge on basics of computer based vulnerabilities
CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.
CO3 To demonstrate the enumeration and vulnerability analysis methods
CO4: To gain knowledge on hacking options available in Web and wireless applications.
CO5: To acquire knowledge on the options for network protection.
CO6: To use tools to perform ethical hacking to expose the vulnerabilities.

                                                                TOTAL:60 PERIODS
TEXTBOOKS
1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

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

COURSE NAME: MODERN CRYPTOGRAPHY   **L   T   P   C**

COURSE CODE:191ITV35   2   0   2   3

COURSE OBJECTIVES:
- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

UNIT I   INTRODUCTION   6
Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions.
Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI,
Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption. Goldreich-Levin Theorem: Relation
between Hardcore Predicates and Trap-door permutations.

UNIT II   FORMAL NOTIONS OF ATTACKS   6
Attacks under Message Indistinguishability: Chosen Plaintext Attack (IND-CPA), Chosen Ciphertext Attacks
(IND-CCA1 and IND-CCA2), Attacks under Message Non-malleability: NM-CPA and NMCCA2,
Inter-relations among the attack model

UNIT III   RANDOM ORACLES   6
Provable Security and asymmetric cryptography, hash functions. One-way functions: Weak and Strong one-way
functions. Pseudo-random Generators (PRG): Blum-Micali-Yao Construction,Construction of more powerful
PRG, Relation between One-way functions and PRG, Pseudorandom Functions (PRF)

UNIT IV   BUILDING A PSEUDORANDOM PERMUTATION   6
The LubyRackoff Construction: Formal Definition, Application of the LubyRackoff Construction to the
construction of Block Ciphers, The DES in the light of LubyRackoff Construction
.
UNIT V   MESSAGE AUTHENTICATION CODES   6
Left or Right Security (LOR). Formal Definition of Weak and Strong MACs, Using a PRF as a MAC, Variable
length MAC. Public Key Signature Schemes: Formal Definitions, Signing and Verification, Formal Proofs of
Security of Full Domain Hashing. Assumptions for Public Key Signature Schemes: One-way functions Imply
Secure One-time Signatures. Shamir's Secret Sharing Scheme. Formally Analyzing Cryptographic Protocols. Zero
Knowledge Proofs and Protocols.

                                                                    30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Implement Feige-Fiat-Shamir identification protocol.
2. Implement GQ identification protocol.
3. Implement Schnorr identification protocol.
4. Implement Rabin one-time signature scheme.
5. Implement Merkle one-time signature scheme.
6. Implement Authentication trees and one-time signatures.
7. Implement GMR one-time signature scheme

COURSE OUTCOMES:
CO1: Interpret the basic principles of cryptography and general cryptanalysis.
CO2: Determine the concepts of symmetric encryption and authentication.
CO3: Identify the use of public key encryption, digital signatures, and key establishment.
CO4: Articulate the cryptographic algorithms to compose, build and analyze simple cryptographic solutions.
CO5: Express the use of Message Authentication Codes.

TOTAL:60 PERIODS

TEXT BOOKS:
1.Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag.
2.Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition)

REFERENCES:
1.ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

COURSE NAME: NETWORK SECURITY   **L   T   P   C**

COURSE CODE:191ITV36	**2**	**0**	**2**	**3**

COURSE OBJECTIVES:
- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

UNIT I   INTRODUCTION   8
Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II   KEY MANAGEMENT AND AUTHENTICATION   7
Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III   ACCESS CONTROL AND SECURITY   4
Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT IV   APPLICATION LAYER SECURITY   5
Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT V   SECURITY PRACTICES   6
Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Implement symmetric key algorithms
2. Implement asymmetric key algorithms and key exchange algorithms
3. Implement digital signature schemes
4. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
5. Check message integrity and confidentiality using SSL
6. Experiment Eavesdropping, Dictionary attacks, MITM attacks
7. Experiment with Sniff Traffic using ARP Poisoning
8. Demonstrate intrusion detection system using any tool.
9. Explore network monitoring tools
10. Study to configure Firewall, VPN

COURSE OUTCOMES:
At the end of this course, the students will be able:
CO1: Classify the encryption techniques
CO2: Illustrate the key management technique and authentication.
CO3 Evaluate the security techniques applied to network and transport layer
CO4: Discuss the application layer security standards.
CO5: Apply security practices for real time applications.

TOTAL:60 PERIODS

TEXT BOOKS:
 1.Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014,   Pearson, ISBN 13:9780133354690.

REFERENCES:
 1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
 2. Linux ip tables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978- 0596005696.
 3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327- 141-1.
 4. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
 5.The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

COURSE NAME :SECURITY AND PRIVACY IN CLOUD	L	T	P	C
COURSE CODE:191ITV37	2	0	2	3

COURSE OBJECTIVES:
- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I   FUNDAMENTALS OF CLOUD SECURITY CONCEPTS   7
Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II   SECURITY DESIGN AND ARCHITECTURE FOR CLOUD   6
Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III   ACCESS CONTROL AND IDENTITY MANAGEMENT   6
Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention

UNIT IV   CLOUD SECURITY DESIGN PATTERNS   6
Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V   MONITORING, AUDITING AND MANAGEMENT   5
Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. simulate resource management using cloud sim
3. simulate log forensics using cloud sim
4. simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization,etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario
9. implement an attribute-based access control mechanism based on a particular scenario
10. Develop a log monitoring system with incident management in the cloud

COURSE OUTCOMES:
CO1: Understand the cloud concepts and fundamentals.
CO2: Explain the security challenges in the cloud.
CO3: Define cloud policy and Identity and Access Management.
CO4: Understand various risks and audit and monitoring mechanisms in the cloud.
CO5: Define the various architectural and design considerations for security in the cloud.
                                                              TOTAL:60 PERIODS
TEXTBOOKS
1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, ―Cloud Computing:‖, Wiley 2013
2. Dave shackleford, ―Virtualization Security‖, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, ―Cloud Security and Privacy‖, O'REILLY 2011
REFERENCES
1. Mark C. Chu-Carroll ―Code in the Cloud‖,CRC Press, 2011
2.Mastering Cloud Computing Foundations and Applications Programming RajkumarBuyya Christian Vecchiola, S. ThamaraiSelvi

COURSE CODE:191ITV38   2   0   2   3

COURSE OBJECTIVES:
- To develop semantic web related simple applications
- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

UNIT I   FUNDAMENTALS OF SOCIAL NETWORKING   6
Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

UNIT II   SECURITY ISSUES IN SOCIAL NETWORKS   6
The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world

UNIT III   EXTRACTION AND MINING IN SOCIAL NETWORKING DATA   6
Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy

UNIT IV   PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES   6
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, What is Neo4j, Nodes, Relationships, Properties.

UNIT V   ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT   6
Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning
                                                   30 PERIODS

COURSE OUTCOMES:
CO1: Develop semantic web related simple applications
CO2 : Address Privacy and Security issues in Social Networking
CO3: Explain the data extraction and mining of social networks
CO4: Discuss the prediction of human behavior in social communities
CO5: Describe the applications of social networks

PRACTICAL EXERCISES: **30 PERIODS**
1. Design own social media application
2. Create a Network model using Neo4j

3. Read and write Data from Graph Database
4. Find "Friend of Friends" using Neo4j
5. Implement secure search in social media
6. Create a simple Security & Privacy detector

TOTAL:60 PERIODS

TEXT BOOKS

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. BorkoFurht, Handbook of Social Network Technologies and Application, First Edition,Springer, 2010.
3. Learning Neo4j 3.x Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

REFERENCES

1. Easley D. Kleinberg J., Networks, Crowds, and Markets – Reasoning about a Highly Connected World‖, Cambridge University Press, 2010.
2. Jackson, Matthew O., Social and Economic Networks‖, Princeton University Press, 2008.
3. GuandongXu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking -Techniques and applications‖, First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling‖, IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009.

VERTICALS IV - CREATIVE MEDIA

Verticals			Course Code	Name of the Course	Category	L	T	P	Credits
IV CREATIVE MEDIA		I	191ITV41	Augmented Reality / Virtual Reality		2	0	2	3
		II	191ITV42	Digital marketing		2	0	2	3
		III	191ITV43	Game Development		2	0	2	3
		IV	191ITV44	Multimedia and Animation		2	0	2	3
		V	191ITV45	Multimedia Data Compression and Storage		2	0	2	3
		VI	191ITV46	UI and UX Design		2	0	2	3
		VII	191ITV47	Video Creation and Editing		2	0	2	3
		VIII	191ITV48	Visual Effects		2	0	2	3
				TOTAL		**16**	**0**	**16**	**24**

COURSE CODE: 191ITV41   **2   0   2   3**

COURSE OBJECTIVES:
- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in thedevelopment of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications

UNIT I   INTRODUCTION   7
Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectoriesand Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies- Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II   VR MODELING   6
Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III   VR PROGRAMMING   6
VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV   APPLICATIONS   6
Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications - Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR inRobotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V   AUGMENTED REALITY   5
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation- Navigation-Wearable devices.

30 PERIODS

PRACTICAL EXERCISES:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply texturesover them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobileapplications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating fullhaptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtualwalkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of AR and VR

CO2: Understand the tools and technologies related to AR/VR

CO3: Know the working principle of AR/VR related Sensor devices

CO4: Design of various models using modeling techniques

CO5: Develop AR/VR applications in different domains

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VRexperiences for mobile", Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", AddisonWesley, 2016
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application,Design", Morgan Kaufmann, 2003.

COURSE NAME: DIGITAL MARKETING   **L T P C**

COURSE CODE: 191ITV42   **2 0 2 3**

COURSE OBJECTIVES:

- The primary objective of this module is to examine and explore the role and importance ofdigital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and howits effectiveness can be measured.

UNIT I   INTRODUCTION TO ONLINE MARKET   6
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II   SEARCH ENGINE OPTIMISATION   6
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement.

UNIT III   E- MAIL MARKETING   6
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting.

UNIT IV   SOCIAL MEDIA MARKETING   6
Social Media Marketing - Social Media Channels- Leveraging Social media for brandconversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V   DIGITAL TRANSFORMATION   6
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

30 PERIODS

PRACTICAL EXERCISES:
1. Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aidwith the branding of the company and how it aids its potential customer segments.
2. Perform keyword search for a skincare hospital website based on search volume andcompetition using Google keyword planner tool.
3. Demonstrate how to use the Google WebMasters Indexing API

4. Discuss an interesting case study regarding how an insurance company manages leads.
5. Discuss negative and positive impacts and ethical implications of using social media forpolitical advertising.
6. Discuss how Predictive analytics is impacting marketing automation.

30 PERIODS

COURSE OUTCOMES:
CO1: To examine and explore the role and importance of digital marketing in today'srapidly changing business environment.
CO2: To focuses on how digital marketing can be utilized by organizations and how itseffectiveness can be measured.
CO3: To know the key elements of a digital marketing strategy.
CO4: To study how the effectiveness of a digital marketing campaign can be measured
CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO,SEM, Social media and Blogs.

TOTAL: 60 PERIODS

TEXT BOOKS
1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education;
2. First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education.

COURSE NAME: GAME DEVELOPMENT   **L T P C**
COURSE CODE: 191ITV43   **2 0 2 3**

COURSE OBJECTIVES:
- To know the basics of 2D and 3D graphics for game development.

- To know the stages of game development.
- To understand the basics of a game engine.
- To survey the gaming development environment and tool kits.
- **To learn and develop simple games using Pygame environment**

UNIT I   **3D GRAPHICS FOR GAME DESIGN**   **6**

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II   **GAME DESIGN PRINCIPLES**   **6**

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III   **GAME ENGINE DESIGN**   **6**

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV   **OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS**   **6**

**Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, UnitySingle
player and Multi-Player games.**

UNIT V   **GAME DEVELOPMENT USING PYGAME**   **6**

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games – Puzzle Games.

30 PERIODS

COURSE OUTCOMES:
CO1:Explain the concepts of 2D and 3d Graphics
CO2:Design game design documents.
CO3:Implementation of gaming engines.
CO4:Survey gaming environments and frameworks.
CO5:Implement a simple game in Pygame.

EXPERIMENTS:

1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI.
   Conceptualize the theme for a 2D game.

2. Character design, sprites, movement and character control
3. Level design: design of the world in the form of tiles along with interactive and collectibleobjects.
4. Design of interaction between the player and the world, optionally using the physicsengine.
5. Developing a 2D interactive using Pygame
6. Developing a Puzzle game
7. Design of menus and user interaction in mobile platforms.
8. Developing a 3D Game using Unreal
9. Developing a Multiplayer game using unity

30 PERIODS
TOTAL: 60 PERIODS

REFERENCES

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: A Platform AgnosticApproach", Addison Wesley,2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice to Professional", Apress,2007.
3. Paul Craven, "Python Arcade games", Apress Publishers,2016.
4. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics", Second Edition, CRC Press,2006.
5. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011.

COURSE NAME: MULTIMEDIA AND ANIMATION   **L T P C**
COURSE CODE: 191ITV44   **2 0 2 3**
COURSE OBJECTIVES:
- To grasp the fundamental knowledge of Multimedia elements and systems

- To get familiar with Multimedia file formats and standards
- To learn the process of Authoring multimedia presentations
- To learn the techniques of animation in 2D and 3D and for the mobile UI
- To explore different popular applications of multimedia

UNIT I   **INTRODUCTION TO MULTIMEDIA**   **6**

Definitions, Elements, Multimedia Hardware and Software, Distributed multimedia systems, challenges: security, sharing / distribution, storage, retrieval, processing, computing. Multimedia metadata, Multimedia databases, Hypermedia, Multimedia Learning.

UNIT II   **MULTIMEDIA FILE FORMATS AND STANDARDS**   **6**

File formats – Text, Image file formats, Graphic and animation file formats, Digital audio and Video file formats, Color in image and video, Color Models. Multimedia data and file formats for the web.

UNIT III   **MULTIMEDIA AUTHORING**   **6**

Authoring metaphors, Tools Features and Types: Card and Page Based Tools, Icon and Object Based Tools, Time Based Tools, Cross Platform Authoring Tools, Editing Tools,Painting and Drawing Tools, 3D Modeling and Animation Tools, Image Editing Tools, audio Editing Tools, Digital Movie Tools, Creating interactive presentations, virtual learning,simulations.

UNIT IV   **ANIMATION**   **6**

Principles of animation: staging, squash and stretch, timing, onion skinning, secondary action, 2D,2 ½ D, and 3D animation, Animation techniques: Keyframe, Morphing, Inverse Kinematics, Hand Drawn, Character rigging, vector animation, stop motion, motion graphics, , Fluid Simulation, skeletal animation, skinning Virtual Reality, Augmented Reality.

UNIT V   **MULTIMEDIA APPLICATIONS**   **6**

Multimedia Big data computing, social networks, smart phones, surveillance, Analytics, Multimedia Cloud Computing, Multimedia streaming cloud, media on demand, security and forensics, Online social networking, multimedia ontology, Content based retrieval from digital libraries.

