HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CURRICULUM AND SYLLABUS

Under CBCS

(Applicable for Students admitted from Academic Year 2020-21)

B. Tech. Data Science and Artificial Intelligence

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

VISION AND MISSION

MOTTO

"To Make Every Man A Success and No Man A Failure"

VISION

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instil highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT

- Integrity, Innovation, Internationalization

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING
VISION AND MISSION

VISION

To excel in Computer Science and Engineering education, research and project management by empowering the students with strong conceptual knowledge.

MISSION

M1: To educate the students with basic foundation blocks of core and allied disciplines of Computer Science and Engineering.

M2: To provide practical skills in the advancements of the Computer Science and Engineering field required for the growing dynamic IT and ITES industries.

M3: To sculpt strong personal, technical, research, entrepreneurial, and leadership skills.

M4: To inculcate knowledge in lifelong learning, professional ethics and contribution to the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The Program Educational Objectives (**PEOs**) of **B.Tech. Data Science** are listed below:
The graduate after 3-5 years of programme completion will

PEO1: Excel in his/her professional career and/or pursue higher education including research by applying the knowledge of Data Science

PEO2: Demonstrate the technical skills to analyze and design appropriate solutions for problems with social consciousness and ethical values.

PEO3: Adapt themselves to organizational needs by understanding the dynamically changing technologies.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)
(To be achieved by the student after every semester/year/and at the time of graduation)

At the end of this program, graduates will be able to

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.

PO4: **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.

PO5: **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.

PO6: **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.

PO7:   **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.

PO8:   **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9:   **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10:   **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.

PSO 1. Apply mathematical, conceptual knowledge of computing and analytical skills to demonstrate statistical analysis of data, to build and assess data-based models.

PSO 2. Formulate and use appropriate machine learning models to explore the hidden solutions related to business-related challenges and visually interpret the findings effectively.

PSO 3. Demonstrate principles of Data Science and Artificial Intelligence to analyze business problems, extract meaningful information, and assess findings to meet societal and organizational needs.

B.TECH. DATA SCIENCE									
(165 CREDIT STRUCTURE)									
SEMESTER – I									
SL. NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	HS/ES	ELA4101/ MEA4101	Professional English and Soft Skills /Engineering Graphics and Computer Aided Design	1	1	2	3	1	4
2	BS	MAA4101	Matrices and Calculus	3	0	2	4	0	5
3	BS	PHA4102/ CYA4101	Engineering Physics/Engineering Materials	3	0	0	3	1	3
4	PC	CSA4101	Problem Solving Using C	2	0	2	3	0	4
5	ES	EEB4101/ CSB4101	Introduction to Digital Systems / Engineering and Design	2	0	2	3	1	3
7	ES	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
8	BS	PHA4131/ CYA4131	Engineering Physics Lab/ Materials Chemistry Lab	0	0	2	1	0	2
			Total	11	1	12	17.5	5	23
SEMESTER – II									
SL. NO	**COURSE CATEGORY**		**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	MAA4117	Analytical Mathematics	3	1	0	4	0	5
2	BS	PHA4102/ CYA4101	Engineering Physics/ Engineering Materials	3	0	0	3	1	3
3	HS/ES	ELA4101/ MEA4101	Professional English and Soft Skills /Engineering Graphics and Computer Aided Design	1	1	2	3	1	4
4	ES	EEB4101/ CSB4101	Introduction to Digital Systems / Engineering and Design	2	0	2	3	1	4
5	ES	GEA4102	Sustainable Engineering Systems	2	0	0	2	1	3
6	PC	CSB4119	Python for Data Science	3	0	2	4	1	5
7	PC	CSB4120	Data Structures	3	0	2	4	1	5

8	ES	GEA4131	Engineering Immersion Lab	0	0	2	0.5	2	2
9	BS	PHA4131/ CYA4131	Engineering Physics Lab/ Materials Chemistry Lab	0	0	2	1	0	2
			Total	17	1	14	24.5	9	33

B.TECH. DATA SCIENCE
(165 CREDIT STRUCTURE)

SEMESTER – III

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4202	Applied Linear Algebra	3	1	0	4	0	4
2	PC	CSB4201	Design and Analysis of Algorithms	2	1	2	4	1	5
3	PC	CSB4202	Database Management Systems	3	0	0	3	1	3
4	PC	CSB4204	Computer Architecture	3	0	2	4	0	5
4	PC	CSB4205	R for Data Science	2	0	2	3	1	4
5	DE	CSC**	Department Elective-I	3	0	0	3	0	3
6	NE	CSD**	Non-Department Elective- I	2	0	0	2	0	2
7	PC	CSB4232	Database Management Systems Lab	0	0	3	1	0	3
			Total	18	1	11	24	3	30

SEMESTER – IV

SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4302	Probability and Statistics	3	0	2	4	0	5
2	PC	CSB4303	Artificial Intelligence	3	0	0	3	0	3
3	PC	CSB4218	Operating Systems	3	0	0	3	1	3
4	PC	CSB4221	Data Handling and Visualization	3	0	0	3	1	3
5	DE	CSC**	Department Elective-II	2	0	2	3	0	4
6	NE	CSD**	Non-Department Elective–II	2	0	0	2	0	2

7	PC	CSB4242	Operating Systems Lab	0	0	3	1	0	3
8	PC	CSB4246	Data Handling and Visualization lab	0	0	3	1	0	3
9	PC	CSB4243	Design Project-I	0	0	2	1	0	2
10	PC	CSB4244	Internship	0	0	0	1	0	0
			Total	16	1	10	22	3	27

B.TECH. DATA SCIENCE									
(165 CREDIT STRUCTURE)									
SEMESTER – V									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	BS	MAA4219	Discrete Mathematics	3	0	2	4	1	5
2	PC	CSB4318	Data Warehousing and Data Mining	3	0	2	3	1	3
3	PC	CSB4317	Machine Learning	3	0	2	4	1	4
4	PC	CSB4320	Digital Marketing Analytics	1	0	2	2	1	3
5	HS	GEA4216	Professional Ethics and Life Skills	2	0	0	2	1	2
6	DE	CSC**	Department Elective-III	2	0	2	3	0	4
7	NE	CSD**	Non-Department Elective–III	2	0	0	2	0	2
8	PC	CSB4333	Data Mining Tools Lab	0	0	3	1	0	3
9	PC	CSB4332	Design Project with IoT	0	0	3	1	0	3
			Total	18	0	10	22	2	28

SEMESTER – VI									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CSB4304	Deep Learning	3	1	0	4	1	4
2	PC	CSB4305	Virtualization and Cloud Computing	3	0	2	4	1	4
3	PC	CSB4306	Business Intelligence and Analytics	3	0	0	3	1	3
4	PC	CSB4319	Modern Software Engineering	3	0	2	4	1	5

5	HS	GEA4304	Business Economics	2	0	0	2	1	2
6	DE	CSC**	Department Elective-IV	2	0	2	3	0	4
7	NE	CSD**	Non-Department Elective–IV	2	0	0	2	0	2
8	PC	CSB4344	Business Intelligence and Analytics Lab	0	0	3	1	0	3
9	PC	CSB4342	Design Project-II	0	0	2	1	0	2
10	PC	CSB4343	Internship	0	0	0	1	0	0
Total				18	1	11	25	5	30

B.TECH. DATA SCIENCE									
(165 CREDIT STRUCTURE)									
SEMESTER – VII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CSB4401	Software Project Management	2	0	2	3	1	3
2	PC	CSB4402	Big Data and Analytics	3	0	2	4	1	5
3	PC	CSB4406	Time series analysis and Forecasting	2	0	2	3	0	4
4	PC	CSB4407	Natural Language Processing and Analytics	2	0	2	3	0	4
5	NE	CSC**	Department Elective–V	2	0	2	3	0	4
6	DE	CSD**	Non-Department Elective-V	2	0	0	2	0	2
7	PC	CSB4432	Practical Case Study on Data Science	2	0	2	3	0	4
8	PC	CSB4431	Design Project-III	0	0	2	1	0	2
Total				16	0	12	22	1	28
SEMESTER – VIII									
SL. NO	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1	PC	CSB4441	Project & Viva – voce	0	0	16	8	0	16

Total				0	0	16	8	0	16
Total							**165**		

LIST OF DEPARTMENTAL ELECTIVES									
S.No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
DEPARTMENT ELECTIVE – I (SEMESTER III)									
1	DE	CSC4264	Advanced Java Programming	2	0	2	3	0	4
2	DE	CSC4257	Stream Processing and Analytics	2	0	2	3	0	4
3	DE	CSC4265	Advanced Android Application Development	2	0	2	3	0	4
DEPARTMENT ELECTIVE – II (SEMESTER IV)									
4	DE	CSC4283	Advanced Computer Networks	2	0	2	3	0	4
5	DE	CSC4376	IoT cloud and data analytics	2	0	2	3	0	4
6	DE	CSC4358	Statistical Inference for Data Science	2	0	2	3	0	4
DEPARTMENT ELECTIVE – III (SEMESTER V)									
7	DE	CSC4373	Blockchain Technology	2	0	2	3	0	4
8	DE	CSC4364	Social Network Analytics	2	0	2	3	0	4
9	DE	CSC4365	Intelligent Database System	2	0	2	3	0	4
DEPARTMENT ELECTIVE – IV (SEMESTER VI)									
10	DE	CSC4380	SAS Programming	2	0	2	3	0	4
11	DE	CSC4277	Smart Sensor Technologies	2	0	2	3	0	4
12	DE	CSC4381	Cyber Forensic analytics	2	0	2	3	0	4
DEPARTMENT ELECTIVE – V (SEMESTER VII)									
13	DE	CSC4465	High-Dimensional Data Analysis	2	0	2	3	0	4
14	DE	CSC4466	Conditional Monitoring Techniques for Data Science	2	0	2	3	0	4
15	DE	CSC4467	Image Analytics	2	0	2	3	0	4

<u>SEMESTER – I</u>

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
COURSE CODE	ELA4101	COURSE CATEGORY	HS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
C O	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Understand the importance of professional communication and applying the knowledge.				8,9,10
2	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations, enhance pronunciation skills based on the knowledge of phonetics.				8,9,10
3	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems.				8,9,10
4	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments.				8,9,10
5	Imbibe soft skills to excel in interpersonal skills essential for workplace.				8,9,10
Prerequisites: Plus Two English-Intermediate Level					
MODULE 1: THE ELEMENTS OF COMMUNICATION (9)					

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business Communication-Professional Communication-barriers to communication – strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short Conversations-Situational communication-dialogue writing -Language Functions- analyze the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

- Rogerson, Trish Stott & Derek Utley.2011
- Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)
- Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2: AURAL –ORAL COMMUNICATION IN ENGLISH   (9)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)- neutral accent-sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS, Professional Speaking Skills by Aruna Koneru, Oxford Press, Face to face series Cambridge University Press, Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela.

MODULE 3: GRAMMAR AND DEVELOPMENT OF READING SKILLS	(9)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles- comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on student's area of specialization answering questions-reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins IELTS, Cambridge books Practical English Usage by Michael Swan, Cambridge University Press

MODULE 4: EFFECTIVE WRITING AND BUSINESS COMMUNICATION	(9)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data (bar chart, pie chart, line graphs).

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS, IELTS Academic Writing 1, New Insights into IELTS, CUP.

MODULE 5: SOFT SKILLS	(9)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management-Lateral Thinking (De Bono's Six Thinking Hats) and Problem-Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.
Soft Skills for Everyone by Jeff Butterfield, Cengage Learning Education and personality development, K. Manoharan English for Life and the Workplace through the LSRW&T skills, Lateral Thinking skills by Edward De Bono.

TEXT BOOKS	
1.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press, 2009.

REFERENCE BOOKS	
1.	Sabina Pillai and Agna Fernandez,"Soft Skills & Employability Skills",Cambridge University Press 2018.
2.	Steve Hart et al."Embark, English for Undergraduates", Cambridge University Press, 2016
3.	Skills for the TOEFL IBT Test, Collins, 2012 edition
4.	Jeff Butterfield "Soft Skills for Everyone", Cengage Learning, 2010 edition
5.	Dolly John,"English for Life and the Workplace Through LSRW&T skills" Pearson Publications, 2014.
6.	Aruna Koneru,"Professional Speaking Skills", Oxford Publications, 2015
7.	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
8.	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002
9.	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
10.	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation, 2015
11.	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.
E BOOKS	

	E BOOKS
1.	https://www.britishcouncil.in/english/courses-business
2.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3.	http://www.bbc.co.uk/learningenglish/english/
4.	http://www.antimoon.com/how/pronunc-soundsipa.htm
5.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6.	Oneshopenglish.com
7.	Breakingnews.com
8.	https://www.britishcouncil.in/english/courses-business
MOOC	
1.	https://www.mooc-list.com/tags/english
2.	https://www.mooc-list.com/course/adventures-writing-stanford-online
3.	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	MEA4101	**COURSE CATEGORY**	ES	**L-T-P-S**	1 -1- 2 -1
CIA	60%			**ESE**	40%
LEARNING LEVEL	BTL-5				
CO	**COURSE OUTCOMES**				**PO**
Upon completion of this course, the students will be able to					
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.				1,2,5
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids.				1,2,5
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models.				1,2,5
4	Apply the 3D model commands to generate and solid object.				1,2,5
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.				1,2,5
6	Develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.				1,2,3,5
Prerequisites: Nil					
MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES					**(12)**
Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer					

Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Self-Study: Solid modelling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING   (15)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three-Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing.

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Self-study: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15)

Principles of isometric projection and solid modelling. Isometric drawing – ISO Planes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modeling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

Self-study: Surface modelling and solid modelling commands

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING   (15)

Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software.

2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer.

Self-study: CAD commands for modelling and   views generation

MODULE 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING   (15)

Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice.

Self-study: CAD commands for modelling and views generation

TEXT BOOKS

1.	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016.

REFERENCE BOOKS	
1.	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes
2.	Engineering Drawing and Graphic Technology-International Edition, Thomas E.
3.	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R.
4.	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C.
5.	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry,
6.	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing,
E BOOKS	
1.	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2.	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html
MOOC	
1.	http://nptel.ac.in/courses/112103019/
2.	http://nptel.ac.in/courses/105104148/

COURSE TITLE	MATRICES AND CALCULUS			CREDITS	4
COURSE CODE	MAA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL – 4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Able to study the concepts of matrices and apply them in related engineering problems.				1,2,4
2	Capable to use the features of Differential Calculus in optimization problems.				1,2,4
3	Able to extend the concepts of integral calculus in finding area and volume.				1,2,4
4	Skilled to solve ordinary differential equations in engineering problems.				1,2,4
Prerequisites : Nil					

MODULE 1: MATRICES   **(15)**

Characteristic equation – Eigenvalues and Eigenvectors – Properties – Cayley Hamilton theorem (Statement only) – Verification and inverse of the matrix using Cayley Hamilton theorem-Diagonalization of matrices using similarity transformation.

Suggested Reading: Basics of Matrices

Lab 1: Eigenvalues and Eigenvectors, Verification and inverse using Cayley Hamilton theorem-Diagonalization

MODULE 2: DIFFERENTIAL CALCULUS   **(15)**

Methods of differentiation of functions – Product and Quotient rules – Inverse trigonometric functions – Implicit function – parametric form. Partial differentiation – Total differentiation- Taylor's series – Maxima and minima of functions of two variables.

Suggested Reading: Basics of Differentiation

Lab 2: Taylor's series – Maxima and minima of functions of two variables

MODULE 3: INTEGRAL CALCULUS (15)

Integration – Methods of integration – Substitution method – Integration by parts – Integration using partial fraction – Bernoulli's formula. Applications of Integral Calculus: Area, Surface and Volume.

Suggested Reading: Basics of Integrations

Lab 3: Applications of Integral Calculus: Area, Surface area and Volume.

MODULE 4: ORDINARY DIFFERENTIAL EQUATIONS (15)

Second order differential equations with constant coefficients – Particular integrals – e^{ax}, $Sin ax, Cos ax, x^m$, e ^{ax} Cos bx, e ^{ax} Sin bx. Solutions of homogeneous differential equations with variable coefficients – Variation of parameters.

Suggested Reading: Basics of Differential Equations.

Lab 4: Solution of Second order differential equations.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Eighth Edition, Laxmi Publications Pvt Ltd., 2011.
3. Chandrasekaran A, "A Text book of Engineering Mathematics I", Dhanam Publications, Chennai, 2017.

REFERENCE BOOKS

1. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
2. Weir, M.D and Joel Hass, Thomas' Calculus, 12th Edition, Pearson India, 2016.
3. Advanced Engineering Mathematics With Matlab, Third Edition,2011 by CRC Press.

E BOOKS

1. http://nptel.ac.in/courses/111105035/
2. https://www.edx.org/.../introduction-engineering-mathematics-utarlingtonx-engr3

MOOC

1. https://www.mooc-list.com/tags/engineering-mathematics

COURSE TITLE	ENGINEERING PHYSICS (Common to ECE, EEE, CSE & IT)			CREDITS	3
COURSE CODE	PHA4102	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 3				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	**S**olve basic problems in mechanics and also understand the properties of matter.	1,2
2	Have knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2
3	Knowledge on fundamental concepts of Quantum physics.	1,2
4	Have fundamental knowledge on semiconductors and discrete devices.	1,2
5	Understand the concept, working and application of lasers and fiber optics.	1,2

Prerequisites : Knowledge in fundamentals of physics at higher secondary level.

MODULE 1: PROPERTIES OF MATTER & HEAT (9)

Elasticity - Hooke's law – Elastic Moduli – Young's modulus - Rigidity modulus - Bulk modulus - Twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - Depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivity of good and bad conductors – Forbe's method – theory and experiment – Lee's disc method for bad conductors.

MODULE 2: ACOUSTICS AND ULTRASONICS (9)

Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.

MODULE 3: QUANTUM PHYSICS (9)

Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)

MODULE 4: CRYSTAL PHYSICS AND MAGNETISM (9)

Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.

MODULE 5: PHOTONICS AND FIBRE OPTICS (9)

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser - Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.

LAB / MINI PROJECT / FIELD WORK

NA

TEXT BOOKS

1.	P.Mani, " Engineering Physics", Vol-I & II, Dhanam Publications, Chennai. (2011)
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi. (2010)

REFERENCE BOOKS

1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications. (2007)
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi. (2003)

E BOOKS

1.	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2.	http://iopscience.iop.org/book/978-1-6817-4585-5
3.	https://www.springer.com/in/book/9783319206295

MOOC

1.	http://nptel.ac.in/courses/115106061/
2.	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
COURSE CODE	CYA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Suggest suitable metals for alloying.	1,2,4,6
2	Identify the materials apt for engineering applications.	1,2,4,6
3	Select high temperature materials for engineering applications.	1,2,4,6
4	Map the properties of nanomaterials with their applications.	1,2,4,6
5	Suggest suitable materials for electronic applications.	1,2,4,6

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1: CRYSTAL STRUCTURE AND PHASE RULE   (9)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2: POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES.	(9)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites – Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3: NANOMATERIALS AND MOLECULAR SIEVES	(9)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4: MATERIALS FOR ELECTRONIC APPLICATONS	(9)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5: LUBRICANTS, ADHESIVES AND EXPLOSIVES	(9)

Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.

LAB / MINI PROJECT/FIELD WORK

 NA

TEXT BOOKS

1.	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi – 2012
2.	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3.	Composite materials, K.K. Chawala, 3rd ed., (2012) Springer-Verlag, New York
4.	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
5.	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, (2001), Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK.

E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2.	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `

MOOC	
1.	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2.	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	PROBLEM SOLVING USING C			CREDITS	3
COURSE CODE	CSA4101	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Describe the basics of digital computer and programming languages.	1,2,8,12
2	Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem.	1,2,3,5,12
3	Design and Implement C program using Control Statements and Functions.	1,2,3,5,9,10,12
4	Design and Implement C program using Pointers and File operations.	1,2,3,12
5	Identify the need for embedded C in real-time applications.	1,2,6,12

Prerequisites: Nil

MODULE 1 – PROGRAMMING LANGUAGES AND PROBLEM SOLVING TECHNIQUES   (6L+6P)

Introduction – Fundamentals of digital computers - Programming languages -Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code.

Practical Component:

Drawing Flowcharts using E- Chart & Writing pseudo code for the following problems

(i) Greatest of three numbers

(ii) Sum of N numbers

(iii) Computation of nCr

MODULE 2: FUNDAMENTALS OF C   (6L+6P)

Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements.

Practical Component:

(i) Program to illustrate arithmetic and logical operators

(ii) Program to read and print data of different types

(iii) Program to calculate area and volume of various geometrical shapes

(iv) Program to compute biggest of three numbers

(v) Program to print multiplication table

(vi) Program to convert days to years, months and days

(vii) Program to find sum of the digits of an integer.

MODULE 3: FUNCTIONS, ARRAYS AND STRINGS	(6L+6P)

Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements.

Practical Component:

(i) Program to compute Factorial, Fibonacci series and sum of n numbers using recursion

(ii) Program to compute sum and average of N Numbers stored in an array

(iii) Program to sort the given n numbers stored in an array

(iv) Program to search for the given element in an array

(v) Program to do word count

(vi) Program to insert a substring in a string

(vii) Program to concatenate and compare two strings

(viii) Program using pre-processor statements

MODULE 4: POINTERS, STRUCTURES AND UNION	(6L+6P)

Pointers – Dynamic Memory allocation – Structure and Union – Files.

Practical Component:

(i) Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation

(ii) Program to read and print records of a student/payroll database using structures

(iii) Program to simulate file copy

(iv) Program to illustrate sequential access file

(v) Program to illustrate random access file

MODULE 5: INTRODUCTION TO EMBEDDED C	(6L+6P)

Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler.

Practical component:

Simple programs using embedded C

LAB / MINI PROJECT / FIELD WORK

NA

TEXT BOOKS

1.	Jeyapoovan T, "Fundamentals of Computing and Programming in C", Vikas Publishing house, 2015.

2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.

