RAJALAKSHMI ENGINEERING COLLEGE
(An Autonomous Institution Affiliated to Anna University, Chennai)
Choice Based Credit System (CBCS)
REGULATIONS – 2019 (Revised)
B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
CURRICULUM

Vision

To promote highly Ethical and Innovative Computer Professionals through excellence in teaching, training and research.

Mission

- To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.
- To promote research activities amongst the students and the members of faculty that could benefit the society.
- To impart moral and ethical values in their profession

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will demonstrate their technical skills and competency in various applications through the use of Artificial Intelligence and Data Science.

PEO 2: To produce motivated graduates with capability to apply acquired knowledge and skills in data analytics and visualization to develop viable systems**.**

PEO 3: Graduates will establish their knowledge by adopting Artificial Intelligence and Data Science technologies to solve the real world problems

PEO 4: To produce graduates with potential to participate in life-long learning through professional developments for societal needs with ethical values.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Artificial Intelligence and Data Science Learning Program will demonstrate

PSO 1: Foundation Skills: Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analysis.

PSO 2: Problem-Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business automation.

PSO 3: Successful Progression: Ability to critique the role of information and analytics for an innovative career, research activities and consultancy

CURRICULUM
B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
Regulations 2019 (Revised) | Total Credits:162

SEMESTER I								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	HS19151	Technical English	HS	3	2	1	0	3
2.	MA19156	Linear Algebra and Calculus	BS	4	3	1	0	4
LAB ORIENTED THEORY COURSES								
3.	PH19241	Physics for Information Science	BS	5	3	0	2	4
4.	GE19141	Programming using C	ES	6	2	0	4	4
5.	GE19122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1
NON CREDIT COURSES								
6.	MC19102	Indian Constitution and Freedom Movement	MC	3	3	0	0	0
			TOTAL	**23**	**13**	**2**	**8**	**16**

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SEMESTER II								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19254	Probability and Inferential Statistics	BS	4	3	1	0	4
2.	GE19101	Engineering Graphics	ES	4	2	2	0	4
LAB ORIENTED THEORY COURSES								
3.	EE19242	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4
4.	EC19243	Principles of Digital Electronics	ES	5	3	0	2	4
5.	CS19241	Data Structures	PC	7	3	0	4	5
LABORATORY COURSES								
6.	GE19121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1
7.	CS19211	Python Programming Lab	PC	4	0	0	4	2
NON CREDIT COURSES								
8.	MC19101	Environmental Science and Engineering	MC	3	3	0	0	0
			TOTAL	**34**	**17**	**3**	**14**	**24**

SEMESTER III								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19356	Discrete Mathematics for AI	BS	4	3	1	0	4
2.	GE19301	Life Science for Engineers	BS	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	AD19341	Fundamentals of Data Science	PC	5	3	0	2	4
4.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4
5.	AD19342	Introduction to Operating System	PC	5	3	0	2	4
6.	AI19342	Object Oriented Programming using JAVA for AI	PC	7	3	0	4	5
NON CREDIT COURSES								
7.	MC19301	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0
			TOTAL	**32**	**21**	**1**	**10**	**24**

SEMESTER IV								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	MA19456	Optimization Techniques for AI	BS	4	3	1	0	4
2.	AD19401	Healthcare Analytics	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	AI19341	Principles of Artificial Intelligence	PC	5	3	0	2	4
4.	CS19443	Database Management System	PC	7	3	0	4	5
5.	AD19441	Introduction to Data Analytics	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
6.	GE19421	Soft Skills I	EEC	2	0	0	2	1
			TOTAL	**26**	**15**	**1**	**10**	**21**

SEMESTER V								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective I	PE	3	3	0	0	3
2.		Open Elective – I	OE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
3.	CB19342	Computational Statistics	BS	4	3	0	2	4
4.	CS19542	Computer Networks	PC	7	3	0	4	5
5.	AD19541	Software Engineering Methodologies	PC	5	3	0	2	4
LABORATORY COURSES								
6.	AD19511	R Programming Laboratory	PC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7.	AD19512	Mini Project on Data Science	EEC	4	0	0	4	2
8.	GE19521	Soft Skills II	EEC	2	0	0	2	1
			TOTAL	**32**	**15**	**1**	**16**	**24**

SEMESTER VI								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.	AD19651	Business Analytics	PC	3	3	0	0	3
2.	AD19652	Data and Information Security	PC	3	3	0	0	3
3.		Professional Elective II	PE	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
4.	AI19442	Fundamentals of Machine Learning	PC	5	3	0	2	4
5.	IT19541	Web Technology	PC	5	3	0	2	4
6.	AD19643	Innovation and Design Thinking for Artificial Intelligence and Data Science	PC	5	3	0	2	4
EMPLOYABILITY ENHANCEMENT COURSES								
8.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1
			TOTAL	**26**	**18**	**0**	**8**	**22**

SEMESTER VII								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective III	PE	3	3	0	0	3
2.		Professional Elective IV	PE	3	3	0	0	3
3.		Open Elective-II	OE	3	3	0	0	3
4.	AD19751	Basics of Computer Vision	PC	3	3	0	0	3
LAB ORIENTED THEORY COURSES								
5.	AI19741	Big Data Technology	PC	5	3	0	2	4
LABORATORY COURSES								
6.	AD19711	Project Phase-I	EEC	6	0	0	6	3
			TOTAL	**23**	**15**	**0**	**8**	**19**

SEMESTER VIII								
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES								
1.		Professional Elective-V	PE	3	3	0	0	3
2.		Professional Elective-VI	PE	3	3	0	0	3
LABORATORY COURSES								
3.	AD19811	Project Phase-II	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

TOTAL NO. OF CREDITS: 162

PROFESSIONAL ELECTIVES (PE)

Elective – I								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P51	Knowledge Representation in AI	PE	4	2	0	2	3
2.	AD19P52	Game Programming	PE	4	2	0	2	3
3.	AD19P53	Mobile Application and Development	PE	4	2	0	2	3
4.	CS19P12	Distributed Systems	PE	4	2	0	2	3

Elective – II								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P61	Embedded Systems and Programming	PE	4	2	0	2	3
2.	AD19P62	Data Mining Techniques	PE	4	2	0	2	3
3.	CS19P06	Human Computer Interaction	PE	4	2	0	2	3
4.	AD19641	Advanced Artificial Intelligence	PE	4	2	0	2	3

Elective – III								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P71	Robotic Process Automation	PE	4	2	0	2	3
2.	AD19P72	Predictive Analytics	PE	4	2	0	2	3
3.	IT19P85	Social Networks	PE	3	3	0	0	3
4.	CS19741	Cloud Computing	PE	4	2	0	2	3

Elective – IV								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P74	Ethics of Artificial Intelligence	PE	3	3	0	0	3
2.	AD19P75	Engineering Economics	PE	3	3	0	0	3
3.	IT19P76	Image processing and Vision Techniques	PE	4	2	0	2	3
4.	AD19P76	Video Processing	PE	4	2	0	2	3

Elective – V								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P77	Cyber Security Systems	PE	4	2	0	2	3
2.	AI19P75	Information Retrieval	PE	4	2	0	2	3
3.	AI19P76	Supply Chain Analytics	PE	3	3	0	0	3
4.	IT19P78	Software Testing	PE	3	3	0	0	3

Elective – VI								
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
1.	AD19P78	Speech Processing and Analytics	PE	4	2	0	2	3
2.	AI19P79	Business Intelligence and Analytics	PE	3	3	0	0	3
3.	IT19P74	Internet of Things	PE	3	3	0	0	3
4.	IT19P84	Parallel Computing	PE	3	3	0	0	3

S.NO	**Course Category**	**Credits per Semester**								**Total Credits**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
1	**HS**	3	0	0	0	0	0	0	0	3
2	**BS**	8	4	7	4	4	0	0	0	27
3	**ES**	5	13	0	0	0	0	0	0	18
4	**PC**	0	7	17	16	11	18	7	0	76
5	**PE**	0	0	0	0	3	3	6	6	18
6	**OE**	0	0	0	0	3	0	3	0	6
7	**EEC**	0	0	0	1	3	1	3	6	14
8	**MC**	0	0	0	0	0	0	0	0	0
	Total	16	24	24	21	22	22	19	12	162

HS – Humanities and Science BS – Basic Science ES – Engineering Science

PC – Professional Core PE – Professional Elective OE – Open Elective

EEC – Employability Enhancement Courses

SEMESTER I

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
HS19151	TECHNICAL ENGLISH	HS	2	1	0	3

Objectives:

- To enable learners to acquire basic proficiency in English reading and listening.
- To write in English precisely and effectively.
- To speak flawlessly in all kinds of communicative contexts.

UNIT-I	VOCABULARY BUILDING	9

The concept of word formation – Root words from foreign languages and their use in English – Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives – Synonyms, antonyms, and standard abbreviations. Compound words – abbreviation – single word substitution – Listening: Listening comprehension, listening to motivational speeches, podcasts and poetry. Speaking: Short talks on incidents – place of visit – admiring personalities, etc.

UNIT-II	BASIC WRITING SKILLS	9

Sentence structures – Use of phrases and clauses in sentences – punctuation – coherence – Organizing principles of paragraphs in documents – Techniques for writing precisely. **Reading & Writing** – Free writing – paragraphs – article reading and writing criticism – change of tense forms in short text or story – inferential reading – rewrite or interpret text – prepare questions based on the text. **Speaking:** Everyday situations – conversations and dialogues, speaking for and against.

UNIT-III	GRAMMAR AND LANGUAGE DEVELOPMENT	9

Subject-verb agreement- Noun-pronoun agreement – Articles – Prepositions – Redundancies. Reading & Writing: Read from innovation and ideas that changed the world, newspaper column writing – Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps, pictures, etc.)

UNIT-IV	WRITING FOR FORMAL PRESENTATION	9

Nature and Style of sensible Writing – Describing – Defining – Classifying – Providing examples or evidence – Writing introduction and conclusion. Reading & Writing – Read from Literary pieces – identify different parts text – Difference between print and digital writing. Writing: Recommendations – Foreword – Review of book. Speaking- Formal Presentations – Debate on social issues/taboos and solutions.

UNIT-V	EXTENDED WRITING AND SPEAKING	9

Writing: Précis writing – Essay writing – workplace communication: Resume – Business letters and emails – Proposals. Speaking: Panel discussion – reporting an event – mock interview – Master Ceremony.

Total Contact Hours	:	45

Course Outcomes:

On completion of the course students will be able to

- Discuss and respond to the listening content.
- Read and comprehend different texts and appreciate them.
- Understand structures and techniques of precise writing.
- Analyze different genres of communication and get familiarized with new words, phrases, and sentence structures.
- Write and speak appropriately in varied formal and informal contexts.