30 PERIODS

LIST OF EXPERIMENTS:
Working with Image Editing tools:

Install tools like GIMP/ InkScape / Krita / Pencil and perform editing operations:

Ø Use different selection and transform tools to modify or improve an image

Ø **Create logos and banners for home pages of websites.**

Working with Audio Editing tools:

Ø **Install tools like, Audacity / Ardour for audio editing, sound mixing and special effects like fade-in or fade-out etc.,**

Ø **Perform audio compression by choosing a proper codec.**

Working with Video Editing and conversion tools:
Install tools like OpenShot / Cinelerra / HandBrake for editing video content.

Ø **Edit and mix video content, remove noise, create special effects, add captions.**

Ø **Compress and convert video file format to other popular formats.**

Working with web/mobile authoring tools:

Adapt / KompoZer/ BlueGriffon / BlueFish / Aptana Studio/ NetBeans / WordPress /ExpressionWeb:

Ø **Design simple Home page with banners, logos, tables quick links etc**

Ø **Provide a search interface and simple navigation from the home page to the inside pages of thewebsite.**

Ø **Design Responsive web pages for use on both web and mobile interfaces.**

Working with Animation tools:
Install tools like, Krita, Wick Editor, Blender:

Ø **Perform a simple 2D animation with sprites**

Ø **Perform simple 3D animation with keyframes, kinematics**

- Working with Mobile UI animation tools: Origami studio / Lottie / Framer etc.,

Working with E-Learning authoring tools:

Install tools like EdApp / Moovly / CourseLab/ IsEazy and CamStudio/Ampache, VideoLAN:

Ø **Demonstrate screen recording and further editing for e-learning content.**

Ø **Create a simple E-Learning module for a topic of your choice.**
Creating VR and AR applications:

Ø **Any affordable VR viewer like Google Cardboard and any development platform likeOpenspace 3D / ARCore etc.**

Note: all tools listed are open source. Usage of any proprietary tools in place of open source toolsis not restricted.

30 PERIODS
TOTAL: 60 PERIODS

WEB REFERENCES:

1. https://itsfoss.com/
2. https://www.ucl.ac.uk/slade/know/3396
3. https://handbrake.fr/

4. https://opensource.com/article/18/2/open-source-audio-visual-production-tools
   https://camstudio.org/
5. https://developer.android.com/training/animation/overview
6. https://developer.android.com/training/animation/overview (UNIT-IV)

COURSE OUTCOMES:

- Get the bigger picture of the context of Multimedia and its applications
- Use the different types of media elements of different formats on content pages
- Author 2D and 3D creative and interactive presentations for different target multimediaapplications.
- Use different standard animation techniques for 2D, 21/2 D, 3D applications
- Understand the complexity of multimedia applications in the context of cloud, security,bigdata streaming, social networking, CBIR etc.,

TEXT BOOKS:

1. Ze-Nian Li, Mark S. Drew, Jiangchuan Liu, Fundamentals of Multimedia", Third Edition,Springer Texts in Computer Science, 2021. (UNIT-I, II, III)

REFERENCES:

1. John M Blain, The Complete Guide to Blender Graphics: Computer Modeling & Animation,CRC press, 3rd Edition, 2016.
2. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press,2018.
3. Prabhat K.Andleigh, Kiran Thakrar,   "Multimedia System Design", PearsonEducation, 1st Edition, 2015.
4. Mohsen Amini Salehi, Xiangbo Li, "Multimedia Cloud Computing Systems", SpringerNature, 1st Edition, 2021.
5. Mark Gaimbruno, "3D Graphics and Animation", Second Edition, New Riders, 2002.
6. Rogers David, "Animation: Master – A Complete Guide (Graphics Series)", Charles RiverMedia, 2006.
7. Rick parent, "Computer Animation: Algorithms and Techniques", Morgan Kauffman, 3rdEdition, 2012.

COURSE NAME: MULTIMEDIA DATA COMPRESSION AND STORAGE L T P C

COURSE CODE: 191ITV45   2   0   2   3

COURSE OBJECTIVES:

- To understand the basics of compression techniques
- To understand the categories of compression for text, image and video
- To explore the modalities of text, image and video compression algorithms
- To know about basics of consistency of data availability in storage devices

- To understand the concepts of data streaming services

UNIT I   BASICS OF DATA COMPRESSION   6
Introduction —Lossless and LossyCompression– Basics of Huffmann coding- Arithmetic coding-
Dictionary techniques- Context based compression – Applications

UNIT II   IMAGE COMPRESSION   6
Lossless Image compression – JPEG-CALIC-JPEG LS-Prediction using conditional averages – Progressive
Image Transmission – Lossless Image compression formats – Applications - Facsimile encoding

UNIT III   VIDEO COMPRESSION   6
Introduction – Motion Compensation – Video Signal Representation – H.261 – MPEG-1- MPEG-2- H.263.

UNIT IV   DATA PLACEMENT ON DISKS   6
Statistical placement on Disks – Striping on Disks – Replication Placement on Disks – Constraint allocation
on Disks – Tertiary storage Devices – Continuous Placement on Hierarchical storage system – Statistical
placement on Hierarchical storage systems – Constraint allocation on Hierarchical storage system

UNIT V   DISK SCHEDULING METHODS   6
Scheduling methods for disk requests – Feasibility conditions of concurrent streams– Scheduling methods
for request streams

30 PERIODS

LIST OF EXPERIMENTS
1. Construct Huffman codes for given symbol probabilities.
2. Encode run lengths with fixed-length code.
3. Lempel-Ziv algorithm for adaptive variable-length encoding
4. Compress the given word using arithmetic coding based on the frequency of the letters.
5. Write a shell script, which converts all images in the current directory in JPEG.
6. Write a program to split images from a video without using any primitives.
7. Create a photo album of a trip by applying appropriate image dimensions and format.
8. Write the code for identifying the popularity of content retrieval from media server.
9. Write the code for ensuring data availability in disks using strip based method.
10. Program for scheduling requests for data streams.

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:

CO1: Understand the basics of text, Image and Video compression
CO2: Understand the various compression algorithms for multimedia content
CO3: Explore the applications of various compression techniques
CO4: Explore knowledge on multimedia storage on disks
CO5: Understand scheduling methods for request streams

TEXT BOOKS

1. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Series in MultimediaInformation and Systems, 2018, 5th Edition.
2. Philip K.C.Tse, Multimedia Information Storage and Retrieval: Techniques and Technologies, 2008

REFERENCES

1. David Salomon, A concise introduction to data compression, 2008.
2. Lenald Best, Best's Guide to Live Stream Video Broadcasting, BCB Live Teaching series,2017.
3. Yun-Qing Shi, Image And Video Compression For Multimedia Engineering FundamentalsAlgorithms And Standards, Taylor& Francis,2019
4. Irina Bocharova, Compression for Multimedia, Cambridge University Press; 1st edition,2009.

COURSE NAME: UI AND UX DESIGN   **L T P C**
COURSE CODE: 191ITV46   **2 0 2 3**

COURSE OBJECTIVES:
- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I   FOUNDATIONS OF DESIGN   6
UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming

and Game storming - Observational Empathy

UNIT II   FOUNDATIONS OF UI DESIGN   6
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

UNIT III   FOUNDATIONS OF UX DESIGN   6
Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

UNIT IV   WIREFRAMING, PROTOTYPING AND TESTING   6
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE   6
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

30 PERIODS

LIST OF EXPERIMENTS
1. Designing a Responsive layout for an societal application
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wireflow diagram for application using open source software
5. Exploring various open source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Brainstorming feature for proposed product
8. Defining the Look and Feel of the new Project
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UIprinciples)
10. Identify a customer problem to solve
11. Conduct end-to-end user research - User research, creating personas, Ideation process (Userstories,

Scenarios), Flow diagrams, Flow Mapping

12. Sketch, design with popular tool and build a prototype and perform usability testing andidentify improvements

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1:Build UI for user Applications
CO2:Evaluate UX design of any product or application
CO3:Demonstrate UX Skills in product development
CO4:Implement Sketching principles
CO5:Create Wireframe and Prototype

TEXT BOOKS
1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly2021

REFERENCES
1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition ,O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web &Mobile", Third Edition, 2015
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature.

COURSE NAME: VIDEO CREATION AND EDITING   L T P C
COURSE CODE: 191ITV47   2 0 2 3

COURSE OBJECTIVES:

- To introduce the broad perspective of linear and nonlinear editing concepts.
- To understand the concept of Storytelling styles.
- To be familiar with audio and video recording. To apply different media tools.
- To learn and understand the concepts of AVID XPRESS DV 4.

UNIT I   **FUNDAMENTALS**   **6**

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks

associated with altering reality through editing.

UNIT II   STORYTELLING   6

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III   USING AUDIO AND VIDEO   6

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV   WORKING WITH FINAL CUT PRO   6

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V   WORKING WITH AVID XPRESS DV 4   6

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

30 PERIODS

LIST OF EXPERIMENTS

1. Write a Movie Synopsis (Individual/Team Writing)
2. Present team stories in class.
3. Script/Storyboard Writing(Individual Assignment)
4. Pre-Production: Personnel, budgeting, scheduling, location scouting, casting, contracts &agreements
5. Production: Single camera production personnel & equipment, Documentary Production
6. Writing The Final Proposal: Overview, Media Treatments, Summary, Pitching
7. Write Documentary & Animation Treatment
8. Post-production: Editing, Sound design, Finishing

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to:
CO1:Compare the strengths and limitations of Nonlinear editing.
CO2:Identify the infrastructure and significance of storytelling.
CO3:Apply suitable methods for recording to CDs and VCDs. CO4:Address the core issues of advanced editing and training techniques.
CO5:Design and develop projects using AVID XPRESS DV 4

TEXT BOOKS

1. Avid Xpress DV 4 User Guide, 2007.
2. Final Cut Pro 6 User Manual, 2004.
3. Keith Underdahl, "Digital Video for Dummies", Third Edition, Dummy Series, 2001.
4. Robert M. Goodman and Partick McGarth, "Editing Digital Video: The Complete Creativeand Technical Guide", Digital Video and Audio, McGraw – Hill 2003.

COURSE NAME: VISUAL EFFECTS   **L T P C**
COURSE CODE: 191ITV48   **2 0 2 3**

COURSE OBJECTIVES
- To get a basic idea on animation principles and techniques
- To get exposure to CGI, color and light elements of VFX
- To have a better understanding of basic special effects techniques
- To have a knowledge of state of the art vfx techniques
- To become familiar with popular compositing techniques

UNIT I   ANIMATION BASICS   6

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation,

limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II   CGI, COLOR, LIGHT   6

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model

UNIT III   SPECIAL EFFECTS   6

Special Effects – props, scaled models, animatronics, pyrotechniques, Schüfftan process, Particle effects – wind, rain, fog, fire

UNIT IV   VISUAL EFFECTS TECHNIQUES   6

Motion Capture, Matt Painting, Rigging, Front Projection.Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving

UNIT V   COMPOSITING   6

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

30 PERIODS

Laboratory Experiments:

Using Natron:

- Understanding Natron Environment:
- Working with color and using color grading
- using Channels
- Merging images
- Using Rotopaint
- performing Tracking and stabilizing
- Transforming elements
- Stereoscopic compositing

Using Blender:

Ø Motion Tracking – camera and object tracking
Ø Camera fx, color grading, vignettes
Ø Compositing images and video files
Ø Multilayer rendering

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1: To implement animation in 2D / 3D following the principles and techniques
CO2: To use CGI, color and light elements in VFX applications
CO3: To create special effects using any of the state of the art tools
CO4: To apply popular visual effects techniques using advanced tools
CO5: To use compositing tools for creating VFX for a variety of applications

TEXT BOOKS:

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES:

1. Jon Gress, "Digital Visual Effects and Compositing", New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics", Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, "Introduction to Visual Effects A Computational Approach", Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, "Lighting for Animation: The art of visual storytelling
   , Routledge, 1st Edition, 2016.
5. Eran Dinur, "The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, " The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures", Third Edition, 2020.and Games", Routledge, 1st Edition, 2022.
7. https://www.blender.org/features/vfx/
8. https://natrongithub.github.io/

VERTICALS - V QUANTUM COMPUTING

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
V	I	191ITV51	Physics to Quantum Computing		3	0	0	3
	II	191ITV52	Quantum Circuits		3	0	0	3

QUANTUM COMPUTING								
	III	191ITV53	Quantum Computer Systems design		3	0	0	3
	IV	191ITV54	Quantum Computing Architecture and Algorithms		3	0	0	3
	V	191ITV55 -	Quantum Information		3	0	0	3
	VI	191ITV56	Quantum Internet		3	0	0	3
	VII	191ITV57	Quantum machanics and atoms		3	0	0	3
	VIII	191ITV58	Quantum ML		3	0	0	3
			TOTAL		**24**	**0**	**0**	**24**

COURSE NAME: PHYSICS TO QUANTUM COMPUTING
COURSE CODE: 191ITV51

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	**PHOTONS AND WAVE-PARTICLE DUALITY**				9

Introduction–Young's Double Slit Experiment– Photoelectric effect: Einstein's Quanta – Experiment of Aspect and Collaborators-Properties of Photon-A Diffraction Experiments with Photons-Young's Double-Slit Experiment Revisited- Three Rules of Quantum Mechanics- Two-Slit Which-Way Experiment.

UNIT-II	**THE MACHINERY OF QUANTUM MECHANICS**				9

Introduction–Schrodinger's Equation–Observables-Spectral Theory–Dirac Notation.

UNIT-III	MEASUREMENT	9

Introduction–VON Neumann Measurement-Uncertainty Principle–No-Cloning Theorem– Quantum Zero Effect.

UNIT-IV	INTERACTION FREE MEASUREMENTS	9

Introduction-Seeing in the Dark: Conceptual Scheme-Elitzur-Vaidman Scheme- Optimal Interaction-Free Measurements..

UNIT-V	EPR PARADOX	9

Introduction–Hallmarks of Physical Theories–EPR and Reality–Bell's Theorem- Mermin's Reality Machine.

TEXTBOOKS

1. Reinhold Blumel.,"Foundations of Quantum Mechanics-From Photons to Quantum Computers"formation", Jones nad Bartlett Publishers, Sudbury, Massachusetts,2010

COURSE NAME: QUANTUM CIRCUITS
COURSE CODE: 191ITV52

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	INTRODUCTION				9

Introduction– Quantum Mechanics and Quantum Logic- Quantum Computation and Circuit Desgn- Boolean Logic – Quantum Logic- Qubits and Measurements- Quantum Operations-Quantum Circuit and Gate Libraries.

UNIT-II	REPRESENTATION OF QUANTUM FUNCTIONALITY	9

From Conventional to Quantum Logic–Decision Diagrams for Quantum Logic – Binary Decision Diagram-Quantum Decision Diagram- Characteristics Function- Quantum Multiple Valued Decision Diagrams- Basic concepts- Formal Definition- Canonicity- Construction and Manipulation-Changing the variable order.

UNIT-III	CHALLENGES AND INITIAL APPROACHES	9

Design Challenges–Initial Synthesis Approaches- Synthesis of Boolean Components- Synthesis of Arbitrary Quantum Functionality.