REFERENCE BOOKS

1.	Ashok Kamthane, "Computer Programming", Pearson Education, 7th Edition, Inc 2017.
2.	Yashavant Kanetkar, "Let us C", 15th edition, BPP publication, 2016.
3.	S.Sathyalakshmi, S.Dinakar, "Computer Programming Practicals – Computer Lab Manual", Dhanam Publication, First Edition, July 2013.

E BOOKS

1.	https://en.wikibooks.org/wiki/C_Programming

MOOC

1.	https://onlinecourses.nptel.ac.in/noc18-cs10/preview
2.	https://www.coursera.org/specializations/c-programming

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	COURSE CATEGORY	ES	L-T-P-S	2- 0- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able	
1	To understand basic operation in digital systems and instruments.	1,2,4,6
2	To gain knowledge on basic functioning of sensors and display units.	1,2,4,6
3	To familiarize the concepts of signal processing and converting elements.	1,2,4,6
4	To acquire the knowledge of microcontrollers and applications	1,2,4,6
5	To attain the basic concepts of consumer electronics and communication devices.	1,2,4,6

Prerequisites : Physics and Mathematics

MODULE 1: INTRODUCTION TO DIGITAL SYSTEMS	(12)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).

Suggested Reading: Basics of number systems.

Applications: All digital systems in consumer and industrial electronics.

Lab: - (*To be done in Simulation environment*)

1. Logic gates simulation
2. Boolean Identities and Property verification
3. Digital controller design

MODULE 2: SENSORS AND DISPLAYS	(16)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

Applications: Measurements and Instrumentation. **Lab**: - (*To be done in Simulation environment*)

1. Simulation of Sensor characteristics- potentiometer
2. Simulation of Sensor Characteristics-Strain Gauge
3. Simulation of Sensor characteristics-LVDT
4. Simulation of Sensor characteristics-RTD
5. Simulation of Sensor Characteristics-Thermocouple

MODULE 3: SIGNAL CONDITIONING CIRCUITS	(10)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

Applications: Instrumentation **Lab**: - (To be done in Simulation environment)

1. Simulation of DC bridges
2. Operational amplifier applications
3. Active filter simulation
4. ADC- DAC simulation.

MODULE 4: INTRODUCTION TO MICRO CONTROLLERS	(16)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

Applications: Control system**. Lab**: - (To be done in Simulation environment)

1. PLC Ladder logic simulation.
2. Proportional controller simulation.
3. Proportional + Integral controller simulation.
4. Proportional + Derivative controller simulation.
5. Proportional +Integral + Derivative controller simulation.

MODULE 5: CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM	(6)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

Applications: Home Appliances, Modern communication

LAB / MINI PROJECT/FIELD WORK

Field trip to consumer electronics industry.

TEXT BOOKS

1.	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2.	Op-amps and Linear Integrated Circuits,Ramakant A. Gayakwad,4th edition, Prentice Hall, 2015.
3.	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4.	The 8051 Microcontroller And Embedded Systems Using Assembly And C, Sepehr Naimi, Sarmad Naimi, Muhammad Ali Mazidi, Second edition, 2017.
5.	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
1.	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
2.	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
3.	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
4.	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
5.	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1.	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2.	https://electronics.howstuffworks.com/home-audio-video-channel.htm
3.	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
4.	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
5.	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
6.	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
7.	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/Course_home2_5.html

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	CSB4101	COURSE CATEGORY	ES	L-T-P-S	2- 0- 2 -1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Identify the different elements involved in good designs and to apply them in practice when called for.				1,2,3,5
2	Interpret the product oriented and user-oriented aspects that make the design a success.				1,2,5
3	Think of innovative designs incorporating different segments of knowledge gained in the course				1,2,3,5
4	Have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.				1,2
5	Learn economic and environmental Issues, trade aspects and IPR				1,2,6,7
Prerequisites: Nil					
MODULE 1: INTRODUCTION TO COMPUTER ENGINEERING DESIGN					**(9)**

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions- Ceiling fan, Group Presentation and discussion**.**

MODULE 2: PROCESSES IN DESIGN FOR COMPUTER SCIENCE ENGINEERING   (9)

Design process- Different stages in design and their significance; Defining the design space; Analogies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed 2D drawings; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any two products.

MODULE 3: PROTOTYPING IN COMPUTER ENGINEERING DESIGN   (9)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.

Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in any engineering specialization. Develop any design with over 50% standard items as parts.

MODULE 4: QUALITY ASPECTS IN COMPUTER ENGINEERING DESIGN   (9)

Design for "X"; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc.

Project: Example: List out the design requirements(x) for designing a rocket shell of 3-meter diameter and 8-meter length. Design mineral water bottles that could be packed compactly for transportation.

MODULE 5: USER CENTRED DESIGNS   IN COMPUTER SCIENCE ENGINEERING   (9)

Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wet grinders; Printed motifs; Role of colours in design. Make sharp corners and change them to smooth curves-check the acceptance. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it.

Project: Examine the possibility of value addition for an existing product.

TEXT BOOKS

1.	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919

2.	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3.	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4.	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5.	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6.	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	ENGINEERING IMMERSION LAB			CREDIT	0.5
COURSE CODE	GEA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-2
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, students will be able to		
1	Identify and use the tools, accessories and perform troubleshooting	1,2,4,5,12
2	Perform software installations, assembling, fabrication techniques.	1,2,4,5,12

SLOT X - LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING WORKSHOP
1. Welding: Arc welding: Butt joints
2. Lap joints.
3. Machining: Facing
4. Turning

II. AUTOMOBILE ENGINEERING
1. Dismantling and Studying of two stroke gasoline engine.
2. Assembling of two stroke gasoline engine.
3. Dismantling and Studying of four stroke gasoline engine
4. Assembling of four stroke gasoline engine.

III. AERONAUTICAL ENGINEERING
1. Study of Flow Pattern around Various Objects.
2. Force measurement on Aircraft Model
3. Determination of Young's Modulus for Aluminum Cantilever Beam
4. Binary Addition & Subtraction using Microprocessor

IV. CIVIL ENGINEERING
1. Plumbing- Basic Pipe Connection using valves, couplings and elbows.
2. Carpentry – Sowing, Planning and making common Joints.
3. Bar Bending
4. Construction of a 50 cm height brick wall without mortar using English Bond.

SLOT X - LIST OF EXPERIMENTS

V.ELECTRICAL ENGINEERING

1. Study of tools and accessories.
2. Study of cables.
3. Staircase wiring, Tube light and Fan connection.
4. Measurement of energy using single phase energy meter.

VI. ELECTRONICS ENGINEERING

1. Study of Active and Passive Components.
2. Study of Logic Circuits.
3. Making simple circuit using Electronic Components.
4. Measuring of parameters for signal using CRO.

VII. COMPUTER SCIENCE

1. Troubleshooting different parts of the computer peripherals, Monitor, Keyboard & CPU.
2. Installation of various operating systems, their capabilities, Windows, Unix, Linux.
3. Installation of commonly used software like MS Office
4. Assembling digital computer.

VIII. MECHATRONICS ENGINEERING

1. Study of Key Elements of Mechatronics Systems
2. Sensors – Load Cell, Thermocouple
3. Actuators – Linear & Rotary Actuators
4. Interfacing & Measurements – Virtual Instrumentation

REFERENCE BOOKS	
1	Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2015.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid, CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
4	Robert Quesada, Jeyapoovan T., Computer Numerical Control Machining and Turning Centers, Pearson Education, New Delhi, 2006

METHOD OF ALLOCATION FOR ENGINEERING IMMERSION LAB

SLOT X : MECH, AERO, AUTO, CIVIL EXPERIMENTS
SLOT Y : EEE, ELECTRONICS, CSE, MECHATRONICS EXPERIMENTS
- EVERY CLASS OF
  - GROUP A (AERO, AUTO, MECH, MCT, CHEM, BIO, CIVIL
  - GROUP B (CSE, IT, ECE, EEE, AEROSPACE)
GETS DIVIDED INTO 4 SUB - GROUPS NAMELY a, b, c, d -- EACH CONSISTING OF 15 TO 20 STUDENTS MAX.
- FOR EXAMPLE: **GROUP A STUDENTS WILL OCCUPY SLOT X**
  - WEEK 1 : SLOT X ---
    - ✓ a – MECH; b – AUTO; c – AERO ; d – CIVIL
  - WEEK 2 : SLOT X ---
    - ✓ b – MECH; c – AUTO; d – AERO ; a – CIVIL
- THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)
- **GROUP B STUDENTS WILL OCCUPY SLOT Y**
  - WEEK 1 : SLOT Y ---
    - ✓ a – EEE; b – ECE; c – CSE ; d – MCT

- WEEK 2 : SLOT Y ---
  - ✓ b – EEE; c – ECE; d – CSE ; a – MCT
- ➢ THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

COURSE TITLE	ENGINEERING PHYSICS LAB (Common to all engineering branches)			CREDIT	1
COURSE CODE	PHA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Analyze material's elastic properties.	1,2,3,4
2	Determine thermal conductivity of bad conductor.	1,2,3,4
3	Measure coefficient of viscosity of liquids.	1,2,3,4
4	Determine wavelength of laser.	1,2,3,4
5	Describe V-I characteristics of diode.	1,2,3,4

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)

1. Torsional Pendulum – Determination of rigidity modulus of the material of a wire.
2. Non Uniform Bending – Determination of Young's Modulus.
3. Uniform Bending – Determination of Young's Modulus.
4. Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
5. Lee's Disc – Determination of thermal conductivity of a bad conductor.
6. Air – Wedge – Determination of thickness of a thin wire
7. Spectrometer – refractive index of a prism
8. Semiconductor laser – Determination of wavelength of laser using grating
9. Semiconductor diode – VI characteristics

TEXT BOOK

1. P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005

REFERENCE BOOKS

1. Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2. P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015

E BOOK

1	http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LAB	CREDITS	1

	(Common to ALL branches of Engineering)				
COURSE CODE	CYA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Characterize basic properties of refractory ceramics	1,2,4,6
2	Prepare resins and composites.	1,2,4,6
3	Estimate metal ions present in samples using instrumental techniques.	1,2,4,6
4	Develop adsorption isotherm.	1,2,4,6
5	Find properties of lubricants and other oil samples.	1,2,4,6

Prerequisites: Knowledge in basic chemistry practical at higher secondary level.

LAB / MINI PROJECT/FIELD WORK

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Determination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS

1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017

E BOOKS

1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html

MOOC

1.	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2.	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER II

COURSE TITLE	ANALYTICAL MATHEMATICS			CREDITS	4
COURSE CODE	MAA4117	COURSE CATEGORY	BS	L-T-P-S	3- 0- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

C O	COURSE OUTCOMES	P O
	Upon completion of this course, the students will be able to	
1	Evaluate surface and volume integrals.	1,2,4
2	Perform vector operations and interpret the results geometrically.	1,2,4
3	Solve the system of ordinary differential equations using Laplace Transform.	1,2,4
4	Know that any periodic function satisfying Dirichlet's conditions can be expressed as a Fourier series.	1,2,4
5	Understand complex variable theory, applications of analytic function and harmonic conjugate.	1,2,4

MODULE 1: MULTIPLE INTEGRALS   (12)

Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral – Change of variables between Cartesian and polar coordinates.

Suggested Reading: Line Integrals
Lab: Area and Volume of double integration and triple integration.

MODULE 2: VECTOR CALCULUS   (12)

Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces – Solenoidal and Irrotational vector fields. Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelepiped.

Suggested Reading: Basics of Vectors
Lab: Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields.

MODULE 3: LAPLACE TRANSFORMS   (12)

Laplace transform – Conditions of existence – Transform of elementary functions – properties – Transforms of derivatives– Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients.

Suggested Reading: Basics of Transform
Lab: Solutions of differential equations using Laplace transform

MODULE 4: FOURIER SERIES   (12)

Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis.

Suggested Reading: Basics of series
Lab: Expansion of functions using Fourier series

MODULE 5: COMPLEX VARIABLES	**(12)**

Functions of a complex variable – Analytic function – Cauchy - Riemann equations (Statement only) – Properties of analytic function (Statement only) – Construction of Analytic functions by Milne – Thomson method.

Suggested Reading: Complex Numbers

Lab: Verification of Analytic Function

TEXT BOOKS	
1.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	A.P.Santhakumaran, P.Titus, Engineering Mathematics - II, NiMeric Publications, Nagercoil, 2012.
3.	Chandrasekaran A, Engineering Mathematics- II, Dhanam Publication, 2014
4.	Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson Publication, Second Edition, 2016.

REFERENCE BOOKS	
1.	Sastry, S.S, —Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
2.	Wylie, R.C. and Barrett, L.C., —Advanced Engineering Mathematics —Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
3.	Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E BOOKS	
1.	http.// nptel.ac.in/courses/122104017/28
2.	https://www.khanacademy.org/.../double-integrals.../double-integral.
3.	nptel.ac.in/courses/115101005/downloads/lectures-doc/Lecture-1.p
4.	nptel.ac.in/syllabus/122104017/
5.	nptel.ac.in/courses/111105035/22
6.	nptel.ac.in/syllabus/111103070/

MOOC	
1.	https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x

COURSE TITLE	**ENGINEERING PHYSICS** (Common to ECE,EEE,CSE & IT)			**CREDITS**	**3**
COURSE CODE	**PHA4102**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-0-0-1**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	**BTL- 3**				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Solve basic problems in mechanics and also understand the properties of matter.	1,2
2	Have knowledge of acoustics and ultrasonics which would facilitate in acoustical design of buildings and also be able to employ ultrasonics as an engineering tool.	1,2
3	Knowledge on fundamental concepts of Quantum physics.	1,2
4	Have fundamental knowledge on semiconductors and discrete devices.	1,2
5	Understand the concept, working and application of lasers and fiber optics.	1,2

Prerequisites: Knowledge in fundamentals of physics at higher secondary level.

MODULE 1: PROPERTIES OF MATTER & HEAT (9)

Elasticity - Hooke's law – Elastic Moduli – Young's modulus - Rigidity modulus - Bulk modulus - Twisting couple on a wire - Torsional pendulum - determination of rigidity modulus of a wire - Depression of a cantilever - Young's modulus by cantilever - uniform and non-uniform bending.

Thermal conductivity – experimental determination of thermal conductivity of good and bad conductors – Forbe's method – theory and experiment – Lee's disc method for bad conductors.

MODULE 2: ACOUSTICS AND ULTRASONICS (9)

Classification of sound - characteristics of musical sound – intensity - loudness - Weber Fechner law - Decibel - Reverberation - Reverberation time, derivation of Sabine's formula for reverberation time(Jaeger's method) - absorption coefficient and its determination - factors affecting acoustics of building (Optimum reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies - Ultrasonics- production – Magnetostriction and Piezoelectric methods – properties – applications.

MODULE 3: QUANTUM PHYSICS (9)

Black body radiation- Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's law from Planck's theory – Compton effect – Theory and experimental verification – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box Extension to 3 dimension (no derivation)

MODULE 4: CRYSTAL PHYSICS AND MAGNETISM (9)

Crystal - Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - 'd' spacing in cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - coordination number - Packing factor for SC, BCC, FCC and HCP structures.

Magnetic dipole moment - atomic magnetic moments- magnetic permeability and susceptibility - Types of magnetism: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism – ferrimagnetism - domain structure – hysteresis - hard and soft magnetic materials – applications.

MODULE 5: PHOTONICS AND FIBRE OPTICS (9)

Principle of lasers - Stimulated absorption - Spontaneous emission, stimulated emission - population inversion - pumping action - active medium - laser characteristics – Nd-Yag laser -CO_2 laser -

Semiconductor laser - applications - optical fiber - principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - types of optical fibers - single and multimode, step index and graded index fibers - fiber optic communication system.

LAB / MINI PROJECT / FIELD WORK
NA

TEXT BOOKS	
1.	P.Mani, " Engineering Physics", Vol-I & II, Dhanam Publications, Chennai. (2011)
2.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi. (2010)

REFERENCE BOOKS	
1.	Arthur Beiser, "Concepts of Modern Physics", Tata Mc Graw – Hill Publications. (2007)
2.	Rajendran V. Marikani A., "Applied Physics for engineers", 3rd edition, Tata Mc Graw –Hill publishing company Ltd., New Delhi. (2003)

E BOOKS	
1.	https://www.bookyards.com/en/book/details/13921/Elements-Of-Properties-Of-Matter
2.	http://iopscience.iop.org/book/978-1-6817-4585-5
3.	https://www.springer.com/in/book/9783319206295

MOOC	
1.	http://nptel.ac.in/courses/115106061/
2.	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	ENGINEERING MATERIALS (Common to ALL Branches of Engineering)			CREDITS	3
COURSE CODE	CYA4101	COURSE CATEGORY	BS	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Suggest suitable metals for alloying.	1,2,4,6
2	Identify the materials apt for engineering applications.	1,2,4,6
3	Select high temperature materials for engineering applications.	1,2,4,6
4	Map the properties of nanomaterials with their applications.	1,2,4,6
5	Suggest suitable materials for electronic applications.	1,2,4,6

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

MODULE 1: CRYSTAL STRUCTURE AND PHASE RULE	(9)

Basic Crystal Systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure.

Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule.

MODULE 2: POWDER METALLURGY, INORGANIC MATERIALS AND COMPOSITES.   (9)

Steel – Composition, types, heat-treatment, Abrasives – Classification, Properties, Uses - Refractories – Classification, Properties, Applications. Glasses – Properties, Types, Specialty glasses.

Composites - Introduction - Definition – Constituents – Classification - Fiber-reinforced Composites – Types and Applications.

Powder Metallurgy – Preparation of metal/alloy– Advantages and limitations.

MODULE 3: NANOMATERIALS AND MOLECULAR SIEVES   (9)

Introduction – Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** FE-SEM, TEM (Principle and Applications only).

Zeolite Molecular sieves – composition, structure, classification - applications – ion exchange, adsorption, separation, laundry, catalysis.

MODULE 4: MATERIALS FOR ELECTRONIC APPLICATONS   (9)

Liquid Crystals- Introduction – Characteristics – Classification- Thermotropic crystals- - Polymorphism in Thermotropic Liquid Crystals – Molecular arrangement in various states of Liquid Crystals, Lyotropic Liquid Crystals- Applications.

Conducting and Super conducting Organic electronic materials - Applications.

Engineering plastics: Polycarbonate – Properties and uses- Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications - Biodegradable Polymers, examples and applications.

MODULE 5: LUBRICANTS, ADHESIVES AND EXPLOSIVES   (9)

Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications). Explosives – Requisites, Classification, Precautions during storage – Rocket propellants – Requisites - Classification.

LAB / MINI PROJECT/FIELD WORK

NA

TEXT BOOKS

1.	P.C. Jain and Monicka Jain, Engineering Chemistry, Dhanpat Raj Publishing Company (P) Ltd, New Delhi – 2012
2.	Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co. Jalandar, 2004.
3.	Composite materials, K.K. Chawala, 3rd ed., (2012) Springer-Verlag, New York
4.	Nanocomposite Science and Technology, P. M. Ajayan, L. S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
5.	Mechanics and Analysis of Composite Materials, V.V. Vasiliev and E.V. Morozov, (2001), Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 lGB, UK.

E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2.	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf `

MOOC	
1.	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2.	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	PROFESSIONAL ENGLISH AND SOFT SKILLS			CREDITS	3
COURSE CODE	ELA4101	COURSE CATEGORY	HS	L-T-P-S	1- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Understand the importance of professional communication and applying the knowledge.	8,9,10
2	Integrate the knowledge of phonetics, enhancing the listening skills in formal and real-life situations, enhance pronunciation skills based on the knowledge of phonetics.	8,9,10
3	Construct appropriate sentences in English Language, applying grammatical rules and mastery in syntax. Develop reading skills and derive the contextual meaning, case studies and analyzing problems.	8,9,10
4	Integrate creativity in the writing skills both in formal and informal situations, related to environment, society and multidisciplinary environments.	8,9,10
5	Imbibe soft skills to excel in interpersonal skills essential for workplace.	8,9,10
Prerequisites : Plus Two English-Intermediate Level		
MODULE 1: THE ELEMENTS OF COMMUNICATION (9)		

Importance of communication through English -Process of communication and factors that influence speaking- Importance of audience and purpose- Principles of Communication-comparing general communication and business Communication-Professional Communication-barriers to communication – strategies to overcome communication barriers-formal and informal communication

Suggested Activities:

Self-introduction-short Conversations-Situational communication-dialogue writing -Language Functions-analyse the speech and comment-distinguish formal and informal style of communication-using bias-free language- news reports.

Suggested Reading:

- Rogerson, Trish Stott & Derek Utley.2011
- Elements of Effective Communication: 4th Edition, Plain and Precious Publishing, USA, by Randal S. Chase (Author), Wayne Shamo (Author)
- Effective Communication Skills, MTD Training & Ventus Publishing (e book)

MODULE 2: AURAL –ORAL COMMUNICATION IN ENGLISH   (9)

Vowels- diphthongs- consonants - International Phonetic Alphabet (IPA) ; phonemic transcription (simple words)-syllable division and word stress –enunciation-GIE script(General Indian English)- neutral accent-sentence rhythm and weak forms - contrastive stress in sentences to highlight different words - intonation varieties of Spoken English : Standard Indian, American and British-Speaking to Communicate-speech acts - Language Patterns

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible).

Suggested activities: (Audio CD) Listen and repeat, listen to the sentences and fill in the blanks, Listening to passages and answering questions, marking the stressed syllable, phonemic script of simple words, sentence rhythm and intonation (rising tone and falling tone), short speeches. Individual presentations-dynamics of a group discussion

Suggested sources:

Cambridge IELTS, Professional Speaking Skills by Aruna Koneru, Oxford Press, Face to face series Cambridge University Press, Speaking Effectively, Cambridge University Press, Jeremy Comfort, Pamela.

