ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

UG Curriculum and Syllabus

(1 to 8 Semesters)

B.TECH – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Choice Based Credit System (CBCS)

REGULATION 2019

ERODE SENGUNTHAR ENGINEERING COLLEGE, ERODE
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REGULATION – 2019
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULAM

Induction Program (Mandatory)	3 weeks duration
Induction program for students to be offered right at the start of the first year	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept. / Branch & Innovations

B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
Minimum credits to be earned: 165 (for Eight Semester)

SEMESTER I

THEORY

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19BS101	Calculus and its Applications	I,III	1,2,3,4,12	2	3	1	0	4	40	60	100	BS
19BS102	Engineering Physics	I	1,2,4,5,6,8,9	-	2	0	2	3	40	60	100	BS
19BS103	Engineering Chemistry	I,III	1,2,3,4,5,7,12	-	3	0	0	3	40	60	100	BS
19HS101	Communicative English	II	2,3,6,9,10,12	3	3	0	0	3	40	60	100	HS
19ES108	Problem Solving and C Programming	I, III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	ES
19TPS01	Soft Skill -1	II,III	8,9,10,12	3	1	0	1	1.5	40	60	100	EEC

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19ES109	C Programming Laboratory	I,III	1,2,3,4,5,12	1,2	0	0	2	1	60	40	100	ES
19ES106	Engineering Graphics	IV	1,2,3,5,10,12	-	0	0	4	2	60	40	100	ES
19BS105	Chemistry Laboratory	III	1,2,3,4,5,12	-	0	0	4	2	60	40	100	BS
			TOTAL		15	1	14	22.5	420	480	900	-

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		SEMESTER II											
THEORY													
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19BS201	Vector Calculus and Complex Variables	I,III	1,2,3,4,12	2	3	1	0	4	40	60	100	BS
19BS204	Physics for Information Science	I	1,3,4,5,7	-	3	0	0	3	40	60	100	BS
19MC201	Environmental Science and Engineering	I, II	1,2,3,4,5,6,7,8,12	-	3	0	0	0	40	60	100	MC
	Language Elective				3	0	0	3	40	60	100	HS
19ES201	Problem Solving and Python Programming	I, III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	ES
19ES203	Fundamentals of Electrical and Electronics Engineering	I, IV	1,2,3,4	-	3	0	0	3	40	60	100	ES
19TPS02	Soft Skill -II	II,III	8,9,10,12	3	1	0	1	1.5	40	60	100	EEC
PRACTICAL													
19ES213	Problem Solving and Python Programming Laboratory	I, II	1,2,3,4,12	1,2	0	0	2	1	60	40	100	ES
19ES224	Engineering Practices Laboratory	I, II	1, 2, 3, 5	2	0	0	2	1	60	40	100	ES
				TOTAL	19	1	6	19.5	400	500	900	-

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SEMESTER III

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19BS305	Discrete Mathematics	I,III	1,2,3, 4,12	2	3	1	0	4	40	60	100	BS
19ES302	Digital Electronics	I, III, IV	1,2,3, 4,12	2	3	0	0	3	40	60	100	ES
19AD301	Foundations of Data Science	I, III	1,2,3,4, 12	1,2	3	0	0	3	40	60	100	PC
19AD302	Data Structures & Analysis of Algorithms	I, III	1,2,3,4, 12	1,2	3	0	0	3	40	60	100	PC
19AD303	Fundamentals of Operating Systems	I, III	1,2,3,4, 12	1, 2	3	0	0	3	40	60	100	PC
19TPS03	Quantitative Aptitude and Logical Reasoning - I	II,III	1,2,9, 10,12	3	2	0	0	0	40	60	100	EEC
19MC301	Indian Constitution	II,III	6, 8,10, 11,12	-	2	0	0	0	40	60	100	MC

PRACTICAL

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
19ES308	Digital Electronics Laboratory	I, III	1,2,3,4, 5,12	2	0	0	4	2	60	40	100	ES
19AD304	Data Structures & Algorithms Laboratory	I, III	1,2,3,4, 5,12	1,2	0	0	4	2	60	40	100	PC
		TOTAL			19	1	8	20	400	500	900	-

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SEMESTER IV

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19BS406	Statistical methods for Data Analysis	I,III	1,2,3,4,12	2	3	1	0	4	40	60	100	BS
19AD401	Introduction to Artificial Intelligence	I,III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PC
19AD402	Computer Architecture & Organization	I, III	1,2,3,4,12	1,2	3	0	0	3	40	60	100	PC
19CS403	Object Oriented Programming	I, III	1,2,3,8,10,12	1,2	3	0	0	3	40	60	100	PC
19IT302	Data Base Management Systems	I, III	1,2,3, 4,12	1,2	3	0	0	3	40	60	100	PC
19HS402	Universal Human Values 2: Understanding Harmony	II, IV	8	3	2	1	0	3	40	60	100	HS
19TPS04	Quantitative Aptitude and Logical Reasoning - II	I, II, IIIIV	1,2,9, 10,12	3	2	0	0	0	40	60	100	EEC

PRACTICAL

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19CS406	Object Oriented Programming Laboratory	I, III	1,2,3,4,12	1,2	0	0	4	2	60	40	100	PC
19IT305	DBMS Laboratory	I, III	1,2,3,4 5,12	1,2	0	0	4	2	60	40	100	PC
19AD403	Statistical Computing Laboratory	I,III	1,2,3,4,5, 12	1,2	0	0	4	2	60	40	100	PC
19HS401	Language Skills	II	5,9,10,12	3	0	0	2	-	100	-	100	EEC
	TOTAL				20	2	14	25	520	480	1000	-

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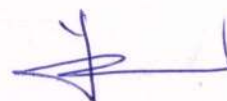
SEMESTER VI

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19AD601	Data Security	I,III	1,2,3,4,5, 8,12	2	3	0	0	3	40	60	100	PC
19AD602	Data Visualization Techniques	I,III	1,2,3,5,12	2	3	0	0	3	40	60	100	PC
19AD603	Internet of Things & its applications	I,II,III IV	1,2,3,4,5, 6,7,10,11, 12	1,2	3	0	0	3	40	60	100	PC
	Open Elective II				3	0	0	3	40	60	100	OE
	Professional Elective II				3	0	0	3	40	60	100	PE
19AD604	Natural Language Processing	I,III	1,2,3,4,5, 8,12	2	3	0	0	3	40	60	100	PC
19TPS06	Quantitative Aptitude and Logical Reasoning - IV	I,II,III	1,2,3,4, 12	3	2	0	0	0	40	60	100	EEC

PRACTICAL

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
19AD605	Data Visualization & NLP Laboratory	I,III	1,2,3,4,5, 8,12	2	0	0	4	2	60	40	100	PC
19AD606	IoT Laboratory	I,II,III	1,2,3,4,5, 8,12	2	0	0	4	2	60	40	100	PC
	TOTAL				20	0	10	22	500	500	1000	-

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SEMESTER V

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19AD501	Big Data Analytics Methods	I,III	1,2,3,4,5, 12	1,2	3	0	0	3	40	60	100	PC
19AD502	Software Engineering	I, III	1,2,3,4,5 ,8,9,10, 11,12	1,2	3	0	0	3	40	60	100	PC
	Open Elective I				3	0	0	3	40	60	100	OE
19AD503	Computer Networks	II,III	10,11	3	3	0	0	3	40	60	100	HS
	Professional Elective I				3	0	0	3	40	60	100	PE
19AD504	Machine Learning Techniques	I,II,III	1,2,3,4,5, 12	1,2	3	0	0	3	40	60	100	PC
19TPS05	Quantitative Aptitude and Logical Reasoning - III	I, II, III	1,2,9, 10,12	3	2	0	0	0	40	60	100	EEC

PRACTICAL

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19AD505	Data Analytics Laboratory	I,II,III	1,2,3,4,5, 7,8,9,10, 12	1,2	0	0	4	2	60	40	100	PC
19AD506	Machine Learning Laboratory	I,II,III	1,2,3,4,5, 8,9,12	1,2	0	0	4	2	60	40	100	PC
	TOTAL				20	0	10	22	500	500	1000	-

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SEMESTER VII

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
19AD701	Predictive Analysis	I,III	1,2,3,4,5, 12	1,2	3	0	0	3	40	60	100	PC
19AD702	Deep Learning Algorithms and Architecture	I,III	1,2,3,4,5, 12	2	3	0	0	3	40	60	100	PC
	Professional Elective III				3	0	0	3	40	60	100	PE
	Professional Elective IV				3	0	0	3	40	60	100	PE
19AD703	High Performance Computing	I,II,III	1,2,3,4,5, 10,12	1,2	3	0	0	3	40	60	100	PC
	Open Elective III				3	0	0	3	40	60	100	OE

PRACTICAL

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
19AD704	Deep Learning Algorithms Laboratory	I,II,III	1,2,3,4, 5,9,10, 11,12	2	0	0	4	2	60	40	100	PC
19AD705	Project Work Phase I	I,II,III, IV	1,2,3,45 ,6,7,8,9, 10,11,1 2	1,2, 3	0	0	2	1	60	40	100	EEC
			TOTAL		18	0	6	21	360	440	800	-

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SEMESTER VIII

THEORY

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEO	PO	PSO					CA	ES	Tot.	
	Professional Elective V				3	0	0	3	40	60	100	PE
	Professional Elective VI				3	0	0	3	40	60	100	PE

PRACTICAL

Code No	Course	PEO	PO	PSO	L	T	P	C	CA	ES	Tot.	Category
19AD801	Project Work Phase II	I, II, III, IV	1,2,3,4,5, 6,7,8,9, 10,11,12	1,2,3	0	0	12	6	60	40	100	EEC
	TOTAL				6	0	14	12	140	160	300	-

S. No.	Category	Credits Per Semester								Total Credit	Credits in %	Range of Total Credits (AICTE)	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	12	7	4	4	-	-	-	-	27	16.67	15%	20%
2	ES	6	8	5	-	-	-	-	-	19	11.73	10%	15%
3	HS	3	3	-	3	3	-	-	-	12	7.27	5%	10%
4	PC	-	-	11	18	13	16	11	-	69	42.59	40%	45%
5	PE	-	-	-	-	3	3	6	6	18	11.11	10%	15%
6	OE	-	-	-	-	3	3	3	-	9	5.56	5%	10%
7	EEC	1.5	1.5	-	-	1	-	1	6	11	6.79	5%	10%
	Total	22.5	19.5	20	25	23	22	21	12	165	100	90%	125%

BS- Basic Science   ES-Engineering Science   HS-Humanities and Social Science

PE- Professional Elective   OE- Open Elective   PC- Professional Core

MC – Mandatory course   CA – Continuous Assessment

ES- End semester Examination   EEC-Employability Enhancement Course

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MANDANTORY COURSE

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Tot.	
19MC201	Environmental Science and Engineering	I, II	1,2,3,4, 5,6,7, 8,12	-	3	0	0	0	40	60	100	BS
19MC301	Indian Constitution	II,III	6,8,10, 11,12	-	2	0	0	0	40	60	100	MC

LANGUAGE ELECTIVE

Code No	Course	Objectives & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Tot.	
19HX201	English for Engineers	II	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX202	Hindi	II	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX203	Japanese	II	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS
19HX204	French	II	2,3,6, 9,10,12	3	3	0	0	3	40	60	100	HS

PROFESSIONAL ELECTIVE I

Code No	Course	L	T	P	C	Maximum Marks			Category
						CA	ES	Tot.	
19ADPE01	Embedded System Development	3	0	0	3	40	60	100	PE
19ADPE02	Distributed Systems	3	0	0	3	40	60	100	PE
19ADPE03	Web User Interface Design	3	0	0	3	40	60	100	PE
19ADPE04	Free Open Source Software	3	0	0	3	40	60	100	PE
19ADPE05	Social Networking	3	0	0	3	40	60	100	PE

PROFESSIONAL ELECTIVES – II

Code No	Course	L	T	P	C	Maximum Marks			Category
						CA	ES	Tot.	
19ADPE06	Advanced Python for Data Analysis	3	0	0	3	40	60	100	PE
19ADPE07	Advanced Java Programming	3	0	0	3	40	60	100	PE
19ADPE08	R Programming	3	0	0	3	40	60	100	PE
19ADPE09	Data warehousing and Mining	3	0	0	3	40	60	100	PE
19ADPE10	Web Services Programming and XML	3	0	0	3	40	60	100	PE

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester	I

Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS101	CALCULUS AND ITS APPLICATIONS	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to
- Interpret the introductory concepts of Limit and continuity
- Interpret the introductory concepts of calculus, this will enable them to model and analyze physical phenomena involving continuous change of variables
- Find eigen values and eigen vectors which is one of the powerful tools to handle practical problems arising in the field of engineering.
- Summarize and apply the methodologies involved in solving problems related to functions of several variables.
- Develop enough confidence to identify surface and area there by solving using integration

Course Outcomes: At the end of this course, learners will be able to:
- Apply differentiation to solve maxima and minima problems use both the limit definition and rules of differentiation to differentiate functions
- Identify and model the real time problems using first order linear differential equations. Recognize and solve the higher order ordinary differential equations.
- Analyze the characteristics of a linear system with Eigen values and Eigen vectors.
- Characterize the functions of several variables and get the solutions of the same.
- Integrate the functions for evaluating the surface area and volume.

Unit I	LIMITS AND CONTINUITY	12

Repesentation of a function-Limit of a function-Continuty-Derivatives-Differentiation rules-Maxima and Minima of one variable

Unit II	ORDINARY DIFFERENTIAL EQUATIONS	12

Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchy's linear differential equation - Method of variation of parameters for second order differential equations-Vibrating string-Electrical circuits

Unit III	MULTIVARIABLE CALCULUS	12

Functions of Two Variables - Total Differential - Derivative of implicit functions- Jacobian's- constrained maxima and minima

Unit IV	MULTIPLE INTEGRALS	12

Double integration with constant and variable limits-Region of integration -Change the order of integration - Area as double integral in cartesian coordinates. Triple integral in Cartesian coordinates.
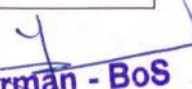
Unit V	EIGEN VALUES AND EIGEN VECTORS	12

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values- Cayley - Hamilton Theorem Orthogonal matrix- Diagonalisation-Quadratic form: Reduction of a quadratic form to a canonical form.

REFERENCE(S):

1.	Thomas Calculus, 14th Edition by Pearson
2.	Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2015.
3.	Peter V. O Neil , Advanced Engineering Mathematics, Eight Edition , Cengage Learning India Private Limited, 2018
4.	C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
5.	Glyn James, Advanced Engineering Mathematics, Third Edition, Wiley India, 2014.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R2019	Semester I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS102	ENGINEERING PHYSICS	2	0	2	3	60	100	

Course Objective (s): The purpose of learning this course is
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology
- To get the basic knowledge on the properties of matters
- To acquire knowledge in Ultrasonics, Laser and fibers
- To enhance the knowledge in quantum theory
- To understand basic concepts of thermal properties of materials

Course Outcomes: At the end of this course, learners will be able :
- To gain knowledge on the basics of properties of matter and its applications
- To acquire knowledge on the concepts of Ultrasonics and their applications
- To have adequate knowledge on the concepts of fiber & Laser and their applications
- To get knowledge on advanced Physics concepts of quantum theory and its applications in tunneling microscopes and
- To understand knowledge on the concepts of thermal properties of materials and their applications in expansion of joints and heat exchangers

Unit I	PROPERTIES OF MATTER	6

Elasticity – Stress-strain diagram and its uses - torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders.

Unit II	ULTRASONICS	6

Introduction–Classification of Sound- Ultrasonics Production - Magnetostriction generator - Piezo electric generator-cavitations-ultrasonic cleaning-Non Destructive Testing- Pulse echo system through transmission and reflection modes- A, B and C – scan displays- Engineering Applications-Cutting, welding and drilling.

Unit III	LASER AND FIBRE OPTICS	6

Lasers: population of energy levels, Einstein's A and B coefficients derivation – Semiconductor lasers: homojunction and heterojunction – Industrial applications of laser. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

Unit IV	QUANTUM PHYSICS	6

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.

Unit V	THERMAL PHYSICS	6

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: heat exchangers, ovens and solar water heaters.

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TEXT BOOK(S):

1.	Bhattacharya, D.K. & Poonam, T. ―Engineering Physics‖. Oxford University Press, 2015
2.	Gaur, R.K. & Gupta, S.L. ―Engineering Physics‖. Dhanpat Rai Publishers, 2012
3	Pandey, B.K. & Chaturvedi, S. ―Engineering Physics‖. Cengage Learning India, 2012

REFERENCE(S):

1.	Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics‖. Wiley, 2015
2.	Serway, R.A. & Jewett, J.W. ―Physics for Scientists and Engineers‖. Cengage Learning, 2010
3.	Tipler, P.A. &Mosca, G. - Physics for Scientists and Engineers with Modern Physics'.W.H. Freeman, 2007

List of Experiments PHYSICS (ANY FIVE)   30 hrs

1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young's modulus by non-uniform bending method
3. Determination of Young's modulus by uniform bending method
4. Determination of wavelength and particle size using Laser
5. Determination of acceptance angle and numerical aperture in an optical fiber
6. Determination of thermal conductivity of a bad conductor – Lee's Disc method
7. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
8. Determination of wavelength of mercury spectrum – spectrometer grating
9. Determination of band gap of a semiconductor
10. Determination of thickness of a thin wire – Air wedge method

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS103	ENGINEERING CHEMISTRY	3	1	0	4	45	100	

Course Objective (s): The purpose of learning this course is to
- Understand the basic concepts of water characterization and treatment methods.
- Know the fundamental concepts of electrochemistry and corrosion.
- Understand the principles and generation of energy in batteries and nuclear reactors.
- Gain knowledge on polymers.
- Know the types of fuels and the manufacture of solid, liquid and gaseous fuels.