Text Book(s):

1. English for Technologists & Engineers, Orient BlackSwan Publications, Chennai, 2012.

Reference Books(s):

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press.
2. Bushan Kumar, Effective Communication Skills, Khanna Publishing House, Delhi.
3. Pushplata, Sanjay Kumar, Communication Skills, Oxford University Press.
4. Michael Swan, Practical English Usage, Oxford University Press, 1995.
5. F.T. Wood, Remedial English Grammar, Macmillan, 2007.
6. William Zinsser, On Writing Well, Harper Resource Book, 2001.
7. Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press, 2006.
8. Exercises in Spoken English, Parts I-III, CIEFL, Hyderabad, Oxford University Press.

CO – PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
HS19151.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
HS19151.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
HS19151.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS19151.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
HS19151.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	1.0	1.7	1.0	1.3	1.0	1.0	1.0	1.0	2.0	2.8	1.0	1.8	2.0	2.0	1.0

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19156	LINEAR ALGEBRA AND CALCULUS	BS	3	1	0	4

Objectives:	
●	To gain knowledge in using matrix algebra techniques and the concepts of basis and dimension in vector spaces.
●	To understand the techniques of calculus those are applied in the Engineering problems.

UNIT-I	MATRICES AND QUADRATIC FORMS	12
Symmetric and skew – symmetric matrices, Hermitian matrix, Unitary matrix and Orthogonal matrices – Eigen values and Eigen vectors – Cayley – Hamilton theorem (statement only) and applications – Similarity transformation – Orthogonal transformation and quadratic forms to canonical forms – Nature of quadratic forms.		
UNIT-II	**VECTOR SPACES**	**12**
Vector spaces – Subspaces – Linear combinations and system of Linear equations – Linear independence and Linear dependence – Bases and Dimensions – Linear Transformation – Matrix representation of Linear Transformation – Null space, Range and dimension theorem.		
UNIT-III	**INNER PRODUCT SPACES**	**12**
Inner product and norms – Gram Schmidt orthonormalization process – Modified Gram Schmidt orthonormalization process – QR Factorization-Singular value decomposition.		
UNIT-IV	**DIFFERENTIAL CALCULUS- FUNCTIONS OF SEVERAL VARIABLES**	**12**
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.		
UNIT-V	**MULTIPLE INTEGRAL**	**12**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.		
	Total Contact Hours : 60	

Course Outcomes:	
On completion of the course students will be able to:	
●	Apply the concept of Eigen values and eigen vectors, diagonalization of a matrix for solving problems.
●	Use concepts of basis and dimension in vector spaces in solving problems.
●	Construct orthonormal basis using inner products and decompose matrices.
●	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.
●	Evaluate surface area and volume using multiple integrals.

Text Book(s):	
1	Grewal B.S., Higher Engineering Mathematics, 44th Edition, Khanna Publishers, New Delhi, 2015.
2	Gilbert Strang, Introduction to linear algebra, 6th Edition, Wellesley Publishers, 2016

Reference Books(s):	
1	Friedberg, A.H., Insel, A.J. and Spence, L., Elementary Linear Algebra, a matrix approach, 2nd edition, Pearson, 2019.
2	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.
3	Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
4	T Veerarajan, Engineering Mathematics –I, McGraw Hill Education, 2018
5	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19156.1	3	3	2	2	2	1	-	-	-	-	1	2	2	3	2
MA19156.2	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.3	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.4	3	3	2	2	3	1	-	-	-	-	1	2	2	3	2
MA19156.5	3	3	1	2	1	1	-	-	-	-	1	2	1	2	2
Average	3	3	1.9	2	2	1	-	-	-	-	1	2	2.2	2.8	2

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
PH19241	PHYSICS FOR INFORMATION SCIENCE	BS	3	0	2	4

Objectives:

- To understand the principles of laser and fibre optics in engineering and technology.
- To understand the advanced concept of quantum theory and applications.
- To study the properties and applications of semiconducting, magnetic, superconducting and optical materials.

UNIT-I QUANTUM PHYSICS **9**

Introduction- Quantum free electron theory-De Broglie's concept-Schrodinger wave equation-Time independent and time dependent equations-Physical significance of wave function – Particle in a one dimensional box – electrons in metals – degenerate states – Fermi – Dirac statistics – Density of energy states – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure – Band gap of nanomaterials.

UNIT-II SEMICONDUCTOR PHYSICS **9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap – semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect.

UNIT-III OPTICAL PROPERTIES OF MATERIALS **9**

Classification of optical materials – carrier generation and recombination processes – Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) – photo current in a P-N diode – Photo transistor-solar cell – LED – Organic LED- Optical data storage techniques-Non Linear Optical materials-properties and applications.

UNIT-IV LASERS AND FIBRE OPTICS **9**

Lasers: Population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction- Applications. Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, and mode) –Double crucible method-splicing technique- losses associated with optical fibers –Fiber optic communication system – fiber optic sensors: pressure and displacement.

UNIT-V MAGNETIC AND SUPERCONDUCTING MATERIALS **9**

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility –Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferrimagnetism – Domain Theory- M versus H 14ehavior – Hard and soft magnetic materials – examples and uses–Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor). Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative), Type-I and Type II Superconductors –Magnetic Levitation-SQUIDS- An overview of High temperature superconductors.

Contact Hours : 45

List of Experiments (Any 10 experiments)

1	Determine the wavelength and angle of divergence of laser beam and numerical aperture using fiber cable.
2	Determine the wavelength of spectrum by using spectrometer.
3	Determine of refractive index of a given prism by using spectrometer.
4	Determine specific resistance of the material of given wires using metre bridge.
5	Verify Ohm's law – series and parallel.
6	Determine the value of Planck's constant using photo electric effect.
7	Determine the band gap of given semiconductor.
8	Determination of Hall coefficient of semiconducting materials.
9	Study the magnetic field produced by current carrying coils by using Helmoltz coil.
10	Study the resonance frequency in series connected LCR circuits.
11	Determine the wavelength of given source by using Newton's ring Experiment.
12	Determine the thickness of the given specimen by using air wedge method.

Contact Hours : 30

Total Contact Hours : 75

Course Outcomes:

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

- Apply the concepts of electron transport in nanodevices.

●	Analyze the physics of semiconductor devices
●	Analyze the properties of optical materials for optoelectronic applications.
●	Use the concepts of Laser and Fiber optics in communication.
●	Use the properties of magnetic and superconducting materials in data storage devices.

Text Book(s):	
1	Bhattacharya, D.K. & Poonam, T. Engineering Physics, Oxford University Press, 2015.
2	Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012.
3	Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
4	Kittel, C. Introduction to Solid State Physics, Wiley, 2005.

Reference Books(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.
4	S. O. Pillai, Solid state physics, New Age International, 2015.
5	Serway, R.A. & Jewett, J.W, Physics for Scientists and Engineers, Cengage Learning.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
PH19241.1	3	3	2	2	2	1	-	1	1	2	1	2	1	1	2
PH19241 .2	3	3	3	2	3	1	1	-	1	2	1	2	1	1	2
PH19241 .3	3	3	3	2	3	1	1	-	1	2	1	2	1	1	1
PH19241 .4	3	3	2	2	3	1	1	-	1	2	1	2	1	-	1
PH19241 .5	3	3	2	2	3	1	1	-	1	2	1	2	1	1	1
Average	3.0	3.0	2.4	2.0	2.8	1.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	1.0	1.4

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
GE19141	PROGRAMMING USING C	ES	2	0	4	4

Objectives:	
●	To develop simple algorithms for arithmetic and logical problems.
●	To develop C Programs using basic programming constructs
●	To develop C programs using arrays and strings
●	To develop applications in C using functions, pointers and structures
●	To do input/output and file handling in C

UNIT-I	**GENERAL PROBLEM SOLVING CONCEPTS**	**6**
Computer – components of a computer system-Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.		
UNIT-II	**C LANGUAGE – TYPES OF OPERATOR AND EXPRESSIONS**	**6**
Introduction- C Structure- syntax and constructs of ANSI C – Variable Names, Data Type and Sizes, Constants, Declarations – Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment and Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation.		
UNIT-III	**I/O AND CONTROL FLOW**	**6**
Standard I/O, Formatted Output – Printf, Variable-length argument lists- Formatted Input – Scanf, Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, GoTo Labels.		
UNIT-IV	**FUNCTIONS AND PROGRAM STRUCTURE**	**6**
Basics of functions, parameter passing and returning type, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, C Pre-processor, Standard Library Functions and return types.		
UNIT-V	**POINTERS, ARRAYS AND STRUCTURES**	**6**
Pointers and addresses, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional arrays, Strings, Initialisation of Pointer Arrays, Command line arguments, Pointers to functions, complicated declarations. Basic Structures, Structures and Functions, Array of structures, Pointer of Structures, Self-referential Structures, Table look up, Typedef, Unions, Bit-fields, File Access –Error Handling, Line I/O, Miscellaneous Functions.		
	Contact Hours : 30	

List of Experiments			
1	Algorithm and flowcharts of small problems like GCD.		
	Structured code writing with:		
2	Small but tricky codes		
3	Proper parameter passing		
4	Command line Arguments		
5	Variable parameter		
6	Pointer to functions		
7	User defined header		
8	Make file utility		
9	Multi file program and user defined libraries		
10	Interesting substring matching / searching programs		
11	Parsing related assignments		
	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**90**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Formulate simple algorithms for arithmetic and logical problems.
●	Implement conditional branching, iteration and recursion.
●	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
●	Use arrays, pointers and structures to formulate algorithms and programs.

●	Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Text Books:	
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India; 2nd Edition, 2015.
2	Byron Gottfried, Programming with C, Second Edition, Schaum Outline Series, 1996.

Reference Books:	
1	Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.
2	YashavantKanetkar, Let Us C, BPB Publications, 15th Edition, 2016.

Web links for virtual lab:	
1	https://www.tutorialspoint.com/compile_c_online.php
2	https://www.codechef.com/ide
3	https://www.jdoodle.com/c-online-compiler
4	https://rextester.com/l/c_online_compiler_gcc

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19141.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE19141.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE19141.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	2
Average	1.4	1.6	2.2	1.6	1.0	-	-	-	1.0	2.0	1.4	1.0	2.0	2.2	2.0

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE19122	ENGINEERING PRACTICES – ELECTRICAL AND ELECTRONICS	ES	0	0	2	1

Objectives:	
●	To provide hands on experience on various basic engineering practices in Electrical Engineering.
●	To impart hands on experience on various basic engineering practices in Electronics Engineering.