MODULE 3: GRAMMAR AND DEVELOPMENT OF READING SKILLS   (9)

Noun Phrase, Verb Phrase, Tense and Aspect, Articles, Pronouns and determiners, Sentence Pattern, interrogative and negative sentences-subject verb agreement -Vocabulary-word formation: prefixes and suffixes, reading passages-inductive vs deductive reading-newspaper articles- comprehension passages –cloze reading-annotating-editing

Suggested Activities:

Identify the errors in sentences, grammar exercises, book reviews, mini project on suggested reading activity - reading technical passages based on student's area of specialization answering questions-reading passage for identifying the contextual meaning

Suggested sources:

Skills for the TOEFL IBT Test, Collins IELTS, Cambridge books Practical English Usage by Michael Swan,

Cambridge University Press	

MODULE 4: EFFECTIVE WRITING AND BUSINESS COMMUNICATION (9)

Paragraph writing- topic sentence-connectives - process writing-Memoranda-Business letters-Resumes /Visumes and job applications-drafting a report-agenda and minutes of the meeting-ATR-project proposals-email etiquette- interpreting visual data (bar chart, pie chart, line graphs).

Suggested activities:

Writing short paragraph based on environment protection, societal issues, health, cultural contexts etc., identifying topic sentences, linking pairs of sentences, cause and effect exercises, formal letters, e mails, drafting project proposals, drafting agenda, minutes of the meeting

Suggested sources:

Cambridge Advanced English, Newspapers, library books, IELTS, IELTS Academic Writing 1, New Insights into IELTS, CUP.

MODULE 5: SOFT SKILLS (9)

Introducing Soft Skills &Life Skills- Myers Briggs Type Indicator – the Big Five Model Personality - Employability Skills- Workplace Etiquette- Professional Ethics -Time Management-Stress Management- Lateral Thinking (De Bono's Six Thinking Hats) and Problem Solving Skills

Suggested Activities:

Mock interviews, GD's, short oral presentation, lateral thinking puzzles, Case analysis and self-study assignments, Worksheet activities.

Suggested Sources:

Soft Skills and Employability Skills by Sabina Pillai and Agna Fernandez, Cambridge University Press, 2018.
Soft Skills for Everyone by Jeff Butterfield, Cengage Learning Education and personality development, K. Manoharan English for Life and the Workplace through the LSRW&T skills, Lateral Thinking skills by Edward De Bono.

TEXT BOOKS

1.	An Introduction to Profession English and Soft Skills with audio CD by Dr. Bikram K. Das et al. Published by Cambridge University Press, 2009.

REFERENCE BOOKS

1.	Sabina Pillai and Agna Fernandez,"Soft Skills & Employability Skills",Cambridge University Press 2018.
2.	Steve Hart et al."Embark, English for Undergraduates", Cambridge University Press, 2016
3.	Skills for the TOEFL IBT Test, Collins, 2012 edition
4.	Jeff Butterfield "Soft Skills for Everyone", Cengage Learning, 2010 edition
5.	Dolly John,"English for Life and the Workplace Through LSRW&T skills" Pearson Publications, 2014.
6.	Aruna Koneru,"Professional Speaking Skills",Oxford Publications, 2015
7.	The official Cambridge guide to IELTS for Academic and General Training, Cambridge University Press, 2014 edition.
8.	Cambridge BEC Vantage, Self-Study edition, Practice Tests, CUP, 2002

9.	English for Business Studies, 3rd edition, Ian Mackenzie, Cambridge University Press
10.	Education and Personality Development by Dr. P.K.Manoharan, APH Publishing Corporation, 2015
11.	Speaking Effectively by Jeremy Comfort et al, Cambridge University Press, 2011.

E BOOKS

1.	https://www.britishcouncil.in/english/courses-business
2.	http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3.	http://www.bbc.co.uk/learningenglish/english/
4.	http://www.antimoon.com/how/pronunc-soundsipa.htm
5.	http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/
6.	Oneshopenglish.com
7.	Breakingnews.com
8.	https://www.britishcouncil.in/english/courses-business

MOOC

1.	https://www.mooc-list.com/tags/english
2.	https://www.mooc-list.com/course/adventures-writing-stanford-online
3.	http://www.cambridgeenglish.org/learning-english/free-resources/mooc/

COURSE TITLE	ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN			CREDITS	3
COURSE CODE	MEA4101	COURSE CATEGORY	ES	L-T-P-S	1 -1- 2 -1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-5				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Understand drafting and computer aided drafting. Remember the commands used in AutoCAD to generate simple drawings.	1,2,5
2	Explain details in a drawing and apply the knowledge to solve simple problems involving straight lines, planes and solids.	1,2,5
3	Understand and Visualize solid objects and apply AutoCAD software commands to generate the graphic models.	1,2,5
4	Apply the 3D model commands to generate and solid object.	1,2,5
5	Apply the viewing AutoCAD commands to generate top view, front view and additional or sectional views.	1,2,5
6	Develop any graphical model of geometrical and simple mechanical objects in AutoCAD software.	1,2,3,5
Prerequisites: Nil		

MODULE 1: BASICS OF ENGINEERING GRAPHICS AND PLANE CURVES (12)

Importance of graphics - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - introduction to Computer Aided Drafting – Computer Hardware – Workstation – Printer and Plotter – Introduction to software for Computer Aided Design and Drafting – Exposure to Solid Modelling software – Geometrical Construction-Coordinate Systems/Basic Entities – 3D printer.

Self-Study: Solid modelling Software commands

MODULE 2: VISUALIZATION, ORTHOGRAPHIC PROJECTIONS AND FREE HAND SKETCHING (15)

Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three-Dimensional objects — Pictorial Projection methods - Layout of views- Free hand sketching of multiple views from pictorial views of objects. Drafting of simple Geometric Objects/Editing.

General principles of presentation of technical drawings as per BIS - Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Conversion to orthographic views from given pictorial views of objects, including dimensioning – Drafting of Orthographic views from Pictorial views.

Self-study: CAD software commands for sketching a drawing

MODULE 3: GEOMETRICAL MODELING ISOMETRIC VIEWS AND DEVELOPMENT OF SURFACES (15)

Principles of isometric projection and solid modelling. Isometric drawing - IsoPlanes and 3D Modelling commands. Projections of Principal Views from 3-D Models. Solid Modeling – Types of modelling - Wire frame model, Surface Model and Solid Model – Introduction to graphic software for solid modelling. Development of Surfaces.

Self-study: Surface modelling and solid modelling commands

MODULE 4: COMPUTER AIDED DESIGN AND DRAFTING (15)

Preparation of solid models of machine components like slide block, solid bearing block, bushed bearing, gland, wall bracket, guide bracket, shaft bracket, jig plate, shaft support (open type), vertical shaft support etc using appropriate modelling software.

2D views and sectional view, computer aided drafting and dimensioning. Generate 2D drawing from the 3D models – generate and develop the lateral surfaces of the objects. Presentation Techniques of Engineering Drawings – Title Blocks – Printing/Plotting the 2D/3D drawing using printer and printing solid object using 3D printer.

Self-study: CAD commands for modelling and   views generation

MODULE 5: SIMPLE DESIGN PROJECTS - COMPUTER AIDED DESIGN AND DRAFTING (15)

Creation of engineering models and their presentation in standard 2D form, 3D Wire-Frame and shaded solids, meshed topologies for engineering analysis, tool-path generation for component manufacture, geometric dimensioning and tolerancing. Use of solid-modelling software for creating associative models at the components and assembly levels in their respective branch of engineering like building floor plans that include: windows, doors, fixtures such as WC, Sink, shower, slide block, etc. Applying colour coding according to drawing practice.

Self-study: CAD commands for modelling and views generation

TEXT BOOKS	
1.	Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016.
REFERENCE BOOKS	
1.	Introduction to AutoCAD – 2D and 3D Design, A.Yarmwood, Newnes
2.	Engineering Drawing and Graphic Technology-International Edition, Thomas E.
3.	Engineering Drawing and Design, Sixth Edition, C. Jensen, J.D. Helsel, D.R.
4.	Technical Drawing-Fourteenth Edition, F. E. Giesecke, A. Mitchell, H. C.
5.	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry,
6.	Warren J. Luzadder and Jon. M. Duff, Fundamentals of Engineering Drawing,
E BOOKS	
1.	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-j-benjamin-pentex-free-ebook-pdf-download.html
2.	http://keralatechnologicaluniversity.blogspot.in/2015/06/engineering-graphics-p-i-varghese.html
MOOC	
1.	http://nptel.ac.in/courses/112103019/
2.	http://nptel.ac.in/courses/105104148/

COURSE TITLE	INTRODUCTION TO DIGITAL SYSTEMS			CREDITS	3
COURSE CODE	EEB4101	**COURSE CATEGORY**	ES	**L-T-P-S**	2- 0- 2- 1
CIA	60%			**ESE**	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able		
1	To understand basic operation in digital systems and instruments.	1,2,4,6
2	To gain knowledge on basic functioning of sensors and display units.	1,2,4,6
3	To familiarize the concepts of signal processing and converting elements.	1,2,4,6
4	To acquire the knowledge of microcontrollers and applications	1,2,4,6
5	To attain the basic concepts of consumer electronics and communication devices.	1,2,4,6

Prerequisites : Physics and Mathematics

MODULE 1: INTRODUCTION TO DIGITAL SYSTEMS	(12)

Analog& Digital signals - Need for digital instruments – Elements of digital instruments – Number systems: - Binary, Hexadecimal - Logic gates - Boolean algebra (Identities and Properties) - Digital controllers (ON-OFF).
Suggested Reading: Basics of number systems.
Applications: All digital systems in consumer and industrial electronics.
Lab: - (*To be done in Simulation environment*)
4.   Logic gates simulation

5. Boolean Identities and Property verification
6. Digital controller design

MODULE 2: SENSORS AND DISPLAYS (16)

Sensors and Transducers –Classification, Potentiometer, Strain Gauge, Piezoelectric Sensor, Linear Variable Differential Transformer, Resistance temperature detectors (RTD), Thermocouples, Tactile transducers - Displays: - Light Emitting Diode (including OLED) displays.

Suggested Reading: Primary sensing elements, introduction to displays.

Applications: Measurements and Instrumentation. **Lab**: - (*To be done in Simulation environment*)

6. Simulation of Sensor characteristics- potentiometer
7. Simulation of Sensor Characteristics-Strain Gauge
8. Simulation of Sensor characteristics-LVDT
9. Simulation of Sensor characteristics-RTD
10. Simulation of Sensor Characteristics-Thermocouple

MODULE – 3: SIGNAL CONDITIONING CIRCUITS (10)

D.C. Bridge- Unbalanced, Push-Pull configuration, Operational amplifiers- Inverting, Non-Inverting, Instrumentation Amplifier, Active filters: - Low pass, High pass - Analog to Digital Converter – Successive Approximation, Digital to Analog Converter - Weighted Resistor.

Suggested Reading: Basic network theorems.

Applications: Instrumentation **Lab**: - (To be done in Simulation environment)

5. Simulation of DC bridges
6. Operational amplifier applications
7. Active filter simulation
8. ADC- DAC simulation.

MODULE – 4 :INTRODUCTION TO MICRO CONTROLLERS (16)

Introduction: Memory types, peripheral devices- Microcontroller (8 bit), Architecture, Graphics Processing Unit (GPU) - Applications: -Interfacing of Digital Input/Output, Analogue Input/Output, Display. Introduction to Programmable Logic Controller (PLC) and PID (Proportional + Integral + Derivative) Controller.

Suggested Reading: Hobby electronics with Microcontroller interface.

Applications: Control system. **Lab**: - (To be done in Simulation environment)

6. PLC Ladder logic simulation.
7. Proportional controller simulation.
8. Proportional + Integral controller simulation.
9. Proportional + Derivative controller simulation.
10. Proportional +Integral + Derivative controller simulation.

MODULE 5 – CONSUMER ELECTRONICS AND COMMUNICATION SYSTEM (6)

Consumer Electronics: Television, Mobile Phones, Air conditioners, Refrigerators, Washing Machine. (Block diagram approach only.)

Communication System: Satellite communication, Global Positioning Systems, Global System for Mobile. (Block diagram approach only.)

Suggested Reading: Consumer Electronics User Manuals.

Applications: Home Appliances, Modern communication

LAB / MINI PROJECT/FIELD WORK

Field trip to consumer electronics industry.

TEXT BOOKS

1.	Digital Fundamentals, Thomas l. Floyd, 11th edition, Pearson 2014.
2.	Op-amps and Linear Integrated Circuits,Ramakant A. Gayakwad,4th edition, Prentice Hall, 2015.
3.	Electronic Instrumentation and Measurements, David A. Bell, Oxford University Press, 2013.
4.	The 8051 Microcontroller And Embedded Systems Using Assembly And C, Sepehr Naimi, Sarmad Naimi, Muhammad Ali Mazidi, Second edition, 2017.
5.	Programmable Logic Controllers, Frank D. Petruzella, McGraw-Hill Education, 2016.
REFERENCE BOOKS	
6.	Digital Logic and Computer Design, M. Morris Mano, Prentice-Hall, 2016
7.	Linear Integrated Circuits, Roy Choudhury, New Age International Publishers, 4th edition, 2011
8.	C and 8051, Thomas W. Schultz, Thomas W. Schultz Publishers, 4th edition,2008
9.	Consumer Electronics, S.P Bali, Pearson Education Asia Pvt., Ltd., 2008 Edition
10.	Global Mobile Satellite Communications Applications (For Maritime, Land and Aeronautical Applications Volume 2), 2nd edition, Springer, 2018
E BOOKS	
1.	http://www.ee.iitm.ac.in/~giri/pdfs/EE4140/textbook.pdf
2.	https://electronics.howstuffworks.com/home-audio-video-channel.htm
3.	http://nptel.ac.in/courses/106108099/Digital%20Systems.pdf
4.	http://nptel.ac.in/courses/112103174/pdf/mod2.pdf
5.	http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors %20and%20Microcontrollers/pdf/Teacher_Slides/mod3/M3L6.pdf
6.	http://nptel.ac.in/courses/108105063/pdf/L-09(SS)(IA&C)%20((EE)NPTEL).pdf
7.	http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro /ui/Course_home2_5.html

COURSE TITLE	ENGINEERING AND DESIGN			CREDIT	3
COURSE CODE	CSB4101	COURSE CATEGORY	ES	L-T-P-S	2- 0- 2 -1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Appreciate the different elements involved in good designs and to apply them in practice when called for.				1,2,5,12
2	Be aware of the product oriented and user-oriented aspects that make the design a success.				1,2,5,12
3	Think of innovative designs incorporating different segments of knowledge gained in the course				1,2,5,12
4	Have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.				1,2,5,12
5	Learn economic and environmental Issues, trade aspects and IPR				1,2,5,12
Prerequisites : Nil					
MODULE 1: INTRODUCTION					**(9)**

Design and its objectives; Design constraints, Design functions, Design means and Design from; Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. Design form, function and strength; How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey-customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

Project: An Exercise in the process of design initiation. A simple problem is to be taken up to examine different solutions- Ceiling fan, Group Presentation and discussion**.**

MODULE 2: PROCESSES IN DESIGN	(9)

Design process- Different stages in design and their significance; Defining the design space; Analogies and "thinking outside of the box"; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of "Complex is Simple". Design for function and strength.

Design detailing- Material selection, Design visualization- Solid modelling; Detailed 2D drawings; Tolerance; Use of standard items in design; Research needs in design; Energy needs of the design, both in its realization and in the applications.

Project: An exercise in the detailed design of any two products.

MODULE 3: PROTOTYPING	(9)

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis.

Engineering the design – From prototype to product. Planning; Scheduling; Supply chains; inventory; handling; manufacturing/construction operations; storage; packaging; shipping; marketing; feed-back on design

Project: List out the standards organizations. Prepare a list of standard items used in any engineering specialization. Develop any design with over 50% standard items as parts.

MODULE 4: QUALITY ASPECTS	(9)

Design for "X"; covering quality, reliability, safety, manufacturing/construction, assembly, maintenance, logistics, handling; disassembly; recycling; re-engineering etc.

Project: Example: List out the design requirements(x) for designing a rocket shell of 3-meter diameter and 8-meter length. Design mineral water bottles that could be packed compactly for transportation.

MODULE 5: USER CENTRED DESIGNS	(9)

Product centered and user centered design. Product centered attributes and user centered attributes. Bringing the two closer. Example: Smart phone. Aesthetics and ergonomics. Value engineering, Concurrent engineering, Reverse engineering in design; Culture based design; Architectural designs; Motifs and cultural background; Tradition and design; Study the evolution of Wet grinders; Printed motifs; Role of colours in design. Make sharp corners and change them to smooth curves-check the acceptance. Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks; product liability. Group presentation of any such products covering all aspects that could make or mar it.

Project: Examine the possibility of value addition for an existing product.

TEXT BOOKS

1.	Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27], ISBN13: 978-0124158917 ISBN-10: 0124158919

2.	Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction - Wiley, ISBN-978-1-118-32458-5
3.	Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996, XI, 489 p. ISBN 978-94-011-3985-4 Springer
4.	Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning, ISBN-13: 978-0-495-66816-9
5.	Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007, XXI, 617p., ISBN 978-1-84628-319-2
6.	Voland, G., Engineering by Design, ISBN 978-93-325-3505-3, Pearson India

COURSE TITLE	SUSTAINABLE ENGINEERING SYSTEMS (Common to ALL Branches of Engineering)			CREDITS	2
COURSE CODE	GEA4102	COURSE CATEGORY	BS	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Articulate the technical and economic fundamentals of key existing and emerging sustainable technologies.				1,2,6,7
2	Demonstrate how the economic and technical performance of various technologies can be measured and compared.				1,2,3,6,7
3	Identify the technical, economic, and social obstacles to the implementation of sustainable technologies.				1,2,6,7
4	Choose social, environmental, and economic metrics to assess sustainable technologies for long-term promise and commercialization.				1,2,6,7
5	Develop a realistic scenario for sustainable technology implementation at a specific location or facility.				1,2,3,6,7
Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.					
MODULE 1: PRINCIPLES OF SUSTAINABLE SYSTEMS					(5)
Sustainability Definitions - Principles of Sustainable Design, Sustainable Engineering -Frameworks for Applying Sustainability Principles - Summary & Activities.					
MODULE 2: TECHNOLOGY DEVELOPMENT AND LIFECYCLE ASSESSMENT					(5)

Technology as a part of anthropogenic environment - Technology readiness levels (TRL) – technical metrics - Emerging, converging, disruptive technologies - Life Cycle Assessment (LCA) methodology - Summary & Activities.

MODULE 3: GREEN ENGINEERING	(5)

Principles of Green Engineering - Frameworks for assessment of alternatives - Green Engineering examples - Multifunctional Materials and Their Impact on Sustainability - Summary & Activities.

MODULE 4: RESOURCE MANAGEMENT TECHNOLOGIES	(5)

Waste management purpose and strategies - Recycling: open-loop versus closed-loop thinking - Recycling efficiency - Management of food waste and composting technologies - E-waste stream management - Reuse and redistribution programs - LCA approach to waste management systems - Summary and Activities.

MODULE 5: SUSTAINABLE WATER AND WASTEWATER SYSTEMS	(5)

Water cycle - Water conservation and protection technologies - Water treatment systems Metrics for assessment of water management technologies-Summary & Activities.

MODULE 6 - BEHAVIORAL ASPECTS AND FEEDBACKS	(5)

Collaborative Decision Making - Role of Community and Social Networking - Human Factor in Sustainability Paradigm - Summary & Activities.

TEXT BOOKS	
1.	Vanek, F.M., and L.D. Albright, Energy Systems Engineering. Evaluation and Implementation, McGraw Hill, 2008.
2.	C.U. Becker, Sustainability Ethics and Sustainability Research, Springer 2012.
3.	J.B. Guinee et al., Life Cycle Assessment: Past, Present, and Future, Environ. Sci. Technol., 2011, 45, 90-96.
4.	Anastas, P.T., Zimmerman, J.B., Innovations in Green Chemistry and Green Engineering, Springer 2013.
5.	Solid Waste Technology & Management, Volume 1 & 2, Christensen, T., Ed., Wiley and Sons., 2010.
6.	Sterman, J.D., in Sustainability Science: The Emerging Paradigm, Weinstein, M.P. and Turner, R.E. (Eds.), Springer Science+Business Media, LLC 2012.

E BOOKS	
1.	David T. Allen, David R. Shonnard, Sustainable Engineering Concepts, Design and Case Studies, Pearson Education, December 2011. (ISBN: 9780132756587)
2.	Gerald Jonker Jan Harmsen, Engineering for Sustainability 1st Edition, A Practical Guide for Sustainable Design, Elsvier 2012. (ISBN: 9780444538475).

MOOC	
1.	https://www.coursera.org/learn/sustainability
2.	https://www.academiccourses.com/Certificate/Sustainability-Studies/India/
3.	https://onlinecourses.nptel.ac.in/noc18_ce08/preview
4.	https://www.coursera.org/learn/ecosystem-services

COURSE TITLE	PYTHON FOR DATA SCIENCE			CREDITS	4
COURSE CODE	CSB4119	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Identify the need for data science and solve basic problems using Python built-in data types and their methods.				1,2,5
2	Design an application with user-defined modules and packages using OOP concept				1,2,3,5,12
3	Employ efficient storage and data operations using NumPy arrays.				1,2,5,12
4	Apply powerful data manipulations using Pandas.				1,2,5,12
5	Do data preprocessing and visualization using Pandas				1,2,3,5,12

Prerequisites: Basic Programming Knowledge

MODULE 1: INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING	(9L+6P)

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators.

Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.

Practical Component:
1. Implement basic Python programs for reading input from console.
2. Perform Creation, indexing, slicing, concatenation and repetition operations on Python built-in data types: Strings, List, Tuples, Dictionary, Set
3. Solve problems using decision and looping statements.
4. Apply Python built-in data types: Strings, List, Tuples, Dictionary, Set and their methods to solve any given problem
5. Handle numerical operations using math and random number functions
6. Create user-defined functions with different types of function arguments.

MODULE 2: FILE, EXCEPTION HANDLING AND OOP	(9L+6P)

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling.

OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

Practical Component:
1. Create packages and import modules from packages.
2. Perform File manipulations- open, close, read, write, append and copy from one file to another.
3. Handle Exceptions using Python Built-in Exceptions

4. Solve problems using Class declaration and Object creation.
5. Implement OOP concepts like Data hiding and Data Abstraction.
6. Solve any real-time problem using inheritance concept.