Course Outcomes: At the end of this course, learners will be able to:
- Make the students conversant with water treatment techniques
- Know the reaction involved in corrosion and corrosion protection methods
- Impart knowledge on renewable energy sources like nuclear and to impart knowledge on energy storage devices
- Aware the synthesis & industrial application of polymers
- Impart knowledge on different types of fuels (solid liquid, gas, primary, secondary and synthetic) and combustion process.

Unit I	WATER CHEMISTRY	9

Hardness of water – types – Estimation of hardness of water by EDTA method– – Domestic water treatment-boiler troubles (scales, sludge, priming, foaming, causticembrittlememt) – Internal conditioning (carbonate, phosphate, sodium aluminate and calgon) .External treatment – Demineralization process – Reverse Osmosis.

Unit II	ELECTROCHEMISTRYAND CORROSION	9

Electrochemical cell - redox reaction, electrode potential- Nernst equation (derivation and problems).Standard hydrogen electrode-Calomel Electrode. Corrosion: chemical & electrochemical corrosion (galvanic, differential aeration) - types-factors influencing corrosion rate corrosion control - sacrificial anode and impressed current cathodic protection method.

Unit III	ENERGYSOURCES	9

Introduction- nuclear energy- nuclear fission- nuclear fusion- nuclear chain reactions- light water reactor-breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium ion battery. Fuel cell :H_2 -O_2 fuel cell.

Unit IV	POLYMER CHEMISTRY	9

Monomers - polymers - polymerization - functionality - degree of polymerization - classification of polymers based on source and applications. Types of polymerization: addition, condensation and copolymerization. Preparation, properties and applications of thermosetting (epoxy resin and bakelite) and thermoplastics (poly vinyl chloride, poly tetrafluoroethylene and PMMA). Rubber: SBR. Compounding of plastics (blow moulding, injection, extrusion) .

Unit V	FUELSANDCOMBUSTION	9

Fuel: Introduction- classification of fuels- solid fuels-coal- proximate and ultimate analysis- manufacture of metallurgical coke (Otto Hoffmann method) – Liquid fuels: Refining of petroleum- synthetic petrol Fischer-Trophs and Bergius processes- knocking- octane number- cetane number – Gaseous fuels: liquefied petroleum gases(LPG)- water gas- bio diesel. Combustion- flue gas analysis (ORSAT Method).

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TEXT BOOK(S):

1.	Jain P.C. and Monica Jain, "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd., New Delhi,2019
2.	Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai,2019

REFERENCE(S):

1.	Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2016.
2.	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi,2017.
3.	Gowariker V.R, Viswanatha.N.V,J ayadevSreedhar-"Polymer Science",P ublishing company New Age International Publishers,New Delhi,2015.
4.	Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2017.
5.	Ashima Srivastava and Janhavi N N., "Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2015.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					Semester	I

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS101	COMMUNICATIVE ENGLISH	3	0	0	3	45	100

Course Objective (s):
- To acquire basic English grammar.
- To develop listening skills to listen lectures and basic videos.
- To enhance the reading skill to comprehend technical writings.
- To improve writing skills to express thoughts freely.
- To develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:
- Improve language usage in LSRW skills.
- Develop listening skills to comprehend general / technical talks.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas of the learners.
- Communicate fluently in real time context.

Unit I	LANGUAGE FOCUS	9

Parts of speech - Word formation - Sentence types (declarative, imperative, exclamatory & interrogative) - Tense forms - Subject - Verb agreement

Unit II	LISTENING	9

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Telephone etiquette - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress

Unit III	READING	9

Completing the sentences - Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure - Close reading

Unit IV	WRITING	9

Paragraph writing (descriptive, narrative, expository & persuasive) - Letter (formal and informal) - Dialogue writing - E-mail - Instructions

Unit V	SPEAKING	9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes

TEXT BOOK(S):

.1 Communicative English by KN Shoba ,Lourdes Joavani Rayen Publised by Cambridge university 2017.

REFERENCE(S):

1 Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.

2 Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

3 Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester I	ES
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES108	PROBLEM SOLVING AND C PROGRAMMING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to
- Know the basics of problem solving and C programming
- Understand Control statements and Arrays in C
- Develop C program using function and Pointers
- Apply Structure and Unions
- Handle files

Course Outcomes: At the end of this course, learners will be able to:
- Solve Problems using Problem solving techniques
- Write program using Control statements and arrays
- Develop application using Functions
- Write program using Structure and union
- Perform Read and Write Operations on Files

UNIT I	PROBLEM SOLVING & BASICS OF C PROGRAMMING	9

Introduction to Problem Solving- Program development- Analyzing and Defining the Problem- Modular Design – Algorithm - Flow Chart - What is a programming language-Types of programming language- Program Development. Environment. Introduction to C Language - C character set - Identifiers and Keywords - Data Types – Constants - Variables - Arrays - Declarations - Expressions - Statements - Symbolic constants - Operators and Expressions - Library Functions - Data Input and Output Functions.

UNIT II	CONTROL STATEMENTS & ARRAYS	9

While Statement - Do While Statement – For Loop – Nested Loop - If Else - Switch - Break - Continue - Comma Operator – Goto Statement. Defining Array – Processing array - Passing array to a function - Multi dimensional array - Array and strings

UNIT III	FUNCTIONS & POINTERS	9

Defining Function - Accessing a Function - Passing Arguments to Functions - Specifying Arguments Data Types - Function Prototypes - Storage Classes - Auto - Static - Extern and Register Variables. Declarations – Pointers to a function - Pointers and one dimensional arrays - Operating a pointer - Pointer and multi dimensional arrays - arrays of pointers - passing functions to other functions

UNIT IV	STRUCTURE AND UNION	9

Definition of Structure and Union - Processing a structure – Bit field representations - Structures and pointers - Passing structure to functions - Self referential structures – Nested structure

UNIT V	FILES	9

File Structure concepts introduction - Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files – Operations on Files – Types of Files, Various input and output functions on Files. Enumerated Data Type – Typedef - Preprocessor Directives - Command Line Arguments

TEXT BOOK	
1	Kernighan B. W. and Ritchie DM, "C Programming Language (ANSI C)", Prentice Hall, 2013
2	Deitel H. M. and Deitel P. J., "C How to Program", Prentice Hall, 2012.

REFERENCES	
1.	Herbert Schildt, "C The Complete Reference", Tata McGraw Hill, 2010
2.	Gottfried Byron, "Programming With C", Tata McGraw Hill, 2011

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester I	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS01	SOFT SKILL -1	1	0	2	2	30	100

Course Objective (s): The purpose of learning this course is

- To develop Inter Personal Skills and be an effective team player.
- To develop professional skills with idealistic, practical and moral values.
- To develop Communication Skills.

Course Outcomes: At the end of this course, learners will be able to:

- Have competent knowledge of grammar
- Understand basic rules.
- Speak and write appropriately applying these rules.
- Communicate effectively
- Enhance their interpersonal relationship building skills with renewed self confidence..

SYLLABUS

Effective English – Written and Spoken English

- Basic rules of Grammar - Parts of Speech – Tenses - Verbs
- Sentence Construction - Vocabulary – Idioms & Phrases – Synonyms – Antonyms.
- Dialogues and Conversations – Writing
- Exercises to practice and improve these skills.

Art of Communication & the Hidden Data Involved

- Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback
- Non Verbal Communication - Body Language of self and others
- Importance of feelings in communication - dealing with feelings in communication

World of Teams

- Self Enhancement - importance of developing assertive skills- developing self confidence developing emotional intelligence
- Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved
- Working with Groups – Dealing with People- Group Decision Making

TOTAL HOURS: 45 (15 Theory +30 Hours Practical)

REFERENCE BOOKS

1. The Seven Habits of Highly Effective People - Stephen R. Covey.

2. All the books in the "Chicken Soup for the Soul" series.

3. Man's search for meaning – Viktor Frankl

4. The greatest miracle in the world – Og Mandino

5. Goal - Eliyahu Goldratt.

6. Working with Emotional Intelligence - David Goleman.

7. Excel in English – Sundra Samuel, Samuel Publications

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8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi

9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.

10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel

11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd

12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester I	ES
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES109	C PROGRAMMING LABORATORY	0	0	2	1	60	100

Course Objective (s): The purpose of learning this course is to
- Understand the basic constructs of C Program
- To write program using Function
- Develop application using Structure, union and Files.

Course Outcomes: At the end of this course, learners will be able to:
- Write program using data types and basic C Constructs
- Write program using Arrays and Function
- Implement Structure and Unions
- Implement Pointers
- Process Files

LIST OF EXPERIMENTS

1. Simple programs to understand the concepts of data types.

2. Familiarizing conditional, control and repetition statements.

3. Usage of single and double dimensional arrays including storage operations.

4. Implementation of functions, recursive functions.

5. Defining and handling structures, array of structures and union.

6. Implementation of pointers, operation on pointers and dynamic storage allocation.

7. Creating and processing data files.

TEXT BOOK

1	Kernighan B. W. and Ritchie DM, "C Programming Language (ANSI C)", Prentice Hall, 2013
2	Deitel H. M. and Deitel P. J., "C How to Program", Prentice Hall, 2012.

REFERENCES

1.	Herbert Schildt, "C The Complete Reference", Tata McGraw Hill, 2010
2.	Gottfried Byron, "Programming With C", Tata McGraw Hill, 2011

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester I	ES

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES106	ENGINEERING GRAPHICS	0	0	4	2	45	100

Course Objective (s): The purpose of learning this course is to
- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment / tools.
- To gain the skills for making fitting joints and household pipe line connections using suitable tools.
- To develop the skills for preparing the green sand mould and to make simple household electrical connection
- To provide hands on training for dismantling and assembling of petrol engines, gear box and pumps.
- To develop the skills for making wood/sheet metal models using suitable tools

Course Outcomes: At the end of this course, learners will be able to:
- Fabricate simple components using carpentry, sheet metal and welding equipment/tools
- Make fitting joints and household pipe line connections using suitable tools.
- Prepare green sand mould and make simple household electrical connections using suitable tools
- Dismantle and assemble petrol engines, gear box and pumps.
- Make simple models using wood and sheet metal.

List of Experiments

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box
2. Fabrication of a simple component using thin and thick plates. (Example: Book rack)
3. Making a simple component using carpentry power tools. (Example: Pen stand/Tool box/ Letter box.
4. Prepare a "V" (or) Half round (or) Square joint from the given mild Steel flat.
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve.
6. Prepare a green sand mould using solid pattern/split pattern.
7. Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket.
8. Dismantling and assembly of Centrifugal Monoblock / Gear Pump / Gear box.
9. Dismantling and assembly of two stroke and four stroke petrol engine.
10. Mini Project (Fabrication of Small Components).

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester I	BS

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS105	CHEMISTRY LABORATORY	0	0	2	1	30	50

Course Objective (s): The purpose of learning this course is to
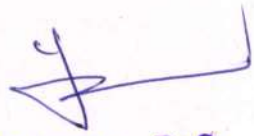
- Determination of total, temporary & permanent hardness of water by EDTA method.
- Determination of chloride content of water sample by Argentometric method.
- Estimation of iron content of the given solution using potentiometer.
- Determination of strength of given hydrochloric acid using pH meter
- Conductometric titration of strong acid vs strong base.

Course Outcomes: At the end of this course, learners will be able to

- Make the student to acquire practical skills in the determination of water quality through volumetric analysis.

- Acquire the knowledge about chloride content in water sample.
- Make the student to acquire practical skills about strength of iron using potentiometric titrations.

- Understand the how to estimate hydrochloric acid in water sample using pH meter.

- Gain the knowledge about conductance of ions.

Exp No.	Name of Experiments (Any Five)
1	Determination of total, temporary & permanent hardness of water by EDTA method.
2	Determination of chloride content of water sample by argentometric method.
3	Determination of strength of given hydrochloric acid using pH meter.
4	Determination of strength of acids in a mixture of acids using conductivity meter.
5	Estimation of iron content of the given solution using potentiometer.
6	Conductometric titration of strong acid vs strong base.
7	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer
8	Estimation of iron content of the water sample using spectrophotometer

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester II	BS
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS201	VECTOR CALCULUS AND COMPLEX VARIABLES	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to
- Summarize problems related to fundamental principles of Vector Calculus
- Apply the methodologies involved in solving problems related to fundamental principles Vector Differentiation and Vector Integration.
- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- Defining a complex function and solving through complex integration

Course Outcomes: At the end of this course, learners will be able to:
- Characterize the calculus of vectors.
- Apply the theoretical aspects of vector integral calculus in their core areas.
- Recognize the differentiation properties of complex functions.
- Identify the complex functions and their mapping in certain complex planes.
- Use the concepts of integration to complex functions in certain regions.

Unit I	DIFFERENTIATION OF VECTORS	12

Vector point function- Directional derivative - Gradient -Divergence -Curl - Solenoidal – Irrotational vector fields –Scalar potential

Unit II	INTEGRATION OF VECTORS	12

Work done - Line Integral - Surface integral- Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

Unit III	ANALYTIC FUNCTIONS	12

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.

Unit IV	MAPPING OF COMPLEX FUNCTIONS	12

Conformal mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

Unit V	COMPLEX INTEGRATION	12

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series- Classification of Singularities - Cauchy's Residue Theorem

REFERENCE(S):

1	Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi 2015
2.	C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd, 2003
3.	J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill,New Delhi, 1996
4.	Peter V. O. Neil, Advanced Engineering Mathematics, Eighth Edition ,Cengage Learning India Private Limited, 2018
5.	Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2007

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester II	BS

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS204	PHYSICS FOR INFORMATION SCIENCE	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is

To understand the essential principles of Physics of semiconductor device and Electron transport properties.

Become proficient in magnetic, super conducting and optical properties of materials and applications of Nanomaterials in computer

Course Outcomes: At the end of this course, learners will be able:
- To acquire knowledge on basics of semiconductor physics and its applications in various devices,
- To get knowledge on magnetic properties of materials and their applications
- To gain knowledge on super conducting materials and quantum computing
- To have the necessary understanding on the functioning of optical materials for optoelectronics,
- To understand the basics of nanomaterials and carbon nanotubes.

Unit I	SEMICONDUCTOR PHYSICS	9

Introduction- types of semiconductors - Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Hall effect theory (n-type and p-type semiconductors) and its experiment- Applications- FET, MOSFET and Silicon control rectifier (qualitative treatment only).

Unit II	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction- Domain Theory, Hysteresis, soft and hard magnetic materials-Ferrites-applications-magnetic recording and readout-storage of magnetic data-Tapes, Floppy disc and magnetic disk drives and GMR

Unit III	SUPER CONDUCTING MATERIALS	9

Introduction-super conducting phenomena-Properties of super conductors-Meissner effect-isotope effect- Type I & Type II super conductor, High TC super conductor-Applications of super conductor-Magnetic levitation and SQUIDS- super conducting computing-quantum computing (qualitative concepts)

Unit IV	OPTICAL MATERIALS	9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and Semiconductors (concepts only) – Excitons – Traps – Luminescence - Flourescence and phosphorescence - LCD, Optical storage device-CD ROM-DVD ROM-Blu ray-DVD RAM

Unit V	NANOELECTRONIC DEVICES	9

Introduction – Nanomaterials-Synthesis-physical vapour deposition-quantum confinement – quantum dot- Applications of nanomaterials- 3D printers-magnetic semiconductors– spintronics - Nanobots-Single electron transistor-DNA computing- Carbon nanotubes: preparation-Chemical Vapour Deposition technique- Properties and applications

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TEXT BOOK(S):	
1.	Jasprit Singh, —Semiconductor Devices: Basic Principles‖, Wiley 2012.
2.	Kasap, S.O. —Principles of Electronic Materials and Devices‖, McGraw-Hill Education, 2007.
3	Kittel, C. —Introduction to Solid State Physics‖. Wiley, 2005.
REFERENCE(S):	
1.	Garcia, N. & Damask, A. —Physics for Computer Science Students. Springer-Verlag, 2012.
2.	Hanson, G.W. —Fundamentals of Nanoelectronics. Pearson Education, 2009
3.	Rogers, B., Adams, J. &Pennathur, S. —Nanotechnology: Understanding Small Systems. CRC Press, 2014

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II	MC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19MC201	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	0	45	100	

Course Objective (s): The purpose of learning this course is to
- Study the nature and facts about environment.
- Finding and implementing scientific, technological and economic solutions to environmental problems.
- Know the types of natural resources and the individual role in conserving the resources.
- Apply the knowledge to various social issues by understanding the environmental legislation laws.
- Study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Outcomes: At the end of this course, learners will be able to:
- Extend their knowledge in maintaining ecological balance and make use of their knowledge in the preservation of biodiversity.
- Outline the role of human being in maintaining a clean environment and useful environment for the future generations.
- Explain the constituents of environment, precious resources in the environment and conservation of natural resources.
- Find the role of government and Non-Government organization and explain the various rain water harvesting techniques.
- Develop their awareness about population growth, Family planning Programme and HIV/AIDS and extend their knowledge in role of information technology in environment & human health.