List of Experiments				
A. ELECTRICAL ENGINEERING PRACTICE				
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.			
2	Fluorescent lamp wiring.			
3	Stair case wiring.			
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.			
5	Measurement of resistance to earth of electrical equipment.			
B. ELECTRONICS ENGINEERING PRACTICE				
1	Study of Electronic components and equipment's – Resistor, colour coding, measurement of AC signal parameter (peak-peak, RMS period, frequency) using CRO.			
2	Study of logic gates AND, OR, XOR and NOT.			
3	Generation of Clock Signal.			
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.			
5	Measurement of ripple factor of HWR and FWR.			
	Total Contact Hours	**:**	**30**	

Course Outcomes:	
On completion of the course, the students will be able to	
●	Fabricate electrical and electronic circuits
●	Formulate the house wiring
●	Design the AC-DC converter using diode and passive components

REFERENCE	
1	Bawa H.S., Workshop Practice, Tata McGraw – Hill Publishing Company Limited, 2007.
2	Jeyachandran K., Natarajan S. &Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.
3	Jeyapoovan T., Saravanapandian M. &Pranitha S., Engineering Practices Lab Manual,Vikas Publishing House Pvt.Ltd, 2006.
4	Rajendra Prasad A. &Sarma P.M.M.S., Workshop Practice,SreeSai Publication, 2002.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19122.1	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
GE19122.2	3	3	3	3	2	2	2	-	2	1	3	3	-	-	-
GE19122.3	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
Average	3	3	3	3	2.67	1.33	1.33	-	2	1	3	3	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19102	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0

Objectives:	
•	To inculcate the values enshrined in the Indian constitution
•	To create a sense of responsible and active citizenship
•	To know about Constitutional and Non- Constitutional bodies
•	To understand sacrifices made by the freedom fighters

UNIT-I	INTRODUCTION	9
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens. Constitution meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.		
UNIT-II	**STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT**	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.		
UNIT-III	**STRUCTURE AND FUNCTION OF STATE GOVERNMENT AND LOCALBODY**	**9**
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayat Raj: Introduction, Elected officials and their roles, ,Village level: Role of Elected and Appointed officials,		
UNIT-IV	**CONSTITUTIONAL FUNCTIONS AND BODIES**	**9**
Indian Federal System – Center – State Relations – President's Rule – Constitutional Functionaries – Assessment of working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and other Constitutional bodies-. NITI Aayog, Lokpal, National Development Council and other Non –Constitutional bodies.		
UNIT-V	**INDIAN FREEDOM MOVEMENT**	**9**
British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Rule-Rise of Nationalism in India-Indian Freedom Struggle under Mahatma Gandhi-Non- Cooperation Movement-Civil Disobedience Movement- Quit India Movement-British Official response to National movement- Independence of India Act 1947-Freedom and Partition.		
	Total Contact Hours : 45	

Course Outcomes:	
On completion of the course, the students will be able to	
●	Understand the functions of the Indian government
●	Understand and abide the rules of the Indian constitution.
●	Gain knowledge on functions of state Government and Local bodies
●	Gain Knowledge on constitution functions and role of constitutional bodies and non-constitutional bodies
●	Understand the sacrifices made by freedom fighters during freedom movement

Text Book(s):	
1	Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, New Delhi., 21st edition, 2013.
2	BipanChandra,History of Modern India, Orient Black Swan, 2009.
3	Bipan Chandra, India's Struggle for Independence, Penguin Books, 2016.
4	Maciver and Page, Society: An Introduction Analysis, MacMilan India Ltd., New Delhi.2nd edition, 2014.
5	P K Agarwal and K N Chaturvedi, PrabhatPrakashan Constitution of India, New Delhi, 1st edition, 2017.

Reference Books(s) / Web links:	
1	Sharma, Brij Kishore, Introduction to the Constitution of India, Prentice Hall of India, New Delhi.

2	U.R.Gahai, Indian Political System, New Academic Publishing House, Jalandhar.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC19102.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
Average	-	-	-	-	-	1.0	1.0	3.0	2.0	-	-	1.0	-	-	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

SEMESTER II

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19254	PROBABILITY AND INFERENTIAL STATISTICS	BS	3	1	0	4

Objectives:	
●	To provide the required mathematical support in real life problems.
●	To gain knowledge of sampling techniques and use testing of hypothesis for parameter estimation.

UNIT-I	**ONE – DIMENSIONAL RANDOM VARIABLE**	**12**
Probability- Conditional Probability- Bayes Theorem-Discrete and continuous random variables – Moments – Moment generating function –Binomial, Poisson, Geometric, Uniform, Exponential, and Normal,Chi-square, t, F distributions.		
UNIT-II	**TWO – DIMENSIONAL RANDOM VARIABLES**	**12**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation andLinear regression- Multiple correlation and multiple regression–Applications of Central Limit Theorem.		
UNIT-III	**SAMPLING AND ESTIMATION THEORY**	**12**
Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling – Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.		
UNIT-IV	**TESTING OF HYPOTHESIS**	**12**
Statistical hypothesis – Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, F and Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit.		
UNIT-V	**NON PARAMETRIC TESTS**	**12**
Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test.		
	Total Contact Hours : 60	

Course Outcomes: On completion of course students will be able to	
●	Apply the basic concepts of probability, one dimensional and two dimensional Random Variables.
●	Apply the concept of correlation and regression in real life situation.
●	Apply the concept of sampling distribution and estimation theory in forecasting.
●	Use the concepts of Testing of Hypothesis for industrial problems.
●	Use the concepts of Non Parametric Testing for Non-Normal Populations.

Text Book (s):	
1	Veerarajan T, 'Probability and Statistics, Random Processes and Queueing Theory', First edition, McGrawHill,2018.
2	I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 8th Edition, 2015

Reference Books(s):	
1	Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2008.
2	Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.
3	D.C. Montgomery &E.Peck, Introduction to Linear Regression Analysis, 5th Edition, 2012.
4	A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, vol. I & II, World Press, 2016
5	A.M. Mood, F.A. Graybilland D.C. Boes, Introduction to the Theory of Statistics, McGraw Hill Education.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19254.1	3	3	2	2	1	1	-	-	-	-	1	2	1	2	1
MA19254.2	3	3	2	2	1	1	-	-	-	-	1	2	1	2	1
MA19254.3	3	3	2	2	2	1	1	-	-	-	2	2	2	3	2
MA19254.4	3	3	2	3	2	1	1	-	-	-	2	2	2	3	2
MA19254.5	3	3	2	3	2	1	1	-	-	-	2	2	2	3	2
Average	3	3	2	1.4	1.6	1	0.6	-	-	-	1.6	2	1.6	2.6	1.6

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE19101	ENGINEERING GRAPHICS	ES	2	2	0	4

Objectives:	
●	To understand the importance of the drawing in engineering applications
●	To develop graphic skills for communication of concepts, ideas and design of engineering products
●	To expose them to existing national standards related to technical drawings
●	To improve their visualization skills so that they can apply these skills in developing new products
●	To improve their technical communication skill in the form of communicative drawings

CONCEPTS AND CONVENTIONS (Not for Examination)			1
Importance of graphics in Engineering Applications–Use of drafting Instruments– BIS conventions and specifications– Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.			
UNIT-I	**PLANECURVES AND FREE HAND SKETCH**		**11**
Curves used in engineering practices: Conics–Construction of ellipse, parabola and hyperbola by eccentricity method– Construction of cycloids, Construction of involutes of square and circle drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects			
UNIT-II	**PROJECTION OFPOINTS, LINESAND PLANESURFACE**		**12**
Orthographic projection- principles-Principal planes- projection of points. First angle projection – Projection of straight lines inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method- Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.			
UNIT-III	**PROJECTIONOFSOLIDS**		**12**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.			
UNIT-IV	**PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENTOF SURFACES**		**12**
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of the section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.			
UNIT-V	**ISOMETRIC AND PERSPECTIVEPROJECTIONS**		**12**
Principles of isometric projection–isometric scale–Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders and cones. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.			
	Total Contact Hours	**:**	**60**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Construct different plane curves and free hand sketching of multiple views from pictorial objects.
●	Comprehend the theory of projection and to draw the basic views related to projection of points, lines and planes
●	Draw the projection of solids in different views
●	Draw the projection of Sectioned solids and development of surfaces of solids
●	Visualize and prepare Isometric and Perspective view of simple solids

Text Book (s):	
1	Bhatt N.D. and Panchal V.M., Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2	Natrajan K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2017.

Reference Books(s):	
1	Varghese P I., Engineering Graphics, McGraw Hill Education (I) Pvt.Ltd. 2013.
2	Venugopal K. and PrabhuRaja V., Engineering Graphics, New Age International (P) Limited, 2008.
3	Gopalakrishna K.R., Engineering Drawing, (Vol. I&II combined), Subhas Stores, Bangalore, 2017.
4	Basant Agarwal and Agarwal C.M., Engineering Drawing, McGraw Hill, New Delhi, 2018.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19101.1	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.2	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.3	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.4	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.5	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
Average	2.0	-	-	-	-	-	-	-	-	1.0	-	2.0	-	-	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EE19242	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4

Objectives:	
●	To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.
●	To impart knowledge on the phenomenon of resonance in RC, RL and RLC series and parallel circuits.
●	To provide knowledge on the principles of electrical machines and electronic devices.
●	To learn the concepts of different types of electrical measuring instruments and transducers.
●	To teach methods of experimentally analyzing electrical circuits, electrical machines, electronic devices and transducers.

UNIT-I	DC CIRCUITS	9
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.		
UNIT-II	**AC CIRCUITS**	**9**
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections		
UNIT-III	**ELECTRICAL MACHINES**	**9**
Construction, Principles of operation and characteristics of; DC machines, Transformers (single and three phase), Synchronous machines, three phase and single-phase induction motors.		
UNIT-IV	**ELECTRONIC DEVICES & CIRCUITS**	**9**
Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias – Semiconductor Diodes –Bipolar Junction Transistor – Characteristics –Field Effect Transistors – Transistor Biasing – Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier.		
UNIT-V	**MEASUREMENTS & INSTRUMENTATION**	**9**
Introduction to transducers – Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect – Classification of instruments – PMMC and MI Ammeters and Voltmeters – Multimeter –Digital Storage Oscilloscope.		
	Contact Hours : 45	

List of Experiments			
1	Verification of Kirchhoff's Laws.		
2	Load test on DC Shunt Motor.		
3	Load test on Single phase Transformer.		
4	Load test on Single phase Induction motor.		
5	Characteristics of P-N junction Diode.		
6	Half wave and Full wave Rectifiers.		
7	Characteristics of CE based NPN Transistor.		
8	Inverting and Non- Inverting Op-Amp circuits.		
9	Characteristics of LVDT, RTD and Thermistor.		
	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Analyse DC and AC circuits and apply circuit theorems.
●	Realize series and parallel resonant circuits.
●	Understand the principles of electrical machines.
●	Understand the principles of different types of electronic devices, electrical measuring instruments and transducers.