MODULE 3: INTRODUCTION TO NUMPY   (9L+6P)

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes.

Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting-Unique and Other Set Logic.

Practical Component:

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.

2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.

3. Computation on NumPy arrays using Universal Functions and Mathematical methods.

4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.

5. Load an image file and do crop and flip operation using NumPy Indexing.

MODULE 4: DATA MANIPULATION WITH PANDAS   (9L+6P)

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries-Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.

Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.

Practical Component:

1. Create Pandas Series and DataFrame from various inputs.

2. Import any CSV file to Pandas DataFrame and perform the following:
   (a) Visualize the first and last 10 records
   (b) Get the shape, index and column details
   (c) Select/Delete the records(rows)/columns based on conditions.
   (d) Perform ranking and sorting operations.
   (e) Do required statistical operations on the given columns.
   (f) Find the count and uniqueness of the given categorical values.
   (g) Rename single/multiple columns.

MODULE 5:DATA CLEANING PREPARATION AND VISUALIZATION   (9L+6P)

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas.

Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Practical Component:

1.Import any CSV file to Pandas DataFrame and perform the following:
   (a) Handle missing data by detecting and dropping/ filling missing values.
   (b) Transform data using apply() and map() method.
   (c) Detect and filter outliers.

(d) Perform Vectorized String operations on Pandas Series.

(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

TEXT BOOKS

1.	Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
3.	Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

REFERENCE BOOKS

1.	Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2.	Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

E BOOKS

1.	https://www.programmer-books.com/introducing-data-science-pdf/
2.	https://www.cs.uky.edu/~keen/115/Haltermanpythonbook.pdf
3.	http://math.ecnu.edu.cn/~lfzhou/seminar/[Joel_Grus]_Data_Science_from_Scratch_First_Princ.pdf

MOOC

1.	https://www.edx.org/course/python-basics-for-data-science
2.	https://www.edx.org/course/analyzing-data-with-python
3.	https://www.coursera.org/learn/python-plotting?specialization=data-science-python

COURSE TITLE	DATA STRUCTURES			CREDITS	4
COURSE CODE	CSB4120	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Implement abstract data types for linear data structures.	1,2,4,12
2	Apply the different linear and non-linear data structures to problem solutions.	1,2,3
3	Solve problems by applying suitable data structures with the algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.	1,2,3
4	Define graphs and illustrate graph traversals	1,2,3
5	Analyze the various sorting algorithms.	1,2,3

Prerequisites: C Programming Language

MODULE 1: INTRODUCTION TO DATA STRUCTURES	(9L+6P)

Introduction to Data Structures – Fundamental Elements – Asymptotic Notations: Big-Oh, Omega and Theta – Best, Worst and Average case Analysis: Definition and an example -Arrays and its

representations – 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).

Practical Component:

1. Design, develop and execute a program in C to implement singly linked list where each node consists of integers. The program should support following functions.

    a. Create a singly linked list

    b. Insert a new node

    c. Delete a node if it is found, otherwise display appropriate message

    d. Display the nodes of singly linked list

2. Design, develop and execute a program in C to implement doubly linked list where each node consists of integers. The program should support following functions.

    a. Create a doubly linked list

    b. Insert a new node

    c. Delete a node if it is found, otherwise display appropriate message

    d. Display the nodes of doubly linked list

MODULE 2: LINEAR DATA STRUCTURES	(9L+6P)

Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

Practical Component:

1.Write a C program for implementation of stack using array or pointers

2. Write a C program for implementation of queue using array or pointers

3. Write a C program for implementation of circular queue using array or pointers

4. Design, develop and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The operators are +(add), -(subtract), *(multiply), /(divide)

5. Using array representation for a polynomial, design, develop and execute a program in C to add two polynomials and then print the resulting polynomial.

MODULE 3: NON LINEAR DATA STRUCTURES	(9L+6P)

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap.

Practical Component:

1.Write a program in C to construct binary tree and binary tree traversal

2. Programs to implement the various operations on AVL Tree

3. Design, develop and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to heap. Use the array representation of heap. Display the array at the end of insertion phase.

MODULE 4: GRAPHS AND APPLICATIONS OF GRAPHS	(9L+6P)

Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

Practical Component:

1. Construct a Minimum spanning Tree using Prim's and Kruskal's algorithm.
2. Construct the shortest path in a graph using Dijkstra's algorithm.

MODULE 5: Searching and Sorting	(9L+6P)

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

Practical Component:

1. Create a binary search tree of integers and display the integers in ascending order using a traversal algorithm.
2. Write a Program to implement hash table using linear and quadratic probing
3. Write a C program to apply the sorting techniques

TEXT BOOKS	
1.	Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C",2nd edition,2015.
2.	Mark Allen Weiss, —Data Structures and Algorithm Analysis in C‖, 2nd Edition, Pearson Education,1997.
3.	Reema Thareja, —Data Structures Using C‖, Second Edition , Oxford University Press, 2011
REFERENCE BOOKS	
1.	Y. Langsam, M. J. Augenstein and A. M. Tanenbaum, —Data Structures using C, Pearson Education Asia, 2004.
2.	Seymour Lipschutz, "Data Structures with C", McGraw Hill Education, Special Indian Edition, 2014
3.	R.F.Gilberg, B.A.Forouzan, "Data Structures", Second Edition, Thomson India Edition, 2005.
E BOOKS	
1.	https://courses.csail.mit.edu/6.851/spring12/scribe/lec12.pdf (Fusion Data Structures)
MOOC	
1.	https://nptel.ac.in/courses/106102064/
2.	https://www.udemy.com/algorithm/

COURSE TITLE	ENGINEERING IMMERSION LAB				CREDIT	0.5
COURSE CODE	GEA4131	COURSE CATEGORY		BS	L-T-P-S	0-0-2-2
CIA	80%				ESE	20%
LEARNING LEVEL	BTL-3					
CO	COURSE OUTCOMES					PO

	Upon completion of this course, students will be able to	
1	Identify and use the tools, accessories and perform troubleshooting	1,2,4,5,12
2	Perform software installations, assembling, fabrication techniques.	1,2,4,5,12

SLOT X - LIST OF EXPERIMENTS

I. MECHANICAL ENGINEERING WORKSHOP
5. Welding: Arc welding: Butt joints
6. Lap joints.
7. Machining: Facing
8. Turning

II. AUTOMOBILE ENGINEERING
5. Dismantling and Studying of two stroke gasoline engine.
6. Assembling of two stroke gasoline engine.
7. Dismantling and Studying of four stroke gasoline engine
8. Assembling of four stroke gasoline engine.

III. AERONAUTICAL ENGINEERING
5. Study of Flow Pattern around Various Objects.
6. Force measurement on Aircraft Model
7. Determination of Young's Modulus for Aluminum Cantilever Beam
8. Binary Addition & Subtraction using Microprocessor

IV. CIVIL ENGINEERING
5. Plumbing- Basic Pipe Connection using valves, couplings and elbows.
6. Carpentry – Sowing, Planning and making common Joints.
7. Bar Bending
8. Construction of a 50 cm height brick wall without mortar using English Bond.

SLOT X - LIST OF EXPERIMENTS

V.ELECTRICAL ENGINEERING
5. Study of tools and accessories.
6. Study of cables.
7. Staircase wiring, Tube light and Fan connection.
8. Measurement of energy using single phase energy meter.

VI. ELECTRONICS ENGINEERING
5. Study of Active and Passive Components.
6. Study of Logic Circuits.
7. Making simple circuit using Electronic Components.
8. Measuring of parameters for signal using CRO.

VII. COMPUTER SCIENCE
5. Troubleshooting different parts of the computer peripherals, Monitor, Keyboard & CPU.
6. Installation of various operating systems, their capabilities, Windows, Unix, Linux.
7. Installation of commonly used software like MS Office
8. Assembling digital computer.

VIII. MECHATRONICS ENGINEERING
5. Study of Key Elements of Mechatronics Systems
6. Sensors – Load Cell, Thermocouple
7. Actuators – Linear & Rotary Actuators
8. Interfacing & Measurements – Virtual Instrumentation

REFERENCE BOOKS	
1	Jeyapoovan T and Saravanapandian M., Engineering practices lab manual, 4th Edition, Vikas publishing House, New Delhi, 2015.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid, CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2011
4	Robert Quesada, Jeyapoovan T., Computer Numerical Control Machining and Turning Centers, Pearson Education, New Delhi, 2006

METHOD OF ALLOCATION FOR ENGINEERING IMMERSION LAB

SLOT X : MECH, AERO, AUTO, CIVIL EXPERIMENTS

SLOT Y : EEE, ELECTRONICS, CSE, MECHATRONICS EXPERIMENTS

➤ EVERY CLASS OF
- GROUP A (AERO, AUTO, MECH, MCT, CHEM, BIO, CIVIL
- GROUP B (CSE, IT, ECE, EEE, AEROSPACE)

GETS DIVIDED INTO 4 SUB - GROUPS NAMELY a, b, c, d -- EACH CONSISTING OF 15 TO 20 STUDENTS MAX.

➤ FOR EXAMPLE: **GROUP A STUDENTS WILL OCCUPY SLOT X**
- WEEK 1 : SLOT X ---
  - ✓ a – MECH; b – AUTO; c – AERO ; d – CIVIL
- WEEK 2 : SLOT X ---
  - ✓ b – MECH; c – AUTO; d – AERO ; a – CIVIL

➤ THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

➤ **GROUP B STUDENTS WILL OCCUPY SLOT Y**
- WEEK 1 : SLOT Y ---
  - ✓ a – EEE; b – ECE; c – CSE ; d – MCT
- WEEK 2 : SLOT Y ---
  - ✓ b – EEE; c – ECE; d – CSE ; a – MCT

➤ THE ABOVE SCHEDULE WILL BE ON ROTATION EVERY MONTH (ONE CYLCE PER MONTH)

COURSE TITLE	ENGINEERING PHYSICS LAB (Common to all engineering branches)			CREDIT	1
COURSE CODE	PHA4131	COURSE CATEGORY	BS	L-T-P-S	0-0-2-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES			PO	
Upon completion of this course, the students will be able to					
1	Analyze material's elastic properties.			1,2,3,4	
2	Determine thermal conductivity of bad conductor.			1,2,3,4	
	Measure coefficient of viscosity of liquids.			1,2,3,4	
	Determine wavelength of laser.			1,2,3,4	
	Describe V-I characteristics of diode.			1,2,3,4	

Prerequisites: Knowledge in basic physics practical at higher secondary level.

List of Experiments (Any Five Experiments)
10.   Torsional Pendulum – Determination of rigidity modulus of the material of a wire.
11.   Non-Uniform Bending – Determination of Young's Modulus.
12.   Uniform Bending – Determination of Young's Modulus.
13.   Viscosity – Determination of co-efficient of viscosity of a liquid by Poiseuille's flow.
14.   Lee's Disc – Determination of thermal conductivity of a bad conductor.
15.   Air – Wedge – Determination of thickness of a thin wire
16.   Spectrometer – refractive index of a prism
17.   Semiconductor laser – Determination of wavelength of laser using grating
18.   Semiconductor diode – VI characteristics

TEXT BOOK
1.   P. Mani, engineering Physics Practicals, Dhanam Publications, Chennai, 2005

REFERENCE BOOKS
1. Glenn V.Lo, Jesus Urrechaga - Aituna, Introductory Physics Laboratory Manual, Part-I, Fall 2005 Edition.
2. P. Kulkarni, Experiments in Engineering Physics Bachelor of Engineering and Technology, Edition 2015

E BOOK
1.   http://www.aurora.ac.in/images/pdf/departments/humanities-and-sciences/engg-phy-lab-manual.pdf

COURSE TITLE	MATERIALS CHEMISTRY LAB (Common to ALL branches of Engineering)			CREDITS	1
COURSE CODE	CYA4131	**COURSE CATEGORY**	BS	**L-T-P-S**	0-0-2-0
CIA	80%			**ESE**	20%
LEARNING LEVEL	BTL-3				
CO	**COURSE OUTCOMES**				**PO**
Upon completion of this course, the students will be able to					
1	Characterize basic properties of refractory ceramics				1,2,4,6
2	Prepare resins and composites.				1,2,4,6
3	Estimate metal ions present in samples using instrumental techniques.				1,2,4,6
4	Develop adsorption isotherm.				1,2,4,6
5	Find properties of lubricants and other oil samples.				1,2,4,6
Prerequisites: Knowledge in basic chemistry practical at higher secondary level.					
LAB / MINI PROJECT/FIELD WORK					

1. Construction of Phenol-Water Phase diagram.
2. Determination of viscosity of polymer using Ostwald Viscometer.
3. Preparation of urea-formaldehyde resin.
4. Determination of porosity of a refractory.
5. Determination of Apparent Density of porous solids.
6. Determination of Viscosity Index of lubricants.
7. Estimation of dye content in the effluent by UV-Visible spectrophotometry.
8. Determination of viscosity of oil using Red-Wood Viscometer.
9. Determination of Copper / iron content in the alloy by colorimetry.
10. Estimation of sodium and potassium ions by Flame Photometry.
11. Verification of Beer-Lambert's law using gold nanoparticles.
12. Dpythetermination of adsorption isotherm for acetic acid on activated charcoal.

REFERENCE BOOKS	
1.	J. Mendham, R.C. Denney, J.D. Barnes and N.J.K. Thomas, Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2009
2.	D.P. Shoemaker and C.W. Garland, Experiments in Physical Chemistry, 8th edition, McGraw Hill, London, 2008
3.	S. Sumathi, Laboratory work book for Engineering Chemistry Practical, 2015
4.	Laboratory Manual of Testing Materials, William Kendrick Hatt and Herbert Henry Scofield, Andesite Press, 2017
E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
MOOC	
1.	https://ocw.mit.edu/courses/chemistry/5-111-principles-of-chemical-science-fall-2008/video-lectures/lecture-32/
2.	https://www.coursetalk.com/providers/coursera/courses/introduction-to-chemistry-1

SEMESTER III

COURSE TITLE	APPLIED LINEAR ALGEBRA			CREDITS	4
COURSE CODE	MAA4202	COURSE CATEGORY	PC	L-T-P-C	3-1-0-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					

1	Use computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces (Computational and Algebraic Skills)	1,2
2	Use visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in R2 and R3 , as well as conceptually extend these results to higher dimensions. (Geometric Skills)	1,2,5,12
3	Critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra. (Proof and Reasoning)	1,2,3,5,12
4	Use technology, where appropriate, to enhance and facilitate mathematical understanding, as well as an aid in solving problems and presenting solutions (Technological Skills).	1,2,5,12
5	Communicate and understand mathematical statements, ideas and results, both verbally and in writing, with the correct use of mathematical definitions, terminology and symbolism (Communication Skills)	1,2,3,5,12

Prerequisites: -

MODULE 1: VECTOR SPACES (12)

Introduction - Definitions and Examples of a Vector Space - Subspace - Linear Dependence and Independence.

MODULE 2: BASIS AND DIMENSION (12)

Definition of Basis and Dimension -Vector Space as a Direct Sum of Subspaces - Null Space and Range Space – Rank – Nullity- Sylvester's Inequality.

MODULE 3: INNER PRODUCT SPACES (12)

Definitions-examples and properties - Norm as length of a vector- Distance between two vectors- Orthonormal basis-Orthonormal projection-Gram Schmidt processes of orthogonalization.

MODULE 4 : LINEAR TRANSFORMATIONS (12)

Definitions and examples-Properties of linear transformations- Equality of linear transformations- Kernel and Rank of linear transformations-Composite transformations.

MODULE 5: MATRIX LINEAR TRANSFORMATIONS (12)

Inverse of a linear transformation- Matrix of a linear transformation- Matrix of the sum of two linear transformations and a scalar multiple of a linear transformation -Matrix of composite linear transformation -Matrix of inverse transformation -Change of basis-Similar matrices.

TEXT BOOKS

| 1. | Matrix and Linear Algebra aided with MATLAB, Kanti Bhushan Datta, PHI Learning Pvt.Ltd, New Delhi(2009). |

REFERENCE BOOKS

| 1. | Howard Anton, Chris Rorres., Elementary Linear Algebra, John Wiley and Sons, Inc. |
| 2. | K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India, New Delhi |

3.	S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New Yark.

COURSE TITLE	DESIGN AND ANALYSIS OF ALGORITHMS			CREDITS	4
COURSE CODE	CSB4201	COURSE CATEGORY	PC	L-T-P-S	2- 1- 2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Use the asymptotic notations to analyze worst-case and average case running times of algorithms	1,2,4,12
2	Identify the limitations of algorithms in problem solving.	1,2,3,4
3	Describe the various algorithmic techniques and its real time applications.	1,2,3,4
4	Solve the real word problems using graphs.	1,2,3,4
5	Determine an efficient algorithm for NP hard problems.	1,2,3,4,10,11

Prerequisites: C Programming and Data Structures

MODULE 1: INTRODUCTION   (9L+6P)

Introduction and motivation-Input size, worst case, average case. Quantitative efficiency Big O, Big omega and Big Theta-Basic Efficiency classes. Recurrences-The substitution method -The recursion-tree method, and Master method.

Practical Component:
1. Calculate complexity of algorithms using step count method.
2. Solve the recurrences using three different methods a) substitution method, b) recursion tree, c) master method

MODULE 2: BRUTE FORCE AND DIVIDE-AND-CONQUER   (9L+6P)

Brute Force: - Travelling Salesman Problem - Knapsack Problem - Assignment Problem - Divide and Conquer Approach: - Binary Search - Quick Sort - Merge Sort.
Practical Component:
1. Solve problems using brute force approach and analyze its complexity
2. Solve problems using divide and conquer approach and analyze its complexity

MODULE 3: GREEDY APPROACH AND DYNAMIC PROGRAMMING   (9L+6P)

Greedy Approach: - An activity-selection problem, Huffman codes. Dynamic Programming:– Matrix-chain multiplication-- Optimal Binary Search Algorithms
Practical Component:
1. Solve problem using Greedy approach and analyze its complexity
2. Solve problem using dynamic programming approach and analyze its complexity

MODULE 4: GRAPH ALGORITHMS   (9L+6P)

Representing Graphs-Breadth First Search (BFS)-Depth First Search (DFS)- Single source shortest-path-Dijkstra's algorithm-All pair shortest-path algorithm- Floyds and Warshalls algorithm -Minimum cost spanning tree Prim's algorithm-and Kruskal's algorithm.

Practical Component:
1. Implement Single source shortest path algorithm and Analyze its complexity
2. Implement All source shortest path algorithm and Analyze its complexity
3. Implement Minimum spanning tree algorithm and analyze its complexity

MODULE 5: BACKTRACKING AND APPROXIMATION ALGORITHMS	(9L+6P)

Backtracking: - 8 Queens - Hamiltonian Circuit Problem - Branch and Bound - Assignment Problem - Knapsack Problem: Intractability: NP completeness-Approximation algorithms for NP-hard problems – Travelling salesman problem – Knapsack problem

Practical Component:
1. Implement Approximation algorithms for Traveling salesman problem and analyze its complexity
2. Implement Approximation algorithms for Knapsack problem and analyze its complexity

Suggested reading:

https://www.edutechlearners.com/design-analysis-algorithms.

TEXT BOOKS	
1.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.

REFERENCE BOOKS	
1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms",Third Edition, Pearson Education,2017.
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. Steven S. Skiena, "The Algorithm Design Manual", Second Edition, Springer, 2008.

COURSE TITLE	DATABASE MANAGEMENT SYSTEMS			CREDITS	3
COURSE CODE	CSB4202	COURSE CATEGORY	PC	L-T-P-S	3- 0-0- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					

1	Recall the basic concepts of database systems.	1,2,12
2	Identify the SQL queries for a given scenario.	1,2,4,12
3	Illustrate relational database theory, and be able to write relational algebra expressions for queries.	1,2,3,4,12
4	Summarize the various data storage devices and types of indexes.	1,2,12
5	Demonstrate transaction processing and concurrency control.	1,2,4,12
6	Explain Object oriented dB, Distributed dB, XML, data warehousing and Mobile database.	1,2,12

Prerequisites: Nil

MODULE 1: INTRODUCTION AND CONCEPTUAL MODELING　　　　　　　(9)

Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.

MODULE 2: RELATIONAL MODEL　　　　　　　　　　　　　　　(9)

SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependencies and Normalization for Relational Databases (up to BCNF).

MODULE 3: DATA STORAGE AND QUERY PROCESSING　　　　　　(9)

Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+Tree – Query Processing.

MODULE 4: TRANSACTION MANAGEMENT　　　　　　　　　(9)

Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Recovery Techniques.

MODULE 5: CURRENT TRENDS　　　　　　　　　　　　　　(9)

Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Distributed data Storage – Querying and Transformation. – Data Mining and Data Warehousing and Mobile Database.

TEXT BOOKS

1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan- —Database System Concepts‖, Sixth Edition, McGraw-Hill, 2011.

REFERENCE BOOKS

1.	Ramez Elmasri and Shamkant B. Navathe, —Fundamental Database Systems‖, Seventh Edition, Pearson Education,2016.
2.	Raghu Ramakrishnan, —Database Management System, Tata McGraw-Hill Publishing Company, Third Edition, 2014.
3.	Jiawei Han, Micheline Kamber, Jian Pei -Data Mining Concepts and Techniques, Morgan Kaufmann, Third Edition, 2012.

E BOOKS

1.	https://ff.tu-

	sofia.bg/~bogi/knigi/BD/Database%20Management%20Systems.%202nd%20Ed.pdf
MOOC	
1.	https://www.udemy.com/database-management-system/
2.	https://www.edx.org/course/database-systems-concepts-design-gtx-cs6400x-1

COURSE TITLE	COMPUTER ARCHITECTURE			CREDITS	4
COURSE CODE	**CSB4204**	**COURSE CATEGORY**	PC	**L-T-P-S**	**3-0-2-0**
CIA	**50%**			**ESE**	**50%**
LEARNING LEVEL	BTL -2				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Recall the basic structure and operation of a computer system.	1,2
2	Familiarize with arithmetic and logic unit and implementation of different arithmetic operations.	1,2
3	Explain the concept of pipelining and parallelism.	1,2
4	Know the difference between Cache and Virtual memory and related performance issues.	1,2
5	Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.	1,2

Prerequisites: Nil

MODULE 1: INTRODUCTION	(9)

Eight ideas – Components of a computer system – Technology – Performance – Power wall – Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions– Addressing and addressing modes.