Unit I	ECOSYSTEMS AND BIODIVERSITY	10

Environment: Scope – importance - need for public awareness -Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social - ethical - aesthetic values - Hotspots of biodiversity
-Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts. Conservation of biodiversity - In-situ and Ex-situ conservation.

Unit II	ENVIRONMENTAL POLLUTION	8

Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.

Unit III	NATURAL RESOURCES	9

Forest resource - Use-over exploitation -deforestation - Water resource - use-over utilization of surface and ground water - conflicts over water - Mineral resource - use-exploitation-environmental effects of extracting and using mineral resource - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resource - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.

Unit IV	SOCIAL ISSUES AND THE ENVIRONMENT	9

Sustainable & Unsustainable development-Water conservation - rain water harvesting (roof top method)- climate change-global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry
– 12 Principles of Green chemistry – Application of Green chemistry.

Unit V	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth - variation among nations - Population explosion & its consequences – Family, child, women welfare programmes - Human rights - HIV/AIDS – Human health and environment - Role of information technology in environment and human health.

TEXT BOOK(S):

1.	Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015)
2.	Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing Co. Pvt. Ltd., Chennai,12th Edition (2016)

REFERENCE(S):

1.	Masters, Gilbert M, —Introduction to Environmental Engineering and Sciencell, Second Edition, Pearson Education, New Delhi (2012).
2.	Santosh Kumar Garg, Rajeshwarigarg, smfRanjniGarg —Ecological and Environmental Studiesll Khanna Publishers, NaiSarak, Delhi (2014).
3.	R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard", Vol. I and II, Enviro Media.
4.	Dharmendra S. Sengar, "Environmental law", Prentice Hall of India PVT LTD, New Delhi, 2007. 4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2005
5.	Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2015.

M.P

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REFERENCE(S)

1.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
2.	Brian Heinold, "Introduction to Programming Using Python",Mount St. Mary's University, 2013.
3.	Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4.	Cunningham, Sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE			R 2019	Semester II	ES

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES201	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand problem solving concepts .
- To understand why Python is a useful scripting language for developers and to read and write simple Python programs.
- To develop Python programs with conditionals and loops
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python

Course Outcomes:

At the end of this course, learners will be able to

- Apply problems solving techniques to real world problems.
- Recognize and construct common programming idioms: variables, loop, branch, and input/output.
- To design, code, and test Python programs using List, Tuples and Strings
- To write code using dictionaries and functions
- To read and write data from/to files in Python Programs.

Unit I	COMPUTATIONAL THINKING	9

Introduction to Computational Thinking –From abacus to machine – The first Software –First Modern Computer-Information and data - Converting information into data -Data Capacity Problem Solving Techniques: General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops Case Study: Raptor and Scratch Tools.

Unit II	INTRODUCTION TO PYTHON	9

History-   Features - Setting up path - Working with Python -   Basic Syntax - Variable and Data Types - Operator - Conditional Statements – Looping – Control Statements.

Unit III	STRING MANIPULATION, LIST AND TUPLES	9

Creating String - Accessing Strings - Basic Operations - String slices - Function and Methods – Creating List - Accessing list - Operations on List - Working with lists - Function and Methods – Creating tuple - Tuple Operations – Functions and Methods.

Unit IV	DICTIONARIES AND FUNCTIONS	9

Creating Dictionaries - Accessing values in dictionaries - Working with dictionaries - Properties – Functions - Defining a function - Calling a function - Types of functions - Function Arguments - Anonymous functions - Global and local variables.

Unit V	MODULES, FILES AND EXCEPTION HANDLING	9

Modules - Importing module - Math module - Random module - Packages - Composition Files - Opening and closing file- File Opening Modes - Reading and writing files – Functions Exception Handling - Exception - Exception Handling - Except clause - Try , finally clause User Defined Exceptions.

TEXT BOOK(S)	
1,	David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2,	Michael Dawson ,"Python Programming for the Absolute Beginner" , 3rd Edition, 2010.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX201	ENGLISH FOR ENGINEERS	3	0	0	3	45	100	

Course Objective (s):
- To acquire the usage of grammar in English language.
- To develop listening skills which will enable to listen lectures and comprehend different types of texts.
- To enhance the reading skill to comprehend technical writings.
- To improve writing skills to express thoughts freely.
- To develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:
- Improve their language usage in LSRW skills.
- Develop listening skills to understand sentence stress and intonations.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas of the learners.
- Communicate fluently in pair / team.

Unit I	LANGUAGE FOCUS	9

Voice(Active & Passive) - Reported speech - Conditionals - Collocations - Discourse markers - One word substitution - Phrasal verbs - Error identification

Unit II	LISTENING	9

Listening for specific information – Identifying sentence stress - Rhythm - Intonation

Unit III	READING	9

Reading graphs and charts - Skimming and scanning texts – Identifying topic sentences - Understanding the structure of a text

Unit IV	WRITING	9

Job Application, Letter and Resume - Recommendations - Report writing (accident and survey) - Writing review (book and movie) - Transcoding (interpreting charts & diagrams)

Unit V	SPEAKING	9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Language Functions: suggesting - comparing and contrasting -Expressing - finding out facts, attitudes and opinions

TEXT BOOK(S):

1.	Communicative English by KN Shoba ,Lourdes JoavaniRayen Published by Cambridge university Revised Edition 2018

REFERENCE(S):

1	Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively and Developing Speaking Skills for Business English, Cambridge: Cambridge University Press, 2002.
2	Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes. United Kingdom: Cambridge University Press, 2004.
3	Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.
4	Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX202	HINDI	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- To help students to acquire the basics of Hindi
- To teach them how to converse in Hindi on various occasions
- To help learners acquire the ability to understand a simple technical text in Hindi

Course Outcomes: At the end of this course, learners will be able to:
1. An ability to communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Proper vocabulary

Unit I	HINDI ALPHABET	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises. Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu& Visarg -Table of Alphabet -Vocabulary.

Unit II	NOUNS IN HINDI	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

Unit III	PRONOUNS AND TENSES	9

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

Unit IV	CLASSIFIED VOCABULARY	9

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

Unit V	SPEAKING	9

Model Sentences - Speaking practice for various occasions.

TEXT BOOK(S):

1.	Elementary Hindi: Learn to Communicate in Everyday Situations by Richard Delacy Tuttle Publication 2013
2	Colloquial Hindi: The Complete Course for Beginners by Tej K. Bhatia

REFERENCE(S):

1	B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009
2	Syed, Prayojan Mulak Hindi, RahamathullahVani Prakasan, New Delhi, 2002.
3	Ramdev, Vyakaran Pradeep, Saraswathi Prakasan, Varanasi, 2004.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II	HS

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX204	FRENCH	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- To help students acquire the basics of French language
- To teach them how to converse in French in various occasions

Course Outcomes: At the end of this course, learners will be able to:
- The students will become familiar with the basics of French language and start conversing in French.

Unit I	Alphabet Français	6

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - trémacédille - écrire son nom dans le français (spellingone -sname in French) - Les noms de jours de la semaine (Days of the week)

Unit II	Numbers, month & year (Nombre, mois et année)	6

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

Unit III	Language Skills & Grammar (Compétences linguistiques et grammaire)	10

Moyens de transport (Transport) - Noms de Professions (Professions) - Nomsd'endroitscommuns (Places) - Nationalités (Nationalities) ECOUTER : (Listening) Écouter I - alphabet associéà des prénomsfrançais - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez - Vous (Introducingoneself)LIRE :Lireles phrases simples

Unit IV	Grammar (et grammaire)	12

Pronoms (Pronouns) - Nomscommunsmasculins et de femme (Common masculine and Femininenouns) - Verbescommuns (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profilsd'utilisateursd'interlingua (alter ego)PARLER :Parler de saville - Parler de sa profession

Unit V	Speaking & Writing (Parler et écrire)	11

Narration de son nom et l'endroitoù on vit - Son âge et date de naissance - Numéro de téléphoneet'dresse- Narration du temps - La France en Europe PARLER :Conversation entre deuxamis - Jouer la scène ÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune carte postale

TEXT BOOK(S):

1.	Le Bon Usage by M. Grevisse Publisher- Duculot 14 edition (25 January 2001)
2	Advanced French by Monique L'Huillier, Cambridge University Press,2013

REFERENCE(S):

1	Alter ego+ Niveau a1
2	Grammaire Progressive du Français
3	Collins Easy Learning French Verbs& Practice
4	FrançaisLinguaphone
5	Françaisl.Harrisonburg: The Rosetta Stone: Fairfield Language Technologies

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester II	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HX203	JAPANESE	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to
- To help students acquire the basics of Japanese language
- To teach them how to converse in Japanese in various occasions
- To teach the students the Japanese cultural facets and social etiquette

Course Outcomes: At the end of this course, learners will be able to communicate effectively with:
- Improved fluency in Japanese
- Clarity on the basic sounds of the Japanese language
- Proper vocabulary

Unit I	Introduction	9

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions Numerals. N1 wa N2 des - N1 wa N2 jaarimasen - S ka - N1mo - N1 no N2 - .san - Kanji - Technical Japanese Vocabulary (25 Numbers) - Phonetic and semantic resemblances between Tamil and Japanese

Unit II	Vocabulary & Grammar 語彙と文法	9

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so jaarimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha-V masendeshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

Unit III	Noun & Types 名詞とタイプ	9

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye moikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 woshimus - Naniwoshimasuka - Nan & Nani - N1(Place) de V - V masenka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 - Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit IV	Vocabulary & Grammar 語彙と文法	9

Introduction to Adjectives - N1wanaadj des. N1 wa ii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonna N2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 gasukimasu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 gaarimasu - imasuN1(Place) ne N2 gaarimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit V	Root Word & Vocabulary 語彙と語彙	9

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 thoDhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical Japanese Vocabulary (25 Numbers)

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester II	ES

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES203	FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to
- To know about the Electric circuit laws, single and three phase circuits and wiring
- To understand the Function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To understand the various measuring instruments

Course Outcomes: At the end of this course, learners will be able to:
- Apply the concept of electric circuit laws to analyze the electric circuits.
- Analyze the working principles of electrical machines.
- Understand the concepts of various electronic devices.
- Design the logic gates, Half and Full adder.
- Choose appropriate instruments for electrical measurement for a specific application

Unit I	ELECTRICAL CIRCUITS	9

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Unit II	ELECTRICAL MECHANICS	9

Construction, Principle of Operation , Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor

Unit III	SEMICONDUCTOR DEVICES AND APPLICATIONS	9

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics

Unit IV	DIGITAL ELECTRONICS	9

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip – Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

Unit V	MEASUREMENTS & INSTRUMENTATION	9

Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical - ,Classification of instruments - Types of indicating Instruments – Oscilloscopes – three phase power measurements – instrument transformers (CT and PT)

TEXT BOOK(S):

1.	D P Kothari and I.J Nagarath, "Electrical Machines "Basic Electrical and Electronics Engineering", McGraw Hill Education(India) Private Limited, Third Reprint ,2016
2.	Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008
3.	Leonard S Bobrow, "Foundations of Electrical Engineering", Oxford University Press, 2013

REFERENCE(S):

1.	Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2.	Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
3.	Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester II	ES

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES213	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Course Outcomes:

At the end of this course, learners will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

List of Experiments

- Find the Greatest among three numbers without using third variable
- Sum of the Digits of a Number
- Generation of Prime Numbers
- Implement a sequential search
- Create a calculator program
- Explore string functions
- Implement Selection Sort
- Implement Stack
- Read and write into a file
- Demonstrate usage of basic regular expression
- Demonstrate use of advanced regular expressions for data validation.
- Demonstrate use of List
- Demonstrate use of Dictionaries
- Create Comma Separate Files (CSV), Load CSV files into internal Data Structure

TEXT BOOK(S)

1,	David Riley and Kenny Hunt, "Computational Thinking for the Modern Problem Solver", Chapman & Hall/CRC, 2014.
2	Michael Dawson ,"Python Programming for the Absolute Beginner" , 3rd Edition, 2010.

REFERENCE(S)

1.	M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
2.	Brian Heinold, "Introduction to Programming Using Python",Mount St. Mary's University, 2013.
3.	Allen Downey, Green Tea Press Needham, "Think Python, How to Think Like a Computer Scientist", Massachusetts.
4.	Cunningham, Sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II	ES

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES224	ENGINEERING PRACTICES LABORATORY	0	0	2	1	30	100

Course Objective (s):

The purpose of learning this course is

- To provide a practical exposure to basic engineering practices like making of simple electrical and electronic circuits
- To have an understanding on the use of various tools, instruments and methods
- To enable the students to appreciate the practical difficulties and safety issues

Course Outcomes:

At the end of this course, learners will be able to

- Appreciate the practical skills needed even in making of simple circuits
- Attend minor defects especially in items used in day to day life
- Aware of the safety aspects involved in using tools and instruments

ELECTRICAL ENGINEERING PRACTICE

1. Comparison of incandescent, Fluorescent, CFL and LED lamps.
2. Study of Protection Circuits (small relay, fuse, MCB, HRC, MCCB, ECCB).
3. Familiarization of households Electrical Gadgets (Iron Box, WetGrinder).
4. Understanding of Domestic and Industrial wiring.
5. Earthing and its significance.
6. Troubleshooting in Electrical Circuits.
7. Study of inverter fed UPS/Emergency lamp

ELECTRONICS ENGINEERING PRACTICE

1. Identifications symbolic representation of active and passive electronic components
2. Soldering and tracing of electronic circuits and checking its continuity
3. Assembling of A.C. to D.C, D.C to A.C. Circuits in bread Board and Mini project.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester II EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS201	SOFT SKILL - II	1	0	2	2	30	100

Course Objective (s): The purpose of learning this course is

- To develop Communication Skills.
- To develop Creative Thinking.

Course Outcomes: At the end of this course, learners will be able to:

- Work together in teams and accomplish objectives in a cordial atmosphere.,
- Face interviews
- Face GDs and presentations.
- Understand the etiquette necessary to present oneself in a professional setting.
- Develop the etiquette necessary to present oneself in a professional setting

<div align="center">SYLLABUS</div>

Interview, GD & Presentation Skills

- Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback
- GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback.
- Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback
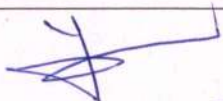
Business Etiquette & Ethics

- Grooming etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress.
- Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.

TOTAL : 45 HOURS (Theory : 15 + Practical 30)

REFERENCE BOOKS

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester	III
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS305	DISCRETE MATHEMATICS	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to
- Understand the notion of mathematical thinking and be able to apply them in problem solving.
- Understand the notion of mathematical proofs and be able to apply them in problem solving
- Understand and use the terms Cardinality, finite, countably infinite and uncountably infinite, and determine which of these characteristics is associated with a given set.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment
- Work and apply Boolean in logical circuits

Course Outcomes: At the end of this course, learners will be able to:
- Formulate short proofs using the following methods: direct proof, indirect proof and proof by contradiction.
- Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions and integers.
- Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.
- Recognize properties of graphs and its applications
- Solve Boolean functions and minimize circuits using gates

Unit I	LOGIC AND PROOFS	12

Propositional Logic – Applications of Propositional logic-Propositional equivalences – Predicates and Quantifiers – Nested Quantifiers – Rules of inference – Introduction to proofs

Unit II	COUNTING	12

The basics of counting – The pigeonhole principle – Permutations and combinations – Generating functions –Principle of Inclusion and Exclusion

Unit III	RELATIONS	12

Relations and their properties – n-ary Relations and their Applications- Representing relations – Closures of relations-Equivalence relations- partial orderings.

Unit IV	GRAPHS	12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths –shortest path problems – planar graphs – graph coloring.

Unit V	BOOLEAN ALGEBRA	12

Boolean functions- representing Boolean functions – logic gates-minimization of circuits.

REFERENCE(S):

1.	Kennath H Rosan, "Discrete Mathematics and Its Applications" Seventh Edition, Tata McGraw Hill, 2012.
2.	Ralph. P. Grimaldi,"Discrete and Combinatorial Mathematics: An Applied Introduction", Fifth Edition, Pearson Education Asia, New Delhi, 2007.
3.	Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", sixth edition , Pearson Education Pvt Ltd., New Delhi, 2010.
4.	Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2008.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester III	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES302	DIGITAL ELECTRONICS	3	0	0	3	60	100	

Course Objective (s):

The purpose of learning this course is

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

Course Outcomes:

At the end of this course, learners will be able to

- Simplify Boolean functions using KMap
- Design and Analyze Combinational and Sequential Circuits
- Implement designs using Programmable Logic Devices
- Write HDL code for combinational and Sequential Circuits
- Design Register, Counter and Memory

Unit I	BOOLEAN ALGEBRA AND LOGIC GATES	9

Digital Systems, Binary Numbers, Number Conversions-Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Introduction to Boolean Algebra and Logic Gates –Boolean functions - Canonical and Standard Forms-Digital Logic gates –Digital Integrated Circuits-Introduction, Special Characteristics, Different Logic Families

Unit II	GATE LEVEL MINIMIZATION	9

Introduction, The Map Method, Four Variable Map, Five Variable Map, Product of Sums Simplification, Don't Care Conditions, NAND and NOR implementation, Exclusive –OR Function,

Unit III	COMBINATIONAL LOGIC	9

Combinational circuits- Analysis and Design Procedure- Binary Adder- Subtractor- Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders- Encoders- Multiplexers-

Unit IV	SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL LOGIC	9

Sequential circuits- Latches – Flip flops – Analysis of Clocked Sequential Circuits –State Reduction and Assignment- Design Procedure. Asynchronous Circuits- Analysis Procedure- Circuits with Latches – Reduction of State Flow Tables – Race Free State Assignment –Hazards- Design Example.