●	Experimentally analyze the electric circuits, electrical machines, electronic devices, and transducers.
Text Book(s):	
1	J.B.Gupta, Fundamentals of Electrical Engineering and Electronics,S.K.Kataria& Sons Publications, 2002.
2	D P Kothari and I.J Nagarath, Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint,2016
3	Thereja .B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand & Co. Ltd., 2008

Reference Books(s):	
1	Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, 2007
2	John Bird,Electrical Circuit Theory and Technology, Elsevier, First Indian Edition, 2006
3	Allan S Moris, Measurement and Instrumentation Principles, Elsevier, First Indian Edition, 2006
4	Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall of India, 2006
5	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, Basic Electrical Engineering, McGraw Hill Education(India) Private Limited, 2009

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EE19242.1	2	2	2	3	3	2	1	-	-	-	-	3	2	2	2
EE19242.2	1	2	2	3	2	2	3	-	-	-	-	-	1	-	1
EE19242.3	2	3	2	1	2	2	2	-	2	-	-	1	2	2	2
EE19242.4	3	3	2	3	1	2	2	-	-	-	2	2	2	1	2
EE19242.5	3	3	2	2	2	1	2	1	2	1	2	1	2	3	2
Average	2.2	2.6	2.0	2.4	2.0	1.8	2.0	1.0	2.0	1.0	2.0	1.8	1.8	2.0	1.8

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
EC19243	PRINCIPLES OF DIGITAL ELECTRONICS	ES	3	0	2	4

Objectives:	
●	To learn the basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions
●	To understand the design of various Combinational circuits.
●	To extrapolate the design of Synchronous Sequential circuits using Flip-Flops.
●	To know the design procedure of Asynchronous Sequential circuits and its problems.
●	To understand the concept of Programmable Logic Devices for the design of digital circuits and Familiar with Verilog HDL.

UNIT-I	BOOLEAN ALGEBRA AND LOGIC GATES	9
Fundamentals: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS). **Minimization Techniques:** Minimization of Boolean expressions using Boolean Laws, Karnaugh map, Quine McCluskey method of minimization, don't care conditions. Logic Gates: NAND– NOR implementations.		
UNIT-II	**COMBINATIONAL CIRCUITS**	**9**
Half adder, Full Adder, Half subtractor, Full subtractor, Carry Look Ahead adder, Parallel Binary Adder/Subtractor, BCD adder, Binary Multiplier, Parity generator, Parity checker, Magnitude Comparator, Encoder, Decoder, Multiplexer-Logic function implementation, Demultiplexer. Code converter- Binary to Gray and Gray to Binary		
UNIT-III	**SYNCHRONOUS SEQUENTIAL CIRCUITS**	**9**
Memory elements: Latches, Flip-flops: RS, JK, D, T, Master-Slave, Triggering of Flip Flops, Realization of one flip flop using other flip flop. **Design:** Synchronous and Asynchronous counters – Up/Down counter, Modulo–N counter. Shift Registers – SISO, SIPO, PISO, PIPO, Universal Shift Registers. Shift Register Counters – Ring counter, Shift counter. Design of synchronous sequential circuits using Moore and Mealy model		
UNIT-IV	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**9**
Design and analysis of asynchronous sequential circuits using Fundamental and pulse mode, Problems in Asynchronous sequential Circuits- Races, Cycles and Hazards.		
UNIT-V	**PROGRAMMABLE LOGIC DEVICES**	**9**
Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of Combinational Logic Circuits using PROM, PLA, PAL. Implementation of basic combinational circuits using Verilog HDL.		
	Contact Hours :	**45**

List of Experiments	
1	Implementation of Binary to Gray and Gray to Binary code converters
2	Logic function implementation of Multiplexer and De-multiplexer using logic gates.
3	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- Flop.
4	Design and Implementation of 4-bit Asynchronous and BCD Synchronous counters.
5	Implementation of Adder and Subtractor using Verilog HDL.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

- ❖ IC Trainer Kit – 15 Nos
- ❖ Bread Boards – 15 Nos
- ❖ Ics each 50 Nos – 7400,7402, 7404, 7486, 7408, 7432, 7411, 74151, 74150, 7474, 7476
- ❖ System with HDL

	Contact Hours	:	**30**
	Total Contact Hours	:	**75**

Course Outcomes: On completion of the course, the students will be able to	
●	Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization techniques.
●	Design and Implement Combinational circuits.

●	Construct Synchronous Sequential circuits using Flip-Flops.
●	Design Asynchronous Sequential circuits and analyse its problems.
●	Implement digital circuits using Programmable Logic Devices and Familiar with Verilog HDL.

Text Books:	
1	Morris Mano & Michael D Ciletti, "Digital Design: With an Introduction to Verilog HDL, 5th Edition, Pearson Education ,2013.
2	Charles H.Roth. "Fundamentals of Logic Design", 7th Edition, Thomson Learning, 2014.

Reference Books:	
1	John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2	John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3	Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
4	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
5	Donald D.Givone, "Digital Principles and Design", TMH, 2003.

Web links for virtual lab:	
1	http://vlabs.iitkgp.ernet.in/dec/#

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
EC19243.1	2	2	1	2	2	-	-	-	-	-	-	1	1	2	-
EC19243.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.2	1.2	1.8	1.2	1.2	-	-	-	-	-	-	1.6	1.6	2.0	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CS19241	DATA STRUCTURES	PC	3	0	4	5

Objectives:	
●	To apply the concepts of List ADT in the applications of various linear and nonlinear data structures.
●	To demonstrate the understanding of stacks, queues and their applications.
●	To analyze the concepts of tree data structure.
●	To understand the implementation of graphs and their applications.
●	To be able to incorporate various searching and sorting techniques in real time scenarios.

UNIT-I	LINEAR DATA STRUCTURES – LIST	9
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).		
UNIT-II	**LINEAR DATA STRUCTURES – STACKS, QUEUES**	**9**
Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue –DEQUE –applications of queues.		
UNIT-III	**NON LINEAR DATA STRUCTURES – TREES**	**9**
Tree Terminologies- Binary Tree–Representation-Tree traversals – Expression trees – Binary Search Tree–AVL Trees –Splay Trees – Binary Heap – Applications.		
UNIT-IV	**NON LINEAR DATA STRUCTURES – GRAPHS**	**9**
Graph Terminologies – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Shortest path – Dijikstra's Algorithm – Minimum Spanning Tree- Prim's Algorithm.		
UNIT-V	**SEARCHING, SORTING AND HASHING TECHNIQUES**	**9**
Searching- Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Quick sort – Merge Sort. Hashing- Hash Functions –Collision resolution strategies- Separate Chaining – Open Addressing – Rehashing.		
	Contact Hours : 45	

List of Experiments			
1	Array implementation of Stack and Queue ADTs		
2	Array implementation of List ADT		
3	Linked list implementation of List, Stack and Queue ADTs		
4	Applications of List, Stack and Queue ADTs		
5	Implementation of Binary Trees and operations of Binary Trees		
6	Implementation of Binary Search Trees		
7	Implementation of AVL Trees		
8	Implementation of Heaps using Priority Queues		
9	Graph representation and Traversal algorithms		
10	Applications of Graphs		
11	Implementation of searching and sorting algorithms		
12	Hashing –any two collision techniques		
	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**105**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Analyze the various data structure concepts.
●	Implement Stacks and Queue concepts for solving real-world problems.
●	Analyze and structure the linear data structure using tree concepts.
●	Critically Analyse various non-linear data structures algorithms.
●	Apply different Sorting, Searching and Hashing algorithms.

Text Books:

1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2002.
2	ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.

Reference Books:	
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, McGraw Hill, 2002.
2	Aho, Hopcroft and Ullman,Data Structures and Algorithms, Pearson Education, 1983.
3	Stephen G. Kochan, Programming in C, 3rd edition, Pearson Education.
4	Ellis Horowitz, SartajSahni and Susan Anderson Freed,Fundamentals of Data Structures in C, 2ndEdition, University Press, 2008.

Web links for virtual lab (if any)	
1	http://vlabs.iitb.ac.in/vlab/labscse.html

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19241.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19241.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
GE19121	ENGINEERING PRACTICES – CIVIL & MECHANICAL	ES	0	0	2	1

Objectives:
• To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

List of Experiments				
CIVIL ENGINEERING PRACTICE				
1.	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.			
2.	Preparation of basic plumbing line sketches for wash basins, water heaters, etc.			
3.	Hands-on-exercise: Basic pipe connections –Pipe connections with different joining components.			
Carpentry Works:				
4.	Study of joints in roofs, doors, windows and furniture.			
5.	Hands-on-exercise: Woodwork, joints by sawing, planning and chiseling.			
MECHANICAL ENGINEERING PRACTICE				
6.	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.			
7.	Gas welding practice.			
Basic Machining:				
8.	Simple Turning and Taper turning			
9.	Drilling Practice			
Sheet Metal Work:				
10.	Forming & Bending:			
11.	Model making – Trays and funnels			
12.	Different type of joints.			
Machine Assembly Practice:				
13.	Study of centrifugal pump			
14.	Study of air conditioner			
		Total Contact Hours	**:**	**30**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Perform plumbing activities for residential and industrial buildings considering safety aspects while gaining clear understanding on pipeline location and functions of joints like valves, taps, couplings, unions, reducers, elbows, etc.
●	Perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of the joints in roofs, doors, windows and furniture.
●	Produce joints like L joint, T joint, Lap joint, Butt joint, etc. through arc welding process while acquiring in depth knowledge in the principle of operation of welding and other accessories
●	Perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling machine
●	Perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19121.1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.2	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.3	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.4	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	1.0	1.0	-	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	T	P	C
CS19211	PYTHON PROGRAMMING LAB	PC	0	0	4	2

Objectives:	
●	Learn the Python Environment using interactive and script mode
●	Implement Python programs with conditionals and loops.
●	Use functions for structuring Python programs.
●	Represent compound data using Python lists, tuples and dictionaries.
●	Read and write data from/to files in Python.

List of Experiments				
1	Implement simple python programs using interactive and script mode.			
2	Develop python programs using id() and type() functions			
3	Implement range() function in python			
4	Implement various control statements in python.			
5	Develop python programs to perform various string operations like concatenation, slicing, Indexing.			
6	Demonstrate string functions using python.			
7	Implement user defined functions using python.			
8	Develop python programs to perform operations on list			
9	Implement dictionary and set in python			
10	Develop programs to work with Tuples.			
11	Create programs to solve problems using various data structures in python.			
12	Implement python program to perform file operations.			
13	Implement python programs using modules and packages.			
14	Mini Project			
		Total Contact Hours	**:**	**60**

Course Outcomes:	
On completion of the course, the students will be able to	
●	Run Python Programs at interactive and script mode.
●	Implement Python programs with conditionals and loops.
●	Develop Python programs stepwise by defining functions and calling them.
●	Use Python lists, tuples and dictionaries for representing compound data.
●	Read and write data from/to files in Python

Web links for virtual lab	
1	https://www.python.org/shell/
2	https://www.tutorialspoint.com/execute_python_online.php
3	https://www.onlinegdb.com/

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19211.1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CS19211.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.3	2	2	3	2	1	-	-	-	1	-	2	1	2	2	-
CS19211.4	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	-
Average	1.5	1.5	2.3	1.5	1.0	-	-	-	1.0	-	1.5	1.0	1.8	1.8	-

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19101	ENVIROMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0

Objectives:	
●	To understand the importance of natural resources, pollution control and waste management.
●	To provide the students awareness on the current social issues and environmental legislations.