Practical Component: Installation and demonstration of CPU/OS simulator

ALP Programs using immediate/direct/indirect/ register indirect addressing modes

MODULE 2: ARITHMETIC FOR COMPUTERS	(9)

ALU - Integer Addition, Integer Subtraction, Dealing/ Detecting with Overflow - Designing ALU for MIPS, Multiplication- Multiply Algorithm- Optimized Multiplier- Faster Multiplier, Division- Divide Algorithm- Optimized Divider – Floating Point operations- Standard- IEEE Floating-Point Format.

Practical Component: Addition and subtraction of binary numbers, multiplication (Booth Algorithm) and division (Restoration Method) of binary numbers.

MODULE 3: MIPS & PIPELINING	(9)

Basic MIPS implementation – Building data path – Control Implementation scheme – Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards – Exceptions.

Practical Component: Simulation of pipelining using web-based MIPS simulation environment

MODULE 4 - INSTRUCTION-LEVEL PARALLELISM	(9)

Instruction-level-parallelism – Parallel processing challenges – Flynn's classification – Hardware Multithreading – Multicore processors.

Practical Component: Execution and working of Multithreading programming concepts relating it to Computer Architecture.

MODULE 5 – MEMORY AND I/O	(9)

Memory hierarchy - Cache Memory - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

Practical Component: Implementation of Associative Mapping, set associative mapping and Direct Mapping Using CPU/OS

TEXT BOOKS	
1.	David A. Patterson and John L. Hennessy, "Computer organization and design', Morgan Kaufmann / Elsevier, Fifth edition,

REFERENCE BOOKS	
1.	William Stallings, "Computer Organization and Architecture", Tenth Edition, Pearson Education, 2016.
2.	V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization", VI th edition, Mc Graw-Hill Inc, 2012.
3.	Vincent P. Heuring, Harry F. Jordan, "Computer System Architecture", Second Edition, Pearson Education, 2005.

E BOOKS	
1.	https://sites.google.com/site/uopcog/ebooks
2.	https://inspirit.net.in/books/academic/Computer%20Organisation%20and%20Architecture%208e%20by%20William%20Stallings.pdf

MOOC	
1.	http://nptel.ac.in/courses/106102062/
2.	http://nptel.ac.in/courses/106103068/

COURSE TITLE	R FOR DATA SCIENCE				CREDITS	3
COURSE CODE	CSB4205	COURSE CATEGORY	PC	L-T-P-S	2-0-2-1	
CIA	60%			ESE	40%	
LEARNING LEVEL	BTL-3					
CO	COURSE OUTCOMES				PO	
Upon completion of this course, the students will be able to						

1	Identify and execute basic syntax and programs in R.	1,2,3,12
2	Perform the Matrix operations using R built in functions	1,2,3,4,5,12
3	Apply non numeric values in vectors	1,2,3,4,5,12
4	Create the list and data frames	1,2,3,4,5,12
5	Exploit the graph using ggplot2.	1,2,3,4,5,12

Prerequisites: Statistics

MODULE 1: Overview of R   (6L+6P)

History and Overview of R- Basic Features of R-Design of the R System- Installation of R- Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation- Saving Work and Exiting R- Conventions- R for Basic Math- Arithmetic- Logarithms and Exponentials- E-Notation- Assigning Objects- Vectors- Creating a Vector- Sequences, Repetition, Sorting, and Lengths- Subsetting and Element Extraction- Vector-Oriented Behavior

Practical Component:

Develop the R program for Basic Mathematical computation –

MODULE 2:   MATRICES AND ARRAYS   (6L+6P)

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions- Subsetting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication- Matrix Inversion-Multidimensional Arrays- Subsets, Extractions, and Replacements

Practical Component:

Create and manipulate data stored in arrays and matrices.

MODULE 3: NON-NUMERIC VALUES   (6L+6P)

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences- Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting

Practical Component:

To carry out exercises with non-numeric data present the findings with inferences.

MODULE 4: LISTS AND DATA FRAMES   (6L+6P)

Lists of Objects-Component Access-Naming-Nesting-Data Frames-Adding Data Columns and Combining Data Frames-Logical Record Subsets-Some Special Values-Infinity-NaN-NA-NULL-Attributes-Object-Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions-

Practical Component:

To create and process data using lists and frames.

MODULE 5:   BASIC PLOTTING   (6L+6P)

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an Existing Plot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms-- READING AND WRITING FILES- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations

Practical Component:

To create simple applications by connecting to data sources and generate different types of graphical representations.	

TEXT BOOKS	
1.	Tilman M.Davies,"THE BOOK OF R - A FIRST PROGRAMMING AND STATISTICS" Library of Congress Cataloging-in-Publication Data,2016.

REFERENCE BOOKS	
1.	Roger D. Peng,"R Programming for Data Science"Lean Publishing, 2016.
2.	Hadley Wickham, Garrett Grolemund," R for Data Science",OREILLY Publication,2017
3.	Steven Keller, "R Programming for Beginners", CreateSpace Independent Publishing Platform 2016.
4.	Kun Ren ,"Learning R Programming", Packt Publishing,2016

E BOOKS	
1.	https://web.itu.edu.tr/~tokerem/The_Book_of_R.pdf

MOOC	
1.	https://online-learning.harvard.edu/subject/r
2.	https://www.udemy.com/course/r-basics/
3.	https://www.datacamp.com/courses/free-introduction-to-r

COURSE TITLE	DATABASE MANAGEMENT SYSTEMS LAB			CREDITS	1
COURSE CODE	CSB4232	COURSE CATEGORY	PC	L-T-P-S	0- 0- 3- 0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Populate and query a database using SQL commands.	1,2
2	Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS	1,2,3
3	Implementing Indexing on table.	1,2,3
4	Programming PL/SQL including stored procedures, stored functions, cursors, packages	1,2,3
5	Solve basic issues of simple database applications and construct a real time database application using current techniques	1,2,3,4,5

Prerequisites: Nil	
LIST OF EXPERIMENTS:	
1.	To study Basic SQL commands (create table, use , drop, insert) and execute the following queries using these commands: (CO1)

- Create a table 'Emp' with attributes 'ename','ecity','salary','enumber','eaddress','depttname'.
- Create another table 'Company' with attributes 'cname', ccity','empnumber' in the database 'Employee'.

2. To study the viewing commands (select , update) and execute the following queries using these commands:
   - Find the names of all employees who live in Delhi.
   - Increase the salary of all employees by Rs. 5,000.
   - Find the company names where the number of employees is greater than 10,000.
   - Change the Company City to Gurgaon where the Company name is 'TCS'.

3. To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands:
   - Add an attribute named ' Designation' to the table 'Emp'.
   - Modify the table 'Emp', Change the datatype of 'salary' attribute to float.
   - Drop the attribute 'depttname' from the table 'emp'.
   - Delete the entries from the table 'Company' where the number of employees are less than 500.

4. To study the commands that involve compound conditions (and, or, in , not in, between , not between , like , not like) and execute the following queries using these commands:
   - Find the names of all employees who live in 'Gurgaon' and whose salary is between Rs. 20,000 and Rs. 30,000.
   - Find the names of all employees whose names begin with either letter 'A' or 'B'.
   - Find the company names where the company city is 'Delhi' and the number of employees is not between 5000 and 10,000.
   - Find the names of all companies that do not end with letter 'A'.

5. To study the aggregate functions (sum, count, max, min, average) and execute the following queries using these commands:
   - Find the sum and average of salaries of all employees in computer science department.
   - Find the number of all employees who live in Delhi.
   - Find the maximum and the minimum salary in the HR department.

6. To study the grouping commands (group by, order by) and execute the following queries using these commands:
   - List all employee names in descending order.
   - Find number of employees in each department where number of employees is greater than 5.
   - List all the department names where average salary of a department is Rs.10,000.

7. To study the commands involving data constraints and execute the following queries using these commands:
   - Alter table 'Emp' and make 'enumber' as the primary key.
   - Alter table 'Company' and add the foreign key constraint.

- Add a check constraint in the table 'Emp' such that salary has the value between 0 and Rs.1,00,000
- Alter table 'Company' and add unique constraint to column cname
- Add a default constraint to column ccity of table company with the value 'Delhi'

8. To study the commands for joins (cross join, inner join, outer join) and execute the following queries using these commands:
- Retrieve the complete record of an employee and its company from both the table using joins.
- List all the employees working in the company 'TCS'.

9. To study the various set operations and execute the following queries using these commands:
- List the enumber of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true.
- List the enumber of all employees who live in Delhi but whose company is not in Gurgaon.

10. To study the various scalar functions and string functions (power, square, substring, reverse, upper, lower, concatenation) and execute the following queries using these commands:
- Reverse the names of all employees.
- Change the names of company cities to uppercase.
- Concatenate name and city of the employee.

11. To study the commands involving indexes and execute the following queries:
- Create an index with attribute ename on the table employee.
- Create a composite index with attributes cname and ccity on table company.
- Drop all indexes created on table company.

12. To study the conditional controls and case statement in PL-SQL and execute the following queries:
- Calculate the average salary from table 'Emp' and print increase the salary if the average salary is less that 10,000.
- Display the deptno from the employee table using the case statement if the deptname is 'Technical' then deptno is 1, if the deptname is 'HR' then the deptno is 2 else deptno is 3.

13. To study procedures and triggers in PL-SQL and execute the following queries:
- Create a procedure on table employee to display the details of employee to display the details of employees by providing them value of salaries during execution.
- Create a trigger on table company for deletion where the whole table is displayed when delete operation is performed.

14. Consider the tables given below. The primary keys are made bold and the data types are specified.
>   PERSON(driver_id:string , name:string , address:string)
>   CAR(regno:string , model:string , year:int)
>   ACCIDENT(report_number:int , accd_date:date , location:string)
>   OWNS(driver_id:string , regno:string)
>   PARTICIPATED(driver_id:string , regno:string , report_number:int , damage_amount:int)

a. Create the above tables by properly specifying the primary keys and foreign keys.
b. Enter at least five tuples for each relation.

c.	Demonstrate how you
	➢ Update the damage amount for the car with specific regno in the accident with report number 12 to 25000.
d.	Find the total number of people who owned cars that were involved in accidents in the year 2008.

Find the number of accidents in which cars belonging to a specific model were involved.

TEXT BOOKS	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2011.

REFERENCE BOOKS	
1.	Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Seventh Edition, Pearson Education,2016

SEMESTER – IV

COURSE TITLE	PROBABILITY AND STATISTICS			CREDITS	4
COURSE CODE	MAA4302	COURSE CATEGORY	PC	L-T-P-S	3-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL -3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Understand the concept of Probability and one-dimensional random variable.				1,2,12
2	Understand the importance of discrete and continuous distributions.				1,2,12
3	Explore the random experiments specified by two dimensional random variables.				1,2,4,12
4	Perform test of hypothesis as well as calculate confidence interval for the population parameter.				1,2,4,12
5	Obtain knowledge on design of experiments.				1,2,3,12
Prerequisites: Nil					
MODULE 1: PROBABILITY AND RANDOM VARIABLES					(12)

Axioms of Probability- Bayes' Theorem -Random variables – Moments – Moment generating functions.

Suggested Reading: Basic Probability

Lab: Probability density functions

MODULE 2: STANDARD DISTRIBUTIONS	(12)

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions

Suggested Reading: Discrete and Continuous Functions.

Lab: Problems in distributions.

MODULE 3: TWO-DIMENSIONAL RANDOM VARIABLES	(12)

Joint distribution – Marginal and conditional distribution – Co-variance – Correlation and Regression

Suggested Reading: Random Variables

Lab: Two Dimensional Random Variable Problems

MODULE 4: TESTING OF HYPOTHESIS	(12)

Sampling distributions – Testing of Hypothesis – Small samples – t Test, F Test and Chi-square Test – Large samples – Single mean – Difference in means – single proportion and difference in proportions.

Suggested Reading: Sampling Problems

Lab: Testing of Hypothesis

MODULE 5: DESIGN OF EXPERIMENTS	(12)

Analysis of variance – One Way Classification – Completely Randomized block design – Two Way Classification – Randomized block design – Latin Square design.

Suggested Reading: Analysis of variance

Lab: Design of Experiments

TEXT BOOKS

1.	Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.
2.	Johnson. R.A. and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
3.	A. Chandrasekaran, G. Kavitha, "Probability, Statistics, Random Processes and Queuing Theory", Dhanam Publications, 2014.
4.	Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, "MATLAB and its Applications in Engineering", Pearson Publication, Second Edition, 2016.

REFERENCE BOOKS

1.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012.
3.	Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E BOOKS

1.	http:// nptel.ac.in/courses/ IIT-MADRAS/ Principles_of_Communication1/ Pdfs/ 1_5.pdf
2.	https://www.khanacademy.org

MOOC	
1.	https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2

COURSE TITLE	ARTIFICIAL INTELLIGENCE			CREDITS	3
COURSE CODE	CSB4303	COURSE CATEGORY	PC	L-T-P-S	3-0-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL -3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Comprehend different types of problem-solving agents and its applications.	1,2,12
2	Solve problems using informed and uninformed search strategies.	1,2,3,4
3	Compare various Knowledge Representation Logic using scripts and frames.	1,2
4	Comprehend and analyze the different types of learning.	1,2
5	Identify the need of Production system and Planning states.	1,2
6	Use expert system tools to realize the concepts and components of expert system.	1,2,3,5,12

MODULE 1: PROBLEM SOLVING	(9)

Introduction to AI- Agents and Environments – Uninformed Search Strategies- Informed Search Strategies- Local Search Algorithm- Problem Formulation-Constraint Satisfaction Problem.

MODULE 2: KNOWLEDGE REPRESENTATION	(9)

Introduction to Game Playing-Alpha Beta Pruning-Knowledge Representation using First order logic-Knowledge Engineering in First Order Logic-Proportional vs First Order Logic-Resolution-Structured representation of Knowledge Using Scripts and Frames.

MODULE 3: INFERENCE AND LEARNING	(9)

Inference- Forward and Backward Chaining-Unification-Uncertainty-Inference in Bayesian Network – Learning from Observations-Forms of Learning-Inductive Learning-Neural Network-Learning Decision trees-Reinforcement Learning-Case Study-Learning examples with python.

MODULE 4: PRODUCTION SYSTEM AND PLANNING	(9)

Introduction to Production system-control strategies-Rete Algorithm-Planning-STRIPS-Planning with state space search-Partial Order Planning-Planning Graphs-Planning & acting in the real world.

MODULE 5: EXPERT SYSTEM	(9)

Expert System- Architecture and Roles of Expert System-Typical Expert System-MYCIN-XOON-DART-Case Study-Construction of simple reflex agent with sensor and actuator using Arduino.

TEXT BOOKS	
1.	Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2010.
2.	Joseph C. Giarratano , Gary D. Riley ,"Expert Systems : Principles and Programming",4th Edition, 2015.

REFERENCE BOOKS	

1.	Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2.	Janakiraman, K. Sarukesi, 'Foundations of Artificial Intelligence and Expert Systems', Macmillan Series in Computer Science, 2000.
3.	W. Patterson, 'Introduction to Artificial Intelligence and Expert Systems', Prentice Hall of India, 2003.
4.	Prateek Joshi, "Artificial Intelligence with Python", Packt Publishing, 2017.

E BOOKS

1.	https://www.pdfdrive.net/artificial-intelligence-a-modern-approach-3rd-edition-e32618455.html

MOOC

1.	https://www.coursera.org/learn/introduction-to-ai

COURSE TITLE	OPERATING SYSTEMS			CREDITS	**3**	
COURSE CODE	**CSB4218**	**COURSE CATEGORY**	**P C**	**L-T-P-S**		**3-0-0-1**
CIA		**50%**		**ESE**		**50%**
LEARNING LEVEL		**BTL -3**				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Explain the basic functions and structure of operating systems.	1,2
2	Implement the process scheduling algorithms and process synchronization Techniques.	1,2,3
3	Detect and solve Deadlock problems.	1,2,3
4	Implement Memory Management Techniques.	1,2,3
5	Illustrate File system and disk I/O techniques.	1,2

Prerequisites: Nil

MODULE 1: INTRODUCTION (9)

Introduction – Computer System Organization - Computer System Architecture - Computer System Structure - Operating System Operations - Process Management – Memory Management - Storage Management – Protection Security - Operating System Services – User Operating System Interface – System Calls – Types of System calls – System Programs - Process Concept – Process Scheduling – Operations on Processes - Inter-process Communication

Suggested reading: http://nptel.ac.in/courses/106106144/

MODULE 2: PROCESS SCHEDULING **(9)**

Threads – Overview – Multithreading Models - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – The Critical-Section Problem - Peterson's Solution – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors.

MODULE 3: DEADLOCKS **(9)**

System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Structure of Page table - Segmentation.

MODULE 4: PAGING AND FILE SYSTEM (9)

Virtual Memory – Demand Paging – Copy-on Write – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory and Disk Structure – Directory Implementation – Allocation Methods – Free-space Management - Disk Structure – Disk Attachment - Disk Scheduling - RAID Structure.

MODULE 5: DISTRIBUTED SYSTEMS (9)

Advantages of Distributed Systems - Types of Network based Operating Systems - Network Structure - Communication Structure -Communication Protocols – TCP/IP - Robustness - Design Issues - Distributed File Systems

TEXT BOOKS

1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, 2013.

REFERENCE BOOKS

1.	Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
2.	William Stallings, "Operating System", Ninth Edition, Pearson Education, 2018.
3.	Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education, 2016.

E BOOKS

1.	https://it.bmc.uu.se/andlov/dev/books/Operating%20System%20Concepts%206ed.pdf

MOOC

1.	https://in.udacity.com/course/introduction-to-operating-systems--ud923

COURSE TITLE	DATA HANDLING AND VISUALIZATION			CREDITS	3
COURSE CODE	CSB4221	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Understand basics of Data Visualization				1,2,3,5
2	Implement visualization of distributions				1,2,3,5
3	Write programs on visualization of time series, proportions & associations				1,2,3,5
4	Apply visualization on Trends and uncertainty				1,2,3,5
5	Explain principles of proportions				1,2,3,5
Prerequisites: Data Science with Python or R					
MODULE 1: INTRODUCTION TO VISUALIZATION					(9)

Visualizing Data-Mapping Data onto Aesthetics, Aesthetics and Types of Data, Scales Map Data Values onto Aesthetics, Coordinate Systems and Axes- Cartesian Coordinates, Nonlinear Axes, Coordinate Systems with Curved Axes, Color Scales-Color as a Tool to Distinguish, Color to Represent Data Values ,Color as a Tool to Highlight, Directory of Visualizations- Amounts, Distributions, Proportions, x–y relationships, Geospatial Data

MODULE 2: VISUALIZING DISTRIBUTIONS	(9)

Visualizing Amounts-Bar Plots, Grouped and Stacked Bars, Dot Plots and Heatmaps, Visualizing Distributions: Histograms and Density Plots- Visualizing a Single Distribution, Visualizing Multiple Distributions at the Same Time, Visualizing Distributions: Empirical Cumulative Distribution Functions and Q-Q Plots-Empirical Cumulative Distribution Functions, Highly Skewed Distributions, Quantile-Quantile Plots, Visualizing Many Distributions at Once-Visualizing Distributions Along the Vertical Axis, Visualizing Distributions Along the Horizontal Axis

MODULE 3: VISUALIZING ASSOCIATIONS & TIME SERIES	(9)

Visualizing Proportions-A Case for Pie Charts, A Case for Side-by-Side Bars, A Case for Stacked Bars and Stacked Densities, Visualizing Proportions Separately as Parts of the Total ,Visualizing Nested Proportions- Nested Proportions Gone Wrong, Mosaic Plots and Treemaps, Nested Pies ,Parallel Sets. Visualizing Associations Among Two or More Quantitative Variables-Scatterplots, Correlograms, Dimension Reduction, Paired Data. Visualizing Time Series and Other Functions of an Independent Variable-Individual Time Series , Multiple Time Series and Dose–Response Curves, Time Series of Two or More Response Variables

MODULE 4: VISUALIZING UNCERTIANITY	(9)

Visualizing Trends-Smoothing, Showing Trends with a Defined Functional Form, Detrending and Time-Series Decomposition, Visualizing Geospatial Data-Projections, Layers, Choropleth Mapping, Cartograms, Visualizing Uncertainty-Framing Probabilities as Frequencies, Visualizing the Uncertainty of Point Estimates, Visualizing the Uncertainty of Curve Fits, Hypothetical Outcome Plots

MODULE 5: PRINCIPLE OF PROPORTIONAL INK	(9)

The Principle of Proportional Ink-Visualizations Along Linear Axes, Visualizations Along Logarithmic Axes, Direct Area Visualizations, Handling Overlapping Points-Partial Transparency and Jittering, 2D Histograms, Contour Lines, Common Pitfalls of Color Use-Encoding Too Much or Irrelevant Information ,Using Nonmonotonic Color Scales to Encode Data Values, Not Designing for Color-Vision Deficiency

TEXT BOOKS	
1.	Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.