Unit V	REGISTERS, COUNTERS AND MEMORY	9

Registers, Shift Registers, Ripple Counters, Synchronous Counters, Random access memory, Memory Decoding, Error Detection and correction, Read only Memory, Programmable Logic Array, Programmable Array Logic

TEXT BOOK(S)

1.	Malvino, Paul Albert , Leach, Donald P,Gautam Saha: Digital Principles And Applications, TMH 8th Edition, 2014.
2.	Morris Mano and Michael D. Ciletti,"Digital Design", 6th Edition, Pearson Education, 2018

REFERENCE(S)

1.	Bartee, Thomas C: Digital Computer Fundamentals, 4th Edition, TMH.2016.
2.	Floyd, Thomas L: Digital Computer Fundamentals, 11th Edition, Pearson International. 2017.

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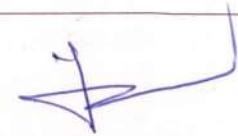|	
4.	D.S. Kushwaha& A.K. Misra, "Data Structures -4 Programming approach with C", PHI Learning, 2012.
5.	Varsha H. Patil, "Data Structures Using C++" Oxford University Press, 2012.
6.	Jean Paul Trembley, Paul G Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, 2007

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD302	DATA STRUCTURES & ANALYSIS OF ALGORITHMS	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To provide a good understanding of the fundamental data structures used in computer science
- To provide a good understanding of how several fundamental algorithms work, particularly those concerned with sorting, searching and graph manipulation
- To educate on the space and time efficiency of most algorithms
- To educate on design o f new algorithms or modify existing ones for new applications
- To introduce graph algorithms

Course Outcomes:

At the end of this course, learners will be able

- To understand and apply computing platform and software for engineering problems

Unit I	INTRODUCTION AND BASIC DATA STRUCTURES	9

Problem solving techniques and examples-Abstract Data Type (ADT)-The list ADT Arrays- Stacks and Queues: Implementation and Application, Circular Queues.

Unit II	ADVANCED DATA STRUCTURES	9

Trees: Preliminaries-Binary Tree- Tree traversals-Binary search Trees-AVL Trees

Unit III	SORTING AND HASHING	9

Sorting by Selection- Sorting by Insertion- Sorting by Exchange- Sorting by Diminishing Increment- Heap Sort- Heaps Maintaining the Heap Property-Building a Heap- Heap sort Algorithm-Quick sort Description-Performance of quick sort-Analysis of Quick Sort. Hashing - General idea-Hash
functions Separate Chaining-Open Addressing-Rehashing-Extendible Hashing.

Unit IV	ALGORITHM DESIGN TECHNIQUES	9

The role of algorithms in computing-Getting Started-Growth of functions. Divide and conquer
dynamic programming-Greedy Algorithm – Backtracking

Unit V	GRAPHS ALGORITHMS	9

Elementary Graph Algorithms-Minimum Spanning Trees-Single-source shortest paths-All pairs shortest paths.

TEXT BOOK(S)

1.	M A Weiss," Data Structures and Algorithm Analysis in C++",3rd Edition, Pearson Education,2007
2.	D.Samantha, "Classic Data Structures", 2nd Edition, PHI Learning, 2012.

REFERENCE(S)

1.	Thomas H Cormen, Charles E Leiserson and Ronald L Rivest," Introduction to Algorithms", 2nd Edition, prentice Hall of India, 2002
2.	R G Dromey,"How to solve it by computers", Pearson Education Asia, 2005.
3.	Robert L Kruse, Clovis L Tando and Bruce P Leung,"Data structures and Program Design in C",2nd Edition, Prentice Hall of India,1990.

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REFERENCE(S)	
1.	Harvey M.Deitel, Paul J. Deitel, David R. Choffnes, "Operating systems", Third edition, Pearson Prentice Hall(2007).
2.	Andrew S. Tanenbaum, Albert S. Woodhull "Operating systems: design And implementation", Third Edition, Pearson Prentice Hall (2006)

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester III	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD303	FUNDAMENTALS OF OPERATING SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basic concepts of operating system.
- To familiarise the OS services that assist system users
- To expose several aspects of OS design including: process, deadlocks and File systems.CPU scheduling and Process synchronization,
- To learn the memory management, Secondary Management and File System Implementation.

Course Outcomes:

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

- Understand the basics of OS
- Determine the efficiency of CPU Scheduling algorithms
- Detect and model Deadlock
- Implement Process Synchronization techniques.
- Simulate disk scheduling and Memory management techniques.

Unit I	INTRODUCTION TO OS AND PROCESS	9

Overview of operating systems-Functionalities, characteristics and types of OS Hardware concepts - CPU states, I/O channels- Memory hierarchy microprogramming –Process concepts
- operations on processes – process states -Concurrent processes – process control block - Process context Threads Concepts

Unit II	CPU SCHEDULING AND SYNCHRONIZATION	9

Job and processor scheduling – scheduling algorithms –Process hierarchies Problems of concurrent processes – critical sections – mutual exclusion – synchronization – Process cooperation, producer and consumer processes – Critical section problem Semaphores – init, wait, signal operations - Use of semaphores to implement mutex, process synchronization – Critical reg.

Unit III	IPC AND DEADLOCK	9

Interprocess Communication (IPC) - Message Passing– Direct and Indirect Communication Deadlock: System model – Deadlock characteristics – Methods for handling deadlocks – Deadlock prevention Deadlock avoidance - Deadlock detection - Deadlock recovery

Unit IV	MEMORYMANAGEMENT	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 V	FILE AND SECONDARY STORAGE MANAGEMENT	9

Secondary Storage Management – disk components - Disk scheduling – swap-space management File organization – blocking and buffering – file descriptor - Directory structure
UNIX file structure Protection and Security - Access rights – access matrix

TEXT BOOK(S)

1.	Abraham Silberschatz, Peter B.Galvin, Greg Gagne, Operating System Concepts. Ninth edition. Addison-Wesley(2015)
2.	William Stallings, "Operating Systems-Internals and Design Principles", Sixth Edition, Pearson Prentice Hall(2009).

Chairman - BoS
Dept. of CSE - ESEC

3. Lewis, Norman. Word Power Made Easy. New York: Pocket Books. 1991.
4. Baron's The Official Guide for New GMAT Review 2015. New Jersey: John Wiley &Sons, Inc.
5. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw- Hill Publishing Company Ltd, 2012
6. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
7. Dr.R S Aggarwal, Quantitative Aptitude, Seventh Revised Edition, S.Chand Publishing Company Ltd, 2013.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester III	EEC

Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS03	QUANTITATIVE APTITUDE , LOGICAL REASONING -I	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to expose the undergraduate students on methods and practices that helps to develop their Knowledge in Basic Grammar, effective communication, Verbal ability , quantitative ability & logical Reasoning.

Course Outcomes: At the end of this course, learners will be able to:
- Perform arithmetical operations with complex numbers and Data analysis.
- Know the tips and tricks of profit and loss through fast track methods.
- Develop the students mental ability of solving aptitude through number systems and speed maths concepts.
- Evaluate critically the real life situations by resorting and analyzing analytical reasoning of key issues and factors.
- Improve the performance in receptive skills while reading and develop the student's productive skills in writing and speaking.

UNIT 1	PARTNERSHIP & PROBLEMS ON NUMBERS	6

PARTNERSHIP: Ratio of division of gains: Simple Partnership – Compound Partnership _ working and sleeping partners.

PROBLEMS ON NUMBERS: Set of numbers is put in the form of puzzles – to analyse the given conditions assume the unknown numbers and form equations.

UNIT 2	HEIGHT AND DISTANCE, PROFIT & LOSS	6

HEIGHT AND DISTANCES: Line of sight – angle of elevation – angle of depression.

PROFIT AND LOSS: Basic definition and types of profit and loss – concept of discount and marked price – concept of true v/s false value – application in data interpretation problems.

UNIT 3	NUMBER SYSTEMS	6

NUMBER SYSTEMS: Numbers and types of Numbers – Properties of Numbers –face value and place value - Divisibility rules – Concept on unit digit and remainder theorem.

UNIT 4	BLOOD RELATIONSHIP,STATEMENT & ASSUMPTION,SITUATION REACTION TEST & DIRECTION SENSE TEST	6

BLOOD RELATIONSHIP: Analysis the gender relationship – Draw the relationship diagram and form the family tree.

STATEMENT AND ASSUMPTION: To assess the given statement and then decide which of the given assumptions is implicit in the statement and choose the correct alternative provided.

SITUATION REACTION TEST: Judge the reasoning power of the candidate and his ability to get correctly and promptly to a situation.

DIRECTION SENSE TEST: Find the distance between the starting and ending points - ability to trace and follow correctly and sense the direction correctly.

UNIT 5	SENTENCE COMPLETION & READING COMPREHENSION	6

SENTENCE COMPLETION: Phrasal Verbs – Examples – Logics.

READING COMPREHENSION: Objectives of Reading Comprehension – Breaking poor Reading Habits – Ways to approach any Reading Comprehension.

TOTAL : 30 HOURS

REFERENCES:

1. Whitehead, Russell and Michael Black. Pass Cambridge BEC Vantage Self-Study Practice Tests with Key, Heinle,a part of Cengage Learning, Delhi, 2003.
2. Murphy, Raymond. English in Use - A Self - study Reference and Practice Book for Intermediate Learners of English.IVed. United Kingdom: Cambridge University Press. 2012.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester III	ES
Course Code	**Course Name**	Hours / Week			Credit	**Total Hours**	**Maximum Marks**	
		L	T	P	C			
19ES308	DIGITAL ELECTRONICS LABORATORY	0	0	4	2	60	100	

Course Objective (s):

The purpose of learning this course is

- To familiarize students with digital ICs, the building blocks of digital circuits
- To provide students the opportunity to set up different types of digital circuits and study their behaviour

Course Outcomes:

At the end of this course, learners will be able to

- Study and Test Logic Gates
- Implement Logic Circuits
- Design and Implement Adder and Subtractor
- Design and Implement Combinational Circuits
- Design and Implement Sequential Logic Circuit

List of Experiments
Study of Logic Gates.
a. Logic gates using discrete Components.
b. Verification of truth table for AND, OR, NOT, NAND, NOR and XOR gates.
c. Realization of NAND and NOR gates
Implementation of Logic Circuits.
d. Verification of Boolean laws.
e. Verification of DeMorgan's law
Adder and Subtractor
f. Implementation of Half-Adder and Full-Adder
g. Implementation of Half-Subtractor and FullSubtractor
Combinational Circuit Design
h. Design of Decoder and Encoder
i. Design of Code Converter.
j. Design of multiplexers and demultiplexers.
Sequential Circuit Design
k. Implementation of Shift registers, Serial Transfer.
l. Ring Counter, 4-bit Binary Counter, BCD Counter.

TEXT BOOK(S)

1.	Malvino, Paul Albert , Leach, Donald P,Gautam Saha: Digital Principles And Applications, TMH 8th Edition, 2014.
2.	Morris Mano and Michael D. Ciletti,"Digital Design", 6th Edition, Pearson Education, 2018

REFERENCE(S)

1.	Bartee, Thomas C: Digital Computer Fundamentals, 4th Edition, TMH.2016.
2.	Floyd, Thomas L: Digital Computer Fundamentals, 11th Edition, Pearson International. 2017.

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		R 2019		Semester III		MC
Course Code	Course Name	Hours /Week		Credit	Total Hours	Maximum Marks	
		L	T	P	C		
19MC301	INDIAN CONSTITUTION	2	0	0	-	30	100

Course Objective (s): The purpose of learning this course is

- To Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: At the end of this course, learners will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Unit I	History of making of Indian Constitution	5
History of Indian Constitution - Drafting Committee, (Composition & Working)		
Unit II	Philosophy of the Indian Constitution	5
Preamble - Salient Features		
Unit III	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	5
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.		
Unit IV	ORGANS OF GOVERNANCE	5
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.		
Unit V	LOCAL ADMINISTRATION	5
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy.		
Unit VI	ELECTION COMMISSION	5
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

TEXT BOOK(S):

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. 3. 4

2. Dr. S. N. Busi, "Dr. B. R. Ambedkar Framing of Indian Constitution", 1st Edition, 2016. Ava Publishers

3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.

REFERENCE (s)

1. D.D. Basu , Introduction to the Constitution of India, Lexis Nexis, 2015.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD304	DATA STRUCTURES & ALGORITHMS LABORATORY	0	0	4	2	60	100	

Course Objective (s):

The purpose of learning this course is to

- Familiarize students in the implementation of searching algorithms, sorting algorithms, linear & non linear data structures, Hashing

Course Outcomes:

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

- Implement searching algorithms and sorting algorithms
- Implement Linear data structures (list, stack & queue)
- Implement non linear data structures (trees and graphs).
- Implement polynomial manipulations
- Implement Hashing algorithms

List of Experiments

- Implementation of array operations: Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem :

- Evaluation of expressions operations on Multiple stacks & queues :

- Implementation of linked lists: inserting, deleting, inverting a linked list.

- Implementation of stacks & queues using linked lists:

- Polynomial addition, Polynomial multiplication Sparse Matrices : Multiplication, addition.

- Recursive and Non recursive traversal of Trees Threaded binary tree traversal.

- AVL tree implementation Application of Trees.

- Application of sorting and searching algorithms Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

TEXT BOOK(S)

1.	Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011
2.	Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.

REFERENCE(S)

1.	Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997.
3.	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

Chairman - BoS
Dept. of CSE - ESEC

Programme	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester IV
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS406	STATISTICAL METHODS FOR DATA ANALYSIS	3	1	0	4	60	100

Course Objective(s): The purpose of learning this course is to

- Demonstrate the knowledge of the Statistics, probability.
- Choose and apply an appropriate statistical analysis or modeling methods to solve problems.
- Expose the applications of statistics in machine learning for prediction.
- Able to analyse data and predict quality control.
- Analyze the contribution of dependent and independent variables in various data analysis techniques.

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

- Know about the entire base of data and its analysis
- Understand about sampling distributions and estimations.
- Understand about the use of hypothesis test results in data analytics.
- Realize the use of non-parametric tests when quick or preliminary data analysis is needed.
- Study about the time series analysis which is helpful to evaluate current achievements in data mining.

UNIT 1	INTRODUCTION	12

Statistics – Definition -Types of variables – Organizing data - Descriptive Measures-Measures of central tendency-mean-median-mode. Deviation - standard- Quartile. Basic definitions and rules for probability, Conditional probability, Independence of events, Baye's theorem, Probability distributions: Normal distributions.

UNIT 2	SAMPLING DISTRIBUTION AND ESTIMATION	12

Introduction to sampling distributions, sampling distribution of the mean. Weak law of large numbers-Central limit theorem-chebyshev 's inequality .Estimation: Point and Interval estimates for Population parameters of large sample and small samples, Determining the sample size,

UNIT 3	TESTING OF HYPOTHESIS - PARAMETRIC TESTS	12

Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. One way and two way classifications - Completely randomized design – Randomized block design-Latin square design

UNIT 4	NON-PARAMETRIC TESTS AND QUALITY CONTROL	12

Chi-square test for goodness of fit and independence of attributes. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov – Test for goodness of fit- Quality improvement and statistics–Statistical quality control - statistical process control –control charts– design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart. Process and product control – attribute charts – p, np and C charts – control charts -performance.

UNIT 5	CORRELATION, REGRESSION AND TIME SERIES ANALYSIS	12

Correlation analysis, Rank correlation and Estimation of regression line. Time series analysis: Variations in time series, Trend analysis, Cyclical variations, Seasonal variations and Irregular variations.

TEXT BOOKS:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.

2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.

Chairman - BoS
Dept. of CSE - ESEC

3	Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum"s Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

Chairman - BoS
Dept. of Maths - ESEC

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD401	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To impart concepts of the Artificial Intelligence.
- To learn the methods of solving problems using Artificial Intelligence.
- To introduce the fundamental concepts of Expert Systems.
- To study about problem solving techniques using various AI based algorithms.
- To understand various knowledge representation techniques
- To provide knowledge of AI systems and its variants.

Course Outcomes:

At the end of this course, learners will be able

- To analyze a problem, identify and define the computing requirements appropriate to its solution.
- To design, implement and evaluate a system / computer based system process, component or program to meet desired needs
- To identify, formulate and solve engineering problems using the concepts of Artificial Intelligence.
- To use current techniques and skills necessary for computing and engineering practice
- Get familiarized with the tools mandatory for handling problem solving techniques

Unit I	INTRODUCTION	8

Introduction - Foundation and history of AI - AI Problems and techniques – AI programming languages – Introduction to LISP and PROLOG – Problem spaces and searches - Blind search strategies; Breadth first - Depth first – Heuristic search techniques Hill climbing - Best first – A* algorithm AO* algorithm – game trees - Minimax algorithm – Game playing – Alpha beta pruning.

Unit II	KNOWLEDGE REPRESENTATION	8

Knowledge representation issues – Predicate logic – logic programming – Sematic nets - Frames and inheritance - constraint propagation –Representing Knowledge using rules – Rules based deduction system.