UNIT-I	NATURAL RESOURCES	9
Environment –definition – scope and importance – forest resources –use and overexploitation –water resources –use and over utilization – dams – benefits and problems – water conservation –energy resources – growing energy needs – renewable and non-renewableenergy sources – use of alternate energy sources –land resources –land degradation – role of an individual in conservation of natural resources		
UNIT-II	**ENVIRONMENTAL POLLUTION**	**9**
Definition – causes, effects and control measures of air pollution –chemical and photochemical reactions in the atmosphere – formation of smog, PAN, acid rain, and ozone depletion- noise pollution –mitigation procedures – control of particulate and gaseous emission (Control of SO2, NOX, CO and HC). Water pollution – definition-causes-effects of water pollutants–marine pollution-thermal pollution-radioactive pollution-control of water pollution by physical, chemical and biological processes–waste water treatment-primary, secondary and tertiary treatment. Soil pollution: definition-causes-effects and control of soil pollution.		
UNIT-III	**SOLID WASTE MANAGEMENT**	**9**
Solid wastes – sources and classification of solid wastes –solid waste management options – sanitary landfill, recycling, composting, incineration, energy recovery options from wastes. Hazardous waste –definition –sources of hazardous waste-classification (biomedical waste, radioactive waste, chemical waste, household hazardous waste)-characteristics of hazardous waste ignitability (flammable) reactivity, corrosivity, toxicity –effects of hazardous waste –case study- Bhopal gas tragedy – disposal of hazardous waste-recycling , neutralization, incineration, pyrolysis, secured landfill – E-waste management –definition-sources-effects –electronic waste recycling technology.		
UNIT-IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**9**
Sustainable development –concept, components and strategies – social impact of growing human population and affluence, food security, hunger, poverty, malnutrition, famine – consumerism and waste products – environment and human health – role of information technology in environment and human health –disaster management– floods, earthquake, cyclone and landslide.		
UNIT-V	**TOOLS FOR ENVIRONMENTAL MANAGEMENT**	**9**
Environmental impact assessment (EIA) structure –strategies for risk assessment–EIS-environmental audit-ISO 14000-precautionary principle and polluter pays principle- constitutional provisions- - pollution control boards and pollution control acts- environmental protection act1986- role of non-government organizations- international conventions and protocols.		
	Total Contact Hours : 45	

Course Outcomes:	
On completion of the course, the students will be able to	
●	Be conversant to utilize resources in a sustainable manner.
●	Find ways to protect the environment and play proactive roles.
●	Apply the strategies to handle different wastes
●	Develop and improve the standard of better living.
●	Be conversant with tools of EIA and environmental legislation.

Text Book(s):	
1	Benny Joseph, “Environmental Science and Engineering”, 2nd edition, Tata McGraw-Hill, New Delhi, 2008.
2	Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, 2ndedition, Pearson Education, 2004.

Reference Books(s):	
1	Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd, New Delhi, 2007.
2	ErachBharucha, "Textbook of Environmental Studies", 3rd edition, Universities Press, 2015.
3	G. Tyler Miller and Scott E. Spoolman, "Environmental Science", 15thedition,CengageLearning India, 2014.
4	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", 3rdedition, Oxford UniversityPress, 2015.
5	De. A.K., "Environmental Chemistry", New Age International, New Delhi, 1996.
6	K. D. Wager, "Environmental Management", W. B. Saunders Co., USA, 1998.

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC19101.1	3	2	3	2	1	3	3	2	1	1	1	1	1	1	1
MC19101.2	3	3	3	2	2	3	3	3	2	1	2	2	1	2	2
MC19101.3	3	3	3	2	2	3	3	3	2	1	2	1	1	2	1
MC19101.4	3	3	3	2	2	3	3	2	2	1	2	2	1	2	2
MC19101.5	2	2	3	1	1	3	3	1	1	2	1	1	1	1	1
Average	2.8	2.6	3.0	1.8	1.6	3.0	3.0	2.2	1.6	1.2	1.6	1.4	1.0	1.6	1.4

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation : "-"

SEMESTER III

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MA19356	DISCRETE MATHEMATICS FOR AI	BS	3	1	0	4

Objectives:	
●	To extend student's Logical and Mathematical maturity and ability to deal with abstraction.
●	To study various enumeration methods using principle of counting.
●	To understand various algebraic structures.
●	To obtain knowledge of discrete structures involving graphs.
●	To obtain knowledge of discrete structures involving trees.

UNIT-I	MATHEMATICAL LOGIC	12
Propositional calculus – propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility – natural deduction system and axiom system; Soundness and completeness.		
UNIT-II	**COMBINATORICS**	**12**
Basic counting sum and product, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.		
UNIT-III	**STRUCTURED SETS**	**12**
Set, relation – Algebraic System : Groups, Semi groups, monoid, homomorphism, cosets, Ring and Field (definition), Relation, Equivalence relations, Poset, Lattices, Hasse diagram, Boolean algebra.		
UNIT-IV	**GRAPH THEORY**	**12**
Introduction – Graph Terminologies – Types of Graphs – Sub Graph- Multi Graph – Regular Graph – Isomorphism – Isomorphic Graphs – Sub-graph – Euler graph – Hamiltonian Graph – Related problems.		
UNIT-V	**TREES**	**12**
Trees –Properties- Distance and Centres – Types – Rooted Tree—Tree Enumeration Labeled Tree – Unlabeled Tree – Spanning Tree – Fundamental Circuits- Cut Sets – Properties – Fundamental Circuit and Cut-set- Connectivity- Separability – Related problems.		
	Total Contact Hours : 60	

Course Outcomes: On completion of the course, the students will be able to	
●	Apply the concepts of logic to test the validity of a program and to arrive at inferences on logical structures.
●	Use the counting principles in implementing various programmes.
●	Analyze sets with operations and conclude the properties about the structures.
●	Handle a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
●	Apply suitable graph model and algorithm for solving applications.

Text Book(s):	
1	Digital Logic & Computer Design, M. Morris Mano, Pearson India Educations Services Pvt. Ltd 2016.
2	Elements of Discrete Mathematics, (Second Edition) C. L. Liu McGraw Hill, New Delhi, 2017.

Reference Books(s):	
1	Introduction to linear algebra. Gilbert Strang Fifth Edition (2016).
2	Introductory Combinatorics, R. A. Brualdi, Fifth Edition, Pearson Education Inc. (2010).
3	Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs Dover edition, (2016).
4	Introduction to Mathematical Logic,(Sixth Edition), E. Mendelsohn, CRC press Taylor & Francis group, (2015).
5	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London, Fifth Printing, (1982).
6	Mathematical Logic for Computer Science,L. Zhongwan, World Scientific Publishing Co. Pte. Ltd., Singapore, (1998).
7	Topics in Algebra, I. N. Herstein, John Wiley and Sons, (1975).

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19356.1	3	3	2	3	-	-	-	-	-	-	-	2	3	3	2
MA19356.2	3	3	2	3	-	-	-	-	-	-	-	2	3	3	2
MA19356.3	3	3	2	3	-	-	-	-	-	-	-	2	2	3	1
MA19356.4	3	3	3	3	2	-	-	-	-	-	2	2	3	3	1
MA19356.5	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
Average	3	3	2.4	3	2	-	-	-	-	-	2	2	2.8	3	1.6

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
GE19301	LIFE SCIENCE FOR ENGINEERS	BS	3	0	0	3

Objectives:	
●	Broad objective of this course is to give an introduction of life science to engineering students.
●	The course helps students to familiarize with human physiology, life style diseases and their management and basic diagnostic aspects.

UNIT-I	**OVERVIEW OF CELLS AND TISSUES**	**9**
Introduction to Bacteria, virus, fungi and animal cells. Organisation of cells into tissues and organs. Functions of vital organs.		
UNIT-II	**HEALTH AND NUTRITION**	**9**
Balanced diet, Importance of RDA, BMR, and diet related diseases. Role of antioxidants PUFA, DHA, Essential amino acids, Essential fatty acids in diet. Water and its significance for human health. Physical and Mental health – Significance of exercise and yoga.		
UNIT-III	**UNHEALTHY PRACTICES AND THEIR IMPACT ON HEALTH**	**9**
Drug induced toxicity, Unhealthy practices – Drug abuse/Narcotics/Smoking/Alcohol/Self-medication/Undue usage of electronic gadgets.		
UNIT-IV	**COMMON DISEASES AND LIFESTYLE DISORDERS**	**9**
Prevention and management of food, water and airborne illness (Common cold, dehydration, food poisoning etc). Lifestyle disorders – obesity, diabetes, stroke, heart attack, ulcer, renal calculi, cancer, AIDS, hepatitis- prevention and management.		
UNIT-V	**DIAGNOSTIC TESTS AND THEIR RELEVENCE**	**9**
Normal range of biochemical parameters, significance of organ function tests, organ donation.		
	Total Contact Hours : 45	

Course Outcomes: On completion of the course, the students will be able to	
●	Classify the living organisms and relate the functions of vital organs
●	Demonstrate the importance of balanced diet and plan methods for healthy living
●	Analyse the hazards of unhealthy practices and take preventive measures
●	Categorise the various life style disorders and recommend ways to manage the common diseases
●	Evaluate and interpret biochemical parameters and their significance

Text Book(s):	
1	Carol D. Tamparo PhD CMA-A (AAMA), Marcia (Marti) A. Lewis EdD RN CMA-AC (AAMA), “Diseases of human body , F.A Davis Company, 2011.
2	Textbook of Medical Biochemistry, Chatterjea and Rana shindae Jaypee Brothers Medical Publishers, 2011.

Reference Books(s):	
1	ArthurT.Johnson, “Biology for Engineers”, CRC Press, Taylor and Francis, 2011.
2	Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, “Cell Biology and Genetics”, Cengage Learning, 2008.
Web link:	
1	https://nptel.ac.in/courses/122103039/

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
GE19301.1	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.2	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.3	3	1	2	2	2	3	1	3	1	2	1	3	3	1	2
GE19301.4	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.5	3	1	2	2	3	3	1	1	1	2	1	3	3	1	2
Average	3	1	2	2	2.2	3	1	1.4	1	2	1	3	3	1	2

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation : "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AD19341	FUNDAMENTALS OF DATA SCIENCE	PC	3	0	2	4

Objectives:	
●	To understand the fundamentals of Data preparation and analysis.
●	To learn the types of data.
●	To interpret the correlation among the data.
●	To know the python libraries and operations on data.
●	To learn about data visualization.