UNIT-IV	SYNTHESIS OF QUANTUM CIRCUIT	9

Synthesis of Boolean Components, Embedding: Handling Irreversible Function Descriptions- Constructions of QMDDs for Boolean Functions- QMDD-Based Synthesis of Reversible Circuits-Synthesis of Clifford Group Operatons-Concepts of the Synthesis Approach- Algorithm- Theoretical Analysis- Experimental Results.

UNIT-V	CORRECTNESS OF MULTIPLE-VALUED IMPLEMENTATIONS	9

Multi-lelvel Quantum Systems–Equivalence Checking in Multi-level Quantum Systems- Functional Equivalence of Quantum Operations-Proposed Equivalence Checking Schemen- Implementation Using QMDDs.

TEXTBOOKS
1. Philipp iemann, Robert Wille,"Compact Representations for the Design of Quantum Logic", Springer ,2017

COURSE NAME: QUANTUM COMPUTER SYSTEMS DESIGN
COURSE CODE: 191ITV53
COURSE OBJECTIVES:
- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantumcomputation.
- To learn the basics of quantum information and the theory behind it.

SYLLABUS	L	T	P	C
	3	0	0	3

UNIT-I	QUANTUM COMPUTING BASIC CONCEPTS	6
	Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions	
UNIT-II	QUANTUM GATES AND CIRCUITS	5
	Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction	
UNIT-III	QUANTUM ALGORITHMS	7
	Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm	
UNIT-IV	QUANTUM INFORMATION THEORY	6
	Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantumnoiseless channel coding theorem - Classical information over noisy quantum channels	
UNIT-V	QUANTUM CRYPTOGRAPHY	6
	Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm -Quantum Key Distribution - BB84 - Ekart 91.	

30 PERIODS

PRACTICAL EXERCISES
1. Single qubit gate simulation - Quantum Composer
2. Multiple qubit gate simulation - Quantum Composer
3. Composing simple quantum circuits with q-gates and measuring the output into classicalbits.
4. IBM Qiskit Platform Introduction
5. Implementation of Shor's Algorithms
6. Implementation of Grover's Algorithm
7. Implementation of Deutsch's Algorithm
8. Implementation of Deutsch-Jozsa's Algorithm
9. Integer factorization using Shor's Algorithm

10. QKD Simulation	**30**
11. Mini Project such as implementing an API for efficient search using Grover's Algorithms	**PERIODS**

TOTAL:60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand the basics of quantum computing.
CO2: Understand the background of Quantum Mechanics.
CO3: Analyze the computation models.
CO4: Model the circuits using quantum computation.environments and frameworks.
CO5: Understand the quantum operations such as noise and error–correction.

TEXTBOOKS:
1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computingfor Everyone".

REFERENCES
1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press,2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge UniversityPress, 2007.

NAME: QUANTUM COMPUTING ARCHITECTURE AND ALGORITHMS
COURSE CODE: 191ITV54

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	QUANTUM ARCHITECTURES				9

Bits Vs Qubits–Reliable and realistic implementation technology– Robust Error Correction and Fault –Tolerant Structures-Quantum Resource Distribution-Simulation of Error Propagation- Stabilizer Method for Quantum Simulation.

UNIT-II	ARCHITECTURAL ELEMENTS	9

Quantum Processing Elements–Quantum Memory Hierarchy–Quantum Addressing Scheme for Classical Memory- Error Correction and Quantum Architecture Design- Teleportation-Based Quantum Architectures.

UNIT-III	QUANTUM ALGORITHMS	9

Quantum Integer Factorization–Order Finding- Quantum Phase Estimation–Eigenvalue Estimation– The Hidden Subgroup Problem- Grover's Algorithm for Quantum Search-Quantum Adiabatic Algorithms.

UNIT-IV	PROGRAMMING THE QUANTUM ARCHITECTURE	9

Physical Level Instruction Scheduling- High Level Compiler Design- Architecture Independent Circuit Synthesis- Mapping Circuits to Architecture- Optimization of the Logical Qubit Tiles.

UNIT-V	ION-TRAP QUANTUM COMPUTER	9

Introduction–Linear Radio-Frequency Ion Trap–Laser Cooling–Cirac-Zoller Scheme-Ca+ Quantum Computere.

TEXTBOOKS

1. Tzvetan. Metodi , Arvin I. Faruque, Frederic T. Chong,"Quantum Computing for Computer Architects", Springer Nature Switzerland, Morgan & Claypool, 2011

COURSE NAME: QUANTUM INFORMATION
COURSE CODE: 191ITV55

SYLLABUS	L	T	P	C
	3	0	0	3

UNIT-I	CLASSICAL INFORMATION THEORY	9
	A very short history–Probabilities and conditional probabilities– Entropy and Information – Information and Thermodynamics-Communication Theory.	

UNIT-II	QUANTUM COMMUNICATION AND QUANTUM KEY DISTRIBUTION	9
	Qubits–Information security–Quantum copying-Optical polarization–Quantum cryptography.	

UNIT-III	GENARALIZED MEASUREMENTS	9
	Ideal vonNeumann measurements–Non-Ideal measurements-Probability operator measures–Optimized measurements– Operations and the post-measurement state.	

UNIT-IV	ENTANGLEMENT AND ITS APPLICATIONS	9
	Entangled states and non-locality-Quantum magic tricks-Ebits and shared entanglement,Quantum dense coding-Teleportation.	

UNIT-V	QUANTUM COMPUTATION	9
	Digital electronics–Principles of quantum computation–Quantum algorithms–Errors and decoherence	

TEXTBOOKS
1. Stephen M. Barnett.,"Introduction to Quantum Information",Oxford University Press,

COUR
SE

NAME: QUANTUM INTERNET
COURSE CODE: 191ITV56

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	QUANTUM NETWORKS				9

Quantum Channels– Quantum Processes- Quantum Process Matrices- Quantum Processes in Quantum Networks-Characterizing Quantum States and Channels-Optical Encoding of Quantum Information- Single Photons- Photon Number- Spatiotemporal- Phase Space- Nonoptical Encoding-Error in Quantum Networks.

UNIT-II	QUANTUM COST VECTOR ANALYSIS AND ROUTING STRATEGIES	9

Quantum Cost Vector Analysis– Costs- Costs as Distance Metrics- Routing Strategies- Single User- Multiple User- Interconnecting and Interfacing Quantum Networks- Optical Interfacing.

UNIT-III	PROTOCOLS FOR QUANTUM INTERNET	9

Optical Routers–Mechanical Switches- Interferometric Switches- Two Channel Two Port Swiches-Multiplexers and Demultiplexers- Single Channel Multiport Swithes- Multichannel Multiport Switches-Crossbar Switches- Optical Stability-State Preparation-Measurement-Evolution- High level Protocols

UNIT-IV	ENTANGLEMENT DISTRIBUTION	9

Entanglement- The Ultimate Quantum Resource- Bell States- GHZ States- Cluster States- Quantum Repeater Networks- First Generation Repeaters- Second Generation Repeaters and Error Correction- Third Generation Repeaters- The Transition to Quantum Netwroks-The Irrelevance of Latency- The Quantum Sneakernet

UNIT-V	QUANTUM CRYPTOGRAPHYAND QUANTUM CLOUD	9

Quantum Cryptography- Quantum Key Distribution- Hybrid Quantum Classical Cryptography- Quantum Anonymous Broadcasting- Quantum Voting- Attacks on Quantum Cryptograpy - Beam Splitter and Photon Number Splitting Attacks- Trojan Horse and Flashback Attacks- Detector Attacks-Quantum Cloud- Outsourced Quantum Computation- Distributed Quantum Computing- Delegated Quantum Computation

TEXTBOOKS

1. Peter P. Rohde,"The Quantum Internet: The Second Quantum Revolution", Cambridge University Press ,2021

COURSE NAME: QUANTUM MECHANICS AND ATOMS
COURSE CODE: 191ITV57

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	**INTRODUCTION**				9
Introduction– The Mass and Size of the Atom- Isotopes- The Nucleus of the AtomRobust Error Correction and Fault –Tolerant Structures-Quantum Resource Distribution-Simulation of Error Propagation- Stabilizer Method for Quantum Simulation.					
UNIT-II	**THE PHOTN, ELECTRON AND WAVES**				9
Wave Character of Light–Thermal Radiation- The Photoelectric Effect, The Compton Effect, Production of Free Electrons, The Charge of Electron, Wave Character of Electron- Some Basic Properties of Matter Waves..					
UNIT-III	**MATHEMATICAL FRAMEWORK OF QUANTUM THEORY**				9
The Particle in a Box–The Schrodinger Equation-The Conceptual Basis of Quantum Theory- Bohr's Model of the Hydrogen Atom.					
UNIT-IV	**QUANTUM MECHANICS OF ATOM**				9
Quantum Mechanics of the Hydrogen Aton, Motion in a central Field, Angular Momentum Eigen functions- The radial Wave functions in a central field, The Radial Wave functions of Hydrogen-Lifting of the Orbital Degeneracy in the Spectra of Alkalai Atoms- Shell Structure, Screening, The Term Diagram- Inner shells.					
UNIT-V	**ATOMS IN MAGNETIC FIELD AND ELECTRIC FIELD**				9
Directional Quantization in a Magnetic Field- Electron Spin Resonance–The Zeeman Effect-Quantum Theory of the Ordinary Zeeman Effect, Quantum Theoretical Treatment of the Electron and Proton Spins-Atoms in Electric Field-Observation of the Stark Effect- Quantum Theory of the Linear and Quadratic Stark Effects-Spin and Photon Echoes..					

TEXTBOOKS
1.   H.Haken, H.C. Wolf,"Atomic and Quantum Physics: An Introduction to the Fundamentals of Experiment and Theory", Springer – Verlag, Berlin Heidelberg , New York ,Tokyo, 1984

COURSE NAME: QUANTUM ML
COURSE CODE: 191ITV58

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	CLUSTERING STRUCTURE AND QUANTUM COMPUTING				9
	Quantum Random Access Memory- Calculating Dot Products- Quantum Principal Component Analysis- Toward Quantum Manifold Embedding- Quantum K-Means- Quantum K-Medians- Quantum Hierarchical Clustering- Computational Complexity.				
UNIT-II	QUANTUM PATTERN RECOGNITION				9
	Quantum Associative Memory- The Quantum Perception- Quantum Neural Networks- Physical Realizations-Computational Complexity.				
UNIT-III	QUANTUM CLASSIFICAITON				9
	Nearest Neighbors- Support Vector Machines with Grover's Search- Support Vector Machines with Exponential Speedup- Computational Complexity				
UNIT-IV	QUANTUM PROCESS TOMOGRAPHY AND REGRESSION				9
	Quantum State Duality- Quantum Process Tomography- Groups- Representation Theory- Parallel Application and Storage of the Unitary- Optimal State for Learning.				
UNIT-V	BOOSTING AND ADIABATIC QUANTUM COMPUTING				9
	Quantum Annealing- Quadratic Unconstrained Binary Optimization- Ising Model- QBoost- Nonconvexity-Sparsity- Bit Depth- Generalization Performance- Mapping to Hardware- Computational Complexity				

TEXTBOOKS
1. Peter Wittek,"Quantum Machine Learning: What Quantum Computing Means to Data Mining ", Elsevier ,2014

VERTICALS - VI - DATA SCIENCE

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
VI DATA SCIENCE	I	191ITV61	Business Analytics		2	0	2	3
	II	191ITV62	Computer Vision		2	0	2	3
	III	191ITV63	Exploratory Data Analysis		2	0	2	3
	IV	191ITV64	Image and Video Analytics		2	0	2	3
	V	191ITV65	Network Security		2	0	2	3
	VI	191ITV66	Neural Networks and Deep Learning		2	0	2	3
	VII	191ITV67	Recommender Systems		2	0	2	3
	VIII	191ITV68	Text and Speech Analysis		2	0	2	3
			TOTAL		**16**	**0**	**16**	**24**

COURSE NAME: BUSINESS ANALYTICS
COURSE CODE: 191ITV61

COURSE OBJECTIVES:
- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

SYLLABUS		L	T	P	C
		2	0	2	3
UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS				6
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration					
UNIT-II	BUSINESS INTELLIGENCE				6
Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions					
UNIT-III	BUSINESS FORECASTING				6
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.					
UNIT-IV	HR & SUPPLY CHAIN ANALYTICS				6
Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.					
UNIT-V	MARKETING & SALES ANALYTICS				6
Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.					

30 PERIODS

LIST OF EXPERIMENTS:
Use MS-Excel and Power-BI to perform the following experiments using a Business data set, andmake presentations.
Students may be encouraged to bring their own real-time socially relevant data set.
I Cycle – MS Excel
1. Explore the features of Ms-Excel.
2. (i) Get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND)
ii) Perform data import/export operations for different file formats.
3. Perform statistical operations - Mean, Median, Mode and Standard deviation, Variance, Skewness, Kurtosis
4. Perform Z-test, T-test & ANOVA
5. Perform data pre-processing operations i) Handling Missing data ii) Normalization
6. Perform dimensionality reduction operation using PCA, KPCA & SVD
7. Perform bivariate and multivariate analysis on the dataset.
8. Apply and explore various plotting functions on the data set.
II Cycle – Power BI Desktop
9. Explore the features of Power BI Desktop
10. Prepare & Load data
11. Develop the data model
12. Perform DAX calculations
13. Design a report
14. Create a dashboard and perform data analysis
15. Presentation of a case study

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30 PERIODS
TOTAL: 60 PERIODS COURSE

</div>

OUTCOMES:

CO1: Explain the real world business problems and model with analytical solutions.

CO2: Identify the business processes for extracting Business Intelligence

CO3 : Apply predictive analytics for business fore-casting

CO4: Apply analytics for supply chain and logistics management

CO5: Use analytics for marketing and sales.

TEXT BOOKS
1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

COURSE NAME: COMPUTER VISION
COURSE CODE: 191ITV62

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

SYLLABUS		L	T	P	C
		2	0	2	3
UNIT-I	INTRODUCTION TO IMAGE FORMATION AND PROCESSING				6
Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.					
UNIT-II	FEATURE DETECTION, MATCHING AND SEGMENTATION				6
Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.					
UNIT-III	FEATURE-BASED ALIGNMENT & MOTION ESTIMATION				6
2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.					
UNIT-IV	3D RECONSTRUCTION				6
Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.					
UNIT-V	IMAGE-BASED RENDERING AND RECOGNITION				6
View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.					

30 PERIODS

LABORATORY EXPERIMENTS:

Software needed:

OpenCV computer vision Library for OpenCV in Python / PyCharm or C++ / Visual Studio or orequivalent

- OpenCV Installation and working with Python
- Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contouranalysis, Bolb detection
- Image Annotation – Drawing lines, text circle, rectangle, ellipse on images
- Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
- Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORBImage features, Feature matching, cloning, Feature matching based image alignment
- Image segmentation using Graphcut / Grabcut
- Camera Calibration with circular grid
- Pose Estimation
- 3D Reconstruction – Creating Depth map from stereo images
- Object Detection and Tracking using Kalman Filter, Camshift

1. docs.opencv.org
2. https://opencv.org/opencv-free-course/

30 PERIODS

TOTAL: 60 PERIODS COURSE

OUTCOMES:

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

CO1: To understand basic knowledge, theories and methods in image processing and computervision.