Unit III	REASONING UNDER UNCERTAINTY	8

Introduction to uncertain knowledge review of probability – Baye's Probabilistic inferences and Dempster Shafer theory –Heuristic methods – Symbolic reasoning under uncertainty- Statistical reasoning – Fuzzy reasoning – Temporal reasoning- Non monotonic reasoning

Unit IV	LANNING AND LEARNING	9

Planning - Introduction, Planning in situational calculus - Representation for planning –Partial order planning algorithm- Learning from examples- Discovery as learning – Learning by analogy – Explanation based learning –Introduction to Neural nets – Genetic Algorithms

Unit V	EXPERT SYSTEMS AND APPLICATIONS	12

Expert systems - Architecture of expert systems, Roles of expert systems – Knowledge Acquisition - Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells. Principles of Natural Language Processing Rule Based Systems Architecture – AI application to robotics - Current trends in Intelligent Systems.

Chairman - BoS
Dept. of CSE - ESEC

TEXT BOOK(S)	
1.	Daugherty, Paul R., and H. James Wilson. Human+ machine: reimagining work in the age of AI. Harvard Business Press, 2018.
2.	Prateek, J.: Artificial Intelligence with Python, pp. 14–16. Packt Publishing, Birmingham (2017)

REFERENCE(S)	
1.	Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017.
2.	Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester IV	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD402	COMPUTER ARCHITECTURE & ORGANIZATION	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basic structure and operation of a digital computer.
- To understand the operation of the arithmetic unit including the algorithms & implementation of fixed point and floating-point addition, subtraction, multiplication & division.
- To know in detail the different types of control and the concept of pipelining.
- To know the hierarchical memory system including cache memory and virtual memory.
- To know the different ways of communicating with I/O devices and standard I/O interfaces.

Course Outcomes:

At the end of this course, learners will be able to

- Design of a pipelined CPU and cache hierarchy
- Analyse and evaluate CPU and memory hierarchy performance
- Design the trade-offs in modern CPU including issues affecting superscalar and dynamically scheduled architectures
- Design hardware of multiprocessors including cache coherence and synchronization
- Design a complex simulation tool to study various micro architectural features.

Unit I	BASIC STRUCTURE OF COMPUTERS	9

Functional units - Basic operational concepts - Bus structures - Performance and metrics - Instructions and instruction sequencing - Hardware - Software Interface - Instruction set architecture - Addressing modes – RISC - CISC

Unit II	ARITHMETIC OPERATIONS	9

Arithmetic Operations - Addition and subtraction of signed numbers - Design of fast adders - Multiplication of positive numbers - Signed operand multiplication and fast multiplication - Integer division- Floating point and fixed point operations

Unit III	BASIC PROCESSING UNIT AND PIPELINING	9

Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Hardwired control - Micro programmed control - Pipelining :Basic concepts - Data hazards - Instruction hazards -Data path and control considerations - Performance considerations - Exception handling - ILP – Hardware and Software approaches.

Unit IV	MEMORY SYSTEM	9

Basic concepts - Semiconductor RAM - ROM - Speed - Size and cost - Cache memories - Improving cache performance - Virtual memory - Memory management requirements - Associative memories -Secondary storage devices

Unit V	I/O ORGANIZATION	9

Accessing I/O devices - Programmed Input/output Interrupts - Direct Memory Access- Buses - Interface circuits - Standard I/O Interfaces (PCI, SCSI, and USB), IOP - CPU Communication.

TEXT BOOK(S)

1.	William Stallings, —Computer Organization and Architecture – Designing for Performance, 10th Edition, Pearson Education, 2016.
2.	John P. Hayes, —Computer Architecture and Organization, 3rd Edition, Tata McGraw Hill, 2017.

REFERENCE(S)

1.	Carl Hamacher, ZvonkoVranesic and SafwatZaky, —Computer Organization and Embedded Systems, 6th Edition, Tata McGraw Hill, 2017
2.	David A. Patterson and John L. Hennessy, —Computer Organization and Design: The Hardware/Software interfacell, 3rd Edition, Elsevier, 2005.
3.	V.P. Heuring, H.F. Jordan, —Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2008.

Chairman - BoS
Dept. of CSE - ESEC

1.	Herbert Schildt, "Java The complete reference", 11th Edition, McGraw Hill Education, 2019.
2.	Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 11th Edition, Prentice Hall

REFERENCE(S)

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.

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD403	OBJECT ORIENTED PROGRAMMING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling &Multi threading
- Know how to handle events

Course Outcomes:

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

- Write Java application programs using OOP principles and proper program structuring
- Demonstrate the concepts of Packages and inheritance
- Write Java programs to implement error handling techniques using exception handling
- Develop application using multi threading
- Write a event based java program

Unit I	INTRODUCTION TO JAVA	6

History of Java – Difference between C++ and Java = Byte Code – The Java Buzz Words - Compiling and Running Java Program – Data Types – Variables – Type Conversion and Casting Arrays : One Dimensional – Multi Dimensional – Alternate Array Declaration - Operators – Control Statements : Selection (if, switch), Iteration Statements(while, do-while, for , nested loops)- Jump Statements(break, continue, return.

Unit II	OBJECT ORIENTED PROGRAMMING BASICS	12

OOP Principles - Class Fundamentals – Declaring Objects -Methods – Constructors- this – Garbage Collection – finalize()- Method Overloading – Object as Parameters – Returning Objects – Access Control – Understanding static(variable, method, block) – Inheritance basics – using super – Multi level inheritance – Dynamic Method dispatch – Abstract class – final - Object class – Packages – Interfaces

Unit III	EXCEPTION HANDLING AND MULTITHREADED PROGRAMMING	9

Exception Handling : Exception fundamentals – uncaught exception – exception types – exception hierarchy- using try and catch – multiple catch blocks – throw, throws, finally – user defined exception

Multithreaded Programming

Java Thread Model – Main Thread – Creating Thread – Thread Methods – Thread priorities – Creating multiple threads – isAlive() and join()- Thread Synchronization – Interthread Communication

Unit IV	STRING HANDLING AND IO STREAMING	9

String Handling:

String Constructors - String concatenation with other data types – Character Extraction Methods – String Comparison - Modifying a String – Searching String – StringBuffer – Wrapper Classes(Integer, Float, Double, Number, Character, Boolean)

IOStreaming

Character Streams and Byte Streams – Reading and Writing Characters and Strings – Reading and Writing Files

Unit V	EVENT HANDLING	9

The Delegation Event Model – Event Classes – Event Listener Interfaces - Layout Managers (Flow, Border, Grid and GridBagLayouts) - Handling Mouse Events - Introduction to Swing – JFrame, JTextField, JButton, JTextArea, JComboBox, JTahhedPane, JScrollPane

TEXT BOOK(S)

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester IV	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19IT302	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- Learn data modeling using the entity-relationship and developing database designs.
- Understand the use of Structured Query Language (SQL) and learn SQL syntax.
- Apply normalization techniques to normalize the database
- Understand the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Course Outcomes:

At the end of this course, learners will be able to
- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Design ER-models to represent simple database application scenarios
- Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
- Familiar with basic database storage structures and access techniques

Unit I	INTRODUCTION	9

History and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence.

Unit II	DATA MODELING	9

Data modeling; conceptual models; object -oriented model; relational data model.; Database query languages: Overview of database languages; SQL; query optimization; 4th-generation environments; embedding nonprocedural queries in a procedural language; introduction to Object Query Language.

Unit III	RELATIONAL DATABASES	9

Mapping conceptual schema to a relational schema; entity and referential integrity; relational algebra and relational calculus; Relational database design: Database design; functional dependency; normal forms; multi valued dependency; join dependency; representation theory.

Unit IV	TRANSACTION PROCESSING	9

Transactions; failure and recovery; concurrency control

Unit V	PHYSICAL DATABASE DESIGN & INTRODUCTION TO NOSQL	9

Storage and file structure; indexed files; hashed files; signature files; b -trees; files with dense index; files with variable length records; database efficiency and tuning. NoSQL-MongoDB-Introduction to Data Mining and Data Warehousing.

TEXT BOOK(S)

1.	A. Silberschatz, H. F. Korth& S. Sudershan, Database System concepts, McGraw Hill, 6th Edition, 2013.
2.	C. J. Date, An introduction to Database Systems, Addison Wesley,8th Edition, 2006.

REFERENCE(S)

1.	R. Elmasri& S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 6th Edition, 2011.
2.	H. Garcia et al. Database System implementation, Prentice Hall, 2000

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester IV	HS
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS402	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	2	1	0	3	60	100

Course Objective (s): The purpose of learning this course is to
- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Salient Features of the Course: The salient features this course is to
- It presents a universal approach to value education by developing the right understanding of reality (i.e. a worldview of the reality "as it is") through the process of self-exploration.
- The whole course is presented in the form of a dialogue whereby a set of proposals about various aspects of the reality are presented and the students are encouraged to self-explore the proposals by verifying them on the basis of their natural acceptance within oneself and validate experientially in living.
- The prime focus throughout the course is toward affecting a qualitative transformation in the life of the student rather than just a transfer of information.
- While introducing the holistic worldview and its implications, a critical appraisal of the prevailing notions is also made to enable the students discern the difference on their own right.

Course Methodology: The methodology of this course is :
- To explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
- The course is in the form of 28 lectures (discussions) and 14 practice sessions.
- It is free from any dogma or value prescriptions.
- It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation – the whole existence is the lab and every activity is a source of reflection.
- This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
- This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Module 1 – Introduction to Value Education   6+3
Lectures - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations *Tutorials* [Practice Session] - *Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance*
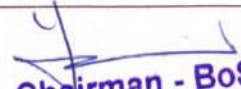
Module 2 – Harmony in the Human Being   6+3
Lectures - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials [Practice Session] - *Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body*

Chairman - BoS
Dept. of CSE - ESEC

Module 3 –	**Harmony in the Family and Society**	**6+3**

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials [Practice Session] - *Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal*

Module 4 –	**Harmony in the Nature/Existence**	**4+2**

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature – Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Tutorials [Practice Session] - *Exploring the Four Orders of Nature - Exploring Co-existence in Existence*

Module 5 –	**Implications of the Holistic Understanding**	**6+3**

Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession

Tutorials [Practice Session] - *Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order*

Course Outcomes: At the end of this course, learners will be able to:
- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- Students would become more responsible in life, and in handling problems with sustainable solutions.
- Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction .
- Students would have better critical ability .

TEXT BOOK(S):

1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

REFERENCE BOOK(S):

1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3.	The Story of Stuff (Book)
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher
6.	Slow is Beautiful - Cecile Andrews
7.	Economy of Permanence - J C Kumarappa
8.	Bharat Mein Angreji Raj – PanditSunderlal

Chairman - BoS
Dept. of CSE - ESEC

9.	Rediscovering India - by Dharampal
10.	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

SUGGESTED ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. *Example*:

Assessment by faculty mentor: 10 marks

Self-assessment: 10 marks & *Assessment by peers*: 10 marks

Socially relevant project/Group Activities/Assignments: 20 marks

Semester End Examination: 50 marks

The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester IV	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS04	QUANTITATIVE APTITUDE AND LOGICAL REASONING - II	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to expose the undergraduate students on methods and practices that helps to develop their Knowledge in Basic Grammar, effective communication, Verbal ability , quantitative ability & logical Reasoning.

Course Outcomes: At the end of this course, learners will be able to:
- Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken to solve Aptitude Questions.
- Enhance the basic mathematical skills by explaining L.C.M and H.C.F concepts.
- Calculate the interest by using modern methods instead of traditional methods.
- Induce their critical thinking by solving the syllogism and course of action.
- Get knowledge in Jumbled Sentence based on Company Pattern and understand the rules of active and passive voice conversion and tricks.

UNIT 1	DATA INTERPRETATION & CLOCKS	6

DATA INTERPRETATION: Tabulation – bar graphs – pie charts – line graphs.
CLOCKS: Definition – important points – angular difference between two hands at different timings- incorrect clock.

UNIT 2	H.C.F & L.C.M	6

H.C.F & L.C.M: FACTORS of multiples - The concept of GCD – Shortcuts for finding the HCF – The concept of LCM –shortcuts for finding the LCM.- product of two numbers – co-primes – H.C.F & L.C.M of fractions – H.C.F AND L.C.M of decimal fractions – comparison of fractions.

UNIT 3	SIMPLE & COMPOUND INTEREST	6

SIMPLE INTEREST: To find the principal – rate of interest – number of years – using formulae and shortcuts methods.
COMPOUND INTEREST: Compounded Annually – Compounded Half-Yearly – Compounded Quarterly – Compounded annually but time is in fraction – Rates are different for different years.

UNIT 4	STATEMENT & COURSE OF ACTION, SYLLOGISM & DATA SUFFICIENCY	6

STATEMENT AND COURSE OF ACTION: To analyse the statement and then decide which of the courses of action should be a step or decision taken for improvement, follow-up or further action in regard to the given statement.
SYLLOGISM/ LOGICAL VENN DIAGRAMS: To find the Relationship between the two things or not - classification of propositions – immediate deductive inference – mediate deductive inference.
DATA SUFFICIENCY: Reasoning ability using a set of directions.

UNIT 5	PARA JUMBLED / JUMBLED SENTENCES & ACTIVE AND PASSIVE VOICE	6

PARA JUMBLED / JUMBLED SENTENCES: Objective of Jumbled Paragraphs – Types of Jumbled paragraphs – Jumbled Words
ACTIVE AND PASSIVE VOICE : Objectives – Rules – Common Mistakes in Active / Passive Voice – Exceptions

TOTAL : 30 HOURS

REFERENCES:
1. Whitehead, Russell and Michael Black. Pass Cambridge BEC Vantage Self-Study Practice Tests with Key, Heinle, a part of Cengage Learning, Delhi, 2003.
2. Murphy, Raymond. English in Use - A Self - study Reference and Practice Book for Intermediate Learners of English.IVed. United Kingdom: Cambridge University Press. 2012.
3. Lewis, Norman. Word Power Made Easy. New York: Pocket Books.1991.
4. Baron's The Official Guide for New GMAT Review 2015. New Jersey: John Wiley &Sons, Inc.
5. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
6. Dr.R S Aggarwal, Quantitative Aptitude, Seventh Revised Edition, S.Chand Publishing Company Ltd, 2013.

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester IV	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19IT305	DBMS LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is

- To learn the fundamentals of data models to conceptualize and depict a database system using ER diagram.
- To understand the relational database implantation using SQL with effective relational database design concepts
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design along with Query optimization techniques.

Course Outcomes:

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

- Use the Relational model, ER diagrams.
- Familiarize to use SQL commands to manage the database
- Apply concurrency control and recovery mechanisms for practical problems.
- Design effective Databases for enterprise applications
- Install and work with MangoDB

List of Experiments

1. Conceptual Database design using E-RDIAGRAM.
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of in built functions
5. Implementation of Join operation and Nested Queries, Practicing set operators in SQL queries
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
8. Application Development using front end tools
   a. Inventory Control System
   b. Railway Reservation System
   c. Bank Management System
   d. Payroll Processing System
   e. Hotel Management System
   f. Project Management System
   g. Student Information System 9

Working with MongoDB

TEXT BOOK(S)

1.	A. Silberschatz, H. F. Korth& S. Sudershan, Database System concepts, McGraw Hill, 6th Edition, 2013.
2.	C. J. Date, An introduction to Database Systems, Addison Wesley,8th Edition, 2006.

REFERENCE(S)

1.	R. Elmasri& S. B. Navathe, Fundamentals of database systems, Addison Wesley, 6th Edition, 2011.
2.	H. Garcia et al. Database System implementation, Prentice Hall, 2000

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester IV	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HS401	LANGUAGE SKILLS	0	0	2	0	30	100	

Course Objective (s): The purpose of learning this course is
- To involve the students in effective listening activities.
- To improve the oral communication skills in proper manner.
- To focus the effective reading of general and technical text.
- To enhance and comprehend the written text.
- To integrate LSRW skills.

Course Outcomes: At the end of this course, learners will be able to
- Understand the technical talks.
- Communicate to his peer group properly.
- Comprehend the general and technical text.
- Write the reports and job application in clear manner.
- Integrate LSRW skills.