REFERENCE BOOKS	
1	Tony Fischetti, Brett Lantz, R: Data Analysis and Visualization,O'Reilly ,2016
2	Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems,Apress, 2018

E BOOKS	
1.	https://www.netquest.com/hubfs/docs/ebook-data-visualization-EN.pdf

MOOC	

| 1. | https://www.coursera.org/learn/data-visualization |
| 2. | https://www.coursera.org/learn/python-for-data-visualization#syllabus |

COURSE TITLE		OPERATING SYSTEMS LAB			CREDITS	1
COURSE CODE		CSB4242	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA		80%			ESE	20%
LEARNING LEVEL		BTL - 3				
CO		COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to						
1	Install and use operating systems with an understanding of professional, ethical and social issues. Windows, Linux etc.					1,2,5,12
2	Implement the process scheduling algorithms and process synchronization techniques.					1,2,3
3	Solve Deadlock problems & to perform memory allocation.					1,2,3
4	Implement Memory Management Techniques.					1,2,3
Prerequisites: C Programming Language						
LIST OF EXPERIMENTS						

1. Program to report the behaviour of the OS to get the CPU type and model, kernel version.
2. Shell programming
   a. command syntax
   b. write simple functions
   c. basic tests
3. Shell programming
   a. loops
   b. patterns
   c. expansions
   d. substitution
4. Program to get the amount of memory configured into the computer, amount of memory currently available.
5. Implement the various process scheduling mechanisms such as FCFS, SJF, Priority, round – robin.
6. Implement the solution for reader – writer's problem.
7. Implement the solution for dining philosopher's problem.
8. Implement banker's algorithm.
9. Implement the first fit; best fit and worst fit file allocation strategy.
10. Write a program to create processes and threads.

REFERENCE BOOKS	
1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, 2013.
2.	Harvey M. Deitel, "Operating Systems", Third Edition, Pearson Education, 2004.
3.	William Stallings, "Operating System", Ninth Edition, Pearson Education, 2018.
4.	Andrew S. Tanenbaum, "Modern Operating Systems", 4th Edition, Pearson Education, 2016.
E BOOKS	
1.	https://www.goodreads.com/book/show/83833.Operating_System_Concepts
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc16_cs10/preview
2.	https://in.udacity.com/course/introduction-to-operating-systems--ud923

COURSE TITLE	DATA HANDLING AND VISUALIZATION LAB			CREDITS	1
COURSE CODE	CSB4246	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					

1	Understand basics of Data Visualization	1,2,3,5
2	Implement visualization of distributions	1,2,3,5
3	Write programs on visualization of time series, proportions & associations	1,2,3,5
4	Apply visualization on Trends and uncertainty	1,2,3,5
5	Explain principles of proportions	1,2,3,5

Prerequisite: Python or R

LIST OF EXPERIMENTS:

1. Download the House Pricing dataset from Kaggle and map the values to Aesthetics
2. Use different Color scales on the Rainfall Prediction dataset
3. Create different Bar plots for variables in any dataset
4. Show an example of Skewed data and removal of skewedness
5. For a sales dataset do a Time Series visualization
6. Build a Scatterplot and suggest dimension reduction
7. Use Geospatial Data-Projections on datasets in
   http://www.gisinindia.com/directory/gis-data-for-india
8. Create the a trend line with a confidence band in any suitable dataset
9. Illustrate Partial Transparency and Jittering
10. Illustrate usage of different color codes

REFERENCE BOOKS

1.	Claus Wilke, "Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures", 1st edition, O'Reilly Media Inc, 2019.

SEMESTER- V

COURSE TITLE	DISCRETE MATHEMATICS			CREDITS	4
COURSE CODE	MAA4219	COURSE CATEGORY	B S	L-T-P-S	3-1-0-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
C O	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Write an argument using logical notation and determine if the argument is valid or not valid.				1,2,3,4
2	Understand the ideas of permutations and combinations.				1,2,3,4
3	Demonstrate an understanding of relations and functions				1,2,3,4
4	Recognize the principles of the group theory.				1,2,3,4
5	Design model problems in computer science using Graphs.				1,2,3,4
Prerequisites: Nil					
MODULE 1: LOGICS AND PROOFS				**(12)**	

Propositions – Logical connectives – Compound propositions – Conditional and bi-conditional propositions – Truth tables – Tautologies and contradictions – Contra positive – Logic equivalences and implications. Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements.

Suggested Reading: Basics of logical operators

MODULE2: COMBINATORICS	(12)

Mathematical Induction-Strong induction and well ordering – the basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – inclusion and exclusion and applications.

Suggested Reading: Basics of probability

MODULE 3: SETS AND FUNCTIONS	(12)

Sets: Relations on sets – Types of relations and their properties – Partitions – Equivalence relations –

Partial ordering – Poset – Hasse diagram. Functions: Characteristic function of a set – Hashing functions

– Recursive functions – Permutation functions.

Suggested Reading: Basic concepts of sets and Functions

MODULE 4: ALGEBRAIC SYSTEMS	(12)

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and groupcodes – Decodes.

Suggested Reading: Basics of Groups

MODULE 5: GRAPHS	(12)

Graphs and graphs models – Graph terminology and special types of graphs – Representing graphs andgraph isomorphism – connectivity – Euler and Hamilton paths.

Suggested Reading: Basics of Graphs

TEXT BOOKS	
1.	A. Singaravelu, M. P. Jeyaraman, "Discrete Mathematics", Meenakshi Agency, 2013.
2.	Kenneth H. Roshan, "Discrete Mathematics and its Applications", Tata McGraw Hill, 2011.

REFERENCE BOOKS	
1.	Trembly J.P and Monohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2003.
2.	Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, 2002.
3.	J. A. Bondy and U.S.R Murty, "Graph Theory", Springer, 2008.

E BOOKS	
1.	http://nptel.ac.in/courses/106106094/
2.	https://onlinecourses.nptel.ac.in/noc16_ma01/preview

MOOC	
1.	https://www.edx.org/course/understanding-queues

COURSE TITLE	DATA WAREHOUSING AND DATA MINING			CREDITS	3
COURSE CODE	CSB4318	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Describe the functionality of data warehousing component and working of online analytical processing	1,2
2	Analyze data preprocessing and generate frequent patterns from a given data set.	1,2,3
3	Identify standard classification algorithms and assess the quality of classification models.	1,2,3
4	Demonstrate basic clustering models and perform outlier analysis.	1,2,3
5	Apply data mining on real time applications and infer the outcomes.	1,2,3,4,5,6
6	Choose the appropriate tools for performing Data mining for a given data set and infer the findings.	1,2,3,4,5,6,8,9

Prerequisites : Nil

MODULE 1: DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING	(9L)

Basic of Data Warehouse - Data Warehouse Modeling: Data Cube and OLAP - Data Warehouse Implementation - Data Generalization by Attribute-Oriented Induction - Data Cube Computation - Data Cube Computation Methods - Processing Advanced Kinds of Queries by Exploring Cube Technology - Multidimensional Data Analysis in Cube Space.

Suggested Activity:

1. Downloading and/or installation of WEKA data mining toolkit.

   http://www.cs.waikato.ac.nz/ml/weka/downloading.html

2. Understand the features of WEKA tool kit such as Explorer, Knowledge flow interface, Experimenter, command-line interface.

MODULE 2: INTRODUCTION, DATA PREPROESSING AND MINING FREQUENT PATTERNS AND ASSOCIATON	(9L)

Introduction to data mining – kinds of data – Kinds of patterns to be mined – Technologies – applications – issues in mining – Data objects and attribute types – statistical distribution of data – data visualization – Measuring Data similarity and dissimilarity – Need for preprocessing – Data cleaning – Data Integration – Data reduction - Data Transformation and Data Discretization - Frequent Itemsets, Closed Itemsets, and Association Rules - Frequent Itemset Mining Methods.

Suggested Activity:

1. Navigate the options available in the WEKA(ex.select attributes panel,preprocess panel,classify panel,cluster panel,associate panel and visualize)

2. Load a data set (ex.Weather dataset,Iris dataset,etc.)

3. Perform data preprocessing tasks and Demonstrate performing association rule mining on

data sets

MODULE 3: CLASSIFICATION (9L)

Basics – Decision tree Induction – Baye's Classification - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy - Bayesian Belief Networks - Classification by Backpropagation - Support Vector Machines - Classification Using Frequent Patterns - Lazy Learners (or Learning from Your Neighbors) - Other Classification Methods.

Suggested Activity:

1. Demonstrate performing classification on data sets Classification Tab**.**

2. Load each dataset into Weka and run id3, j48 classification algorithm, study the classifier output. Compute entropy values, Kappa statistic**.**

3. Compare classification results of ID3,J48, Naïve-Bayes and k-NN classifiers for each dataset , and reduce which classifier is performing best and poor for each dataset and justify.

MODULE 4: CLUSTERING (9L)

Basics - Partitioning Methods - Hierarchical Method - Density-Based Methods - Grid-Based Methods - Evaluation of Clustering - Clustering with Constraints - Outliers and Outlier Analysis - Outlier Detection Methods - Statistical Approaches - Proximity-Based Approaches - Clustering-Based Approaches.

Suggested Activity:

1. Demonstrate performing clustering on data sets Clustering Tab.

2. Explore other clustering techniques available in Weka**.**

MODULE 5: DATA MINING TRENDS AND RESEARCH FRONTIERS (9L)

Mining Complex Data Types - Other Methodologies - Data Mining Applications - Data Mining and Society – Data Mining Trends – Real world applications – Data Mining Tool study.

Suggested Activity:

1. Prediction and Analysis of Student Performance by Data Mining in WEKA.

TEXT BOOKS

1.	

REFERENCE BOOKS

1.	Alex Berson and Stephen J. Smith. "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 2016.
2.	Pieter Adrians, Dolf Zantinge. "Data Mining", Addison Wesley, 2000.

E BOOKS

1.	https://cs.wmich.edu/~yang/teach/cs595/han/ch01.pdf

MOOC

1.	https://www.edx.org/learn/data-mining
2.	https://www.coursera.org/specializations/data-mining

COURSE TITLE	MACHINE LEARNING			CREDITS	4
COURSE CODE	CSB4317	COURSE CATEGORY	PC	L-T-P-S	3-0-2- 1

CIA	60%		ESE	40%
LEARNING LEVEL	BTL-4			

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Identify various machine learning algorithms and terminologies and perform data pre-processing using standard ML library.	1, 2,3,5,12
2	Design a predictive model using appropriate supervised learning algorithms to solve any given problem.	1,2,3,4,5,12
3	Develop an application using appropriate unsupervised learning algorithms for performing clustering and dimensionality reduction.	1,2,3,4,5,12
4	Solve complex problems using artificial neural networks and kernel machines.	1,2,3,4,5,12
5	Implement probabilistic graphical models for suitable applications.	1,2,3,4,5,12

Prerequisites : Probability and Statistics

MODULE 1: INTRODUCTION TO MACHINE LEARNING	(9L+6P)

Machine Learning Fundamentals –Types of Machine Learning - Supervised, Unsupervised, Reinforcement- The Machine Learning process.

Terminologies in ML- Testing ML algorithms: Overfitting, Training, Testing and Validation Sets- Confusion matrix -Accuracy metrics- ROC Curve- Basic Statistics: Averages, Variance and Covariance, The Gaussian- The Bias-Variance trade off- Applications of Machine Learning.

Practical Component:
- (i) Installation of Python Libraries/ MATLAB tools for Machine Learning
- (ii) Data pre-processing using Python Machine Learning libraries/ MATLAB.

Suggested reading:
➢ Introduction to Machine Learning - http://nptel.ac.in/courses/106106139/

MODULE 2: SUPERVISED LEARNING	(9L+6P)

Regression: Linear Regression – Multivariate Regression- Classification: Linear Discriminant Analysis, Logistic Regression- K-Nearest Neighbor classifier.

Decision Tree based methods for classification and Regression- Ensemble methods.

Practical Component: (Using Python Libraries /MATLAB)
- (i) Design a model to predict the housing price from Boston Dataset using Multivariate Linear Regression.
- (ii) Build a classifier using Logistic Regression, k- Nearest Neighbor / Decision Tree to classify whether the given user will purchase a product or not from a social networking dataset.

MODULE 3: UNSUPERVISED LEARNING	(9L+6P)

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

Practical Component: (Using Python Libraries / MATLAB)

(i)	Segment a customer dataset based on the buying behaviour of customers using K-means/Hierarchical clustering.	
(ii)	Dimensionality reduction of any CSV/image dataset using Principal Component Analysis.	

MODULE 4: ARTIFICIAL NEURAL NETWORKS AND KERNEL MACHINES	**(9L+6P)**

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

Practical Component: (Using Python Libraries / MATLAB)

(i)	Recognition of MNIST handwritten digits using Artificial Neural Network.
(ii)	Build an email spam classifier using SVM.

MODULE 5: PROBABILISTIC GRAPHICAL MODELS	**(9L+6P)**

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

Practical Component: (Using Python Libraries / MATLAB)

(i)	Classify the given text segment as 'Positive' or 'Negative' statement using the Naïve Bayes Classifier.
(ii)	Predict future stock price of a company using Monte Carlo Simulation.

TEXT BOOKS

1.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2.	Andreas C. Mueller, Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Publications, 1st edition, 2016.
3.	Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, "Machine Learning", Pearson Education, 2018.
4.	Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2011.

REFERENCE BOOKS

1.	Andreas C. Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly,2016.
2.	Sebastian Raschka, "Python Machine Learning", Packt Publishing, 2015.
3.	Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction",2nd Edition, Springer, 2017.
4.	Ethem Alpaydin, "Introduction to Machine Learning", 2nd Revised edition, MIT Press,2010.

E BOOKS

1.	https://www.ibm.com/downloads/cas/GB8ZMQZ3

MOOC

1.	https://www.edx.org/course/machine-learning-fundamentals-2
2.	https://www.coursera.org/learn/machine-learning

COURSE TITLE	**DIGITAL MARKETING ANALYTICS**	**CREDITS**	**3**

COURSE CODE	CSB4320	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Relate to digital media marketing and the need for analytics on the data captured.				1,2,3
2	Choose the appropriate tools for performing different digital analytics on the digital marketing data.				2,3,4,5
3	Analyze and appraise the outcomes of digital influence and listening.				3,9,10
4	Formulate a research plan and perform search analysis on the digital marketing data.				2,3,10,11
5	Summarize the strategies for Mobile analytics and Business Intelligence				9,10

Prerequisites: Data Analytics

MODULE 1: DIGITAL MEDIA AND ANALYTICS	(6)

Digital media types – Owned and earned social metrics – Paid searches and Organic Searches - Aligning Digital and Traditional Analytics – Identifying social media listening tools – Understanding social media engagement software – Social media engagement tools.

MODULE 2: TOOLS FOR DIGITAL ANALYTICS	(12)

Social Media Listening Tools - Evolution, Social analytics life cycle, Social media monitoring software: Sysomos, Radian6, Visible Technologies, Zoho social and others. Search Analytics Tools – Basics of search, Search analytics use cases, Search data, Google trends, YouTube trends, Google Adwords keyword, Yahoo clues, Collecting insights through search data. Audience Analysis Tools – Audience Analysis Use Cases, Audience analysis tool types – Audience analysis Techniques, Event Triggers. Content Analysis Tools - Content Audits-Optimizing Content Distribution, Analysing Content Consumption. Engagement Analysis Tools – Social Media Engagement Software (SMES), using SMES, study of different SMES in the market.

MODULE 3: DIGITAL INFLUENCE AND LISTENING	(9)

Reality of Digital Influence - Media List - Klout, PeerIndex - Online Versus Offline Influence - Using the Influencer List - Developing Social Media Listening Program - Using Listening Data for Program Planning - Implementing Listening Program - Conversation Audit - Online Influencers - Conducting Social brand benchmarking - Use of Online data for crisis anticipation - Identifying known issues - Crisis day monitoring and ongoing reporting - Corrections after crisis - Improving customer service - Social customer service conflict - Social customer service models.

MODULE 4: RESEARCH PLAN AND SEARCH ANALYSIS	(9)

Launching new product – Product life cycle – Introduction Phase – Growth Phase – Maturity Phase. Formulating research plan – Developing source list – Research methods – Constructing reports – Delivering reports – Report use cases – Building central repository of information – Search analytics for digital strategy – Search analytics for content strategy and planning – Search analytics for paid advertising.

MODULE 5: ROI, MOBILE ANAYTICS AND BUSINESS INTELLIGENCE	(9)
Return on Investment (ROI) – Return on Engagement, Influence, Experience – Tracking ROI – Understanding measurement fundamentals – Measurement reporting cadence - Mobile Analytics – Mobile market landscape – Mobile marketing measurement – Marketing activities – Audience/visitor metric – Mobile app performance - Social CRM – Social CRM initiative – Social CRM Initiative - Future of Digital Data – Business Intelligence	

TEXT BOOKS	
1.	Chuck Hemann and Ken Burbary, "Digital Marketing Analytics: Making Sense of Consumer Data in a Digital World", Que Publishing, 1 edition, ISBN-13: 978-0789750303, 2013.

REFERENCE BOOKS	
1.	Simon Kingsnorth, "Digital Marketing Strategy: An Integrated Approach to Online Marketing", Kogan Page Publisher, First edition, ISBN-13: 978-0749474706, 2016.
2.	Dave Chaffey, Fiona Ellis-Chadwick, "Digital Marketing – Strategy, Implementation and Practice", Pearson Education, Sixth edition, ISBN-13: 978-1292077611, 2016.

E BOOKS	
1.	Eric Enge, Andy Crestodina, Larry Kim, Steve Rayson and Chad White, "How the Pros Turn Marketing Analytics Into Effective Marketing Strategies", Alexa, An Amazon Company. https://blog.alexa.com/wp-content/uploads/2016/12/How-to-Pros-Turn-Marketing-Analytics-into-Effective-Marketing-Strategies-ebook.pdf

MOOC	
1.	https://www.coursera.org/learn/marketing-analytic

COURSE TITLE	PROFESSIONAL ETHICS AND LIFE SKILLS			CREDITS	2
COURSE CODE	GEA4216	COURSE CATEGORY	HS	L-T-P-S	2-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL -3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1.	Understand human values.	6,7,8
2.	Follow Engineering ethics and safety.	6,7,8
3.	Take responsibilities and rights.	6,7,8
4.	Understand life skills.	6,7,8

MODULE 1: HUMAN VALUES	(6)
Definition of ethics-Morals values and ethics – integrity-Work ethics- Service Learning-Civic Virtue-Respect for others- Caring-Sharing-Honesty-Courage - Valuing time-Cooperation-Commitment-	

Empathy-Self-confidence-Character-Spirituality-Introduction to Yoga and meditation for professional excellence and stress management.

Self-Study: Case study of Discovery failure

MODULE 2: ENGINEERING ETHICS	(6)

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Self-study: Study the Bhopal gas tragedy

MODULE 3: SAFETY, RESPOSIBILITIES AND RIGHTS	(6)

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

Self-study: Chernobyl explosion, Nuclear and thermal power plant issues

MODULE 4: LIFE SKILLS	(6)

Definition, Relevance, Types of values, changing concepts of values-aims and values of value education- basic etiquette-morals and values in life-dealing with people. Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses.

Self-study: Influences - Peer pressure, familial and societal expectations, media

MODULE 5: SOCIETIES IN PROGRESS	(6)

Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility.

Self-study: Personal value and professional value of Engineers on societies perception

TEXT BOOKS	
1.	Subramanian R., Professional ethics, Oxford University press, 2010.
2.	Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2008

REFERENCE BOOKS	
1.	Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy.
2.	Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics).
3.	Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics).
4.	Ruchika Nath, Value Education, APH Publishing Corporation, New Delhi, 2008.

COURSE TITLE	DATA MINING TOOLS LAB			CREDITS	1
COURSE CODE	CSB4333	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0

CIA	80%			ESE	20%
LEARNING LEVEL	BTL-3				
CO	**COURSE OUTCOMES**				**PO**
Upon completion of this course, the students will be able to					
1	Apply data mining tools for various phases of data mining.				1,2,3,5
2	Implement the classification techniques with different algorithms.				1,2,3,5
3	Demonstrate and apply clustering techniques with different algorithms.				1,2,3,5
4	Apply association rule for mining.				1,2,3,5
5	Design a single and multi-layer neural network.				1,2,3,5
Prerequisite: NIL					

LIST OF EXPERIMENTS:

1. Demonstration of pre-processing on dataset car.arff
2. Demonstration of pre-processing on dataset diabetes diagnosis
3. Demonstration of classification rules process on dataset using ID3 and J48 algorithm.
4. Implement the classification rules process on car dataset using Naïve Baye's algorithm in Weka explorer.
5. Demonstration of classification rule process on dataset using simple K-means algorithm in weka explorer.
6. Build a Neural Network model to process Diabetic diagnosis dataset.
7. Demonstration of classification on dataset diabetic diagnosis and car using decision table algorithm in weka explorer.
8. Demonstration of association rule using dataset diabetic diagnosis using apriori algorithm in weka explorer.
9. Demonstration of classification on dataset diabetic and car in Matlab.
10. Demonstration of clustering on dataset diabetic and car in Matlab.

REFERENCE BOOKS

1.	The WEKA Workbench Eibe Frank, Mark A. Hall, and Ian H. Witten Online Appendix for "Data Mining: Practical Machine Learning Tools and Techniques" Morgan Kaufmann, Fourth Edition, 2016
2.	Han, M.Kamber, "Data Mining: Concept and Techniques", Academic Press, Morgan Kaufmann Publishers, 3rd Edition, 2012.
3	http://www.cs.waikato.ac.nz/ml/weka/downloading.html
4.	https://www.tutorialspoint.com/weka/what_is_weka.htm

COURSE TITLE	DESIGN PROJECT WITH IoT			CREDITS	1
COURSE CODE	CSB4332	COURSE CATEGORY	PC	L-T-P-S	0-0-3-0
CIA	80%			ESE	20%
LEARNING LEVEL	BTL -3				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Identify the sensors and actuators required for their application and control through simple programs	1,2,12
2	Create network connectivity over different components by applying network protocol for interoperability	1,2,12
3	Differentiate the two basic IoT gateways Raspberry pi / Arduino and select the one which is suitable for their requirement.	1,2,3,12
4	Develop a system which satisfy the real-time requirements for automation	1,2,3,12
5	Describe the difference between Healthcare and other applications and their security.	1,2,3,12

Prerequisites: Basic Programming Language, Python

LIST OF EXPERIMENTS

1. Basics of Internet of Things: Sensors, Actuators, IoT architecture and Gateway.

2. IoT Networking: Connectivity technologies, Protocols and Interoperability in IoT.

3. Blinking LED through Raspberry pi or Arduino.

4. IoT sensors interface with Raspberry pi or Arduino (Temperature/Light sensors).

5. Integration of Actuators with Raspberry pi or Arduino (Servo motor/Relay).

6. Capture Image with Raspberry pi or Arduino.

7. Design Traffic control system: using Raspberry pi or Arduino.

8. Design Temperature dependent auto cooling system: Using Raspberry pi or Arduino.

9.	IoT applications in home automation: Implementing IoT home application using Raspberry pi or Arduino.
10.	Case study: Emergence of IoT Healthcare.