CO2: To implement basic and some advanced image processing techniques in OpenCV.

CO3: To apply 2D a feature-based based image alignment, segmentation and motion estimations.

CO4: To apply 3D image reconstruction techniques

CO5: To design and develop innovative image processing and computer vision applications.

TEXT BOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts inComputer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education,Second Edition, 2015.

REFERENCES:

1.Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision,Second Edition, Cambridge University Press, March 2004.

2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

COURSE NAME: EXPLORATORY DATA ANALYSIS
COURSE CODE: 191ITV63

COURSE OBJECTIVES:
- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

SYLLABUS	L	T	P	C
	2	0	2	3
UNIT-I **EXPLORATORY DATA ANALYSIS**				6
EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.				
UNIT-II **EDA USING PYTHON**				6
Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.				
UNIT-III **UNIVARIATE ANALYSIS**				6
Introduction to Single variable: Distribution Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality.				
UNIT-IV **BIVARIATE ANALYSIS**				6
Relationships between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines.				
UNIT-V **MULTIVARIATE AND TIME SERIES ANALYSIS**				6
Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time- based indexing – Visualizing – Grouping – Resampling.				

30 PERIODS

PRACTICAL EXERCISES:
1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features inR on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualization techniquesand present an analysis report.

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand the fundamentals of exploratory data analysis.
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS:
1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.(Unit 3,4,5)

REFERENCES:
1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

COURSE NAME: IMAGE AND VIDEO ANALYTICS
COURSE CODE: 191ITV64

COURSE OBJECTIVES:
- To understand the basics of image processing techniques for computer vision.
- To learn the techniques used for image pre-processing.
- To discuss the various object detection techniques.
- To understand the various Object recognition mechanisms.
- To elaborate on the video analytics techniques.

SYLLABUS	L	T	P	C
	2	0	2	3

UNIT-I	INTRODUCTION	6

Computer Vision – Image representation and image analysis tasks - Image representations – digitization – properties – color images – Data structures for Image Analysis - Levels of image data representation - Traditional and Hierarchical image data structures.

UNIT-II	IMAGE PRE-PROCESSING	6

Local pre-processing - Image smoothing - Edge detectors - Zero-crossings of the second derivative - Scale in image processing - Canny edge detection - Parametric edge models - Edges in multi-speralct images - Local pre-processing in the frequency domain - Line detection by local pre-processing operators - Image restoration.

UNIT-III	OBJECT DETECTION USING MACHINE LEARNING	6

Object detection– Object detection methods – Deep Learning framework for Object detection– bounding box approach-Intersection over Union (IoU) –Deep Learning Architectures-R-CNN-Faster R-CNN-You Only Look Once(YOLO)-Salient features-Loss Functions-YOLO architectures

UNIT-IV	FACE RECOGNITION AND GESTURE RECOGNITION	6

Face Recognition-Introduction-Applications of Face Recognition-Process of Face Recognition-DeepFace solution by Facebook-FaceNet for Face Recognition- Implementation using FaceNet-Gesture Recognition.

UNIT-V	VIDEO ANALYTICS	6

Video Processing – use cases of video analytics-Vanishing Gradient and exploding gradient problem-RestNet architecture-RestNet and skip connections-Inception Network-GoogleNet architecture-Improvement in Inception v2-Video analytics-RestNet and Inception v3.

30 PERIODS

LIST OF EXERCISES
1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using thehomogeneity criterion of equal intensity
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e)Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition
7. Write a program for event detection in video surveillance system

30 PERIODS   TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the basics of image processing techniques for computer vision and videoanalysis.

CO2: Explain the techniques used for image pre-processing.

CO3: Develop various object detection techniques.

CO4: Understand the various face recognition mechanisms.

CO5: Elaborate on deep learning-based video analytics.

TEXT BOOK:
1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras,Apress 2021(UNIT-III,IV and V)

REFERENCES
1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education,2003.
4. E. R. Davies, (2012), "Computer & Machine Vision", Fourth Edition, Academic Press.

COURSE NAME: NETWORK SECURITY
COURSE CODE: 191ITV65
COURSE OBJECTIVES:

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

SYLLABUS	L	T	P	C
	2	0	2	3
UNIT-I **INTRODUCTION**				8
Basics of cryptography, conventional and public-key cryptography, hash functions, authentication,and digital signatures.				
UNIT-II **KEY MANAGEMENT AND AUTHENTICATION**				7
Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.				
UNIT-III **ACCESS CONTROL AND SECURITY**				4
Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.				
UNIT-IV **APPLICATION LAYER SECURITY**				5
Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security				
UNIT-V **SECURITY PRACTICES**				6
Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security				

30 PERIODS

LIST OF EXERCISES

1. Implement symmetric key algorithms
2. Implement asymmetric key algorithms and key exchange algorithms
3. Implement digital signature schemes
4. Installation of Wire shark, tcpdump and observe data transferred in client-server communication using UDP/TCP and identify the UDP/TCP datagram.
5. Check message integrity and confidentiality using SSL
6. Experiment Eavesdropping, Dictionary attacks, MITM attacks
7. Experiment with Sniff Traffic using ARP Poisoning
8. Demonstrate intrusion detection system using any tool.
9. Explore network monitoring tools
10. Study to configure Firewall, VPN

30 PERIODS
TOTAL:60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able:
CO1: Classify the encryption techniques
CO2: Illustrate the key management technique and authentication.
CO3 Evaluate the security techniques applied to network and transport layer
CO4: Discuss the application layer security standards.
CO5: Apply security practices for real time applications.

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCES:

1. Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.
2. Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.
3. Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.
4. Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.
5. The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148.

COURSE NAME: NEURAL NETWORKS AND DEEP LEARNING
COURSE CODE: 191ITV66
COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

SYLLABUS	L	T	P	C
	2	0	2	3
UNIT-I **INTRODUCTION**				6
Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.				
UNIT-II **THIRD-GENERATION NEURAL NETWORKS**				6
Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.				
UNIT-III **ACCESS CONTROL AND SECURITY**				6
Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation,Image Compression.				
UNIT-IV **DEEP FEEDFORWARD NETWORKS**				6
History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.				
UNIT-V **RECURRENT NEURAL NETWORKS**				6
Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.				

30 PERIODS

LAB EXPERIMENTS:

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Improve the Deep learning model by fine tuning hyper parameters.
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre trained model on Keras for Transfer Learning
9. Perform Sentiment Analysis using RNN
10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
11. Image generation using GAN

Additional Experiments:
12. Train a Deep learning model to classify a given image using pre trained model
13. Recommendation system from sales data using Deep Learning
14. Implement Object Detection using CNN
15. Implement any simple Reinforcement Algorithm for an NLP problem

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Apply Convolution Neural Network for image processing.
CO2: Understand the basics of associative memory and unsupervised learning networks.
CO3: Apply CNN and its variants for suitable applications.
CO4: Analyze the key computations underlying deep learning and use them to build and train deepneural networks for various tasks.
CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

COURSE NAME: RECOMMENDER SYSTEMS
COURSE CODE: 191ITV67
COURSE OBJECTIVES:

- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms forRecommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

SYLLABUS			L	T	P	C
			2	0	2	3
UNIT-I	INTRODUCTION					6

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)
Suggested Activities:

- Practical learning – Implement Data similarity measures.
- External Learning – Singular Value Decomposition (SVD) applications

Suggested Evaluation Methods:

- Quiz on Recommender systems.
- Quiz of python tools available for implementing Recommender systems

UNIT-II	CONTENT-BASED RECOMMENDATION SYSTEMS	6

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.
Suggested Activities:

- Assignment on content-based recommendation systems
- Assignment of learning user profiles

Suggested Evaluation Methods:

- Quiz on similarity-based retrieval.
- Quiz of content-based filtering

UNIT-III	COLLABORATIVE FILTERING	6

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection
Suggested Activities:

- Practical learning – Implement collaborative filtering concepts
- Assignment of security aspects of recommender systems

Suggested Evaluation Methods:

- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT-IV	ATTACK-RESISTANT RECOMMENDER SYSTEMS	6

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack - Group attack – Strategies for robust recommender design - Robust recommendation algorithms.
Suggested Activities:

- Group Discussion on attacks and their mitigation
- Study of the impact of group attacks
- External Learning – Use of CAPTCHAs

Suggested Evaluation Methods:

- Quiz on attacks on recommender systems
- Seminar on preventing attacks using the CAPTCHAs

UNIT-V	EVALUATING RECOMMENDER SYSTEMS	6

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design - Design Issues – Accuracy metrics – Limitations of Evaluation measures
Suggested Activities:

- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Suggested Evaluation Methods:

- Quiz on evaluation design
- **Problems on accuracy measures**

30 PERIODS

PRACTICAL EXERCISES:
1. Implement Data similarity measures using Python
2. Implement dimension reduction techniques for recommender systems
3. Implement user profile learning
4. Implement content-based recommendation systems
5. Implement collaborative filter techniques
6. Create an attack for tampering with recommender systems
7. Implement accuracy metrics like Receiver Operated Characteristic curves

30 PERIODS
TOTAL 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand the basic concepts of recommender systems.
CO2: Implement machine-learning and data-mining algorithms in recommender systemsdata sets.
CO3: Implementation of Collaborative Filtering in carrying out performance evaluation ofrecommender systems based on various metrics.
CO4: Design and implement a simple recommender system.
CO5: Learn about advanced topics of recommender systems.
CO6: Learn about advanced topics of recommender systems applications

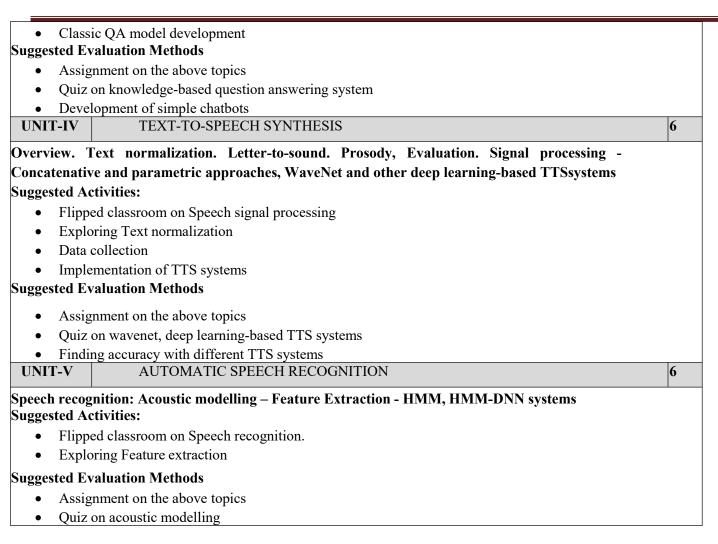| TEXTBOOKS: |
|---|
| 1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016. |
| 2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed. |
| 3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1sted, Springer (2011), |
| 4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rdedition, Cambridge University Press, 2020. |

COURSE NAME: TEXT AND SPEECH ANALYSIS
COURSE CODE: 191ITV68

COURSE OBJECTIVES:
- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

SYLLABUS		
UNIT-I	NATURAL LANGUAGE BASICS	**6**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model
Suggested Activities
- Flipped classroom on NLP
- Implementation of Text Preprocessing using NLTK
- Implementation of TF-IDF models

Suggested Evaluation Methods
- Quiz on NLP Basics
- Demonstration of Programs

UNIT-II	TEXT CLASSIFICATION	6

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models
Suggested Activities
- Flipped classroom on Feature extraction of documents
- Implementation of SVM models for text classification
- External learning: Text summarization and Topic models

Suggested Evaluation Methods
- Assignment on above topics
- Quiz on RNN, Transformers
- Implementing NLP with RNN and Transformers

UNIT-III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	6

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems
Suggested Activities:
- Flipped classroom on language models for QA
- Developing a knowledge-based question-answering system

- Classic QA model development

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on knowledge-based question answering system
- Development of simple chatbots

UNIT-IV	TEXT-TO-SPEECH SYNTHESIS	6

**Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing -
Concatenative and parametric approaches, WaveNet and other deep learning-based TTSsystems**

Suggested Activities:

- Flipped classroom on Speech signal processing
- Exploring Text normalization
- Data collection
- Implementation of TTS systems

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on wavenet, deep learning-based TTS systems
- Finding accuracy with different TTS systems

UNIT-V	AUTOMATIC SPEECH RECOGNITION	6

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

Suggested Activities:

- Flipped classroom on Speech recognition.
- Exploring Feature extraction

Suggested Evaluation Methods

- Assignment on the above topics
- Quiz on acoustic modelling

30 PERIODS

PRACTICAL EXERCISES
1. Create Regular expressions in Python for detecting word patterns and tokenizing text
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
5. Implement the Word2Vec model
6. Use a transformer for implementing classification
7. Design a chatbot with a simple dialog system
8. Convert text to speech and find accuracy
9. Design a speech recognition system and find the error rate

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to
CO1: Explain existing and emerging deep learning architectures for text and speech processing
CO2: Apply deep learning techniques for NLP tasks, language modelling and machine translation
CO3: Explain coreference and coherence for text processing
CO4: Build question-answering systems, chatbots and dialogue systems
CO5: Apply deep learning models for building speech recognition and text-to-speech systems

TEXTBOOK
1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

REFERENCES:
1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

VERTICALS VII - MACHINE LEARNING

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
VII MACHINE LEARNING	I	191ITV71	Cognitive Science		2	0	2	3
	II	191ITV72	Data Exploration and Visualization		2	0	2	3
	III	191ITV73	Game Theory		2	0	2	3
	IV	191ITV74	Machine Learning for Signal Processing		3	0	0	3
	V	191ITV75	Machine Learning with Bigdata		3	0	0	3
	VI	191ITV76	Machine Learning with Python		2	0	2	3
	VII	191ITV77	Neural Networks and Deep Learning		2	0	2	3
	VIII	191ITV78	Text and Speech Analysis		2	0	2	3
			TOTAL		**18**	**0**	**12**	**24**

COURSE NAME: COGNITIVE SCIENCE
COURSE CODE: 191ITV71

COURSE OBJECTIVES:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

SYLLABUS		L	T	P	C
		2	0	2	3
UNIT-I	**PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE**				6
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory - Language Understanding and Processing.					
UNIT-II	**COMPUTATIONAL INTELLIGENCE**				6
Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.					
UNIT-III	**PROBABILISTIC PROGRAMMING LANGUAGE**				6
WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration					
UNIT-IV	**INFERENCE MODELS OF COGNITION**				6
Generative Models – Conditioning – Causal and statistical dependence – Conditionaldependence – Data Analysis – Algorithms for Inference.					
UNIT-V	**LEARNING MODELS OF COGNITION**				6
Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models–Learning (Deep) Continuous Functions – Mixture Models.					

30 PERIODS

PRACTICAL EXERCISES
1. Demonstration of Mathematical functions using WebPPL.
2. Implementation of reasoning algorithms.
3. Developing an Application system using generative model.
4. Developing an Application using conditional inference learning model.
5. Application development using hierarchical model.
6. Application development using Mixture model.

30 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the underlying theory behind cognition.

CO2: Connect to the cognition elements computationally.

CO3: Implement mathematical functions through WebPPL.