Unit I	LISTENING	6

Listening and its importance –Listening strategies - Listen to a process information - give information, as part of a simple explanation - Being an active listener: giving verbal and non-verbal feedback - taking lecture notes

Unit II	SPEAKING	6

Give personal information - ask for personal information - express ability - ask for clarification - pronunciation basics - pronunciation practice - conversation starters: Pep talk - stressing syllables and speaking clearly - summarizing academic readings and lectures

Unit III	READING	6

Strategies for effective reading - Read and recognize different types of texts - Predicting content using photos and title - Read for details - Use of graphic organizers to review and aid comprehension - Understanding pronoun reference and use of connectors in a passage- speed reading techniques

Unit IV	WRITING	6

Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph – Write a paragraph with reasons and examples - Write an opinion paragraph – E-mail writing - Types of essays- descriptive-narrative- issue-based-argumentative-analytical

Unit V	INTEGRATION OF LSRW	6

Task based Instruction : watching a video –Listing, Sorting, ordering, comparing and analyzing the ideas – Reading a newspaper and creating topic based videos

TEXT BOOK(S):

1	Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2	Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011
3	Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCE(S):

1.	Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
2.	E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan
3.	Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD501	BIGDATA ANALYTICS METHODS	3	0	0	3	45	100

Course Objective (s):
The purpose of learning this course is

- Describe the Basic concepts of Big Data Characteristics and Analytics
- Examine the Hadoop and MapReduce framework for processing large volume of data sets
- Work with NoSQL databases such as MongoDB and Cassandra
- Understand the basics of enterprise reporting using open source tools
- To analyze the big data for useful business applications and familiar with the Visualization

Course Outcomes:
At the end of this course, learners will be able to:
- Identify the characteristics and challenges of big data analytics
- Implement the Hadoop and MapReduce framework for processing massive volume of data
- Install and Use NoSQL databases
- Write Pig Scripts and Hive Query to access NoSQL data
- Explore the usage of Hadoop and its integration tools to manage Big Data and Use Visualization Techniques

Unit I	INTRODUCTION TO BIG DATA	9

Classification of Digital Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data – Data Warehouse and Hadoop Environment - Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics important - Data Science - Data Scientist - Terminologies used in Big Data Environments – Basically Available Soft State Eventual Consistency - Top Analytics Tools

Unit II	HADOOP	9

Hadoop: Features – Advantages – Versions – Ecosystems – Distributions – Hadoop Versus RDBMS – Distributed Computing Challenges – History - Hadoop Overview - Use Case of Hadoop - Hadoop Distributors – Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem – MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.

Unit III	NOSQL- MONGODB AND CASSANDRA	9

NoSQL-Types of NoSQL Databases - Why NoSQL? - Advantages of NoSQL, SQL versus NoSQL, NewSQL - MongoDB-Terms used in RDBMS and MongoDB, Data Types in MongoDB, CRUD(Create, Read, Update and Delete) Cassandra - Features of Cassandra, CQL Data Types, CQLSH, Key spaces, CRUD, Collections, Using a Counter, Time To Live(TTL),Alter table data, Import and Export, System Tables.

Unit V	HIVE & PIG DATA PROCESSING	9

Hive - Hive Architecture, Data Types, File Format, Hive Query Language, RCFILE Implementation, SERDE, UDF Pig - Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Type, Piggy Bank, UDF (User Defined Function), Parameter Substitution, Diagnostic Operator Jasper Report - Introduction to

Jasper Reports, Jasper soft Studio, Connecting to MongoDB NoSQL database, Connecting to Cassandra NoSQL Databases

Unit V	FRAMEWORKS AND VISUALIZATION	9

Zookeeper – Installation and Configuration - Running Zookeeper - Sqoop – Architecture - Import and Export Data – Sqoop Job – Flume – Log Collection – Working with Twitter Stream - Oozie – Simple and Complex Flow – Components – Service/Scheduler – Workflow – Apache Spark – Lambda Architecture – Spark Streaming – Spark Processing – Apache Kafka – Operations – Visualizations – Visual Data Analysis Techniques – Interaction Techniques.

TEXT BOOK(S)

1.	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, First Edition, 2015
2.	Tom White, "Hadoop, the Definitive guide", O'Reilly Media, 2010

REFERENCE(S)

1.	Judith Huruwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc. (2013)
2.	Donald Miner, "Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", O'Reilly Media, 2012

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD502	SOFTWARE ENGINEERING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To know the fundamentals of project management activities.
- To design software using models.
- To gather knowledge on various software testing, maintenance methods
- To develop an efficient software system through good group cohesiveness.
- To verify the quality of software products

Course Outcomes:

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

- Analyze a problem, identify and define the computing requirements appropriate to its solution.
- Design, implement and evaluate a system / computer based system process, component or program to meet desired needs
- Apply design and development principles in the construction of software systems.
- Apply testing methods for the software products
- improve the product by checking the quality of the software products

Unit I	FUNDAMENTALS OF SE AND REQUIREMENT ENGINEERING	9

Software Engineering Fundamentals; Software processes: Software life-cycle and process models; Process assessment models; Overview of Project Management activities; Software requirements and specifications: Requirements elicitation; Requirements analysis modeling techniques; Functional and nonfunctional requirements; User requirements, System requirements, requirement validation and software requirement specification document. Prototyping - Basic concepts of formal specification techniques

Unit II	SOFTWARE DESIGN	9

Fundamental design concepts and principles; Design characteristics; System Models - Context, Behavioral, Data and, Object models, Architectural design- System structuring, Control models; Structured design; Object-oriented analysis and design; User interface design; Design for reuse; Design patterns;

Unit III	SOFTWARE VALIDATION AND MAINTENANCE	9

Software validation: Validation planning; Testing fundamentals, including test plan creation and test case generation; Black-box and white-box testing techniques; Unit, integration, validation, and system testing; Object-oriented testing; Inspections. Software evolution: Software maintenance; Characteristics of maintainable software; Reengineering; Legacy systems; Software reuse.

Unit IV	SOFTWARE PROJECT MANAGEMENT	9

Team management – Team processes, Team organization and decision -making, Roles and responsibilities in a software team, Role identification and assignment, Project tracking, Team problem resolution; Project planning and scheduling; Software measurement and estimation techniques; Risk analysis and management; Software quality assurance; Software configuration management;.

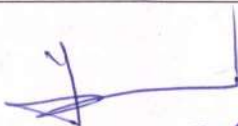| Unit V	SOFTWARE QUALITY PROCESS IMPROVEMENT	9

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Dept. of CSE - ESEC

Overview of Quality management and Process Improvement; Overview of SEI -CMM, ISO 9000, CMMI, PCMM, TQM and Six Sigma; overview of CASE tools. Software tools and environments: Programming environments; Project management tools; Requirements analysis and design modeling tools; testing tools; Configuration management tools;

TEXT BOOK(S)

1.	R. S. Pressman, Software Engineering, a practitioner's approach,McGraw Hill,7th Edition, 2010.
2.	Ian Sommerville, "Software Engineering", 9th Edition, Addison- Wesley, 2011

REFERENCE(S)

1.	PankajJalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
2.	Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
3.	Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited,2007.

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD503	COMPUTER NETWORKS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is
- To study the concepts of data communications and functions of different layers of ISO/OSI
- reference architecture
- To understand the error detection and correction methods and types of LAN
- To study the concepts of sub netting and routing mechanisms.
- To understand the different types of protocols and network components.
- To study the application protocols and network security

Course Outcomes:

At the end of this course, learners will be able to:
- Understand the fundamentals of data communications and functions of layered architecture.
- Practice the error detection and correction methods and understand the different network technologies
- Analyse the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies
- Understand the transport layer principles and reliable data transfer
- Understand the application layer protocols and also the use of cryptography and network security

Unit I	DATA COMMUNICATIONS AND PHYSICAL LAYER	9

Introduction, history and development of computer networks, networks topologies, ISO/OSI model and protocols. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B). MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA.

Unit II	DATA LINK LAYER	9

Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP, bridging and SDN.

Unit III	NETWORK LAYER	9

Internet Protocol, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, , Network Address Translation

Unit IV	TRANSPORT LAYER	9

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, Design issues in protocols at different layers, Socket Programming

Unit V	APPLICATION LAYER	9

DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, symmetric and asymmetric key cryptography, Sharing of symmetric keys – Diffie-Hellman key Exchange, Public Key Infrastructure, Public Key Authentication Protocols, Firewalls.

TEXT BOOK(S)	
1.	AS Tanenbaum, DJ Wetherall, "Computer Networks", 5th Edition, Prentice-Hall, 2013.
2.	Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGraw Hill, 2017

REFERENCE(S)

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Dept. of CSE - ESEC

1.	Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013
2.	William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2017

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Dept. of CSE - ESEC

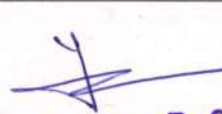| Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD504	MACHINE LEARNING TECHNIQUES	3	0	0	3	45	100

Course Objective (s):
The purpose of learning this course is to

- Understand the basics of Machine Learning
- Know the Supervised & Unsupervised Learning Methods
- Understand the basics of Neural Networks
- Know the basics of Graphics Model used in ML

Course Outcomes:
At the end of this course, learners will be able to:
- Identify various machine learning algorithms and terminologies and perform data pre-processing using standard ML library
- Design a predictive model using appropriate supervised learning algorithms to solve any given problem
- Develop an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction
- Solve complex problems using artificial neural networks
- Implement probabilistic graphical models for suitable applications.

Unit I	INTRODUCTION TO MACHINE LEARNING	9

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised, Reinforcement- The Machine Learning process. Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation SetsConfusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

Unit II	SUPERVISED LEARNING	9

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis, Logistic Regression- K-Nearest Neighbor classifier. Decision Tree based methods for classification and Regression- Ensemble methods.

Unit III	UNSUPERVISED LEARNING	9

Clustering- K-Means clustering, Hierarchical clustering - The Curse of Dimensionality - Dimensionality Reduction - Principal Component Analysis - Probabilistic PCA- Independent Components analysis

Unit IV	ARTIFICIAL NEURAL NETWORKS	9

Perceptron- Multilayer perceptron- Back Propagation – Initialization, Training and Validation Support Vector Machines(SVM) as a linear and non-linear classifier - Limitations of SVM

Unit V	PROBABILISTIC GRAPHICAL MODELS	9

Bayesian Networks - Learning Naive Bayes classifiers-Markov Models – Hidden Markov Models Sampling – Basic sampling methods – Monte Carlo -Reinforcement Learning

TEXT BOOK(S)

1.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2.	Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009.

REFERENCE(S)

1.	Andreas C. Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly,2016
2.	Ethem Alpaydin, "Introduction to Machine Learning", 2nd Revised edition, MIT Press,2010.

Chairman - BoS
Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD506	MACHINE LEARNING LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is to
- Understand the basics of Machine Learning Library of Python/MATLAB
- Know the Implementation of Supervised & Unsupervised Learning Methods
- Understand the application of Neural Networks in ML
- Know the basics of Graphics Model used in ML

Course Outcomes:

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

- Identify various machine learning algorithms and terminologies and perform data pre-processing using standard ML library
- Design a predictive model using appropriate supervised learning algorithms to solve any given problem
- Develop an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction
- Solve complex problems using artificial neural networks
- Implement probabilistic graphical models for suitable applications.

LIST EXPERIMENTS

1. Installation of Python Libraries/ MATLAB tools for Machine Learning
2. Data pre-processing using Python Machine Learning libraries/ MATLAB
3. Design a model to predict the housing price from Boston Dataset using Multivariate Linear Regression.
4. Build a classifier using Logistic Regression, k- Nearest Neighbor / Decision Tree to classify whether the given user will purchase a product or not from a social networking dataset
5. Segment a customer dataset based on the buying behaviour of customers using K-means/Hierarchical clustering
6. Dimensionality reduction of any CSV/image dataset using Principal Component Analysis
7. Recognition of MNIST handwritten digits using Artificial Neural Network
8. Build an email spam classifier using SVM.
9. Classify the given text segment as 'Positive' or 'Negative' statement using the Naïve Bayes Classifier
10. Predict future stock price of a company using Monte Carlo Simulation
11. Choose best machine learning algorithm to implement online fraud detection

TEXT BOOK(S)

1.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2.	Stephen Marsland, "Machine Learning –An Algorithmic Perspective", CRC Press, 2009.

REFERENCE(S)

1.	Andreas C. Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly, 2016
2.	Ethem Alpaydin, "Introduction to Machine Learning", 2nd Revised edition, MIT Press, 2010.

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD505	DATA ANALYTICS LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is to

- Understand the basic Python Packages
- Understand the basics of R Programming
- Apply R for Data Analytics
- Understand Map Reduce Programming
- Understand the architecture of Spark

Course Outcomes:

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

- Implement k-means, linear and Logistic Regression
- Visualize data using R
- Develop Map Reduce Programming
- Execute Queries Using MangoDB and Cassandra
- Work with Apache Spark

LIST EXPERIMENTS

1. Hypothesis Test using R.
2. K-means Clustering using R
3. Implementation of Linear & Logistic Regression
4. Time-series Analysis using R
5. Data Analysis-Visualization using R
6. Install and Configure Hadoop
7. Map Reduce using Hadoop
8. Implementation of Queries using Mongo DB & Cassandra
9. Using Apache Spark for Data Analytics

TEXT BOOK(S)

1.	Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016
2.	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
3.	Garrett Grolemund, "Hands-On Programming with R" , O'Reilly Media, Inc, 2014.

REFERENCE(S)

1.	Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014
2.	Tom White, "Hadoop: The Definitive Guide", O'Reilly Publications, 2011.
3.	Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.

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UNIT 5	SEATING ARRANGEMENTS & DATA SUFFICIENCY	6

SEATING ARRANGEMENTS: Persons seating in the circular – Rectangular – Square.

DATA SUFFICIENCY: Reasoning ability using a set of directions.

TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.

6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester V	EEC

Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19TPS05	QUANTITATIVE APTITUDE AND LOGICAL REASONING - III	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to

- Design to help people make sense of numerical data.
- Calculate the calendars and series in simplified way.
- Understand the concept of the interest amount in SI and CI.
- Know the procedure to deal with a situation and sufficient to determine the answer.
- Teach seating arrangements in rows or in small groups.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken to solve Aptitude Questions.
- Solve the question based on calendar, odd man out and series by using shortcut methods.
- Calculate the interest by using shortcut methods instead of traditional methods.
- Induce their critical thinking by solving the syllogism and course of action.
- Analyze the conditions and do interpretation.

UNIT 1	DATA INTERPRETATION & CLOCKS	6

DATA INTERPRETATION: Tabulation – Bar graphs – Pie charts – Line graphs.

CLOCKS: Definition – important points – Angular difference between two hands at different timings-Incorrect clock.

UNIT 2	CALENDARS, ODDMAN OUT & SERIES	6

CALENDARS: Odd days – Leap year – Ordinary year – Counting of odd days – Day of the week.

ODDMAN OUT & SERIES: Odd man out – Power series – Number series-Sequence of real numbers.

UNIT 3	SIMPLE & COMPOUND INTEREST	6

SIMPLE INTEREST: Principal – Rate of interest – Number of years – Using formulae and shortcuts methods.

COMPOUND INTEREST: Compounded Annually – Compounded Half-Yearly – Compounded Quarterly – Compounded annually – Rates are different for different years.

UNIT 4	STATEMENT & COURSE OF ACTION, SYLLOGISM	6

STATEMENT AND COURSE OF ACTION: Courses of action - Decision taken - Improvement, Follow-up or further action in regard to the given statement.

SYLLOGISM/ LOGICAL VENN DIAGRAMS: Relationship between the two things or not - Classification of propositions – Immediate deductive inference – Immediate deductive inference.

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1.	William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, March 2013.
2.	Bruce Schneier and Neils Ferguson, ―Practical Cryptography , First Edition, Wiley Dreamtech India Pvt Ltd, 2003

REFERENCE(S)

1.	Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd edition, Pearson, 2007
2.	Douglas R Simson ―Cryptography –Theory and practicell, First Edition, CRC Press, 1995
3.	William Stallings and Lawrie Brown, "Computer Security Principles and Practice", Third Edition,2015, Pearson Education International

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD601	DATA SECURITY	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Understand the basics of Number Theory and Security
- Understand various block cipher and stream cipher models.
- Learn the principles of public key cryptosystems
  Understand the need of authentication using hash and digital signature
- Understand the various types of network security, threats and attacks

Course Outcomes:

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

- Understand the fundamentals of security and the significance of number theory in computer security
- Implement different block cipher algorithm and stream cipher algorithms
- Use public key encryption algorithms to provide various security services
- Apply hash functions to provide message authentication and integrity
- Understand the various types of network security, threats and attack Identify

Unit I	FUNDAMENTALS OF SECURITY	9

Computer Security Concepts - Threats, Attacks and Assets – Security Functional Requirements – Fundamental Security Design Principles – Attack Surfaces and Attack Trees. Computer Security Strategy– Number Theory: Prime Numbers and Factorization, Modular Arithmetic, GCD and Euclidean Algorithm, Chinese Remainder Theorem, Multiplication Modulo m and the Totient Function, Problems, Fermat and Euler Theorem. Primitive Roots and the Structure of F^*p, Number in other Bases, Fast Computation of Powers in Z/mZ, Multiplicative Functions, Group Theory, Fields and Problems

Unit II	BLOCK CIPHERS AND MODES OF OPERATIONS	9

Simplified DES -Data Encryption Standard-Block cipher principles-block cipher modes of operation – AES – Triple DES – Blowfish - RC5

Unit III	PUBLIC KEY CRYPTOGRAPHY	9

Principles and characteristics - Need for public key cryptography - Primality Testing - Miller Rabin Test -Diffie Hellman Key Exchange – Man in the middle attack - RSA, Fast Modular Exponentiation Algorithms, Random Number Generation – Finite Fields–Polynomial Arithmetic – ECC–Key Management

Unit IV	HASH FUNCTIONS AND DIGITAL SIGNATURES	9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – El Gamal – Schnorr -Blind Signatures for unreachable payments

Unit V	THREATS, ATTACKS AND APPLICATIONS	9

Buffer overflow, DoS, DDoS, birthday attack, Intrusion Detection and Prevention, SQLB.Tech CSE -Specialisation in Data Science Injections- Phishing-Password Attacks – Computer Virus. Web Security -SSL, TLS, Secure Electronic Transaction, Bitcoin, Email Security -PGP, Tor (The Onion Router).
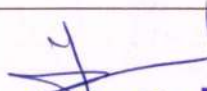
TEXT BOOK(S)

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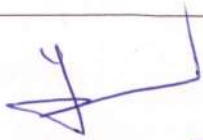| REFERENCE(S)	
1.	Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014
2.	Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007
3.	Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD602	DATA VISUALIZATION TECHNIQUES	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Understand the various types of data, apply and evaluate the principles of data visualization.
- Acquire skills to apply visualization techniques to a problem and its associated dataset.
- Learn how to build visualization dashboard to support decision making.
- Create interactive visualization for better insight using various visualization tools
- To understand the security aspects involved in data visualization

Course Outcomes:

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

- Identify the different data types, visualization types to bring out the insight
- elate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.
- Design visualization dashboard to support the decision making on large scale data.
- Demonstrate the analysis of large dataset using various visualization techniques and tools.
- Discuss the process involved and security issues present in data visualization.