UNIT-I	INTRODUCTION	9
Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data		
UNIT-II	**DESCRIBING DATA**	**9**
Types of Data – Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores		
UNIT-III	**DESCRIBING RELATIONSHIPS**	**9**
Correlation –Scatter plots –correlation coefficient for quantitative Data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean		
UNIT-IV	**PYTHON LIBRARIES FOR DATA WRANGLING**	**9**
Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables		
UNIT-V	**DATA VISUALIZATION**	**9**
Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting – Geographic Data with Basemap – Visualization with Seaborn		
	Total Contact Hours : 45	

List of Experiments	
1	Working with Numpy arrays
2	Working with Pandas data frames
3	Develop python program for Basic plots using Matplotlib
4	Develop python program for Frequency distributions
5	Develop python program for Variability
6	Develop python program for Averages
7	Develop python program for Normal Curves
8	Develop python program for Correlation and scatter plots
9	Develop python program for Correlation coefficient
10	Develop python program for Simple Linear Regression

	Contact Hours	**:**	**30**
	Total Contact Hours	**:**	**75**

Course Outcomes: On completion of the course, the students will be able	
●	To build the model based on the analysis of data.
●	To differentiate the types of data.
●	To understand the relationship and correlation between the data.
●	To use the python libraries and data wrangling
●	To visualize the errors and plots.

Text Book(s):	
1	Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2	Jiawei Han, Micheline Kamber and Jian Pei, " Data Mining: Concepts and Techniques", Third Edition. ISBN 0123814790, 2011
3	Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.

Reference Books(s):	
1	Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016
2	Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015..
3	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
CS19341	DESIGN AND ANALYSIS OF ALGORITHMS	PC	3	0	2	4

Objectives: The student should be made to	
●	Learn and understand the algorithm analysis techniques and complexity notations
●	Become familiar with the different algorithm design techniques for effective problem solving in computing.
●	Learn to apply the design techniques in solving various kinds of problems in an efficient way.
●	Understand the limitations of Algorithm power.
●	Solve variety of problems using different design techniques

UNIT-I	**INTRODUCTION AND ANALYSIS OF ALGORITHMS**	**9**
Introduction –Algorithm Specification –Important Problem types- Performance Analysis: Space Complexity – Time Complexity – Asymptotic Notations – Using Limits for Comparing Orders of Growth – Basic Efficiency Classes- Solving Recurrence Relations: Substitution methods and Master Theorem Method		
UNIT-II	**BRUTE FORCE AND DIVIDE-AND-CONQUER**	**9**
Brute Force: Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem – Divide and Conquer Method: Analysis of Binary Search, Merge sort and Quick sort Algorithms, Integer Multiplication- Finding Minimum and Maximum.		
UNIT-III	**GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING**	**9**
Greedy Method – Minimum Spanning Trees: Kruskals Algorithm– Fractional Knapsack – Huffman Codes – Dynamic Programming: General Method – String Editing – 0/1 Knapsack – Travelling Salesman Problem.		
UNIT-IV	**BACKTRACKING AND BRANCH & BOUND**	**9**
Backtracking: General Method – 8 Queen's Problem – Sum of Subsets Problem – Graph Colouring – Hamiltonian Circuit Problem – Branch and Bound: LC branch and bound – 0/1 Knapsack – Travelling Salesman Problem.		
UNIT-V	**STRING MATCHING AND NP COMPLETE & NP HARD**	**9**
String Matching: Naive String Matching – Rabin Karp – Knuth Morris Pratt – NP Complete and NP Hard Problems: Basic Concepts – Non Deterministic Algorithms – Class of NP Complete and NP Hard – Approximation Algorithms :: Travelling Salesman problem.		
	Contact Hours : 45	

List of Experiments	
1	Finding Time Complexity of algorithms.
2	Design and implement algorithms using Brute Force Technique.
3	Design and implement algorithms using Divide and Conquer Technique.
4	Design and implement algorithms using **G**reedy Technique.
5	Design and implement algorithms using Dynamic Programming.
6	Design and implement algorithms using Backtracking.
7	Design and implement algorithms using Branch and Bound.
8	Implement String Matching algorithms.
	Contact Hours : 30
	Total Contact Hours : 75

Course Outcomes: On completion of the course, the students will be able to	
●	Analyze the time and space complexity of various algorithms and compare algorithms with respect to Complexities.
●	Decide and apply Brute Force and Divide and Conquer design strategies to Synthesize algorithms for appropriate computing problems.
●	Apply Greedy and Dynamic Programming techniques to Synthesize algorithms for appropriate computing problems.
●	Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing
	problems.
●	Apply string matching algorithms in vital applications.

Text Books:	
1	AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2	Ellis Horowitz, Shani, SanguthevarRajasekaran, "Computer Algorithms" Universities Press, Second Edition 2008.

Reference Books:	
1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3	Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
4	Sara Baase Allen Van Gelder, "Computer Algorithms – Introduction to Analysis" Pearson Education Asia, 2010
5	Droomey R. G, "How to solve it by Computer", Pearson Education, 2006.

Web links for virtual lab:	
1	https://www.geeksforgeeks.org/fundamentals-of-algorithms/
2	https://www.hackerrank.com/domains/algorithms

CO – PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19341.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
CS19341.2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.5	1	2	2	2	-	-	-	-	-	-	-	1	3	3	1
Average	2	2.8	2	2	-	-	-	-	-	-	-	1	3	2.8	1.2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AD19342	INTRODUCTION TO OPERATING SYSTEM	PC	3	0	2	4

Objectives:	
•	To study the basic concepts and functions of operating systems.
•	To learn about Processes, Threads, Scheduling algorithms and Deadlocks.
•	To study various Memory Management schemes.
•	To learn I/O Management and File Systems.
•	To learn the basics on Linux, Windows and Android OS.

UNIT-I	INTRODUCTION	9
Operating Systems Overview — OS Structure and Operations –Virtualization - System Calls – Types of System Calls- System Programs-System Boot Process – BIOS – POST- Bootstrap Loader.		
UNIT-II	**PROCESS MANAGEMENT**	**10**
Process Concepts– Process Scheduling - Operations - Interprocess Communication- Threads Overview - CPU Scheduling – FCFS – SJF – Priority – RR – Multilevel Queue Scheduling - Multilevel Feedback Queue - Process Synchronization – Critical Section Problem – Peterson‟s Solution – Synchronization Hardware –Semaphores- Classic Problems of Synchronization – Monitors – Deadlocks –Characterization-Prevention – Avoidance – Detection – Recovery.		
UNIT-III	**MEMORY MANAGEMENT**	**9**
Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of a page table – Segmentation - Virtual Memory – Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames – Thrashing.		
UNIT-IV	**I/O MANAGEMENT**	**9**
File System -Concepts - Access Methods- Directory Structure - Mounting - Protection - File System Implementation – Directory Implementation – Allocation Methods – Free-Space Management - Mass Storage Structure - Disk Scheduling - Disk Management - Swap-Space Management.		
UNIT-V	**LINUX, WINDOWS & ANDROID OS**	**8**
The Linux System – Design Principles – Kernel Modules – Memory Management – Windows 10- Overview- Key Components- Android- Architecture - Security Model.		
	Contact Hours :	**45**

List of Experiments	
1	Installation and Configuration of Linux in a Virtual Machine
2	System monitoring using shell script
3	Text processing using Awk script
4	User-defined Signal Handler
5	Trace system calls with systrace tool
6	Inter-process Communication using Shared Memory
7	Scheduling algorithms – FCFS, SJF, Priority and RR
8	Producer Consumer Problem Solution using Semaphore
9	Bankers Deadlock Avoidance algorithm
10	Contiguous Memory Allocation - First Fit and Best Fit
11	Page Replacement Algorithms - FIFO & LRU
12	Customization of Linux Kernel
13	Develop a Simple LKM
	Contact Hours **60**
	Total Contact Hours **105**

Course Outcomes: On completion of the course, the students will be able to	
•	Understand the concepts of Operating Systems and its structure.
•	Analyze the various Scheduling algorithms and methods to avoid Deadlock.
•	Compare and contrast various memory management schemes.
•	Mount file systems and evaluate various disk scheduling techniques.
•	Understand the basic principles of Linux, Windows and Android operating systems.

Text Books:	
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2	Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android"s Security Architecture",No Starch Press, 2015.

Reference Books:	
1	William Stallings, "Operating Systems – Internals and Design Principles", 9thEdition, Pearson, 2018.
2	Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson, 2016.
3	AchyutGodbole and AtulKahate, "Operating System", 3rd Edition, Tata McGraw Hill, 2017.
4	Pavel Y., Alex I., Mark E., David A., "Windows Internal Part I - System Architecture, Processes, Memory Management and More", 7th Edition, Microsoft Press, 2017.

Web links:	
1	https://www.octawian.ro/fisiere/cursuri/asor/build/html/_downloads/Russinovich_M_WinInternals_part1_7th_ed.pdf
2	https://swayam.gov.in/
3	https://www.youtube.com/watch?time_continue=98&v=xwxgpCKo7c4
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Linux&search_language=English

CO - PO – PSO matrices of course

PO/PSO CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CS19441.1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
CS19441.2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
CS19441.3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
CS19441.4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
CS19441.5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Average	**2.0**	**2.0**	**1.7**	**1.0**	**2.2**	**-**	**1.0**	**1.0**	**1.4**	**2.0**	**2.0**	**2.0**	**2.6**	**2.7**	**1.6**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial

(High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	C
AI19342	OBJECT ORIENTED PROGRAMMING USING JAVA FOR AI	PC	3	0	4	5

Objectives:	
●	To understand Object Oriented Programming concepts and characteristics of Java
●	To know the principles of classes, abstraction and inheritance
●	To create packages, define exceptions and use strings
●	To use I/O streams in applications
●	To build simple programs using collection and regular expression

UNIT-I	INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9
Introduction to Object Oriented Programming – Basic concepts of OOP - An overview of Java - Java Architecture – Data Types – Variables- Arrays- Operators – Control Statements – Command Line Arguments.		
UNIT-II	**CLASSES AND INHERITANCE**	**9**
Defining Classes in Java: Methods, Constructors, Garbage Collection – Access Specifiers – Method Overloading – Inheritance: Super keyword, this keyword, Method Overriding, Abstract Classes – Static Members – Final Method and Class.		
UNIT-III	**PACKAGES, EXCEPTION HANDLING AND STRINGS**	**9**
Packages – Interfaces – Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exceptions, User defined Exceptions – Strings – String Buffer.		
UNIT-IV	**I/O**	**9**
Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.		
UNIT-V	**COLLECTIONS AND REGULAR EXPRESSION**	**9**
Generic Programming – Generic Classes – Generic Methods – Collection Interfaces – Collection Classes. Regular Expression-Classes-Pattern, matcher-Interfaces – Regex Character Classes – Regex Quantifier-Meta charcters.		
	Contact Hours : 45	

List of Experiments		
1	Simple programs using command line arguments.	
2	Programs using control structures.	
3	Programs using arrays.	
4	Programs using Programs using classes and objects.	
5	Programs using inheritance and interfaces.	
6	Programs using packages and abstract class.	
7	Programs to handle different types of exceptions.	
8	Programs using strings and string buffer.	
9	Programs using I/O streams.	
10	Programs using files.	
11	Programs using collections.	
12	Program to validate MAC address using regular expression.	
13	Program to validate Indian driving license number using regular expression.	
14	Program to check whether two convex regular polygons have same center or not.	
15	Program to check if an URL is valid or not using pattern matching.	
	Contact Hours	**: 60**
	Total Contact Hours	**: 105**

Course Outcomes: On completion of the course, the students will be able to	
●	Understand the use of the Object Oriented Programming concepts.
●	Know about the concepts of Abstract, Static and final classes.
●	Understand the concept of packages, exceptions and strings
●	Understand I/O streams in applications.
●	Apply the collection and regular expression in real world applications.