CO4: Develop applications using cognitive inference model.

CO5: Develop applications using cognitive learning model.

TOTAL: 60 PERIODS

TEXT BOOK:
1. Vijay V Raghavan, Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, "The MIT Encyclopedia of the Cognitive Sciences",The MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:
1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/.

COURSE NAME: DATA EXPLORATION AND VISUALIZATION
COURSE CODE: 191ITV72
OBJECTIVES:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

SYLLABUS	L	T	P	C
	2	0	2	3
UNIT-I **EXPLORATORY DATA ANALYSIS**				6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data –Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT-II **VISUALIZING USING MATPLOTLIB**	6

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization –three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT-III **UNIVARIATE ANALYSIS**	6

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level andSpread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT-IV **BIVARIATE ANALYSIS**	6

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

UNIT-V **MULTIVARIATE AND TIME SERIES ANALYSIS**	6

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

30 PERIODS

PRACTICAL EXERCISES
1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world;states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Understand the fundamentals of exploratory data analysis.
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.

TEXT BOOKS:
1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis withPython", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working withData", Oreilly, 1st Edition, 2016. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for SocialScientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:
1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

COURSE NAME: GAME THEORY
COURSE CODE: 191ITV73
COURSE OBJECTIVES:

- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in 41odeIIing applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

SYLLABUS	L	T	P	C
	2	0	2	3

UNIT-I	INTRODUCTION	6

Introduction — Making rational choices: basics of Games — strategy — preferences — payoffs — Mathematical basics — Game theory — Rational Choice — Basic solution concepts-non- cooperative versus cooperative games — Basic computational issues — finding equilibria and learning in games- Typical application areas for game theory (e.g. Google's sponsored search, eBay auctions, electricity trading markets).

UNIT-II	GAMES WITH PERFECT INFORMATION	6

Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games

UNIT-III	GAMES WITH IMPERFECT INFORMATION	6

Games with Imperfect Information — Bayesian Games — Motivational Examples — GeneralDefinitions — Information aspects — Illustrations — Extensive Games with Imperfect - Information —Strategies — Nash Equilibrium —Repeated Games — The Prisoner's Dilemma — Bargaining

UNIT-IV	NON-COOPERATIVE GAME THEORY	6

Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games

— Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two-player, general- sum games — Identifying dominated strategies

UNIT-V	MECHANISM DESIGN	6

Aggregating Preferences — Social Choice — Formal Model — Voting — Existence of social functions — Ranking systems — Protocols for Strategic Agents: Mechanism Design — Mechanism design with unrestricted preferences

30 PERIODS

COURSE OUTCOMES:

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

CO1:Discuss the notion of a strategic game and equilibria and identify the characteristics ofmain applications of these concepts.

CO2:Discuss the use of Nash Equilibrium for other problems.

CO3:Identify key strategic aspects and based on these be able to connect them to appropriategame theoretic concepts given a real world situation.

CO4:Identify some applications that need aspects of Bayesian Games.

CO5:Implement a typical Virtual Business scenario using Game theory.

LABORATORY EXERCISES:

1. Prisoner's dilemma
2. Pure Strategy Nash Equilibrium
3. Extensive Form – Graphs and Trees, Game Trees
4. Strategic Form – Elimination of dominant strategy
5. Minimax theorem, minimax strategies
6. Perfect information games: trees, players assigned to nodes, payoffs, backward Induction, subgame perfect equilibrium,
7. imperfect-information games - Mixed Strategy Nash Equilibrium - Finding mixed-strategy Nash equilibria for zero sum games, mixed versus behavioral strategies.
8. Repeated Games
9. Bayesian Nash equilibrium

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

1. M. J. Osborne, An Introduction to Game Theory. Oxford University Press, 2012.

2. M. Machler, E. Solan, S. Zamir, Game Theory, Cambridge University Press, 2013.

3. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, Algorithmic Game Theory.Cambridge University Press, 2007.

4. A.Dixit and S. Skeath, Games of Strategy, Second Edition. W W Norton & Co Inc, 2004.

5. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic,and Logical Foundations, Cambridge University Press 2008.

6. Zhu Han, DusitNiyato, WalidSaad, TamerBasar and Are Hjorungnes, "Game Theory inWireless and Communication Networks", Cambridge University Press, 2012.

7. Y.Narahari, "Game Theory and Mechanism Design", IISC Press, World Scientific.

8. William Spaniel, "Game Theory 101: The Complete Textbook", CreateSpace Independent Publishing, 2011.

COURSE NAME: MACHINE LEARNING FOR SIGNAL PROCESSING
COURSE CODE: 191ITV75

SYLLABUS	L	T	P	C
	3	0	0	3

UNIT-I	INTRODUCTION TO SIGNAL PROCESSING AND MACHINE LEARNING THEORY	9

Introduction –Continuous-time signals and systems– Discrete-time signals and systems- Random signals and stochastic processes-Sampling and Quantization- FIR and IIR filter design- Digital filter structure and implementations - Multirate Signal Processing- Filter banks and transform design-Discrete mltiscale and transforms- Frames, Parameter estimation- Adaptive filtering- Machine Learning :review and trends- Signal Processing over graphs- Tensor methods in deep learning, Nonconvex graph learning: sparsity, heavy tails, and clustering.

UNIT-II	DIGITAL FILTER STRUCTURES AND THEIR IMPLEMENTATION	9

Properties of digital filters– Synthesis of digital FIR filters-FIR structures- Frequencey Response Masking Filters- The analog approximation problem- Doubly resistively terminated lossless networks- IIR filters- Wave digital filtersSchrodinger's Equation–Observables-Spectral Theory–Dirac Notation.

UNIT-III	MODERN TRANSFORM DESIGN FOR PRACTICAL AUDIO/IMAGE/VIDEO CODING APPLICATIONS	9

Approximations approach via direct scaling–Approximations approach via structural design Wavelet filter design via spectral factorization- Higher order design approach via optimizationt.

UNIT-IV	DATA REPRESENTATION FROM MULTISCALE TRANSFORMS TO NEURAL NETWORKS	9

Wavelets: a multiscale analysis tool-Curvlet and their applications- Contourlets and their applications- Shearlets and their applications- Incorporating wavelets into neural networks: Conceptual Scheme-Elitzur-Vaidman Scheme-Optimal Interaction-Free Measurements..

UNIT-V	MACHINE LEARNING	9

Learning concepts– Unsupervised Learning– Supervised Learning–Ensemble Learning-Deep Learning- CNN visualization- Deep reinforcement learning- current trends.

TEXTBOOKS
1. Reinhold Blumel.,"Signal Processing and Machine Learning Theory" Academic Press Library (Elsevier),,20230

COURSE NAME: MACHINE LEARNING WITH BIGDATA
COURSE CODE: 191ITV76

SYLLABUS		L	T	P	C
		3	0	0	3
UNIT-I	BIG DATA				9
	Introduction – Big Data Evaluation with its Tools- Architecture of Big Data- Issues and Challenges-Big Data Analytics Tools – Big Data Use Cases – Role of Machine Learning for Big Data and IoT.				
UNIT-II	BIG DATA AND PATTERN RECOGNITION				9
	Data Cleaning–Data Integration– Data Transformation- Data Reduction–Classifier- Feature Processing-Clustering.				
UNIT-III	MACHINE LEARNING ALGORITHMS AND APPLICATIONS				9
	History and Purpose of Machine Learning– Concept Well-Defined Learning Problem –General to specific Ordering Over Hypotheses. Version Space and Candidate Elimination Algorithm.				
UNIT-IV	REINFORCEMENT LEARNING				9
	Reinforcement Learning- Model Free RL- Q-Learning- R-Learning- Model Based RL-SARSA Learning – Dyna-Q Learning- Temporal Difference- Monte Carlo Method.				
UNIT-V	APPLICATION OF BIG DATA AND MACHINE LEARNING				9
	Application of Big Data and ML- Healthcare- Banking and Insurance- Transpotation- Media and Entertainment-Education- Ecosystem Conservation- Manufacturing– Agriculture- Issues and Chanllenges.				

45 PERIODS

TEXTBOOKS
2. Uma N.Dulhar, Khaleel Ahmad, Khairol Amali Bin Ahmad , "Machine Learning and Big Data"., John and Wiley and Scrivener Publishing LLC, 2020

COURSE NAME: MACHINE LEARNING WITH PYTHON
COURSE CODE: 191ITV74

SYLLABUS	L	T	P	C
	2	0	2	3

COURSE OBJECTIVES: To impart Knowledge on the following topics:

- To understand the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To use Python data structures –- lists, tuples, dictionaries.
- To develop Python programs with conditionals and functions
- To define Python files, modules and packages.

UNIT - I	BASICS OF MACHINE LEARNING	6

Introduction ,Components of Learning , Learning Models , Geometric Models, Probabilistic Models, Logic Models, Grouping and Grading, Designing a Learning System, Types of Learning, Supervised, Unsupervised, Reinforcement, Perspectives and Issues, Version Spaces, PAC Learning, VC Dimension-Applications Of Machine Learning: Image Recognition – Speech Recognition – Email spam and Malware Filtering – Online fraud detection – Medical Diagnosis.

UNIT - II	SUPERVISED AND UNSUPERVISED LEARNING	6

Decision Trees: ID3, Classification and Regression Trees, Regression: Linear Regression, Multiple Linear Regression, Logistic Regression, Neural Networks: Introduction, Perception, Multilayer Perception, Support Vector Machines: Linear and Non-Linear, Kernel Functions, K Nearest Neighbors. Introduction to clustering, K-means clustering, K-Mode Clustering.

UNIT - III	INTRODUCTION TO PYTHON PROGRAMMING	6

Python interpreter and interactive mode; values and types: int, float, boolean, string, list, tuple and dictionaries; variables,expressions, statements, tuple assignment, precedence of operators, comments; functions, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables.

UNIT - IV	CONTROL FLOW, FUNCTIONS	6

Conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration:state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: squareroot, sum an array of numbers, linear search, selection sort.

UNIT - V	FILES, MODULES, PACKAGES	6

Files and exception: textfiles, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count; Case study: analysis of student performance, employee salary, e-commerce purchases, prediction of Heart Disease.

30 PERIODS

Lab Programs
1. Develop Logistic Regression Model for a given dataset.   2. Implement Simple and Multiple Linear Regression Models.   3. Develop Decision Tree Classification model for a given dataset and use it to classify a new   sample. Build the Gradient Descent model.   5. Perceptron Learning Algorithm [Predict accuracy and Misclassified values]   6. Implement K-Means clustering Algorithm for Malware Analysis.   7. Spam classification using SVM.   8. Sentiment analysis in Machine Learning [How to process and analyze the data]

30 PERIODS

COURSEOUTCOMES	
Oncompletionofthecourse,students will beableto	**TOTAL: 60 PERIODS**

CO1	Apply specific machine learning algorithm for a particular problem.
CO2	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches.
CO3	Identify the various data expressions, statements in python programming.
CO4	Use control flow and function for solving problems in python.
CO5	Read and write data from /to files in Python programs.

REFERENCE BOOKS:
1. CharuC.Aggarwal,"DataClassificationAlgorithmsandApplications",CRCPress,2014.   2. Charu C. Aggarwal, "DATA CLUSTERING Algorithms and Applications", CRC Press, 2014.   3. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012.   4. John V Guttag, ―Introduction to Computation and Programming Using Python‗', Revised and expanded Edition,MITPress, 2013   5. Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter disciplinaryApproach, Pearson India Education Services Pvt. Ltd.,2016.   6. Timothy A.Budd,―Exploring Python, Mc-GrawHill Education(India) PrivateLtd., 2015.

TEXTBOOKS
1. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Prentice Hall of India, 3rd Edition2014.
2. MehryarMohri, AfshinRostamizadeh, AmeetTalwalkar " Foundations of Machine Learning", MIT Press,2012.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 3rdEdition, 1997.
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3 Shroff/O'Reilly Publishers, 2016(http://greenteapress.com/wp/think-python/) 6. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python3.2 Network Theory Ltd., 2011.

COURSE NAME: NEURAL NETWORKS AND DEEP LEARNING
COURSE CODE: 191ITV77
COURSE OBJECTIVES:

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
- To apply auto encoders and generative models for suitable applications.

SYLLABUS		L	T	P	C
		2	0	2	3
UNIT-I	**INTRODUCTION**				6
Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.					
UNIT-II	**ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS**				6
Training Algorithms for Pattern Association-Autoassociative Memory Network-Heteroassociative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Autoassociative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network.					
UNIT-III	**THIRD-GENERATION NEURAL NETWORKS**				6
Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation –Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation,Image Compression.					
UNIT-IV	**DEEP FEEDFORWARD NETWORKS**				6
History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Ruleand Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.					
UNIT-V	**RECURRENT NEURAL NETWORKS**				6
Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – DeepRecurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.					

30 PERIODS

LABORATORY EXERCISES:

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Improve the Deep learning model by fine tuning hyper parameters.
7. Implement a Transfer Learning concept in Image Classification.
8. Using a pre trained model on Keras for Transfer Learning
9. Perform Sentiment Analysis using RNN
10. Implement an LSTM based Autoencoder in TensorFlow/Keras.
11. Image generation using GAN

Additional Experiments:
12. Train a Deep learning model to classify a given image using pre trained model
13. Recommendation system from sales data using Deep Learning
14. Implement Object Detection using CNN
15. Implement any simple Reinforcement Algorithm for an NLP problem

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Apply Convolution Neural Network for image processing.
CO2: Understand the basics of associative memory and unsupervised learning networks.
CO3: Apply CNN and its variants for suitable applications.
CO4: Analyze the key computations underlying deep learning and use them to build and train deepneural networks for various tasks.
CO5: Apply autoencoders and generative models for suitable applications.

TEXT BOOKS:
1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.   2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

REFERENCES:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'ReillyMedia, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

COURSE NAME: TEXT AND SPEECH ANALYSIS

COURSE CODE: 191ITV78

COURSE OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

SYLLABUS	L	T	P	C
	2	0	2	3

UNIT-I	NATURAL LANGUAGE BASICS	6

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.

Suggested Activities

- Flipped classroom on NLP
- Implementation of Text Preprocessing using NLTK
- Implementation of TF-IDF models

Suggested Evaluation Methods

- Quiz on NLP Basics
- Demonstration of Programs

UNIT-II	TEXT CLASSIFICATION	6

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models.