Unit I	INTRODUCTION TO DATA VISUALIZATION	5

Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation

Unit II	VISUALIZATION TECHNIQUES AND ANALYTICS	11

Scalar and Point techniques – Color maps – Contouring – Height Plots - Vector visualization techniques – Vector properties – Vector Glyphs – Vector Color Coding – Matrix visualization techniques. Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map

Unit III	VISUALIZATION TOOLS, TECHNIQUES AND TYPE OF ANALYSIS	9

Introduction to various data visualization tools: R –basics, Data preprocessing, Statistical analysis, Plotly and ggplot library, Tableau, D3.js, Gephi. Time- Series data visualization – Text data visualization – Multivariate data visualization and case studies

Unit IV	VISUALIZATION OF STREAMING DATA AND GEO SPATIAL VISUALIZATION	11

Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis. Chloropleth map, Hexagonal Binning, Dot map, Cluster map, cartogram map Visualization Dashboard Creations - Dashboard creation using visualization tools for the use cases: Finance-marketing-insurance-healthcare etc.,

Unit V	SECURITY DATA VISUALIZATION	9

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization - Intrusion detection log visualization -Attacking and defending visualization systems – Creating security visualization system

TEXT BOOK(S)

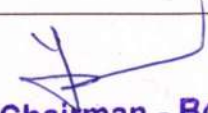| 1.	Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007
2.	Tamara Munzer, Visualization Analysis and Design, CRC Press 2014

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD603	INTERNET OF THINGS AND ITS APPLICATIONS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Understand the concepts and perspectives of Internet of Things
- Apply the knowledge on IoT architecture and modules
- Design Internet of Things with Embedded systems using data analytics

Course Outcomes:

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

- Determine the supporting technologies for design of IoT applications
- Apply the architecture and core modules for IoT applications
- Develop IoT applications using Raspberry Pi
- Illustrate the necessary framework required for IoT application
- Apply data analytics for IoT applications

Unit I	IOT CONCEPTS AND ENABLING TECHNOLOGIES	9

Introduction – Definition and Characteristics of IoT – Benefits of IoT –Physical design of IoT – Logical design of IoT – IoT Enabling Technologies–Resource Management – Resource Partitioning – Computation Offloading – Identification and Resource/Service Discovery – IoT Levels

Unit II	IOT ARCHITECTURE AND ITS CORE MODULES	9

Reference architecture for IoT – SOA based & API oriented architecture – Four layer architecture – Seven Layer architecture – fog computing – Open stack cloud architecture – Gateways,Edge Devices, Data acquisition systems, Cloud services.

Unit III	RASPBERRY PI	9

Overview of Raspberry Pi – General-Purpose Input/Outputs – Sensors with Raspberry Pi – Actuators with Raspberry Pi –Web Server with Raspberry Pi – Raspberry Pi as a Database Server – ESP8266 WiFi Module – Block Diagram, Features, applications

Unit IV	IOT FRAMEWORK & INDUSTRIAL IOT	9

IoT Value Chain – IoT Platforms – Cisco, Salesforce, Azure IoT, Eclipse IoT, Thingworx, GE Predix, AWS IoT, Watson IoT, Kaa – Introduction to Industrial Internet of Things & Industry 4.0 – IIoT Architecture – Applications and Challenges

Unit V	DATA ANALYTICS & IOT APPLICATIONS	9

IoT Data Management – Analytics –Apache Hadoop–Programming Model, JobExecution, Hadoop Cluster – Case Studies – Smart Parking, Smart Irrigation Control, Air Pollution Monitoring, Forest Fire Detection, Weather
Forecasting

TEXT BOOK(S)	
1.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities press Pvt. Ltd., India, 2015.
2.	Mayur Ramgir, "Internet of Things- Architecture, Implementation, and Security", 1st Edition, Pearson Education,India, 2019

REFERENCE(S)	
1.	Rajkumar Buyya, Amir VahidDastjerdi, "Internet of Things: Principles and Paradigms", 1st Edition, Elsevier, USA, 2016

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2.	Charles Bell, "Beginning Sensor Networks with Arduino and Raspberry Pi", 1st Edition, Apress Publishers, USA, 2013.
3.	Dimitrios Serpanos, Marilyn Wolf, "Internet-of-things (IoT) systems: architectures, algorithms, methodologies", 1st Edition, Springer, UK, 2017.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19AD604	NATURAL LANGUAGE PROCESSING	3	0	0	3	45	100	

Course Objective (s):
The purpose of learning this course is to
- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

Course Outcomes:
At the end of this course, learners will be able to:
- Tag a given text with basic Language features
- Design an innovative application using NLP components
- Implement a rule based system to tackle morphology/syntax of a language
- Design a tag set to be used for statistical processing for real-time applications
- Compare and contrast the use of different statistical approaches for different types of NLP applications.

Unit I	INTRODUCTION AND LANGUAGE MODELING	5

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages NLP Applications-Information Retrieval. Language Modeling: Various Grammar- based Language Models-Statistical Language Model.

Unit II	SYNTACTIC ANALYSIS	11

Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar-Constituency- Parsing-Probabilistic Parsing

Unit III	SEMANTIC ANALYSIS AND DISCOURSE PROCESSING	9

Semantic Analysis: Meaning Representation-Lexical Semantics- Ambiguity-Word Sense Disambiguation. Discourse Processing: cohesion-Reference Resolution- Discourse Coherence and Structure

Unit IV	NATURAL LANGUAGE GENERATION AND MACHINE TRANSLATION	11

Natural Language Generation: Architecture of NLG Systems- Generation Tasks and Representations Application of NLG. Machine Translation: Problems in Machine Translation-Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages.

Unit V	INFORMATION RETRIEVAL AND LEXICAL RESOURCES	9

Information Retrieval: Design features of Information Retrieval Systems-Classical, Non-classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame NetStemmers-POS Tagger- Research Corpora

TEXT BOOK(S)

1.	Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008
2.	Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

REFERENCE(S)

Chairman - BoS
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1.	Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.
2.	James Allen, "Natural Language Understanding", 2nd edition, Benjamin /Cummings publishing company, 1995
3.	Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester VI	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD605	DATA VISUALIZATION & NLP LABORATORY	0	0	4	2	60	100

Course Objective (s):

The purpose of learning this course is to
- learn about morphological features of a word by analyzing it.
- Learn to calculate bigrams from a given corpus and calculate probability of a sentence.
- know the importance of selecting proper features for training a model and size of training corpus in learning how to do chunking.

Course Outcomes:

At the end of this course, learners will be able to:
- Acquire and Plot Data
- Visualize streaming dataset for various applications
- Implement Morphology, N-Grams, POS-Tagging
- Build Chunker
- Develop ChatBot

LIST OF EXPERIMENTS

DATA VISUALIZATION
- Acquiring and plotting data.
- Time-series analysis – stock market
- Visualization of various massive dataset - Finance - Healthcare - Census - Geospatial
- Visualization on Streaming dataset (Stock market dataset, weather forecasting)
- Text visualization using web analytics

NLP
- Word Analysis, Morphology
- N-grams
- POS Tagging
- Building Chunker
- Build ChatBot

TEXT BOOK(S)

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008

2. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007

REFERENCE(S)

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014

2. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester VI	PC

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19AD606	IOT LABORATORY	0	0	4	2	60	100

Course Objective (s):
The purpose of learning this course is to
- To understand about the different boards available to develop IoT system
- To build an IoT system and connect to the cloud
- To apply the concept of Internet of Things in the real world scenario
- To implement actuator control in the IoT system

Course Outcomes:
At the end of this course, learners will be able to:
- Use Raspberry Pi for IoT systems
- Apply IoT principles and design tools for developing IoT systems
- Comprehensively record and report the measured data
- Establish connectivity between IoT system and cloud
- Implement control applications using IoT

LIST OF EXPERIMENTS
- Getting familiar with Raspberry Pi
- Blinking LED using Raspberry Pi
- Calibrating and accessing real time sensors data
- Realtime IoT sensor measurement of temperature and humidity on PC
- Generating an alarm for any physical parameter exceeding threshold

Mini project on building IoT system for specific applications
- IoT based intelligent traffic management system
- Smart irrigation system using IoT
- IoT based smart waste management system for smart city
- IoT based weather reporting system
- IoT based water management system
- Any open ended project

TEXT BOOK(S)
1.	Arshdeep Bahga and Vijay Madisetti, Internet of Things – A hands-on approach, Universities Press, 2015
2.	Fei Hu, Security and Privacy in Internet of Things (IoTs): Models, Algorithms & Implementations, CRC Press, Taylor & Francis group, 2016.

REFERENCE(S)
1.	Olivier Hersent, David Boswarthick and Omar Elloumi, The Internet of Things – Key applications and Protocols, Wiley, 2012
2.	Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE01	EMBEDDED SYSTEM DEVELOPMENT	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to
- Learn the architecture and programming of ARM processor.
- Be familiar with the design of embedded computing platform
- Be exposed to the basic concepts of real time Operating system.
- Learn the design techniques for embedded systems
- Know the design and issues of sample embedded systems

Course Outcomes

At the end of this course, learners will be able to:
- Write simple programs for ARM processor
- Explore embedded computing platform.
- Compare the general purpose operating system and the real time operating system
- Design and develop embedded systems
- Model real-time applications using embedded system concepts

Unit I	EMBEDDED COMPUTING WITH ARM PROCESSORS	9

Complex systems and micro processors- The Embedded system design process - Instruction sets for ARM Processor - CPU: programming input and output- supervisor mode, exceptions and traps - Co-processors- Memory system mechanisms - CPU performance - CPU power consumption – safety and security.

Unit II	DESIGN OF EMBEDDED COMPUTING PLATFORM	9

The CPU Bus - Memory devices and systems - Designing with computing platforms - consumer electronics architecture - platform-level performance analysis - Platform-level power management - Components for embedded programs - Models of programs - Assembly, linking and loading - compilation techniques - Program level performance analysis - Software performance optimization - Program level energy and power analysis and optimization - Analysis and optimization of program size - Program validation and testing.

Unit III	EMBEDDED OPERATING SYSTEMS	9

Introduction - Multiple tasks and multiple processes - Multirate systems - Preemptive real-time operating systems - Priority based scheduling - Interprocess communication mechanisms - Evaluating operating system performance - power optimization strategies for processes - Example Real time operating systems

Unit IV	EMBEDDED SYSTEM DESIGN TECHNIQUES	9

Design methodologies - Design flows - Requirement Analysis - Specifications - System analysis and architecture design - Quality Assurance techniques - Distributed embedded systems - MPSoCs and shared memory multiprocessors

Unit V	CASE STUDIES	9

Data compressor - Alarm Clock - Audio player - Software modem - Digital still camera - Telephone answering machine - Engine control unit - Video accelerator – optical disk

TEXT BOOK(S)

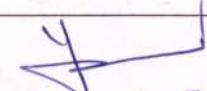| 1.	Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Morgan Kaufmann Publisher (An imprint from Elsevier), Fourth Edition, 2016

REFERENCE(S)

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1.	Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Cengage Learning, Third Edition, 2011.
2.	David. E. Simon, "An Embedded Software Primer", Addison-Wesley Professional, 1st Edition, Eighth Impression, 2009.
3.	Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc Graw Hill, 2003

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PE

Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE02	DISTRIBUTED SYSTEMS	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Study the distributed system principles and various communication models.
- Gain knowledge about peer-to-peer services.
- Understand distributed file systems.
- Study synchronization and replication techniques.
- Study the resource management techniques

Course Outcomes:

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

- Compare the pros and cons of various communication models.
- Address the issues in peer-to-peer services.
- Explore distributed file systems.
- Analyze synchronization and replication algorithms.
- Explore distributed scheduling algorithms

Unit I	INTRODUCTION	9

Introduction – Examples of distributed systems–Trends in distributed systems – Focus on resource sharing – Challenges - World Wide Web - System models – Physical models - Architectural models - Fundamental models.

Unit II	COMMUNICATION IN DISTRIBUTED SYSTEM	9

Inter Process Communication – the API for the Internet protocols – External data representation – Multicast communication - Network virtualization: Overlay networks. MPI - Request-reply protocols – Remote procedure call. Distributed Objects: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches- From Objects to Components: Enterprise Java Beans

Unit III	PEER TO PEER SYSTEMS AND DISTRIBUTED FILE SYSTEMS	9

Introduction – Napster and its legacy – Peer-to-peer Middleware – Routing overlays - Overlay case studies: Pastry, Tapestry. Distributed File Systems – File service architecture – Sun Network File System –Google File System – Name Services and Domain Name System – Directory services – Case studies: The Global Name System, X.500 Directory Service.

Unit IV	SYNCHRONIZATION AND FAULT TOLERANCE	9

Introduction – Clocks, events and process states – Synchronizing physical clocks - Logical time and logical clocks – Global states – Coordination and Agreement – Distributed mutual exclusion – Elections –Transactions - Locks –Optimistic concurrency control – Timestamp ordering – Atomic commit protocols – Concurrency control in distributed systems - Distributed deadlocks.

Unit V	RESOURCE AND PROCESS MANAGEMENT	9

Resource management: Desirable features of a good global scheduling algorithm –Task assignment approach – Load balancing approach – Load sharing approach – Process management: Process migration – Threads

TEXT BOOK(S)

1.	George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2.	Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.

REFERENCE(S)

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1.	Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
2.	Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004
3.	Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, USA, 2003

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE03	WEB USER INTERFACE DESIGN	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- Design web pages with good look and feel using CSS3 and Bootstrap
- Validate and manipulate the contents of the webpage using JavaScript and DOM
- Learn and realize features of NoSQL and Type Script fundamentals
- Understand the concept of server side Java Script Framework Node JS
- Gain knowledge on Angular JS

Course Outcomes:

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

- Design increasingly appealing web pages using CSS3 and Bootstrap
- Create valid and interactive web pages using JavaScript and DOM
- Work with MongoDB and write program in type script
- Write programs of Node JS in server side
- Develop application using Angular JS framework

Unit I	HTML AND CSS3	9

Review of HTML - Lists - Tables - Forms - Internal linking - Meta elements - New HTML5 Form input types – Input and datalist elements and auto complete attribute Types of CSS - Conflicting style sheets - Positioning Elements - Element Dimension - Box model and Text Flow – Color - Box Shadows.

Unit II	JAVASCRIPT AND DOM	9

Introduction to JavaScript - Syntax - Variables and data types - JavaScript Control Statements - Operators - Literals - Functions - Objects - Arrays - Built in objects - JavaScript Event Handling - Form processing with focus, blur, submit, reset - Event Bubbling - Introduction to the Document Object Model - The Document Tree - DOM Collections – Dynamic Style - Using Timer and Dynamic Styles to Create Animated Effects

Unit III	SERVER-SIDE JS FRAMEWORK - NODE.JS	9

Introduction to Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP (Request & Response) – Event Handling - GET & POST

Unit IV	INTRODUCTION TO MONGODB AND TYPESCRIPT	9

Introduction to NoSQL Database – Uses of MongoDB - Difference between MongoDB & RDBMS - MongoDB :Data Types – Database – Collection – Documents - Basic CRUD Operations using MongoDB – Limiting Records – Sorting Records – Aggregation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.TypeScript : Introduction – Features – Installation setup – Variables – Datatypes – Enum – Array – Tuples – Functions - OOP concepts: Interfaces – Modules – Namespaces – Decorators

Unit V	ANGULAR JS	9

Introduction to Angular 4.0 - Needs & Evolution – Features – Architecture overview - Components and Modules – Templates – Change Detection – Directives – Data Binding - Event Binding - Pipes – Nested Components. Template Driven Forms - Model Driven Forms or Reactive Forms - Custom Validators - Dependency Injection - Services - RxJS Observables - HTTP - Routing.

TEXT BOOK(S)

1.	P.J. Deitel, H.M. Deitel, "Internet and World Wide Web – How to program", Fifth Edition, Pearson Education

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	Publishers, 2009
2.	Amol Nayak, "MongoDB Cookbook Paperback" , November 2014
3.	Krasimir Tsonev, "Node.js by Example Paperback", May 2015

REFERENCE(S)

1.	Jeffrey C. Jackson, "Web Technologies - A Computer Science Perspective", Pearson Education, 2011
2.	Agus Kurniawan, "AngularJS Programming by Example", First Edition, Kindle, 2014

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester V	PE
Course Code	**Course Name**	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ADPE04	**FREE OPEN SOURCE SOFTWARE**	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is to

- Learn the context and operation of free and open source software (FOSS) communities and associated software projects.
- Study about Gawk and Linux portable devices.
- Learn Package management system and source code management system
- Be familiar with Web servers.
- Study cloud platform

Course Outcomes:

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

- Able to select appropriate open source licenses.
- Explore the use of gawk.
- Able to manages the packages using different package managers in linux and able to manage source code using versioning systems
- Work with Web servers.
- Explore the open source cloud platform

Unit I	INTRODUCTION TO OPEN SOURCE SOFTWRAE	9

Introduction to Open sources – Need of open sources- Advantages of open sources – Application of open sources-, open source operating system – Linux: Introduction- General Overview – Kernel Mode and User Mode –Advanced concepts – Scheduling – Personalities – Cloning – Signals – Development with Linux – OSS Installation - Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL- AGPL- LGPL - FDL - Implications – FOSS examples.