REFERENCE BOOKS	
1.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
2.	Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" –– CRC Press-2012.
3.	Manoel Carlos Ramon, "Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers", Apress, 2014.
E BOOKS	
1.	http://file.allitebooks.com/20170102/Building%20Arduino%20Projects%20for%20the%20Internet%20of%20Things%202016.pdf
MOOC	
1.	http://learn.sparkfun.com/tutorials/internet-of-things-experiment-guide

SEMESTER – VI

COURSE TITLE	**DEEP LEARNING**			**CREDITS**	**3**
COURSE CODE	**CSB4304**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-1-0- 1**
CIA	**60%**			**ESE**	**40%**
LEARNING LEVEL	**BTL-3**				
CO	**COURSE OUTCOMES**				**PO**
Upon completion of this course, the students will be able to					
1	Design a simple Neural Networks using Linear Perceptron.				1,2,3,5
2	Implement a Convolutional Neural Networks using TensorFlow.				1,2,3,5
3	Develop an application based on Recurrent Neural Network.				1,2,3
4	Solve the Deep Reinforcement Learning problem.				1,2,3
5	Build the Speech and Text applications based deep neural network.				1,2,4,12
Prerequisites : Linear Algebra and Calculus					
MODULE 1: NEURAL NETWORK					**(6L+6P)**
Mechanics of Machine Learning-Neuron-Linear Perceptron-Feed-Forward Neural Networks-Sigmoid, Tanh, and ReLU Neurons- Training Feed-Forward Neural Networks-Fast-Food Problem-Gradient Descent-Delta Rule and Learning Rates.					
Practical Component:					

1. Write a program in Python to Calculate the output of a simple neuron
2. Construct a Perceptron for the classification of data in Python
3. Develop the Python code to Classify the 4-class problem with Multi-layer Perceptron
4. Implement the back propagation algorithm for neural networks and apply it to the task of hand-written digit recognition

MODULE 2: CONVOLUTIONAL NEURAL NETWORKS	(6L+6P)

TensorFlow: Creating and Manipulating TensorFlow Variables-TensorFlow Operations-Neurons in Human Vision-Convolutional Layer-Building a Convolutional Network-Visualizing Learning in Convolutional Networks-Learning Lower Dimensional Representations- Principal Component Analysis- Autoencoder Architecture- Implementing an Autoencoder in TensorFlow.

Practical Component:

Implement linear regression in TensorFlow

1.Build a simple deep neural network with many layers in Python using TensorFlow

2. Implement binary classification for medical diagnosis for a single medical condition like say disease vs. no disease based on a battery of tests.

3. Explore *multi*-class with *Rock Paper Scissors* dataset

4.Implement an Autoencoder in TensorFlow.

MODULE 3: RECURRENT NEURAL NETWORKS	(6L+6P)

Recurrent Neural Networks- Challenges with Vanishing Gradients- Long Short-Term Memory (LSTM) Units- TensorFlow Primitives for RNN Models- Implementing a Sentiment Analysis Model- Solving seq2seq Tasks with Recurrent Neural Networks-Memory Augmented Neural Networks:Neural Turing Machines, Attention-Based Memory Access, Differentiable neural Computers (DNC) -Memory Reuse - Temporal Linking - DNCController Network – Visualizing – Implementing the DNC in TensorFlow.

Practical Component:

1. Implementing a Sentiment Analysis Model in TensorFlow
2. Solve seq2seq Tasks with Recurrent Neural Networks using TensorFlow
3. Implementing the DNC in TensorFlow

MODULE 4: DEEP REINFORCEMENT LEARNING	(6L+6P)

Deep Reinforcement Learning - Masters Atari Games-Markov Decision Processes-Policy Versus Value Learning, Pole-Cart with Policy Gradients-Q-Learning and Deep RecurrentvQ-Networks.

Practical Component:

1. Implement a policy-gradient agent to solve pole-cart-reinforcement learning problem.
2. Implementing Experience Replay in Q-Network using TensorFlow

MODULE 5: APPLICATIONS	(6L+6P)

Applications in Object Recognition and Computer Vision- Unsupervised or generative feature learning-Supervised feature learning and classification- Applications in Multimodal and Multi-task Learning- Multi-modalities: Text and image-Speech and image- Multi-task learning within the speech, NLP or image domain

Practical Component:

1. Build a model to classify movie reviews as *positive or negative* using TensorFlow

2. Develop the CNN Model for Image Classification

TEXT BOOKS	
1.	Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Media, 2017. https://www.oreilly.com/ai/free/files/fundamentals-of-deep-learning-sampler.pdf
2.	Li Deng and Dong Yu "Deep Learning Methods and Applications", Foundations and Trends in Signal Processing, 2013. http://link.springer.com/openurl?genre=book&isbn=978-3-319-73004-2

REFERENCE BOOKS	
1.	Ian Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series", MIT Press, 2017.
2.	SandroSkansi"Introduction to Deep Learning From Logical Calculus to Artificial Intelligence"Springer, 2018.
3.	Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

E-BOOK	
1	https://www.deeplearningbook.org/
2	https://pythonmachinelearning.pro/free-ebook-deep-learning-with-python/
3	https://www.getfreeebooks.com/deep-learning/

MOOC	
1.	https://www.classcentral.com/course/kadenze-creative-applications-of-deep-learning-with-tensorflow-6679
2.	https://in.udacity.com/course/deep-learning--ud730
3.	https://www.edx.org/learn/deep-learning

COURSE TITLE	VIRTUALIZATION AND CLOUD COMPUTING			CREDITS	4
COURSE CODE	CSB4305	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Identify the basic concepts of virtualization.				1,2,4
2	Understand virtualization in terms of Memory, Storage and Network Concepts.				1,2,3,4
3	Recognize the different types of Cloud deployment and delivery models.				1,2,12
4	Apply cloud computing concepts in a real cloud scenario.				2,3,5,12
5	Use and explain cloud file systems with Hadoop technology.				1,2,4,5
Prerequisites: Nil					
MODULE 1: INTRODUCTION TO VIRTUALIZATION					(6L+6P)
Virtualization, Importance of Virtualization, Understanding Virtualization Software, Understanding Hypervisors,					

Describing Hypervisors, Role of Hypervisors, Comparing Hypervisors, Understanding Virtual Machines, Understanding How a Virtual Machine Works, Different types of Virtualization.

Practical Component:
 a. Exploring Oracle Virtual Box
 b. Creating Virtual Machines
 c. Installing OS images into Virtual Machines

MODULE 2: TYPES OF VIRTUALIZATION	(6L+6P)

CPU Virtualization- Configuring VM CPU Options, Tuning Practices for VM CPUs, Memory Virtualization, Configuring VM Memory Options, Tuning Practices for VM Memory, Storage Virtualization, Configuring VM Storage Options, Tuning Practices for VM Storage, Network Virtualization, Configuring VM Network Options, Tuning Practices for Virtual Networks.

Practical Component:
 a. Networking Between Virtual Machines

MODULE 3: INTRODUCTION TO CLOUD COMPUTING	(6L+6P)

Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Comparison among SAAS, PAAS, IAAS, Multitenant software: Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications.

Practical Component:
 a. Exploring Microsoft Azure, AWS, Oracle Cloud Platforms
 b. Deploying Virtual Machine in a Cloud Platform

MODULE 4: CLOUD IMPLEMENTATIONS	(6L+6P)

Cloud deployment models: Public cloud, Private cloud and Hybrid cloud, Cloud delivery models: IaaS, PaaS, SaaS and others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Cloud computing platforms: Infrastructure as a service: Amazon EC2, Platform as a Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing.

Practical Component:
 a. Deploying an application over cloud

MODULE 5: CLOUD FILE SYSTEMS AND TECHNOLOGIES	(6L+6P)

Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo, Map-Reduce: The Map-Reduce model, Cloud Architectures: Workload distribution, Resource pooling, dynamic scalability, elasticity,

Service load balancing, Cloud bursting, Service Technology: SOAP and REST Web services, AJAX and mashups Web services, Service Middleware, Case Study examples.

Practical Component:
a. Demonstration of Google File System

TEXT BOOKS	
1.	Matthew Portnoy, "Virtualization Essentials", 2nd Edition, Wiley Publications, 2016.
2.	Thomas Erl, Zaigham Mahmood, and Ricardo Puttini," Cloud Computing Concepts, Technology & Architecture", Prentice Hall, 2013.

REFERENCE BOOKS	
1	Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley,2011
2	Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3	A. Srinivasan, J. Suresh," Cloud Computing, A practical approach for learning and implementation", Pearson,2014.

E BOOKS	
1.	https://www.manning.com/books/exploring-cloud-computing

MOOC	
1.	https://www.coursera.org/specializations/cloud-computing
2.	https://www.coursera.org/learn/python-for-data-visualization#syllabus

COURSE TITLE	BUSINESS INTELLIGENCE AND ANALYTICS			CREDITS	3
COURSE CODE	CSB4306	COURSE CATEGORY	DE	L-T-P-S	3-0-0-1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 5				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Understand the essentials of BI & data analytics and the corresponding terminologies	1,2,5,6
2	Analyze the steps involved in the BI - Analytics process	1,4,5,6
3	Illustrate competently on the topic of analytics	1,2,4,5,9,12
4	Understand & Implement the Clustering algorithms	1,2,4,5,9,10,11,12
5	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques	1,2,4,5,9,10,11,12
Prerequisites: Weka Tool		
MODULE 1: BUSINESS INTELLIGENCE – INTRODUCTION		(9L)

Introduction - History and Evolution: Effective and Timely decisions, Data Information and Knowledge, Architectural Representation, Role of mathematical Models, Real Time Business Intelligent System.

MODULE 2: BI – DATA MINING & WAREHOUSING	(9L)

Data Mining - Introduction to Data Mining, Architecture of Data Mining and How Data mining works(Process) , Functionalities & Classifications of Data Mining, Representation of Input Data, Analysis Methodologies.

Data Warehousing - Introduction to Data Warehousing, Data Mart, Online Analytical Processing (OLAP) – Tools, Data Modelling, Difference between OLAP and OLTP, Schema – Star and Snowflake Schemas, ETL Process – Role of ETL

MODULE 3: BI – DATA PREPARTTION	(9L)

Data Validation - Introduction to Data Validation, Data Transformation – Standardization and Feature Extraction, Data Reduction – Sampling, Selection, PCA, Data Discretization

MODULE 4: BI – DATA ANALYTICS PROCESS	(9L)

ANALYTICS PROCESS - Introduction to analytics process, Types of Analytical Techniques in BI – Descriptive, Predictive, Perspective, Social Media Analytics, Behavioral, Iris Datasets

MODULE 5: IMPLEMENTATION OF BI – ANALYTICS PROCESS	(9L)

Operational Intelligence: Technological – Business Activity Monitoring, Complex Event Processing, Business Process Management, Metadata, Root Cause Analysis.

TEXT BOOKS	
1.	Carlo-Vercellis, "Business Intelligence Data Mining and Optimization for Decision-Making", First Edition Link : https://bit.ly/3d6XxOr
2.	Drew Bentely, "Business Intelligence and Analytics" ,@2017 Library Pres., ISBN: 978-1-9789-2136-8 Link : https://www.academia.edu/40285447/Business_Intelligence_and_Analytics
3.	Larissa T. Moss & Shaku Atre, "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications", First Edition, Addison-Wesley Professional,2003
4.	Kimball, R., Ross, M., Thornthwaite, W., Mundy, J., and Becker, B. John, "The Data Warehouse Lifecycle Toolkit: Practical Techniques for Building Data Warehouse and Business Intelligence Systems", Second Edition, Wiley & Sons, 2008.

REFERENCE BOOKS	
1.	Cindi Howson, "Successful Business Intelligence", Second Edition, McGraw-Hill Education, 2013.

E BOOKS	
1.	Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence A Managerial Perspective on Analytics", Third Edition, Pearson Publications. Link : https://bit.ly/2YcuLHK

MOOC	
1.	https://www.coursera.org/learn/business-intelligence-data-analytics (Free Course in Course era)

COURSE TITLE	MODERN SOFTWARE ENGINEERING			CREDITS	4
COURSE CODE	CSB4319	COURSE CATEGORY	PC	L-T-P-S	3-0-2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Analyse and choose appropriate process model and represent the given software project scenario.				1,2,3,4,5
2	Elicit the requirements and develop suitable requirement model.				2,3,4,5,10
3	Design the software architecture model based on requirements gathered				3,5,10
4	Distinguish between the different quality assurance strategies and testing methods				2,3,8
5	Summarise the activities of Software Configuration Management				2,3,8
6	Model systems for simple real-life problems using software engineering principles and tools.				1,2,3,5,6,9,10,11

Prerequisites : Nil

MODULE 1: INTRODUCTION SOFTWARE ENGINEERING AND PROCESS MODELS   (18)

Introduction to Software Engineering – Generic Process model – Perspective process model – Specialized process model – Unified process model – Personal and Team process model – Agile process – Extreme programming – Agile process model – Adaptive Software Development (ASD) – Scrum – Dynamic Systems Development Method (DSDM) – Crystal – Feature Driven Development (FDD) – Lean Software Development (LSD) – Agile Modelling (AM), Agile Unified Process (AUP) – Tool set for the Agile process.

Practical Component: Design and develop an Agile process models using Scrum, highlighting the outcome of each stage.

MODULE 2: SOFTWARE REQUIREMENTS ANALYSIS AND MODELING   (15)

Requirements Engineering – Eliciting requirements – Developing use cases – Building the requirement model – Negotiating requirements – validating requirements – Scenario based modelling – UML models – Data modelling – Class based, Flow oriented and Behavioural modelling – Patterns for requirement modelling – Requirement modelling for WebApps.

Practical Component: Consider a real time scenario and using standard tools, develop the Software Requirement Specification Document following the IEEE standards.

MODULE 3: DESIGN CONCEPTS AND PRINCIPLES   (18)

Design process – Design concepts - Design model – Software architecture – Architectural genres – Architectural styles – Architectural design– Component – Designing class based components – Component level design for WebApps – Designing traditional components – Component based development - User Interface Design – Golden rules – Interface analysis and design steps – WebApp

Interface design - WebApp design – Design pyramid – Aesthetic design – Content design – Architectural design – Navigation design – Component level design.

Practical Component: Construct the various design diagrams to represent the process flow and data flow for a given problem specification using Rational Rose / Open source tools.

MODULE 4: SOFTWARE QUALITY ASSURANCE AND TESTING	(12)

Elements of Software Quality Assurance – SQA tools, goals and metrics – Six sigma for Software Engineering – Measures of software reliability and availability – Software safety – ISO 9000 quality standards – SQA plan – Strategic approach to software testing – Verification and validation – Test strategies for conventional software – Test strategies for Object oriented software – Test strategies for WebApps – Validation testing – System Testing – Art of Debugging.

Practical Component: Demonstrate the working of any two standard testing tools.

MODULE 5: SOFTWARE CONFIGURATION MANAGEMENT	(12)

Software Configuration Management – Elements of SCM - SCM Repository – SCM Process – Version control - Change control – Configuration control – Status reporting - Configuration management for WebApps – Content management – Change management – Version control – Auditing and reporting.

Practical Component: Prepare a study report on SCM tools such as Ansible, CFEngine, Chef, Puppet, Salt.

TEXT BOOKS

1.	Roger S. Pressman, Software Engineering- A practitioner's Approach, 7thEditon., McGraw-Hill, 2014.

REFERENCE BOOKS

1.	Ian Sommerville, Software Engineering, Pearson Education Asia, 7th edition, 2011.
2.	Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 2008.
3.	James F Peters and Witold Pedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2007
4.	K.K. Agarwal and Yogesh Singh, "Software Engineering", New Age International Publishers, Third edition, 2008.

E BOOKS

1.	https://edisciplinas.usp.br/mod/resource/view.php?id=1094198

MOOC

1.	https://www.coursera.org/learn/software-processes
2.	https://www.edx.org/course/software-engineering-introduction-ubcx-softeng1x
3.	https://nptel.ac.in/courses/106101061/

COURSE TITLE	BUSINESS ECONOMICS			CREDITS	2
COURSE CODE	GEA4304	COURSE CATEGORY	BS	L-T-P-S	2-0-0- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-2				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Describe the introduction of economics.	1,2, 11
2	Demonstrate about cost analysis.	2, 11
3	Build knowledge about consumer's and producer's behavior.	2, 8, 11
4	Explain about budget.	2, 11
5	Educate about financial services.	2, 11

Prerequisites : Nil

MODULE 1: INTRODUCTION TO ECONOMICS (6)

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics

MODULE2: COST ANALYSIS (9)

Types of Cost, Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis, Economies of Scale Cost Classification

MODULE 3: CONSUMER'S AND PRODUCER'S BEHAVIOUR (9)

Consumer Behavior: Law of Diminishing Marginal utility – Equimarginal Utility – Consumer's Equilibrium - Indifference Curve – Production: Law of Variable Proportion – Laws of Returns to Scale – Producer's equilibrium – Economies of Scale Cost Classification.

MODULE 4: BUDGET (9)

Process of budgeting in India –classification of budgets trends – evaluation systems – types of deficits – fiscal policy – indicators — taxation – centre, state and local – public debt and management.

MODULE 5: FINANCE (9)

Basics of finance and financial environment – instruments of financial markets – financial intermediation – investment banking and brokerage services – securities – types of securities – market for securities – how and where traded – initial public offering (IPO) – secondary markets – trading on exchanges and trading with margins.

TEXT BOOKS

1.	S.Shankaran, Business Economics - Margham Publications.
2.	H.L. Ahuja, Business Economics – Micro & Macro - Sultan Chand & Sons - New Delhi – 55.

REFERENCE BOOKS

1.	S.A.Ross, R.W.Westerfield, J.Jaffe and Roberts: Corporate Finance, McGraw-Hill.
2.	Joseph E Stiglitz: Economics of the Public Sector.

MOOC

1.	https://sites.google.com/site/readbookpdf7734/pdf-download-business-economics-by---mark-taylor-read-online

2.	https://bookboon.com/en/economics-ebooks

COURSE TITLE	BUSINESS INTELLIGENCE & ANALYTICS LAB			CREDITS	1
COURSE CODE	CSB4344	COURSE CATEGORY	DE	L-T-P-S	0-0-3-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL- 5				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Understand the Statistical operations	1,2,5,6
2	Analyze the steps involved in the BI	1,4,5,6
3	Implement mathematical aggregation operators	1,2,4,5,9,12
4	Understand & Implement the K-Means Clustering with Iris Dataset	1,2,5,6, 9,12
5	Demonstrate the real time scenario (Case study) by using BI & Analytics techniques	1,2,4,5,9,10,11,12

Prerequisites: Power BI / Tabula/ R

BUSINESS INTELLIGENCE

1. Import the legacy data from different sources such as (Excel, SqlServer, Oracle etc.) and load in the target system.
2. Perform the Extraction Transformation and Loading (ETL) process to construct the database in the SqlServer / Power BI.

DATA ANALYTICS

3. To get the input from user and perform numerical operations (MAX, MIN, AVG, SUM, SQRT, ROUND) using in R
4. To perform data import/export (.CSV, .XLS, .TXT) operations using data frames in R.
5. To perform data pre-processing operations i) Handling Missing data ii) Min-Max normalization
6. To perform statistical operations (Mean, Median, Mode and Standard deviation) using R.
7. To perform K-Means clustering operation and visualize for iris data set
8. Write R script to diagnose any disease using KNN classification and plot the results.

CASE STUDY

Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.

REFERENCE BOOKS

1.	Cindi Howson, "Successful Business Intelligence", Second Edition, McGraw-Hill Education, 2013.

E BOOKS

1.	Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence A Managerial Perspective on Analytics", Third Edition, Pearson Publications. Link : https://bit.ly/2YcuLHK

SEMESTER-VII

COURSE TITLE	SOFTWARE PROJECT MANAGEMENT			CREDITS	3
COURSE CODE	CSB4401	COURSE CATEGORY	PC	L-T-P-S	2-0-2- 1
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Frame Project Management principles while developing software.				1,2,3,6,11,12
2	Demonstrate basic project management concepts, framework and the process models.				1,2,11
3	Acquire adequate knowledge about software process models and software effort estimation techniques.				1,2,11
4	Estimate the risks involved in various project activities.				2,3,6,11
5	Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.				2,3,11
6	Design staff selection process and address issues related to people management				1,6,8,11,12
Prerequisites : Modern Software Engineering					
MODULE 1: PROJECT EVALUATION AND PROJECT PLANNING					**(9)**
Importance of Software Project Management – Activities - Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.					
MODULE 2: PROJECT LIFECYCLE AND EFFORT ESTIMATION					**(9)**

Software productivity – Factors affecting software pricing – size related metrics & function related metrics – Factors affecting software engineering productivity – Estimation techniques – Algorithmic cost modelling – COCOMO Model – early design model – Reuse model – Project cost drivers - Algorithmic cost models in project planning – Project duration and staffing – Software measurement and metrics – Measurement process – Product metrics – Analysis of measurements – Case studies.

MODULE 3: ACTIVITY PLANNING AND RISK MANAGEMENT	(9)

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

MODULE 4: PROJECT MANAGEMENT AND CONTROL	(9)

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

MODULE 5: STAFFING IN SOFTWARE PROJECTS	(9)

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TEXT BOOKS	
1.	Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCE BOOKS	
1.	Robert K. Wysocki —Effective Software Project Management, Wiley Publication, 2011.
2.	Kelkar Sa, "Software Project Management", Third Edition, PHI Learning, New Delhi, 2012
3.	Gopalaswamy Ramesh, —Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.
4.	Walker Royce: Software Project Management- Addison-Wesley, 1998.