Suggested Activities

- Flipped classroom on Feature extraction of documents
- Implementation of SVM models for text classification
- External learning: Text summarization and Topic models

Suggested Evaluation Methods

- Assignment on above topics
- Quiz on RNN, Transformers
- Implementing NLP with RNN and Transformers

UNIT-III	QUESTION ANSWERING AND DIALOGUE SYSTEMS	6

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -– evaluating dialogue systems

Suggested Activities:

- Flipped classroom on language models for QA
- Developing a knowledge-based question-answering system
- Classic QA model development

Suggested Evaluation Methods

- Assignment on the above topics

- Quiz on knowledge-based question answering system
- Development of simple chatbots

UNIT-IV	TEXT-TO-SPEECH SYNTHESIS	6

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTSsystems

Suggested Activities:
- Flipped classroom on Speech signal processing
- Exploring Text normalization
- Data collection
- Implementation of TTS systems

Suggested Evaluation Methods
- Assignment on the above topics
- Quiz on wavenet, deep learning-based TTS systems
- Finding accuracy with different TTS systems

UNIT-V	AUTOMATIC SPEECH RECOGNITION	6

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems
Suggested Activities:
- Flipped classroom on Speech recognition.
- Exploring Feature extraction

Suggested Evaluation Methods
- Assignment on the above topics
- Quiz on acoustic modelling

30 PERIODS

PRACTICAL EXERCISES

1. Create Regular expressions in Python for detecting word patterns and tokenizing text
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
5. Implement the Word2Vec model
6. Use a transformer for implementing classification
7. Design a chatbot with a simple dialog system
8. Convert text to speech and find accuracy
9. Design a speech recognition system and find the error rate

COURSE OUTCOMES:

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

CO1:Explain existing and emerging deep learning architectures for text and speech processing

CO2:Apply deep learning techniques for NLP tasks, language modelling and machine translation

CO3:Explain coreference and coherence for text processing

CO4:Build question-answering systems, chatbots and dialogue systems

CO5:Apply deep learning models for building speech recognition and text-to-speech systems

TEXTBOOK
1. **Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.**

REFERENCES:
1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

VERTICALS VIII - MANAGEMENT

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
VII MANAGEMENT	I	191ITV81	Behavioral Economics		3	0	0	3
	II	191ITV82	Customer Relation Management		3	0	0	3
	III	191ITV83	Entrepreneurship Development		2	0	2	3
	IV	191ITV84	Financial Management		3	0	0	3
	V	191ITV85	Fundamentals of Management		3	0	0	3
	VI	191ITV86	Human Resource Management for Entrepreneurs		3	0	0	3
	VII	191ITV87	IT Project Management		3	0	0	3
	VIII	191ITV88	Supply Chain Management		3	0	0	3
			TOTAL		**23**	**0**	**2**	**24**

COURSE NAME: BEHAVIORAL ECONOMICS   **L   T   P   C**

COURSE CODE:191ITV81   **3   0   0   3**

COURSE OBJECTIVES:
● To familiarize the students to the basic concepts of management in order to aid in understanding how an   organizatio
function
● To understand the complexity and wide variety of issues managers face in today's business firms.
● To To acquaint the students with the fundamentals of managing business
● To understand individual and group behavior at the workplace so as to improve the effectiveness of an organization.

UNIT I   NATURE AND THEORIES OF MANAGEMENT   **9**
Evolution of management Thought-Classical, Behavioral and Management Science Approaches Management- meaning
levels, management as an art or science, Managerial functions and Roles, Evolution of Management Theory- Classical era
Contribution of F.W.Taylor, Henri Fayol, Neo- Classical-Mayo & Hawthorne Experiments. • Modern era – system &
contingency approach Managerial Skills.

UNIT II   PLANNING AND ORGANIZING   **9**
Planning - Steps in Planning Process - Scope and Limitations - Forecasting and types of Planning- Characteristics   of
sound Plan - Management by Objectives (MBO) - Policies and Strategies - Scope and Formulation - Decision Making
Types, Techniques and Processes. Organisation Structure and Design - Authority and Responsibility Relationships
Delegation of Authority and Decentralisation - Interdepartmental Coordination - - Impact of Technology on Organizationa
design - Mechanistic vs Adaptive Structures - Formal and Informal Organisation.Control: meaning, function, Process an
types of Control

UNIT III   INDIVIDUAL BEHAVIOR   **9**
Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception an
Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Belief
- Communication Types-Process - Barriers - Making Communication Effective.

UNIT IV   GROUP BEHAVIOR   **9**
Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesivenes
Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics - Organizational Structure
Organizational Climate and Culture,Conflict: concept, sources, Types, Stages of conflict, Management of conflic
Organizational Change and Development.

UNIT V   EMERGING ASPECTS OF ORGANIZATIONAL BEHAVIOR   **9**
Comparative Management Styles and approaches - Japanese Management Practices Organizational Creativity an
Innovation - Organizational behavior across cultures - Conditions affecting cross cultural organizational operation
Managing International Workforce, Productivity and cultural contingencies, Cross cultural communication, Management o
Diversity.

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understanding of various management concepts and skills required in the business world

CO2: In-depth knowledge of various functions of management in a real time management context

CO3: Understanding of the complexities associated with management of individual behavior in the organizations

CO4: Develop the skill set to have manage group behavior in Organizations

CO5: Insights about the current trends in managing organizational behavior

TEXT BOOK:

1. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 10th edition,2016.

2. Samuel C. Certo and S.Trevis Certo, Modern Management: Concepts and Skills, Pearson education, 15th edition, 2018.

REFERENCES:

1. Harold Koontz and Heinz Weihrich, Essentials of Management: An International, Innovation, And Leadership Perspective, 10th edition, Tata McGraw-Hill Education, 2015.

2. Charles W.L Hill and Steven L McShane, „Principles of Management, McGraw Hill Education, Special Indian Edition, 2017.

3. Stephen P. Robbins, Timothy A.Judge, Organizational Behavior, PHI Learning / Pearson Education, 16th edition, 2014.

4. Fred Luthans, Organizational Behavior, McGraw Hill, 12th Edition, 2013.

5. Don Hellriegel, Susan E. Jackson and John W,Jr Slocum, Management: A competency- Based Approach, Thomson South Western,11th edition, 2008.

6. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 12th edition, 2008.

7. Stephen P. Robbins, David De Cenzo and Mary Coulter, Fundamentals Of Management, Prentice Hall of India,9 t edition 2016.

8. McShane, Mary V. Glinow, Organizational Behavior, 8th Edition, Tata Mc Graw Hill, 2017.

9. Nelson, Quick, Khandelwal. ORGB – An innovative approach to learning and teaching. Cengage learning. 2nd edition 2012.

10. Robert Konopaske, John M Ivancevich, Michael T Matteson, Organizational Behavior and Management, 11th edition Tata McGraw Hill, 2017.

11. Udai Pareek, Understanding Organizational Behavior, 3rd Edition, Oxford Higher Education, 2011.

12. Jerald Greenberg, Behavior in Organizations, PHI Learning. 10th edition. 2011.

COURSE NAME: CUSTOMER RELATION MANAGEMENT　　　　**L　T　P　C**

COURSE CODE:191ITV82　　　　　　　　　　　　　　　　**3　0　0　3**

COURSE OBJECTIVES:
- To Learn the fundamentals of strategic and operational of CRM
- To understand operational methods of CRM
- To understand different analytical methods of CRM to enhance customer experience.
- To Learn the fundamentals of analytical CRM
- To Understand and apply the elements and tools of CRM to manage customer portfolios.

UNIT I　UNDERSTANDING CUSTOMER RELATIONSHIPS　　　　　　　**9**
CRM definition and constituencies, understanding and misunderstanding CRM, the social CRM fit, commercial context the third sector- not-for-profit, CRM models. Relationship quality, customer lifetime value, relationships with customer and suppliers. Managing the customer lifecycle – customer acquisition, retention and development.

UNIT II　　　STRATEGIC CRM　　　　　　　　　　　　　　**9**
Customer portfolio management (CPM) - Customer portfolio, basic disciplines of CPM, CPM in B2B context, CPM model tools for CPM, strategically significant customers, seven core customer management strategies.

UNIT III　　　OPERATIONAL CRM　　　　　　　　　　　　**9**
Sales force automation (SFA) – SFA and its ecosystem, SFA software functionality, SFA adaptation. Marketing automation (MA) – definition of MA, benefits and software applications. Service Automation (SA) –customer service definition modeling service quality, software for SA, benefits of SA, customer service excellence certification.

UNIT IV　　　ANALYTICAL CRM　　　　　　　　　　　　**9**
Customer database management –corporate customer data, structured and unstructured data, developing a customer database data – integration, warehousing and marts in the CRM context, knowledge management, Analytics for – CRM strategy an tactics, customer lifecycle, structured and unstructured data, Big data analytics in CRM, analytical insights.

UNIT V MANAGING CUSTOMER EXPERIENCE AND VALUE　　　　　　　**9**
Understanding Value and when do customers experience value, Modelling customer-perceived　　value,　　Sources customer value, Value through the marketing mix, Customisation for customer value.Understanding customer experience and concepts, how to manage customer experience,　　CRM vs CEM, Use of CRM software in CEM
　　　　　　　　　　　　　　　　　　　　　　　TOTAL:45 PERIODS
COURSE OUTCOMES:
CO1: Understand the elements of CRM
CO2: Apply the elements of CRM to manage customer portfolios.
CO3 : Understand the tools of CRM
CO4: Apply the tools of CRM to manage customer portfolios.
CO5: Understand different analytical methods of CRM to enhance customer experience

TEXT BOOKS:
1. Buttle Francis and Maklan Stan, Customer Relationship Management – Concepts and Technologies, Special India edition, Fourth edition, Routledge, 2019.
2. Gerardus Blokdyk, Customer Relationship Management – A complete guide 2020 edition, 5starcooks, 2019.

REFERENCES :
1. Henry Assael, Consumer Behavior, Cengage Learning, 6th Edition, 2008
2. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2012.
3. Kumar and Werner Reinartz, Customer Relationship Management, Concept, Strategy and Tools, Springer 2018.
4. Zikmund, Customer Relationship Management, Wiley 2012.
5. G. Shainesh, J. Jagdish N Seth. Customer Relationship Management : Emerging Concepts, Tools and Application, McGraw Hill Education, 2017.

COURSE NAME: ENTREPRENEURSHIP DEVELOPMENT   **L   T   P   C**

COURSE CODE:191ITV83   **2   0   2   3**

COURSE OBJECTIVES:
- To equip and develop the learners entrepreneurial skills and qualities essential to undertake business.
- To impart the learners entrepreneurial competencies needed for managing business efficiently and effectively.

UNIT I   ENTREPRENEURIAL COMPETENCE   9

Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful Entrepreneurs – Knowledge and Skills of an Entrepreneur.

UNIT II   ENTREPRENEURAL ENVIRONMENT   9

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other   Support Organizational Services - Central and State Government Industrial Policies and Regulations.

UNIT III   BUSINESS PLAN PREPARATION   9

Sources of Product for Business - Pre Feasibility Study - Criteria for Selection of Product - Ownership - Capital   Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria

UNIT IV   LAUNCHING OF SMALL BUSINESS   9

Finance and Human Resource Mobilisation - Operations Planning - Market and Channel Selection- Growth   Strategies Product Launching – Incubation, Venture capital, Start-ups.

UNIT V   MANAGEMENT OF SMALL BUSINESS   9

Monitoring and Evaluation of Business - Business Sickness - Prevention and Rehabilitation of Business Units - Effective Management of Small Business - Case Studies.

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**
1. Discuss a Business Plan on /Small scale industry/Food Processing Industry/Agriculture units/Hospital .
2. Undertake SWOT analysis to arrive at your business idea of a product/service

COURSE OUTCOMES:

CO1: The learners will gain entrepreneurial competence to run the business efficiently.

CO2: The learners are   able to undertake businesses in the entrepreneurial environment

CO3: The learners are capable of preparing business plans and undertaking feasible projects.

CO4 : The learners are efficient in launching and develop their business ventures successfully

CO5: The learners shall monitor the business effectively towards growth and development.

TEXTBOOKS   **TOTAL :60 PERIODS**
1. S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2016.
2. R.D.Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2018.
3. Rajeev Roy ,Entrepreneurship, Oxford University Press, 2nd Edition, 2011.
4. Donald F Kuratko,T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning, 2012.
5. Dr. Vasant Desai, "Small Scale Industries and Entrepreneurship", HPH,2006.
6. Arya Kumar. Entrepreneurship, Pearson,2012.
7. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 8 edition ,2017

COURSE NAME: FINANCIAL MANAGEMENT   L   T   P   C

COURSE CODE:191ITV84   3   0   0   3

COURSE OBJECTIVES:
● Understand the fundamental concepts of financial management
● Understand valuation of securities.
● Analyse operating and financial leverages.
● Comprehend and apply the concepts of capital budgeting.
● Understand cash management.

UNIT I INTRODUCTION   9
Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments.Time Value Of Money
Simple and Compound Interest Rates, Amortization, Computing more than once a year,
Annuity Factor.

UNIT II VALUATION OF SECURITIES   9
Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of
Yield and YTM. Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure
Risk,AttitudesToward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset
Pricing Model (CAPM).

UNIT III   OPERATING & FINANCIAL LEVERAGE   9
Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference
Analysis in leverage study. Cost of Capital: Concept, Computation of Specific Cost of Capital for
Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L.

UNIT IV   CAPITAL BUDGETING   9
Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project
Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project
Evaluation and Selection - Alternative Methods. Working Capital Management: Overview, Working Capital Issues,
Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset
Decisions, Estimation of Working Capital.

UNIT V CASH MANAGEMENT   9
Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts,Electronic
Commerce, Outsourcing, Cash Balances to maintain, Factoring. Accounts Receivable Management: Credit &
Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period.
                                                        TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Understand the fundamental concepts of financial management
CO2: Apply valuation of securities and calculate the risk & return in portfolio management.
CO3: Analyse the cost structure of a company using operating and financial leverages.
CO4: Develop capital budgets and to estimate working capital. CO5: Apply cash management Aunt in Business.

TEXTBOOKS

1. Chandra, Prasanna - Financial Management - Theory & Practice, Tata McGraw Hill, 2007.
2. Srivastava, Misra: Financial Management, OUP, 2011.
3. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.
4. Financial Management: Theory & Practice: by Brigham and Ernhardt, 14th edition, Cengage, 2015.
5. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011.
6. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012.

COURSE NAME:FUNDAMENTALS OF MANAGEMENT	L	T	P	C

COURSE CODE:191ITV85	3	0	0	3

COURSE OBJECTIVES:
● To familiarize the students the basic concepts of Management
● To understand the history, evolution and growth of management concepts
● To learn the applications of different functions of Management
● To study the different issues handled by modern managers
● To understand the different challenges faced by modern managers

UNIT I   INTRODUCTION TO MANAGEMENT   9
Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management,Managerial Skills, Challenges of Management; Evolution of Management-Classical Approach-Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT II   PLANNING AND DECISION MAKING   9
General Framework for Planning -Planning Process, Types of Plans, Management by Objectives;   Development of Business Strategy. Decision making and Problem Solving -Programmed and Non- Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT III   ORGANIZATION AND HRM   9
Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation, Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change. Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT IV   LEADERSHIP AND MOTIVATION   9
Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Motivation -Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT V CONTROLLING   9
Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non- Budgetary Controls.Characteristics of Effective Controls, Establishing control systems, Control frequency,and   Methods.
TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Understand the different elements of effective management
CO2: Apply the concepts of planning and decision making in organizations
CO3: Describe the concepts of organization and need for staffing process
CO4: Adopt the concept of directing through motivation and leadership
CO5: Demonstrate the use of control methods in changing business environment

TEXT BOOK:

1. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES :

1. Essentials of Management, Koontz Kleihrich, Tata McGraw Hill.
2. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012
3. Management: Principles, Processes and Practices, Anil Bhat, Arya Kumar –Oxford UniversityPress-, 2008

COURSE NAME:HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS   L   T   P   C

COURSE CODE:191ITV86   **3   0   0   3**

COURSE OBJECTIVES:
● To introduce the basic concepts, structure and functions of human resource management for   entrepreneurs.
● To create an awareness of the roles, functions and functioning of human resource department.
● To understand the methods and techniques followed by Human Resource Management practitioners.