Unit II	LINUX UTILITIES	9

Gwak - Conceptual Overview - Command-Line Syntax - Patterns and Procedures - Built-in Variables – Operators - Variable and Array Assignment - User-Defined Functions - Group Listing of awk Functions and Commands –Specific features - df - env - grep - ifconfig - locate, slocate - ln - netconfig, netcfg - netstat - ping - Snort –traceroute, Linux for portable Devices, Creation of Bootable CD and USB from command line, Case Studies – Samba, CUPS

Unit III	PACKAGE MANAGEMENT AND SOURCE CODE MANAGEMENT	9

Package Management – YUM, RPM, APT. Source Code Management – Usage Models and Systems, Sub Version Control Systems – Command Line Client, Repository Administration, Examining the repository, Providing Remote Access, GIT – Overview, Git Repository Format, Git Commit, Creating and Sharing a New Repository, Git Command Line Client

Unit IV	WEBSERVER AND DEVELOPMENT PLATFORMS	9

Apache HTTP Server and its flavors – Lighttpd - Tornado HTTP static File Server - WAMP server, MySQL, PHP, PYTHON - PERL as development platform.

Unit V	OPEN SOURCE CLOUD	9

Introduction to Cloud, FOSS Cloud Software Environment, Eucalyptus – History, Overview and goals of Eucalyptus, Architecture and components, Compatibility with Amazon EC2, Open Stack – History and overview, Characteristics, Features, Architecture, Components, Open Stack Cloud Operating System

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TEXT BOOK(S)	
1.	RAO M N, Fundamentals of Open source software, PHI New Delhi, 2015
2.	Stephen Figgins, Arnold Robbins, Ellen Siever, Robert Love, Linux in a Nutshell 6th Edition, O'Reilly, 2009

REFERENCE(S)	
1.	Rachna Kapur, Mario Briggs, Getting started with open source development, First Edition, IBM corporation, July 2010
2.	Evi Nemeth, Garth Snyder, Trent R. Hein, Linux Administration Handbook, Second Edition, Pearson Education, 2011

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ADPE05	SOCIAL NETWORKING	3	0	0	3	45	100	

Course Objective (s):
The purpose of learning this course is to
- Understand the Network Structure
- Familiarize with Network Modelling
- Explore various features in Location based Social Networks
- Explore variety of features in Social Networking Site.
- Have in depth idea about Twitter and Github

Course Outcomes:
At the end of this course, learners will be able to:
- Perform various computations on the Social Networks
- Find Missing and duplicated information in the networks
- Analyze Location based Social Media
- Analyze the branded Social Networking Page.
- Perform Twitter analysis and Trend Mining in Github

Unit I	SOCIAL NETWORK STRUCTURE AND MEASURES	9

Basics of network structure – Representing networks- Basic network structures and properties Subnetworks - Describing nodes and edges-Describing networks-Tie Strength

Unit II	ENTITY RESOLUTION AND LINK PREDICTION	9

Modeling networks- Sampling methods- Egocentric network analysis- Link prediction- Entity resolution Incorporating network data-Case Study

Unit III	LOCATION-BASED SOCIAL INTERACTION AND ANALYSIS	9

Location technology-Mobile location sharing-Location-based social media analysis-Privacy and location-based social media-Social sharing and social filtering-Automated recommender systems-Analyzing public-sector social media Case study

Unit IV	UNCOVERING BRAND ACTIVITY, POPULARITY, AND EMOTIONS	9

Facebook brand page -Project planning -Analysis -Noun phrases -Detecting trends in time series - Uncovering emotions

Unit V	TWITTER ANALYSIS AND TRENDS MINING IN GITHUB	9

Getting the data from Twitter - Sentiment analysis -Customized sentiment analysis -Named entity recognition - Combining NER and sentiment analysis -Trends Mining on GitHub -Data pull -Data processing -Data analysis

TEXT BOOK(S)

1.	Jennifer Golbeck "Analyzing the Social Web " Morgan Kaufmann; 1 edition 2013
2.	Siddhartha Chatterjee, Michal Krystyanczuk "Python Social Media Analytics" Packt publishers, 2017

REFERENCE(S)

1.	Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2011
2.	Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, first edition, 2011.

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					Semester VI	PE

Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE06	ADVANCED PYTHON FOR DATA ANALYTICS	3	0	0	3	45	100

Course Objective(s):
- Be able to write relatively advanced, well structured, computer programs in Python
- Be familiar with principles and techniques for optimizing the performance of Python numeric applications
- Understand parallel computing and how parallel applications can be written in Python
- Experiment with developing GPU accelerated Python applications.
- Develop Python applications that utilize big data services

Course Outcomes: At the end of this course, learners will be able to:
- Explain basic principles of Python programming language
- Able to implement object oriented concepts,
- Implement database and GUI applications
- Apply different libraries for data analytics
- Apply statistical analysis to analyze the data.

Unit I	PYTHON FUNDAMENTALS	9

Tuples, Dictionaries, set and frozen set, functions : pre defined and user defined functions, Recursion function, Modules and packages, file operations, Exception handling.

Unit II	INTRODUCTION TO OOPS AND DATABASE CONCEPTS	9

The Object Oriented Programming Data Abstraction - Data Hiding - Encapsulation - Modularity - Inheritance - Polymorphism- Database : Introduction to MySQL - PYMYSQL Connections - Executing queries – Transactions - Handling error.

Unit III	GUI PROGRAMMING	9

Introduction - Tkinter programming - Tkinter widgets - Frame - Button - Label - Entry – Turtle programming – Multi Threading – Regular Expressions - Decorators - Generators - Iterators - Co-routines . CGI – Cookies, File upload.

Unit IV	INTRODUCTION TO DATA ANALYTICS	9

Traditional Data Management Analytical tools - Types of Analytics - Hind sight, ore sight and insight - Dimensions and measures – Libraries for data analytics : Anaconda Numpy - Scipy -Pandas - Matplotlib - Seaborn - Scikit-learn.

Unit V	STATISTICS ANALYSIS	9

Mean, Median, Mode Z-scores - Bias -variance dichotomy - Sampling and t-tests - Sample vs Population statistics - Random Variables - Probability distribution function - Expected value - Binomial Distributions - Normal Distributions - Central limit Theorem - Hypothesis testing - Z-Stats vs T-stats - Type 1 type 2 error - Chi Square test - ANOVA test and F-stats .

TEXTBOOK(S):

1.	Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Pearson; 2 edition,2003.
2.	Big Data: Principles and best practices of scalable realtime data systems, 1st Edition, Nathan Marz,James Warren.

REFERENCE(S):

1.	Python Programming: An Introduction to Computer Science by John M. Zelle, Franklin, Beedle publisher.
2.	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python 2nd Edition, Wes Mc Kinney

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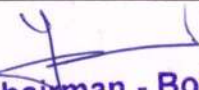| Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019		Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ADPE07	ADVANCED JAVA PROGRAMMING	3	0	0	3	45	100	

Course Objective (s):

The purpose of learning this course is

- To understand the basic concepts of core principles of the Java Language
- To gain knowledge to develop standaloneapplications.3
- To discuss basic principles of HTML, Java Script and XML
- To gain knowledge to develop dynamic Web applications like servlet,jsp.5
- To introduce tools, technologies and framework hence Hibernate and Spring are introduced to enhance web development skills.

Course Outcomes:

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

- Ability to develop the application based on the java concepts
- Ability to solve the real world problems using concepts like swings,JDBC
- Analyze and design web-based information systems to meet certain business needs using HTML5, CSS,JavaScript
- Able to Design and develop interactive, client-side, server-side executable web applications using eclipse.
- Explore the features of various platforms and frameworks like hibernate, Spring ,struts used in web applications development

Unit I	JAVA FUNDAMENTALS	9

Overview of Java - Java modifiers-Wrapper classes-Argument passing in class & object Returning a value- Objects as arguments-Returning objects- Passing an array-constructors– this keyword-Inheritance- Use of super in calling parent class constructor- java.lang.Object and its methods – Passing arguments in super(): super(int), super(String) - super(String,String)-Packages-User defined exception- Collections-Swings-Event Handling-JDBC-JDBC Drivers-JDBC configuration(connection) - Statement – Callable Statement-prepared statements- Scrollable and updatable result sets - Query execution

Unit II	HTML, CSS AND JAVA SCRIPT	9

HTML common tags – List – Tables – Images – Forms – Frames -HTML5- Form design- CSS-Introduction to Java Scripts-storing data (data types) - Objects- Properties-Events- Decision making- Looping Functions-Array-Conversions-Processing HTML forms and validation using JavaScript- XMLDTD, XSD-XSLT-Well-formed XML, valid XML-Creating XML using XSD- DOM and SAX

Unit III	SERVLET	9

Overview of servlet-Servlet configuration-Servlet Architecture- Servlet life cycle-Servlet Request and Response- Generic Servlet ,Http Servlet- web.xml and its need - Servlet configuration-Session racking-servlet

Unit IV	JAVA SERVER PAGES	9

Introduction to JSP – Problem with servlet -Life cycle of JSP- scripting Elements (Expression tag, scriptlets tag and declarations tag)-JSP Directive Elements-page directive - JSP objects-Action Elements – Sharing data Between JSP pages Application Development using eclipse.

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Unit V	JAVA FRAMEWORKS	9

Hibernate Introduction-features-Architecture-Mapping and Configuration Files in Hibernate - Hibernate O/R Mappings –Hibernate query language-Simple examples using hibernate- Spring Introduction- Architecture-IOC container- Dependency Injection Bean – Getting started with Spring MVC framework- Simple examples using Spring-STRUTS – Introduction, Struts framework core components – Installing and setting up struts – Getting started withstruts.

TEXT BOOK(S)

1.	Herbert Schildt, "Java The Complete Reference", 8th Edition, McGraw-Hill Osborne Media, 2015
2.	Paul Deitel, "Internet & World Wide Web: How to Program", Prentice Hall, 5^{th}Edition, 2011.
3.	Gavin King,Christian Bauer,"Java Persistence with Hibernate",Dreamtech press, Kogent Learning Solutions Inc. 2008
4.	Craig Walls, "Spring in Action", Manning, Dreamtech press, 2014

REFERENCE(S)

1.	Cay S. Horstmann and Gary Cornell, "Core Java™, Volume I – Fundamentals" 9^{th}Edition, Prentice Hall,2012
2.	Robert W. Sebesta, "Programming the World Wide Web", Addison-Wesley, 7thEdition, 2012.
3.	UttamK.Roy, "Web Technologies", Oxford University Press, 1st Edition, 2011

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Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE08	R PROGRAMMING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of R Big Data analytics
- To able to appreciate and apply the R programming from a statistical perspective

Course Outcomes:

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

- Create artful graphs to visualize complex data sets and functions
- Write more efficient code using parallel R and vectorization
- Interface R with C/C++ and Python for increased speed or functionality
- Find new packages for text analysis, image manipulation
- Perform statistical analysis of the same

Unit I	INTRODUCING TO R	9

R Data Structures – Help functions in R – Vectors – Scalars – Declarations– recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NU LL values – Filtering – Vectorised if-then else – Vector Equality – Vector Element names

Unit II	MATRICES, ARRAYS AND LISTS	9

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists

Unit III	DATA FRAMES	9

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and Simulations in R

Unit IV	OOP	9

S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor – reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three dimensional plots

Unit V	INTERFACING	9

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering

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TEXT BOOK(S)	
1.	Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2.	Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison- Wesley Data & Analytics Series, 2013.

REFERENCE(S)	
1.	Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2.	Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE				R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ADPE09	DATA WAREHOUSING AND DATA MINING	3	0	0	3	45	100

Course Objective (s):

The purpose of learning this course is to

- To understand basics of data warehouse
- To learn data mining and association mining
- To understand classification and prediction
- To know cluster analysis technique
- To familiarize graph and multimedia mining

Course Outcomes:

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

- Understand the basics of data warehouse
- Apply association rule mining
- Apply classification and prediction techniques
- Analyze data using cluster techniques
- Apply graph and multimedia mining

Unit I	INTRODUCTION TO DATA WAREHOUSE	9

Introduction- a multi dimensional data model – Data cube technology-Data warehouse architecture-Types of OLAP servers-Data warehouse implementation-Data warehousing to data mining

Unit II	INTRODUCTION TO DATA MINING AND ASSOCIATION MINING	9

Data mining – functionalities - Major issues - Data cleaning - Data integration and Transformation - Data reduction - Discretization and concept hierarchy generation-Efficient and scalable frequent item set mining methods-Mining various kinds of association rules- Association mining to correlation analysis-Constraint based association mining

Unit III	CLASSIFICATION AND PREDICTION	9

Introduction – Issues – Classification by decision tree induction - Bayesian classification- Rule based classification. Classification by back propagation- Other classification methods-Prediction-Accuracy and error measures- Evaluating the accuracy

Unit IV	CLUSTER ANALYSIS	9

Cluster analysis – Types of data – Partitioning methods – Hierarchical methods – Density based methods-Grid based methods – Model based Clustering methods – Clustering High dimensional data – Constraint based cluster analysis – outlier analysis-Data mining Applications-Data mining system products-Additional themes on data mining.

Unit V	GRAPH MINING AND MULTIMEDIA MINING	9

Graph mining- Multirelational data mining-Multidimensional analysis and descriptive mining of complex data objects. Spatial data mining-Multimedia data mining-Text mining-Mining the world wide web-Data mining applications

TEXT BOOK(S)

1.	iewei Han, MichelineKamber, "Data mining concepts and techniques", Morgan Kaufmann Pub,2006

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| 2. | William H. Inmon, "Building the data ware house", Wiley Dreamtech (p) Ltd., IV Edition, 2005. |

REFERENCE(S)

1.	Ian H.Witten, Eibe Frank, "Data Mining: Practical M/c Learning tools and techniques with Java implementation", Third Edition, Morgan Kaufman, 2000
2.	K.P.Soman,Shyam Diwakar,V.Ajay, " Insight into Data Mining, theory and practice", PHI Learning private Limited,2010.
3.	Ronen Feldman, James Sangee, "The Text Mining Handbook: Advanced Approaches in analyzing unstructured data", Cambridge University Press, 2007

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Dept. of CSE - ESEC

Department	ARTIFICIAL INTELLIGENCE AND DATA SCIENCE					R 2019	Semester VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ADPE10	WEB SERVICES PROGRAMMING AND XML	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to
- Be able to understand and write well-formed XML documents
- Be able to write the schema for the given XML documents in both DTD and XML Schema languages
- Learn the XML Technologies and modeling databases in XML
- Provide an overview of Service Oriented Architecture and the importance of Web services
- Be able to create, deploy, and call Web services

Course Outcomes:

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

- Understand Web Services and its Infrastructure
- Impart knowledge in XML technologies to build robust XML applications
- Familiarize with concepts of SOA, standards and technologies for building the Web Services
- Use the approaches for providing security for XML documents and the messages exchanged among Web Services
- Deploying and Publishing Web Service

Unit I	XML TECHNOLOGY	9

XML – benefits – Advantages of XML over HTML, EDI, Databases – XML based standards – Structuring with schemas - DTD – XML Schemas – XML processing – DOM – SAX – presentation technologies – XSL – XFORMS – XHTML – Transformation – XSLT – XLINK – XPATH – XQuer.

Unit II	ARCHITECTURE OF WEB SERVICES	9

Business motivations for web services – B2B – B2C – Technical motivations – limitations of CORBA and DCOM – Service-oriented Architecture (SOA) – Architecting web services – Implementation view – web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.

Unit III	WEB SERVICES BUILDING BLOCKS	9

Transport protocols for web services – messaging with web services - protocols - SOAP - describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI – Web service inspection – Ad-Hoc Discovery - Securing web services

Unit IV	IMPLEMENTING XML IN E-BUSINESS	9

B2B – B2C Applications – Different types of B2B interaction – Components of e-business XML systems – ebXML – RosettaNet - Applied XML in vertical industry – web services for mobile devices

Unit V	XML CONTENT MANAGEMENT AND SECURITY	9

Semantic Web – Role of Meta data in web content - Resource Description Framework – RDF schema – Architecture of semantic web – content management workflow – XLANG – WSFL – Securing web services

TEXT BOOK(S)

1.	Ron Schmelzer et al. " XML and Web Services", Pearson Education, 2002.

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| 2. | Keith Ballinger, ". NET Web Services Architecture and Implementation", Pearson Education, 2003. |

REFERENCE(S)

1.	David Chappell, "Understanding .NET A Tutorial and Analysis", Addison Wesley, 2002.
2.	Kennard Scibner and Mark C.Stiver, " Understanding SOAP", SAMS publishing.
3.	Alexander Nakhimovsky and Tom Myers, "XML Programming: Web Applications and Web Services with JSP and ASP", Apress, 2002.

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