Text Books:	
1	Herbert Schildt, ―Java The complete reference‖, 9th Edition, McGraw Hill Education, 2014.
2	Patrick Niemeyer, Daniel Leuck -Learning Java, 4th Edition, O'Reilly Media, June 2013
3	Cay S. Horstmann, Gary cornell, ―Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2013.

Reference Books:	
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.
4	SCJP Sun Certified Programmer for Java 6 Study Guide. McGrawHill, 6th edition.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19342.1	2	2	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.2	3	1	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.3	3	2	2	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.4	3	2	2	-	1	-	-	-	-	-	-	2	3	3	3
AI19342.5	3	2	2	3	1	-	-	-	1	1	3	2	3	3	3
Average	2.8	1.8	1.6	0.6	1	-	-	-	0.2	0.2	0.6	1.4	2.4	2.4	2.4

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
MC19301	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	3	0	0	0

Objectives:	
●	This course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is the core of Indian traditional knowledge system connecting society and nature. Holistic life style of yogic science and wisdom are important in modern society with rapid technological advancements and societal disruptions. The course mainly focuses on introduction to Indian knowledge system, Indian perspective of modern science, basic principles of Yoga and holistic healthcare system, Indian philosophical, linguistic and artistic traditions.

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

UNIT-I	Introduction to Indian Knowledge System	6
Basic structure of the Indian Knowledge System –Veda – Upaveda - Ayurveda, Dhanurveda- Gandharvaveda, Sthapathyaveda and Arthasasthra. Vedanga (Six forms of Veda) – Shiksha, Kalpa, Nirukta, Vyakarana, Jyothisha and Chandas- Four Shasthras - Dharmashastra, Mimamsa, Purana and Tharkashastra		
UNIT-II	**Modern Science and Yoga**	**6**
Modern Science and the Indian Knowledge System – a comparison - Merits and demerits of Modern Science and the Indian Knowledge System - the science of Yoga-different styles of Yoga – types of Yogaasana, Pranayam, Mudras, Meditation techniques and their health benefits – Yoga and holistic healthcare – Case studies.		
UNIT-III	**Indian Philosophical Tradition**	**6**
Sarvadharshan/Sadhdharshan – Six systems (dharshans) of Indian philosophy - Nyaya, Vaisheshika, Sankhya, Yoga, Vedanta-Other systems- Chavarka, Jain (Jainism), Boudh (Buddhism) – Case Studies.		
UNIT-IV	**Indian Linguistic Tradition**	**6**
Introduction to Linguistics in ancient India – history – Phonetics and Phonology – Morphology – Syntax and Semantics-Case Studies.		
UNIT-V	**Indian Artistic Tradition**	**6**
Introduction to traditional Indian art forms – Chitrakala (Painting), Murthikala / Shilpakala (Sculptures), Vaasthukala, Sthaapathya kala (Architecture), Sangeeth (Music), Nruthya (Dance) and Sahithya (Literature) – Case Studies.		
	Total Contact Hours :	**30**

Course Outcomes: On completion of the course, the students will be able to	
●	Understand basic structure of the Indian Knowledge System
●	Apply the basic knowledge of modern science and Indian knowledge system in practice
●	Understand the importance Indian Philosophical tradition
●	Appreciate the Indian Linguistic Tradition.
●	Understand the concepts of traditional Indian art forms

Text Book(s):	
1	V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.
2	Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4	Fritzof Capra, Tao of Physics.
5	Fritzof Capra, The Wave of life.

Reference Books(s):	
1	VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam.
2	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
3	GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya,Vidyanidhi Prakashan, Delhi 2016.
4	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakashan, Delhi 2016.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MC19301.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
Average	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

SEMESTER IV

Subject Code	Subject Name	Category	L	T	P	C
MA19456	**OPTIMIZATION TECHNIQUES FOR AI**	BS	**3**	**1**	**0**	**4**

Objectives:	
●	To learn the concepts of operations research applied in decision making.
●	To develop optimisation techniques applied to transportation models.
●	To understand multistage dynamic programming
●	To obtain knowledge of solving problems using non linear programming.
●	To understand the concepts of project scheduling and critical path.

UNIT-I	**INTRODUCTION TO LINEAR PROGRAMMING**	**12**
Convex sets, Convex function, Linear Programming-formulation, solution by graphical and simplex methods, Primal - Penalty, Two Phase, Principles of Duality.		
UNIT-II	**LINEAR PROGRAMMING EXTENSIONS**	**12**
Transportation Models (Minimising and Maximising Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI algorithm. Case of Degeneracy. Assignment Models (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by Hungarian. Travelling Salesman problem.		
UNIT-III	**INTEGER PROGRAMMING**	**12**
Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming		
UNIT-IV	**NON – LINEAR PROGRAMMING**	**12**
Unconstrained external problems, Newton – Ralphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.		
UNIT-V	**PROJECT SCHEDULING**	**12**
Network diagram representation – Critical path method – Time charts and resource leveling – PERT		
	Total Contact Hours :	**60**

Course Outcomes: On completion of the course students will be able to	
●	Solve optimization problems using simplex method.
●	Analyze problems involving materials and workforce using transportation and assignment models
●	Apply integer programming and linear programming to solve real-life applications.
●	Apply unconstrained optimisation to problems with non linear objective functions.
●	Use PERT and CPM for problems in project management

Text Books:	
1	Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, Seventh Edition, Third Indian Reprint 2004.
2	S. Boyd and L. Vandenberghe, Convex optimization, Cambridge University press,2004

Reference Books / Web links:	
1	Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008
2	G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.
3	Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.
4	Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.
5	Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case studies approach with spreadsheets, Tata Mcgraw Hill, 2005.
6	N. D Vohra, Quantitative Techniques in Management,TataMcgraw Hill, 2010.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19456.1	3	3	2	3	1	-	-	-	-	-	-	2	3	2	1
MA19456.2	3	3	2	3	1	-	-	-	-	-	-	2	2	2	1
MA19456.3	3	3	2	3	1	-	-	-	-	-	-	2	3	2	2
MA19456.4	3	3	2	3	1	-	-	-	-	-	-	2	2	2	2
MA19456.5	3	3	2	3	1	-	-	-	-	-	-	2	2	2	3
Average	**3.0**	**3.0**	**2.0**	**3.0**	**1.0**	**-**	**-**	**-**	**-**	**-**	**-**	**2.0**	**2.4**	**2.0**	**1.8**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
AD19401	HEALTH CARE ANALYTICS	PC	3	0	0	3

Objectives:	
●	Understand the health data formats, health care policy and standards
●	Learn the significance and need of data analysis and data visualization
●	Understand the health data management frameworks
●	Learn the use of machine learning and deep learning algorithms in healthcare
●	Apply healthcare analytics for critical care applications

UNIT-I	INTRODUCTION TO HEALTHCARE ANALYSIS	9
Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach		
UNIT-II	**ANALYTICS ON MACHINE LEARNING**	**9**
Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection		
UNIT-III	**HEALTH CARE MANAGEMENT**	**9**
IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare		
UNIT-IV	**HEALTHCARE AND DEEP LEARNING**	**9**
Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System		
UNIT-V	**CASE STUDIES**	**9**
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Use machine learning and deep learning algorithms for health data analysis
●	Apply the data management techniques for healthcare data
●	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other criticalcare applications
●	Design health data analytics for real time applications
●	Design emergency care system using health data analysis

Text Book(s):	
1	Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.
2	Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.
3	Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.

Reference Books(s):	
1	Hui Jang, Eva K.Lee, “HealthCare Analysis : From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016.
2	Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, “Big Data Analytics in HealthCare”, Springer, 2020.
Web link:	
1	

CO - PO – PSO matrices of course

	PO’s												PSO’s		
CO’s	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	1	3	-	-	-	3	2	1	1	2	2	2
2	3	1	1	3	1	-	-	-	3	2	3	1	3	3	3
3	2	1	2	1	2	-	-	-	2	2	1	3	3	2	1
4	2	2	3	3	1	-	-	-	2	3	1	2	3	2	2
5	1	2	2	1	1	-	-	-	1	3	3	2	2	2	2
AVG	2.2	1.8	2.2	1.8	1.6	-	-	-	2.2	2.4	1.8	1.8	2.6	2.2	2

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
AI19341	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	PC	3	0	2	4

Objectives:

- Understand the various characteristics of a problem solving agent
- Learn about the different strategies involved in problem solving
- Learn about solving problems with various constraints.
- Apply A.I to various applications like expert systems etc.
- Understand the different models of learning

UNIT-I	Introduction to Artificial intelligence and Problem-Solving Agent	9

Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

UNIT-II	Search techniques	9

Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT-III	Constraint satisfaction problems and Game Theory	9

Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT-IV	Knowledge & reasoning	9

Statistical Reasoning: Probability and Bays‟ Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

UNIT-V	Introduction to Machine Learning	9

Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

Contact Hours	:	45

List of Experiments

1	**Programs on Problem Solving**
a	Write a program to solve 8 Queens problem.
b	Solve any problem using depth first search.
c	Implement MINIMAX algorithm.
d	Implement A* algorithm
2	**Programs on Decision Making and Knowledge Representation**
a	Introduction to PROLOG
b	Implementation of Unification and Resolution Algorithm.
c	Implementation of Backward Chaining
d	Implementation of Forward Chaining
3	**Programs on Planning and Learning**
a	Implementation of Blocks World program
b	Implementing a fuzzy inference system
c	Implementing Artificial Neural Networks for an application using python
d	Implementation of Decision Tree
e	Implementation of K-mean algorithm

Contact Hours	**:**	**30**
Total Contact Hours	**:**	**75**

Lab Specifications:

The lab can be implemented using Python or C.