UNIT I   INTRODUCTION TO HRM   9
Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles-Skills - Personne
Management Vs. HRM - Human Resource Policies - HR Accounting -
HR Audit - Challenges in HRM.

UNIT II   HUMAN RESOURCE PLANNING   9
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation-Job   Description
Career Planning - Succession Planning - HRIS - Computer Applications in HR -Recent Trends

UNIT III   RECRUITMENT AND SELECTION   9
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection   Process- Selectio
techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV   TRAINING AND EMPLOYEE DEVELOPMENT   9
Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employe
Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT V CONTROLLING HUMAN RESOURCES   9
Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Disciplin
– Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

                                                                TOTAL 45 : PERIODS

COURSE OUTCOMES:
Upon completion of this course the learners will be able:
CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO 2 To learn about the HR Planning Methods and practices.
CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organizations.

TEXT BOOKS

1. Gary Dessler and Biju Varkkey, Human Resource Management, 14e , Pearson, 2015.
2. Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.
3. David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014
4. R. Wayne Mondy, Human Resource Management, Pearson , 2015.
5. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI
Learning. 2012
6. John M. Ivancevich, Human Resource Management,12e, McGraw Hill Irwin,2013.
7. K. Aswathappa, Sadhna Dash , Human Resource Management - Text and Cases , 9th Edition,McGraw   Hill, 2021.
8. Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

COURSE NAME:IT PROJECT MANAGEMENT   **L**   **T**   **P**   **C**

COURSE CODE:191ITV87   **3**   **0**   **0**   **3**

COURSE OBJECTIVES:
● To learn the concepts of managing IT projects.
● To learn more about planning
● To understand resource allocation, control, and completion
● To learn software quality management
● To understand budgeting and scheduling

UNIT I   INTRODUCTION TO PROJECT MANAGEMENT   **9**
Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project-Portfolio Process-
Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project Teams, Project
support activities, Types of project organizations.

UNIT II   PLANNING AND BUDGETING   **9**
The Planning Process – Work Breakdown Structure – Role of Multidisciplinary teams, Critical path
analysis. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk
management.

UNIT III   SCHEDULING & RESOURCE ALLOCATION   **9**
PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation Gantt Charts-Expediting
project – Resource loading and leveling. Allocating scarce resources Goldratt‟s
Critical Chain.

UNIT IV CONTROL AND COMPLETION   **9**
The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control   system. Proje
Evaluation, Earned Value Analysis, Auditing and Termination, RiskManagement, – Conflict – Origin & Consequence
Managing conflict – Team methods for solving conflict

UNIT V   SOFTWARE QUALITY MANAGEMENT   **9**
Product quality and software quality, quality management systems, principles and features System quality specification an
measurement, Process and product quality approaches, Quality assurance and quality control, project audit and quality audi
Methods of enhancing quality: the different types of testing, inspections, reviews, standards, Management and control o
testing.

            TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Apply project management principles in business situations
CO2: Learn more about planning, budgeting and scheduling
CO3: Optimize resource utilization and time optimization
CO4: Understand resource allocation, control, and completion
CO5: Learn software quality management

TEXT BOOK:
1. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 2005.
2. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education, 2006.
3. Hughes B, Project Management for IT-related Projects. BCS Publications, 2012.

REFERENCES:
1.Gido and Clements, Successful Project Management, Second Edition, Thomson Learning, 2003.
2. Harvey Maylor, Project Management, Third Edition, Pearson Education, 2006.

COURSE NAME:SUPPLY CHAIN MANAGEMENT   **L   T   P   C**

COURSE CODE:191ITV88   **3   0   0   3**

COURSE OBJECTIVES:
● To understand the importance of supply chain management
● To learn decisions in supply chain management for gaining competitive advantage
● To design supply chain networks to enhance supply chain performance
● To plan demand based on inventory and supply
● To understanding the role of logistics in supply chain performance

UNIT I INTRODUCTION   **9**
Supply Chain – Fundamentals, Evolution, Role in Economy, Importance, Decision Phases, Enablers & Drivers of Suppl
Chain Performance; Supply chain strategy; Supply Chain Performance Measures.

UNIT II SUPPLY CHAIN NETWORK   **9**
Distribution Network Design – Role in supply chain, Influencing factors, design options, online sales and distributio
network, Distribution Strategies; Network Design in supply chain – Role, influencing factors, framework for network desig
Impact of uncertainty on Network Design.

UNIT III   PLANNING DEMAND, INVENTORY AND SUPPLY   **9**
Managing supply chain cycle inventory and safety inventory - Uncertainty in the supply chain-,Analyzing impact of suppl
chain redesign on the inventory, Risk Pooling, Managing inventory for short life-cycle products, multiple item -multipl
location inventory management; Pricing and Revenue Management.

UNIT IV   LOGISTICS   **9**
Transportation – Role, Modes and their characteristics, infrastructure and policies, transport documentation, design option
trade-offs in transportation design, intermodal transportation. Logistics outsourcing – catalysts, benefits, value propositio
3PL, 4PL, 5PL, 6PL; International Logistics -objectives, importance in global economy, Characteristics of global suppl
chains, Incoterms.

UNIT V SUPPLY CHAIN INNOVATIONS   **9**
Supply Chain Integration, SC process restructuring, IT in Supply Chain; Agile Supply Chains, Legible supply chain, Gree
Supply Chain, Reverse Supply chain; Supply chain technology trends – AI, Advanced analytics, Internet of Thing
Intelligent things, conversational systems, robotic process automation, immersive technologies, Block chain.

                                   TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Understanding of supply chain fundamentals
CO2: Ability to design supply chain networks to enhance supply chain performance
CO3 : Ability to plan demand based on inventory and supply
CO4: Understanding the role of logistics in supply chain performance
CO5: Awareness of innovations for sustainable supply chains

TEXT BOOKS:

1. Chopra, Sunil, Meindl, Peter and Kalra, D. V.; Supply Chain Management: Strategy, Planning and Operation; Pearson Education, 2015.
2. Altekar, Rahul V.; Supply Chain Management: Concepts and Cases; PHI Learning, 2005.

REFERENCES

1. Sunil Chopra, Peter Meindl and DharamVirKalra, Supply Chain Management-Strategy Planning and Operation, Pearson Education, Sixth Edition, 2016.
2. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 2009
3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson
Education, 5thEdition, 2007.
4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the SupplyChain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.
5. Pierre David, International Logistics, Biztantra, 2011.

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VERTICALS - IX - MARKETING

Verticals		Course Code	Name of the Course	Category	L	T	P	Credits
IX MARKETING	I	191ITV91	Conversational Systems		3	0	0	3
	II	191ITV92	Digital Marketing		2	0	2	3
	III	191ITV93	Enterprise Security		3	0	0	3
	IV	191ITV94	Financial Analytics		3	0	0	3
	V	191ITV95	Marketing Research and Marketing Management		3	0	0	3
	VI	191ITV96	Recommender Systems		2	0	2	3
	VII	191ITV97	Risk Analytics		3	0	0	3
	VIII	191ITV98	Social Text and Media Analytics		3	0	0	3
			TOTAL		**22**	**0**	**4**	**24**

COURSE NAME: CONVERSATIONAL SYSTEMS   **L T P C**
COURSE CODE:191ITV91   **3 0 0 3**

COURSE OBJECTIVES:
- Enable attendees to acquire knowledge on chatbots and its terminologies
- Work with ML Concepts and different algorithms to build custom ML Model
- Better understand on Conversational experiences and provide better customer experiences

UNIT I   FUNDAMENTALS OF CONVERSATIONAL SYSTEMS   9
Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc. Introduction to Top players in Market – Google, MS, Amazon &Market trends Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview.

**UNIT II   FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE   9
PROCESSING**
Introduction: Brief history, Basic Concepts, Phases of NLP, Application of chat bots etc. General chatbot architecture, Basic concepts in chatbots: Intents, Entities, Utterances, Variables and Slots, Fulfillment. Lexical Knowledge Networks (WordNet, Verbnet, PropBank, etc). Lexical Analysis, Part-of-Speech Tagging, Parsing/Syntactic analysis, Semantic Analysis, Word Sense Disambiguation. Information Extraction, Sentiment Analysis.

UNIT III   BUILDING A CHATBOT / CONVERSATIONAL AI SYSTEMS   9
Fundamentals of Conversational Systems (NLU, DM and NLG) - Chatbot framework & Architecture, Conversational Flow & Design, Intent Classification (ML and DL based techniques), Dialogue Management Strategies, Natural Language Generation, UX design, APIs and SDKs, Usage of Conversational Design Tools. Introduction to popular chatbot frameworks – Google Dialog flow, Microsoft Bot Framework, Amazon Lex, RASA Channels: Facebook Messenger, Google Home, Alexa, WhatsApp, Custom Apps. Overview of CE Testing techniques, A/B Testing, Introduction to Testing Frameworks - Botium /Mocha ,Chai Security & Compliance – Data Management, Storage, GDPR, PCI.

UNIT IV   ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES AND CONTACT CENTERS   9
Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction ,etc. to effectively converse, Introduction to Contact centers – Impact & Terminologies. Case studies & Trends, How does a Virtual Agent/Assistant fit in here?

UNIT V   CONVERSATIONAL ANALYTICS AND FUTURE   9
Conversation Analytics : The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems , XRCommerce- What to expect next? – Future technologies and market innovations overview.

COURSE OUTCOMES:
CO1: Familiarize in the NLTK tool kit and the pre-processing techniques of natural language processing.
CO2: Familiarize with the basic technologies required for building a conversational system.
CO3: Build a Chatbot for any application and deploy it
CO4: Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards huma
behavior.
CO5: Build a real time working conversational system for social domain that can intelligently process inputs and generat
relevant replies.

TOTAL :45 PERIODS

TEXTBOOKS:
1. Michael McTear, "Conversational AI: Dialogue Systems, Conversational Agents, and Chatbots", Second Edition, Moran and
Claypool Publishers, 2020.
2. Cathy Pearl, "Designing Voice User Interfaces: Principles of Conversational Experiences", O'REILLY,2016.

COURSE NAME:DIGITAL MARKETING   **L   T   P   C**

COURSE CODE:191ITV92   **2   0   2   3**

COURSE OBJECTIVES:
- The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT I   INTRODUCTION TO ONLINE MARKET   6
Online Market space- Digital Marketing Strategy- Components -Opportunities for building Brand Website -Planning and Creation- Content Marketing.

UNIT II   SEARCH ENGINE OPTIMISATION   6
Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III   E- MAIL MARKETING   6
E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV   SOCIAL MEDIA MARKETING   6
Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers Influencer Marketing.

UNIT V   DIGITAL TRANSFORMATION   6
Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

                                                                30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Subscribe to a weekly/quarterly newsletter and analyze how it's content and structure aid with the branding of the compan and how it aids its potential customer segments.
2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keywor planner tool.
3. Demonstrate how to use the Google WebMasters Indexing API
4. Discuss an interesting case study regarding how an insurance company manages leads.
5. Discuss negative and positive impacts and ethical implications of using social media for political advertising.
6. Discuss how Predictive analytics is impacting marketing automation

COURSE OUTCOMES:

CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment..
CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
CO3: To know the key elements of a digital marketing strategy.
CO4: To study how the effectiveness of a digital marketing campaign can be measured
CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs
                                                                      TOTAL:60 PERIODS

TEXT BOOKS:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education; First edition (July 2017);ISBN-1(933258737X;ISBN-13: 978-9332587373.
2. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449
3. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN1(9788126566938;ISBN13: 9788126566938;ASIN: 8126566930.
4. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Pag Limited..
5. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengag Learning.
6. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

COURSE NAME:ENTERPRISE SECURITY   **L   T   P   C**

COURSE CODE:191ITV93   **3   0   0   3**

COURSE OBJECTIVES:
- To understand enterprise security in today's world.
- To learn how to evaluate business processes related to risk management
- To learn business continuity
- To understand auditing and security issues in software development.

UNIT I   INTRODUCTION   9
Developing a Secure Foundation-threat and vulnerabilities-Security Categorization Applied to Information Types & Information Systems-Minimum Security Requirements-Infrastructure Security Model Components-Systems Security Categorization-Business Impact Analysis-Risk Management.

UNIT II   PLANNING, MANAGEMENT AND MONITORING   9
Phases of Security-Focused Configuration Management-Security Configuration Management Plan-Baseline Identification-Roles and Responsibilities-Measurements-Configuration Audits-Types of Plans-Continuous Monitoring Strategy-Continuous Monitoring Program-Monitoring and Assessment Frequencies.

UNIT III   SECURITY ARCHITECTURE   9
The Meaning of Security - Measuring and Prioritizing Business Risk-Empowering the Customers- Protecting Relationships and Leveraging Trust-The Meaning of Architecture-Information Systems Architecture -Enterprise Security Architecture-Security Architecture Model-The SABSA Model- Contextual and Conceptual Security Architecture

UNIT IV SECURITY POLICY , OPERATIONAL RISK AND ASSURANCE MANAGEMENT   9
Structuring the Content of a Security Policy-Policy Hierarchy and Architecture-Policy Principles- Types of Security Policies-Complexity of Operational Risk Management-Approaches to Risk Assessment-Risk Mitigation-Risk Financing-Assurance of Operational Continuity-Security Audits- Functional & Penetration Testing.

UNIT V   SECURITY ADMINISTRATION, OPERATIONS AND VALIDATION   9
Introduction-Managing the People-Managing Physical and Environmental Security-Managing ICT Operations and Support-Access Control Management-Compliance Management-Security-Specific Operations- Managed Security Services-Product Evaluation and Selection-Business Continuity Management-Certification and Accreditation Process-General Process Phase I & II.

                                                                    TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Design appropriate security architecture with an understanding of the technology
CO2: Create and deploy enterprise solutions in support of organizational goals
CO3: Plan and implement projects related to infrastructure, security, software development.
CO4: Interpret governance policies.
CO5: Manage IT governance policies.

TEXT BOOK:

1. James A. Scholz, Enterprise Architecture and Information Assurance Developing a Secure Foundation, CRC Press, 2013.(UNIT –I &II) 107
2. John Sherwood, Andrew Clark, David Lynas, Enterprise Security Architecture A Business- Driven Approach, CRC Press, 2005. (UNIT-III,IV and V)

REFERENCES :
1. John R.Vacca, Computer and Information Security Handbook, Second Edition, Elsevier 2013.
2. Michael E. Whitman, Herbert J. Mattord, Principal of Information Security, Fourth Edition, Cengage Learning, 2012.

COURSE NAME: FINANCIAL ANALYTICS   **L   T   P   C**

COURSE CODE:191ITV94   **3   0   0   3**

COURSE OBJECTIVES:
- To understand modern analytical tools that specifically target finance applications.
- To understand different management aspects
- To learn financial analysis for decision making
- To understand human resource management
- To learn different business strategy

UNIT I   CORPORATE FINANCE ANALYSIS   9
Basic corporate financial predictive modeling- Project analysis- cash flow analysis- cost of capital, Financial Break eve modeling, Capital Budget model-Payback, NPV, IRR.