Knowledge representation experiments can be performed using a PROLOG TOOL.

Course Outcomes: On completion of the course, the students will be able to	
✍	Basic knowledge representation, problem solving, and learning methods of artificial intelligence.
✍	Provide the apt agent strategy to solve a given problem
✍	Represent a problem using first order and predicate logic
✍	Design applications like expert systems and chat-bot.
✍	Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

Text Books(s):	
1	S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2015.
2	Nils J. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978- 1558605350.

Reference Book(s) / Web link(s):	
1	Elaine Rich, Kevin Knight, &Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2017.
2	Introduction to Artificial Intelligence & Expert Systems, Patterson, Pearson, 1st ed. 2015
3	Logic & Prolog Programming, Saroj Kaushik, New Age International, Ist edition, 2002.
4	Expert Systems: Principles and Programming,11 March 1998. Edition: 4th. ISBN: 9788131501672

CO - PO – PSO matrices of course

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
AI19341.01	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.02	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.03	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.04	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.05	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average Mapping	**2.4**	**2.4**	**1.25**	**2.0**	**2.4**	**1.5**	**1.2**	**1.3**	**1.0**	**-**	**2.4**	**1.8**	**2.0**	**2.0**	**2.0**

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	T	P	C
CS19443	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5

Objectives:	
•	To understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
•	To construct simple and moderately advanced database queries using Structured Query Language (SQL).
•	To know the importance of functional dependency and normalization, and what role it plays in the database design process.
•	To familiarize with the concepts of a database transaction including concurrency control, backup and recovery, and data object locking and handling deadlocks.
•	To work with the foundation for NoSQL technologies.

UNIT-I	INTRODUCTION TO DATABASE SYSTEMS	10
Introduction – Purpose of Database Systems - View of Data –Database Architecture - Relational Databases – Database Schema – Keys – Codd‟s Rule – Relational Algebra – Data Models – Entity Relationship Model – Constraints – Entity Relationship Diagram - Design Issues of ER Model – Extended ER Features – Mapping ER Model to Relational Model.		
UNIT-II	**SQL AND QUERY PROCESSING**	**10**
SQL: Data Definition – Domain types – Structure of SQL Queries - Modifications of the database – Set Operations – Aggregate Functions – Null Values – Nested Sub queries – Complex Queries – Views – Joined relations – Complex Queries – PL/SQL: Functions, Procedures, Triggers, Cursors -Embedded SQL – Query Processing – Heuristics for Query Optimization.		
UNIT-III	**DEPENDENCIES AND NORMALFORMS**	**8**
Motivation for Normal Forms – Functional dependencies – Armstrong‟s Axioms for Functional Dependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF.		
UNIT-IV	**TRANSACTIONS**	**7**
Transaction Concept – State – ACID Properties – Concurrency control - Serializability – Recoverability – Locking based protocols –Timestamp Based Protocol - Deadlock handling.		
UNIT-V	**NoSQL DATABASE**	**10**
Introduction to NoSQL - CAP Theorem – Data Models - Key-Value Databases - Document Databases- Column Family Stores – Graph Databases –Working of NoSQL Using MONGODB/CASSANDRA.		
	Contact Hours : 45	

	List of Experiments
1	Introduction to SQL : DDL,DML,DCL,TCL.SQL clause :SELECT FROM WHERE GROUPBY,HAVING,ORDERBY Using SQLite/MySQL/Oracle SQL clause :SELECT FROM WHERE GROUPBY,HAVING,ORDERBY Using SQLite/MySQL/Oracle
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.
3	Creating an Employee database to set various constraints and sub queries.
4	Optimize a SQL query construct considering time complexity.
5	Write a PL/SQL block to specify constraints by accepting input from the user.
6	Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
7	Implementation of PL/SQL Function.
8	Implementation of PL/SQL Cursor.
9	Implementation of PL/SQL Trigger, Packages.
10	Implementation of NoSQL basic commands using Cassandra/Mongo DB.

11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation, Indexes in NoSQL.
13	**MINI PROJECT** Database Connectivity with Front End Tools(Python/C/C++/JAVA)and Back End Tools(MySQL/SQLite/CASSANDRA/MONGO DB) For any problem selected, write the ER Diagram, apply ER mapping rules, normalize the relations, and follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include
	a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System. e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System i)Library Management System

	Contact Hours	**:**	**60**
	Total Contact Hours	**:**	**105**

Course Outcomes: On completion of the course, the students will be able to:	
●	Understand the use of the Relational model, ER diagrams.
●	Apply SQL Queries to define and manipulate the database.
●	Comprehend the concept of normalization and apply as a case study.
●	Know concurrency control and recovery mechanisms.
●	relate the different models of NoSQL databases.

Text Books:	
1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, “Database System Concepts”, Seventh Edition, Mc Graw Hill, March 2019.
2	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2013.

Reference Books:	
1	RamezElmasri and Shamkant B. Navathe,Fundamentals of Database Systems, 7th Edition, Pearson Education, 2016.
2	C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, 8th Edition, Pearson Education, 2006.
3	AtulKahate, “Introduction to Database Management Systems”, Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl,”Oracle PL/SQL Programming”, 6th edition, Publisher: O'Reilly, 2014.
5	Kristina Chodorow, Shannon Bradshaw, “MongoDB: The Definitive Guide”, 3rd Edition,O'Reilly Media,2019.

Web Link for Virtual Lab	
1.	https://livesql.oracle.com/apex
2.	https://www.jdoodle.com/online-mongodb-terminal/

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19443.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS19443.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS19443.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS19443.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS19443.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	**2.0**	**2.0**	**2.2**	**2.8**	**2.3**	**-**	**-**	**-**	**1.6**	**1.0**	**2.0**	**1.3**	**1.4**	**1.8**	**1.7**

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No Correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	T	P	C
AD19441	INTRODUCTION TO DATA ANALYTICS	PC	3	0	2	4

Objectives:	
●	Understand the health data formats, health care policy and standards
●	Learn the significance and need of data analysis and data visualization
●	Understand the health data management frameworks
●	Learn the use of machine learning and deep learning algorithms in healthcare
●	Apply healthcare analytics for critical care applications

UNIT-I	INTRODUCTION TO BIG DATA	9
Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error		
UNIT-II	**DATA ANALYSIS**	**9**
Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.		
UNIT-III	**MINING DATA STREAMS**	**9**
Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.		
UNIT-IV	**FREQUENT ITEMSETS AND CLUSTERING**	**9**
Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.		
UNIT-V	**FRAMEWORKS AND VISUALIZATION**	**9**
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications		
	Total Contact Hours :	**45**

Course Outcomes: On completion of the course, the students will be able to	
●	Apply the statistical analysis methods
●	Compare and contrast various soft computing frameworks
●	Design distributed file systems
●	Apply Stream data model
●	Use Visualisation techniques

Text Book(s):	
1	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

Reference Books(s):	
1	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
2	Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O‟Reilly, 2011.
Web link:	
1	

DATA ANALYTICS LABORATORY

COURSE OBJECTIVES

To study and write simple programs using the basic packages for handling data

To do various sampling and T,Z,Anova test in various samples

To perform case study and design a system

To demonstrate Time Series Analysis in any real time application

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Suggested Exercises:

1. Random Sampling

2. Z-test case study

3. T-test case studies

4. ANOVA case studies

5. Regression

6. Logistic Regression

7. Time series Analysis

Subject Code	Subject Name (Employability Enhancement Course)	Category	L	T	P	C
GE19421	SOFT SKILLS-I	EEC	0	0	2	1

Description	
●	The course, **"VAP"** intends to enhance the students‟ confidence to communicate in front of an audience effectively.
●	The emphasis is on improving the spoken skills of the students so that they can communicate both, in the college and in the corporate setting to deliver their message successfully
●	In today‟s technology driven world, communicating with confidence is imperative.
●	Hence, this course aims at providing students with the necessary practice in the form of debates, discussions and role plays.

Program Learning Goals :	
●	This program will help our students to build confidence and improve their English communication in order to face the corporate world as well as providing them with opportunities to grow within an organization.

Objectives:	
●	To help students break out of shyness.
●	To build confidence.
●	To enhance English communication skills.
●	To encourage students‟ creative thinking to help them frame their own opinions.

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.
5	Debate	Is competition necessary in regards to the learning process?	The aim of this activity is to develop the students ability to debate and think out of the box

6	Short Talks	Here the students are given topics for which they take one minute to prepare and two minutes to speak. They can write down points but can‟t read them out they can only use it as a reference.	The activity aims at breaking the students‟ shyness and encouraging them to standup in front of the class and speak. It also aims at creating awareness that they are restricted for time so they only speak points that are relevant and important.
7	Debate	Will posting students‟ grades on bulletin boards publicly motivate them to perform better or is it humiliating?	This activity aims at enhancing the students unbiased thought process when it comes to exams and grades as well as develop their skills to debate
8	The Art of diplomacy	The facilitator proceeds to share multiple concepts of conversation and helps the participants to identify the various methods of being diplomatic and how do deal with misinformation.	The aim of the lesson is to provide an opportunity for the participants to learn about body language and choosing the appropriate words for conversation.
9	Debate	Are humans too dependent on computers?	The aim of this activity is to test the students debating skills and thought process with a topic that affects everybody in daily life.
10	Story Completion	The teacher starts to tell a story but after 2 sentences he/she asks students to work in groups to create the rest of the story which includes the plot and the ending.	This activity aims at building their narrating skills as well as their creativity and ability to work in a team.
11	Role play debate	Students scrutinize different points of view or perspectives related to an issue. For example, a debate about the question “Should students be required to wear uniforms at school?” might yield a range of opinions. Those might include views expressed by a student (or perhaps two students – one representing each side of the issue), a parent, a school principal, a police officer, a teacher, the owner of a clothing store, and others.	The aim of this activity is to get students to speak based on other people‟s perspective instead of their own. The students take the role of various characters and debate accordingly.
12	I Couldn‟t Disagree More	This is a game where students practice rebuttal techniques where one student provides a thought or an idea and the other students starts with the phrase I couldn‟t disagree more and continues with his opinion	The aim of this activity is to improve general communication skills and confidence.
13	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.
			Total Contact Hours : 30

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

- Be more confident.
- Speak in front of a large audience.
- Be better creative thinkers.
- Be spontaneous.
- Know the importance of communicating in English.

Reference Books(s):	
1.	Kings Learning work sheets.

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19421.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
GE19421.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
GE19421.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
GE19421.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
GE19421.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	**2.0**	**2.0**	**2.2**	**2.8**	**2.3**	**-**	**-**	**-**	**1.6**	**1.0**	**2.0**	**1.3**	**1.4**	**1.8**	**1.7**

Correlation levels 1, 2 or 3 are as defined below:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"