UNIT II   FINANCIAL MARKET ANALYSIS   9
Estimation and prediction of risk and return (bond investment and stock investment) –Time series -examining nature of dat Value at risk, ARMA, ARCH and GARCH.

UNIT III   PORTFOLIO ANALYSIS   9
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Blac Scholes model and Option implied volatility.

UNIT IV   TECHNICAL ANALYSIS   9
Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategie Prediction of share prices.

UNIT V   CONTROLLING   9
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand different management techniques
CO2: Applyanalytical tools that specifically target finance applications.
CO3: Describefinancial analysis for decision making
CO4:Understand human resource management
CO5:Adopt different business strategy

TEXT BOOK:

1. Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.
2. Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, 25 Oct 2013 by Pavel Ryzhov.

REFERENCES :

1. Quantitative Financial Analytics: The Path To Investment Profits Paperback –Import, 11 Sep 2017 by Edward E William (Author), John A Dobelman.
2. Python for Finance - Paperback – Import, 30 Jun 2017 by Yuxing Yan (Author).
3. Mastering Python for Finance Paperback – Import, 29 Apr 2015 by James Ma Weiming.

COURSE NAME:MARKETING RESEARCH AND MARKETING MANAGEMENT   L   T   P   C

COURSE CODE:191ITV95   **3   0   0   3**

COURSE OBJECTIVES:
- To understand the changing business environment and the fundamental premise underlying market driven strategies.
- To identify the indicators of management thoughts and practices.
- To analyze the nature of consumer buying behavior
- To understanding the marketing research
- To new trends in the arena of marketing

UNIT I   INTRODUCTION   9
Defining Marketing − Core concepts in Marketing – Evolution of Marketing − Marketing Planning Process − Scanning Business environment: Internal and External − Value chain − Core Competencies – PESTEL − SWOT Analysis − Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System − Marketing in global environment – International Marketing − Rural Marketing − Prospects and Challenges

UNIT II   MARKETING STRATEGY   9
Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing − Services marketing – Competition Analysis − Analysis of consumer and industrial markets − Influence of Economic and Behavioral Factors − Strategic Marketing Mix components.

UNIT III   MARKETING MIX DECISIONS   9
Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning − Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels − Managing Retailing, Wholesaling and Logistics − Advertising and Sales Promotions – Pricing Objectives, Policies and Methods.

UNIT IV   BUYER BEHAVIOR   9
Understanding Industrial and Consumer Buyer Behaviour − Influencing factors – Buyer Behavior Models – Online buyer behaviour − Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection − Creating Long Term Loyalty Relationships. Do case studies on understanding consumer Decision making Styles in India - Domestic Vs Foreign brand clothing.

UNIT V   MARKETING RESEARCH & TRENDS IN MARKET   9
Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing − Ethics in marketing – Online marketing trends - social media and digital marketing. Do an analysis on Amazon in India.
                                                                                                             TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Applied knowledge of contemporary marketing theories to the demands of business and management practice
CO2: Enhanced knowledge of marketing strategies for consumer and industrial marketing
CO3 : Deep understanding of choice of marketing mix elements and managing integrated marketing channels
CO4: Ability to analyze the nature of consumer buying behaviour
CO5: Understanding of the marketing research and new trends in the arena of marketing

TEXT BOOKS
1. Philip. T. Kotler and Kevin Lane Keller, Marketing Management, Prentice Hall India, 15th Edition, 2017
2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill Education, 2012

REFERENCES
1. Lamb, Hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching- A south Asian perspective Cengage Learning, 2012.
2. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition, Oxford University Press,5 th edition, 2019.
3. Ramasamy, V.S, Namakumari, S, Marketing Management: Global Perspective Indian Context, Macmillan Education, New Delhi, 6 th edition, 2018.
4. NAG, Marketing successfully- A Professional Perspective, Macmillan 2008.
5. Micheal R.Czinkota, Masaaki Kotabe, Marketing Management, Vikas Thomson Learning, 2nd edition 2006.

COURSE NAME:RECOMMENDER SYSTEMS	L	T	P	C
COURSE NAME:191ITV96	2	0	2	3

COURSE OBJECTIVES:
- To understand the foundations of the recommender system.
- To learn the significance of machine learning and data mining algorithms for Recommender systems
- To learn about collaborative filtering
- To make students design and implement a recommender system.
- To learn collaborative filtering.

UNIT I   INTRODUCTION   6

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems – Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD)

Suggested Activities:
Practical learning – Implement Data similarity measures.
External Learning – Singular Value Decomposition (SVD) applications

Suggested Evaluation Methods:
Quiz on Recommender systems.
Quiz of python tools available for implementing Recommender system**s**

UNIT II   CONTENT-BASED RECOMMENDATION SYSTEMS   6

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

Suggested Activities:
Assignment on content-based recommendation systems
Assignment of learning user profiles

Suggested Evaluation Methods:
Quiz on similarity-based retrieval.
Quiz of content-based filtering

UNIT III   COLLABORATIVE FILTERING   6

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

Suggested Activities:
● Practical learning – Implement collaborative filtering concepts
● Assignment of security aspects of recommender systems

Suggested Evaluation Methods:
- Quiz on collaborative filtering
- Seminar on security measures of recommender systems

UNIT IV   ATTACK-RESISTANT RECOMMENDER SYSTEMS   6

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

Suggested Activities:
● Group Discussion on attacks and their mitigation
● Study of the impact of group attacks

● External Learning – Use of CAPTCHAs

Suggested Evaluation Methods:

● Quiz on attacks on recommender systems
● Seminar on preventing attacks using the CAPTCHAs

UNIT V   EVALUATING RECOMMENDER SYSTEMS   6

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accurac
metrics – Limitations of Evaluation measures

Suggested Activities:

● Group Discussion on goals of evaluation design
● Study of accuracy metrics

Suggested Evaluation Methods:

● Quiz on evaluation design
● Problems on accuracy measures

30 PERIODS

PRACTICAL EXERCISES   **30 PERIODS**

1. Implement Data similarity measures using Python
2. Implement dimension reduction techniques for recommender systems
3. Implement user profile learning
4. Implement content-based recommendation systems
5. Implement collaborative filter techniques
6. Create an attack for tampering with recommender systems
7. Implement accuracy metrics like Receiver Operating Characteristic curves

TOTAL 60 PERIODS

COURSE OUTCOMES:

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

CO1:Understand the basic concepts of recommender systems.

CO2:Implement machine-learning and data-mining algorithms in recommender systems data sets.

CO3:Implementation of Collaborative Filtering in carrying out performance evaluation of recommend systems based on various metrics.

CO4:Design and implement a simple recommender system.

CO5:Learn about advanced topics of recommender systems.

CO6:Learn about advanced topics of recommender systems applications

TEXTBOOKS:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.
3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Sytems Handbook, 1st ed, Springer (2011),
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of massive datasets, 3rd edition, Cambridge University Pres 2020.

COURSE NAME: RISK ANALYTICS   **L   T   P   C**

COURSE CODE:191ITV97   **3   0   0   3**

COURSE OBJECTIVES:
- To develop a basic understanding of risk assessment and its role within the risk management process.
- To understand risk assessment and its role within the risk management process.
- To differentiate between risk assessment and risk management.
- To develop a basic understanding of how to conduct and evaluate an uncertainty analysis for a risk assessment

UNIT I   INTRODUCTION   9
Introduction, Fundamentals of Risk- Risk Planning, Assessment and Management Process and the Systems Approach-Types of Risk Assessment- Risk, Hazard, Performance and Engineering Risk Assessment.

UNIT II   RISK IDENTIFICATION   9
Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA)

UNIT III   RISK PRIORITIZATION & TREATMENT   9
Preliminary Hazard Analysis (PHA), Hazards and Operability Analysis (HAZOP) - Job Safety Analysis (JSA) - Failure Modes and Effects Analysis (FMEA)- Fault Tree Analysis (FTA), Event Tree Analysis (ETA), Decision Trees- Cause-Consequence Analysis (CCA)**.**

UNIT IV   RISK PRIORITIZATION & TREATMENT   9
Risk Probability and Impact Assessment, Risk Index and Risk Ranking - − Risk Matrix, EV Analysis, Sensitivity and Tradeoff Analysis, Modeling and Simulation- Risk Attitude and Risk Tolerance, As Low As Reasonably Practicable (ALARP)- Avoidance, Separation, Reduction, Transfer, Acceptance- Detection, Control, Response and Recovery- Performance Monitoring

UNIT V   SPECIAL TOPICS AND APPLICATION   9
ISO3100, Quality and Reliability- Supply Chain Risk Management- Project Risk Management- Positive Risk/ Opportunities Management- Risk and TOC.

                                                          TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Identify the core types of project risks.
CO2: Use qualitative and quantitative risk assessment methods.
CO3: Competently use risk simulation techniques
CO4: Use risk analysis tools/methods and work in a group to create a risk management plan based on the ISO 31000:2009.
CO5: Identify a range of risk management issues/challenges and the risks as complex systems cascade and be competent to initiate potential actions in response

TEXT BOOK:
1. Marvin Rausand Stein Haugen , Risk Assessment: Theory, Methods, and Applications, Wiley, 2020.

REFERENCES :

1. Mohammad Modarres , Risk Analysis in Engineering Techniques, Tools, and Trends, CRC Press, 2006**.**

COURSE NAME:SOCIAL, TEXT AND MEDIA ANALYTICS   **L T P C**

COURSE CODE:191ITV98   **3 0 0 3**

COURSE OBJECTIVES:
- To understand the basic issues and types of social,text and media mining
- Familiarize the learners with the concept of social, text and media analytics and understand its significance.
- Familiarize the learners with the tools of social, text and media analytics.
- Enable the learners to develop skills required for analyzing the effectiveness of social, text and media for business purposes
- To know the applications in real time systems.

UNIT I   INTRODUCTION TO SOCIAL MEDIA ANALYSIS   9

Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization.

UNIT II   OVERVIEW OF TEXT MINING AND DATA MINING   9

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations –Preprocessing–Types of Problems– basics of document classification- information retrieval clustering
and organizing documents- information extraction- prediction and evaluation- Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures**.**

UNIT III   TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION
     9

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference - Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations – Pattern Extraction - Apriori Algorithm – FP Tree algorithm.

UNIT IV   WEB ANALYTICS TOOLS   9

Click stream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis. Do a case study on Google analytics.

UNIT V   MARKETING RESEARCH & TRENDS IN MARKET   9

Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on FB. Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. Case study : Identify Consumer Preferences and Market Positioning of a New Product.

COURSE OUTCOMES:
CO1: Understand about social, text and media mining
CO2: Understand the significance of social text and media analytics
CO3: Learn tools of social, text and media analytics.

CO4: Develop skills required for analyzing the effectiveness of social text and media for business purposes
CO5: Know the applications in real time systems.

TOTAL :45 PERIODS

TEXT BOOK :
1.Marshall Sponder, Social Media Analytics, McGraw Hill ,2011
2.Charu C. Aggarwal ,ChengXiang Zhai, Mining Text Data, Springer; 2012

REFERENCES :
1. Matthew Ganis, Avinash Kohirkar , Social Media Analytics: Techniques and Insights for Extracting Business Value Out of
Social Media, Pearson, 2016.
2. Jim Sterne, Social Media Metrics: How to Measure and Optimize Your Marketing Investment, Wiley, 2010.
3. Oliver Blanchard ,Social Media ROI: Managing and Measuring Social Media Efforts in Your Organization (Que Biz-Tech)
2019
4. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau "The Text Mining Handbook:Advanced Approaches i
Analyzing Unstructured Data", Springer, paperback 2010
5. Ronen Feldman, James Sanger -" The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data"
Springer, paperback 2010.
6.Tracy L. Tuten, Michael R. Solomon, Social Media Marketing , Sage, 2016.

YEAR	IV	SEMESTER	VIII	L	T	P	C
COURSE CODE / COURSE TITLE		**191CB87A - PROJECT PHASE II**		0	0	24	12

COURSE OBJECTIVES

- ✓ To further develop and advance the project initiated in Phase 1. This could involve refining the project scope, objectives, and plans.
- ✓ To identify and address any challenges or issues that arise during the project implementation, teaching students problem-solving skills in a real-world context.
- ✓ To integrate the knowledge and skills gained in previous coursework into the practical implementation of the project.
- ✓ To emphasize the importance of documenting project processes, decisions, and outcomes for future reference or analysis.
- ✓ To encourage creative and innovative thinking in finding solutions and approaches to project challenges

EVALUATION

14. Start by clarifying the objectives and work done in Phase 1 for the specific project. Ensure that these objectives align with the course or program's learning outcomes.
15. Develop evaluation rubrics and criteria that clearly outline what you'll be assessing. These rubrics should include criteria related to content, presentation, research, teamwork, and other relevant aspects.
16. Evaluate how well the documentation aligns with the project's objectives and scope.
17. Assess students' ability to communicate their work effectively, answer questions, and defend their project decisions.
18. This may include evaluating the technical aspects, creativity, problem-solving, and attention to detail.
19. Evaluate the effectiveness of team collaboration. Consider factors such as communication, delegation of tasks, conflict resolution, and individual contributions.
20. Ensure that students have followed any guidelines, instructions, or best practices relevant to their field of study or industry standards.
21. Provide clear and constructive feedback to students, highlighting their strengths and areas where they can improve.
22. Design the modules and implement the same.
23. Assess the quality of the modules.
24. Coding should be done in any languages based on the output.
25. Ensure that grading is consistent and aligned with the established rubrics.
26. Project implementation output should be verified manually. After the evaluation, compile a final report that summarizes the assessment process and provides recommendations for both individual students and the project as a whole.

COURSE OUTCOMES	
On completion of the course, students will be able to	
CO1	Demonstrate the ability to develop and execute advanced project plans.
CO2	Communicate project progress, findings, and outcomes effectively through comprehensive written reports and oral presentations.
CO3	Work collaboratively in teams to address complex project issues, demonstrating strong teamwork.
CO4	Implement quality assurance and control processes to ensure the quality of project work

CO-PO Mapping												PSO's		
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO2	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO3	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2
CO	3	3	3	2	1	1	1	1	1	1	2	3	3	3	2

Course Assessment methods:

Direct	**Indirect**
Project Reviews	Course Exit Survey
Project Report	
Project Demonstration	

GUIDELINES

Project work shall preferably be batch wise, the strength of each batch shall not exceed maximum of four students.

Viva- voice examination in project work shall be conducted batch-wise.

The CIE marks in the case of projects in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project guide.

Students failing to secure a minimum of 50% of the CIE marks in Project work shall not be eligible for the Project examination conducted by the University and they shall be considered as failed in that/those Course/s. However, they can appear for university examinations conducted in other Courses of the same semester and backlog Courses if any. Students after satisfying the prescribed minimum CIE marks in the Course/s when offered during subsequent semester shall appear for SEE.

Assess the quality of the work.

Norms of final documentation of the project report are to be provided by the Department.