E BOOKS	
1.	https://epdf.pub/queue/effective-software-project-management.html

MOOC	
1.	https://www.coursera.org/learn/uva-darden-project-management

COURSE TITLE	BIG DATA AND ANALYTICS			CREDITS	4
COURSE CODE	CSB4402	COURSE CATEGORY	PC	L-T-P-S	3-0-2- 1
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Outline the importance of Big Data Analytics	1,2
2	Apply statistical techniques for Big data Analytics.	1,2,4,5,12
3	Analyze problems appropriate to mining data streams.	1,2,3,4,5
4	Apply the knowledge of clustering techniques in data mining.	1,2,3,4,5
5	Use Graph Analytics for Big Data and provide solutions	1,2,3,4,5,12
6	Apply Hadoop map Reduce programming for handing Big Data	1,2,3,4,5,12

Prerequisites: Database basics

MODULE 1: INTRODUCTION TO BIG DATA	(9L+6P)

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics - Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Practical Component:
1. Study of R Programming.
2. Hypothesis Test using R.

Suggested reading :https://www.coursera.org/learn/big-data-introduction

MODULE 2: DATA ANALYSIS, CLUSTERING AND CLASSIFICATION	(9L+6P)

Regression Modeling - Multivariate Analysis - Bayesian Modeling - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction. Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes   - Bayes' Theorem - Naïve Bayes Classifier.

Practical Component:
1. K-means Clustering using R
2. Naïve Bayesian Classifier
3. Implementation of Linear Regression
4. Implement Logistic Regression

MODULE 3: STREAM MEMORY	(9L+6P)

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 - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Practical Component:
1. Time-series Analysis

MODULE 4: ASSOCIATION AND GRAPH MEMORY	(9L+6P)

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules   - Applications of Association Rules - Finding Association& finding similarity - Graph Analytics for Big Data: Graph Analytics - The Graph Model - Representation as Triples - Graphs and Network Organization - Choosing Graph Analytics - Graph Analytics Use Cases - Graph Analytics Algorithms and Solution Approaches - Technical Complexity of Analyzing Graphs- Features of a Graph Analytics Platform.

Practical Component:
1. Association Rules using R.

MODULE 5: FRAMEWORKS AND VISUALIZATION	(9L+6P)

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association-Intelligence from unstructured information-Text analytics-Understanding of emerging trends and Technologies-Industry challenges and application of Analytics- Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Practical Component:
1. Data Analysis-Visualization using R.
2. Map Reduce using Hadoop
3. In-database Analytics
4. Implementation of Queries using Mongo DB

TEXT BOOKS

1.	David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
2.	AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012
3.	Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

REFERENCE BOOKS

1.	EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
2.	Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3.	Kim H. Pries and Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers " CRC Press, 2015
4.	Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.
5.	Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.

MOOC	
1.	https://www.edx.org/course/big-data-analytics-2
3.	http://nptel.ac.in/courses/110106072/

COURSE TITLE	TIME SERIES ANALYSIS AND FORECASTING			CREDITS	3
COURSE CODE	CSB4406	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-5				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Knowledge of basic concepts in time series analysis and forecasting	3,4,5,12
2	Understanding the use of time series models for forecasting and the limitations of the methods.	4,5,12
3	Ability to criticize and judge time series regression models.	3,4,5
4	Distinguish the ARIMA modelling of stationary and nonstationary time series	3,4,5
5	Compare with multivariate times series and other methods of applications	3,4,5,12

Prerequisites: Little knowledge about mathematics and programming

MODULE 1: INTRODUCTION OF TIMESERIES ANALYSIS	(6L+6P)

Introduction to Time Series and Forecasting -Different types of data-Internal structures of time series-Models for time series analysis-Autocorrelation and Partial autocorrelation.

Examples of Time series Nature and uses of forecasting-Forecasting Process-Data for forecasting – Resources for forecasting.

 Practical Component:

1.Time Series Data Cleaning

2.Loading and Handling Times series data

3. Preprocessing Techniques

MODULE 2: STATISTICS BACKGROUND FOR FORECASTING	(6L+6P)

Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance.

 Practical Component:

 1.How to Check Stationarity of a Time Series.

 2. How to make a Time Series Stationary?

 3. Estimating & Eliminating Trend.

- Aggregation
- Smoothing
- Polynomial Fitting

4.Eliminating Trend and Seasonality
- Differencing
- Decomposition

MODULE 3: TIME SERIES REGRESSION MODEL	(6L+6P)

Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data- Exponential Smoothing-First order and Second order.

Practical Component:

1.Moving Average time analysis data.

2.Smoothing the Time analysis Data.

3.Check out the Time series Linear and non-linear trends.

4.Create a modelling .

MODULE 4: AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS	(6L+6P)

Autoregressive Moving Average (ARMA) Models - Stationarity and Invertibility of ARMA Models - Checking for Stationarity using Variogram- Detecting Nonstationarity - Autoregressive Integrated Moving Average (ARIMA) Models - Forecasting using ARIMA - Seasonal Data - Seasonal ARIMA Models- Forecasting using Seasonal ARIMA Models Introduction - Finding the "BEST" Model -Example: Internet Users Data- Model Selection Criteria - Impulse Response Function to Study the Differences in Models - Comparing Impulse Response Functions for Competing Models .

Practical Component:

1.Modelling time series
- Moving average
- Exponential smoothing
- ARIMA

2. Seasonal autoregressive integrated moving average model (SARIMA)

MODULE 5: MULTIVARIATE TIME SERIES MODELS AND FORECASTING	(6L+6P)

Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.

Practical Component:

Dependence Techniques
- Multivariate Analysis of Variance and Covariance
- Canonical Correlation Analysis
- Structural Equation Modeling

Inter-Dependence Techniques
- Factor Analysis
- Cluster Analysis

TEXT BOOKS

1.	**Introduction To Time Series Analysis And Forecasting**, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015) https://b-ok.cc/book/2542456/2fa941
2.	**Master Time Series Data Processing, Visualization, And Modeling Using Python** Dr. Avishek Pal Dr. Pks Prakash (2017) https://b-ok.cc/book/3413340/2eb247
3.	**Time Series Analysis And Forecasting By Example**SørenBisgaardMurat Kulahci Technical University Of Denmark Copyright © 2011 By John Wiley & Sons, Inc. All Rights Reserved. https://b-ok.cc/book/1183901/9be7ed
REFERENCE BOOKS	
1.	**Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting** Third Edition.(2016). https://b-ok.cc/book/2802612/149485
2.	**Multivariate Time Series Analysis and Applications**William W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons Ltd. https://b-ok.cc/book/3704316/872fbf
3.	**Time Series Analysis by James D Hamilton** Copyright © 1994 by prince town university press. https://b-ok.cc/book/3685042/275c71
E BOOKS	
1.	https://www.stat.ipb.ac.id/en/uploads/KS/S2%20-%20ADW/3%20Montgomery%20-%20Introduction%20to%20Time%20Series%20Analysis%20and%20Forecasting.pdf
2.	https://ru.b-ok2.org/terms/?q=forecasting
3.	https://otexts.com/fpp2/
4.	http://home.iitj.ac.in/~parmod/document/introduction%20time%20series.pdf
MOOC	
1.	https://www.coursera.org/learn/practical-time-series-analysis
2.	https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/download-course-materials/
3.	https://swayam.gov.in/nd1_noc19_mg46/preview

COURSE TITLE	BLOCKCHAIN TECHNOLOGY			CREDITS	3
COURSE CODE	CSC4373	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Build a bitcoin payment system.				1,2,3
2	Building their own Cryptocurrency and perform Auctions in Ethereum				1,2,3
3	Create and deploy projects using Web3j.				1,2,3

| 4 | Implement an ICO on Ethereum | 1,2,3 |
| 5 | Use Swarm and IPFS for distributed storage. | 1,2,3,4 |

Prerequisites:

MODULE 1: BUILDING A BITCOIN PAYMENT SYSTEM   (6L+6P)

The emergence of blockchain and cryptocurrency-What is blockchain?- Interact with the blockchain- Types of blockchains: Classification of blockchains, Building A Bitcoin payment system : Getting started with Bitcoin, Building a payment gateway.

Practical Component:
1. Run a bitcoin client.
2. Synchronize the blockchain
3. Set up a Regtest environment
4. Build a payment request URI

MODULE 2: CRYPTOCURRENCY AND AUCTIONS IN ETHEREUM   (6L+6P)

Building Your Own Cryptocurrency- Compiling Bitcoin from source- New cryptocurrency – Readercoin: Cloning Bitcoin, Readercoin rebranding- Peer-to-Peer Auctions in Ethereum: Introduction to Ethereum, Building an auction DApp: Auction description, Auction contract in Solidity- Contract code analysis-Enumerations, Arrays, Mappings, Structures, Functions, Modifiers, Inheritance.

Practical component:
1. Prepare your build system and Building Bitcoin Core.
2. Write Hello World smart contract in a higher programming language (Solidity).
3. Solidity example using arrays and functions.

MODULE 3: BLOCKCHAIN-BASED FUTURES SYSTEM   (6L+6P)

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract

Practical component:
1. create a Maven project using Web3j.
2. Construct and deploy your contract (Use deploy method)

MODULE 4: BLOCKCHAINS IN BUSINESS AND CREATING ICO   (6L+6P)

Public versus private and permissioned versus permission less blockchains- Privacy and anonymityin Ethereum- Why are privacy and anonymity important?- The Ethereum Enterprise Alliance- Blockchain-as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and Testing the code.

Practical Component:
1. implement an ICO on Ethereum.

MODULE 5: DISTRIBUTED STORAGE IPFS AND SWARM   (6L+6P)

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup, The web page

Practical component:

1. install IPFS locally on our machine, initialize your node, view the nodes in network and add files and directories
2. install Swarm and run any test file.

TEXT BOOKS

1.	Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt PublishingLimited, 2018.

REFERENCE BOOKS

1.	Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton UniversityPress (2016).

E BOOKS

1.	https://www.velmie.com/practical-blockchain-study

MOOC

1.	https://www.udemy.com/course/build-your-blockchain-az/

COURSE TITLE	NATURAL LANGUAGE PROCESSING AND ANALYTICS			CREDITS	3
COURSE CODE	CSB4407	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Understand the basics of Natural language processing	1,2,3
2	Analyze the text syntactically	1,2,3,4,5,9
3	Analyze the text content Semantically	1,2,3,4,5,9
4	Implement recurrent network for language models	1,2,3,4,5,9
5	Implement a sentiment classification and chatbot systems	1,2,3,4,5,9
Prerequisites: AI, Python Programming		
MODULE 1: INTRODUCTION		**(6L+6P)**

Introduction to NLP, Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit distance, N gram Language Models, Evaluating Language Models

Practical Component:

1. Convert the text into tokens

2. Find the word frequency

3. Demonstrate a bigram language model

4. Demonstrate a trigram language model

5. Generate regular expression for a given text

MODULE 2: SYNTACTIC ANALYSIS	(6L+6P)

English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Part-of-Speech Tagging, Maximum Entropy Markov Models, Grammar Rules for English, Treebanks, Grammar Equivalence and Normal form, Lexicalized Grammar.

Practical Component :

1. Perform Lemmatization

2. Perform Stemming

3. Identify parts-of Speech using Penn Treebank tag set.

4. Implement HMM for POS tagging

5. Build a Chunker

MODULE 3: SEMANTIC ANALYSIS	(6L+6P)

Representation of Sentence Meaning: Computational Desiderata for Representations, Model-Theoretic Semantics, First-Order Logic, Event and State Representations, Description Logics, Semantic roles, Semantic role labeling.

Practical Component:

1. Find the synonym of a word using WordNet

2. Find the antonym of a word

3. Implement semantic role labeling to identify named entities

4. Resolve the ambiguity

5. Translate the text using First-order logic

MODULE 4: SEQUENCE PARSING WITH RECURRENT NETWORKS	(6L+6P)

Simple Recurrent Networks, Applications of RNNs, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Characters and Byte-Pairs.

Practical Component:

1. Implement RNN for sequence labeling

2. Implement POS tagging using LSTM

3. Implement Named Entity Recognizer

4. Word sense disambiguation by LSTM/GRU

MODULE 5: CASE STUDY	(6L+6P)

Sentiment Classification, Dialog Systems and Chatbots

Practical Component:

1. Develop a Movie review system

2. Create a chatbot for a real time application.	

TEXT BOOKS	
1.	Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft), 2019.

REFERENCE BOOKS	
1.	Steven Bird, Ewan Klein, and Edward Loper, Natural Language Processing with Python, First Edition, O'reilly, 2009
2.	Yoav Goldberg, University of Toronto, Neural Network Methods for Natural language Processing, Morgan & Claypool, 2017
3.	Christopher D. Manning, and Hinrich Schütze. *Foundations of statistical natural language processing*. First Edition, MIT press, 1999

E BOOKS	
1.	https://www.cs.vassar.edu/~cs366/docs/Manning_Schuetze_StatisticalNLP.pdf
2.	https://www.nltk.org/book/
3.	https://www.nltk.org/genindex.html

MOOC	
1.	https://www.coursera.org/learn/language-processing

COURSE TITLE	PRACTICAL CASE STUDY ON DATA SCIENCE			CREDITS	3
COURSE CODE	CSB4432	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Build the Model to predict the probability of the bank-loan defaulters	1,2,3,12
2	Develop the Model of Sales Forecasting for Gen Retailers	1,2,3,4,5,12
3	Implement the Decision Tree Model to Predict the Customer Churn	1,2,3,4,5,12
4	Predict the Probability of Malignant and Benign Breast Cancer with Random Forest Model	1,2,3,4,5,12
5	Build the Multiple linear regression model for Predicting Flight Delays	1,2,3,4,5,12
Prerequisites: R Programming		

MODULE 1: BANKING CASE STUDY	(6L+6P)
What Is Data Analytics?-Types of Analytics-Understanding Data and Its Types-Data Analytics and Big Data Tools-Role of Analytics in Various Industries-Analytical Competitors-Key Models and Their	

Applications in Various Industries-Banking Case Study-Applications of Analytics in the Banking Sector-Predicting Bank-Loan Default-Predicting Fraudulent Activity-Logistic Regression Model-Logistic Regression Model Using R

Practical Component:

Case Study: Predicting Bank-Loan Defaults with Logistic Regression Model

Business Problem: To predict the probability of the bank-loan default.

Business Solution: To build the logistic regression model

MODULE 2: RETAIL CASE STUDY	(6L+6P)

Supply Chain in the Retail Industry-Types of Retail Stores-Role of Analytics in the Retail Sector-Customer Engagement-Supply Chain Optimization-Price Optimization-Space Optimization and Assortment Planning-Overview of ARIMA Model-Three Steps of ARIMA Modelling-Seasonal ARIMA Model Using R

Practical Component:

Case Study: Sales Forecasting for Gen Retailers with SARIMA Model

Business Problem: Forecast retail food and beverages sales

Business Solution: Build the time series model using SARIMA

MODULE 3: TELECOMMUNICATION CASE STUDY	(6L+6P)

Types of Telecommunications Networks-Role of Analytics in the Telecommunications Industry-Predicting Customer Churn-Network Analysis and Optimization-Fraud Detection and Prevention-Price Optimization-Decision Tree Model Using R.

Practical Component:

Case Study: Predicting Customer Churn with Decision Tree Model

Business Problem: To predict the probability of the customer churn.

Business Solution: To build the Decision tree model.

MODULE 4: HEALTHCARE CASE STUDY	(6L+6P)

Application of Analytics in the Healthcare Industry-Predicting the Outbreak of Disease and Preventative Management-Predicting the Readmission Rate of the Patients-Healthcare Fraud Detection-Improve Patient Outcomes & Lower Costs-Working of Random Forest Algorithm-Random Forests Model Using R

Practical Component:

Case Study: Predicting Probability of Malignant and Benign Breast Cancer with Random Forest Model

Business Problem: To predict the probability of malignant and benign breast cancer.

Business Solution: To build the Random Forest Model.

MODULE 5: AIRLINE CASE STUDY	(6L+6P)

Application of Analytics in the Airline Industry-Personalized Offers and Passenger Experience-Safer Flights-Airline Fraud Detection-Predicting Flight Delays-Multiple Linear Regression Assumptions and Checking for Violation of Model Assumptions-Multiple Linear Regression Model Using R.

Practical Component:

Case Study: Predicting Flight Delays with Multiple Linear Regression Model

Business Problem: To predict the flight arrival delays

Business Solution: To build the multiple linear regression model.

TEXT BOOKS

1.	Deepti Gupta," Applied Analytics through Case Studies Using SAS and R", Asia-Pacific Holdings Private Limited,2018

REFERENCE BOOKS	
1.	Deborah Nolan, Duncan Temple Lang,"Data Science in R: A Case Studies Approach to Computational Reasoning and Problem Solving", CRC Press,2015
2.	Kerrie Mengersen,Pierre Pudlo,Christian Robert P.," Case Studies in Applied Bayesian Data Science", Springer International Publishing,2020.
3.	Danish Haroon,"Python Machine Learning Case Studies", Apress,2017
4.	Peter Haber,Thomas Lampolt shammer, Manfred Mayr "Data Science – Analytics and Applications", Springer Vieweg,2019.

E BOOKS	
1.	https://link.springer.com/content/pdf/bfm%3A978-1-4842-3525-6%2F1.pdf

MOOC	
1.	https://www.coursera.org/learn/case-studies-business-analytics-accenture
2.	https://intellipaat.com/data-scientist-course-training/
3.	http://www.millionlights.university/datascience

SEMESTER- VIII

COURSE TITLE	PROJECT & VIVA-VOCE			CREDITS	8
COURSE CODE	CSB4441	COURSE CATEGORY	PC	L-T-P-S	0-0-16-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Development of Engineering solution through Analyzing the problem and Applying the Engineering Knowledge.	1,2,3
2	Use research-based knowledge and research methods through modern tools	4,5
3	Work as an individual and as a team in solving complex problem.	9
4	Communicate effectively and write effective reports on the design of Engineering solution.	10, 12
5	Demonstrate the knowledge of project management	11
Design and Development of Solution for the identified Engineering complex problem by applying Engineering knowledge.		

REFERENCE BOOKS	
1.	Neil G. Siegel, Engineering Project Management, Wiley, 2019

2.	Steve Tockey, How to Engineer Software: A Model-Based Approach, Wiley, 2019
3.	Darla-Jean Weatherford, Technical Writing for Engineering Professionals, PennWell, 2016
MOOC	
1.	https://www.coursera.org/specializations/english-for-research-publication-purposes

Weightage of Assessment:

Review / Examination Scheme	Weightage
First Review	10%
Second Review	20%
Third Review	20%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

RUBRICS FOR END SEMESTER EXAMINATION			
Parameter	**Weightage**	**Assessments**	
Title, Objective (TO)	0.05	**Excellent (100%)**	Detailed and extensive explanation of the purpose and need of the project. All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified.
		Good (80%)	Good explanation of the purpose and need of the project. Good justification to the objectives; Methodology to be followed is specified but detailing is not done.
		Average (60%)	Average explanation of the purpose and need of the project. Incomplete justification to the objectives proposed; Steps are mentioned but unclear; without justification to objectives.
		Below Average (40%)	Moderate explanation of the purpose and need of the project. Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not specified properly.
Review of Literature	0.10	**Excellent (100%)**	Detailed extensive explanation of the specification, Limitations of the existing systems.

(RL)			Information is gathered from multiple, research-based sources. Well organized, demonstrates logical sequencing & structure Detailed conclusions are reached from the evidence offered. Research gaps are formed through the literature review and clearly stated.
		Good (80%)	Collects a great deal of information and good study of the existing systems; Information is gathered from multiple sources. Well organized, but demonstrates illogical sequencing or structure. Conclusions are reached from the evidence offered. Research gaps are formed through the literature review.
		Average (60%)	Moderate study of the existing systems; collects some basic information Information is gathered from a limited number of sources. Weakly organized with no logical sequencing or structure. There is some indication of conclusions from the evidence offered. Research gaps were not formed but could be formed through the literature review.
		Below Average (40%)	Explanation of the specifications and the limitations of the existing systems, not very satisfactory; limited information Information is gathered from a single source. No organization, sequencing, or structure. No conclusions are made from the evidence offered Research gaps were not formed and are not apparent from the literature review.
Analytical thinking	0.05	**Excellent (100%)**	Students analyze data or design alternatives systematically, in-depth, and with critical thinking.
		Good (80%)	Data or design alternatives are analyzed mostly systematically. Critical thinking is usually evident.
		Average (60%)	Little evidence that a systematic process was used to analyze data or design alternatives. Critical thinking is often weak

		Below Average (40%)	No evidence that a systematic process was used to analyze data or design alternatives. Critical thinking is not visible.
Design / Implementation	0.10	**Excellent (100%)**	The proposed system has been Designed / implemented using appropriate developing environment in a systematic plan as planned.
		Good (80%)	The proposed system has been partially Designed / implemented using developing environment and deviated from the plan of design.
		Average (60%)	The proposed system has been partially Designed / implemented using developing environment and highly deviated from the plan of design.
		Below Average (40%)	The proposed system has not been Designed / implemented and plan of design is not evident.
Methodology	0.05	**Excellent (100%)**	Division of problem into modules and good selection of computing framework. Appropriate design methodology and properly justification. Complete explanation of the key concepts and strong description of the technical requirements of the project.
		Good (80%)	Division of problem into modules and good selection of computing framework. Design methodology not properly justified. Complete explanation of the key concepts, but in-sufficient description of the technical requirements of the project.
		Average (60%)	Division of problem into modules but inappropriate selection of computing framework. Design methodology not defined properly. Incomplete explanation of the key concepts and in-sufficient description of the technical requirements of the project.
		Below Average (40%)	Partial division of problem into modules and inappropriate selection of computing framework. Design methodology not defined properly. Inappropriate explanation of the key concepts and poor description of the technical requirements of the project

Planning of Project Work	0.05	**Excellent (100%)**	Time frame properly specified and has been followed.
		Good (80%)	Time frame properly specified but has been followed partly.
		Average (60%)	Time frame properly specified, but not being followed.
		Below Average (40%)	Time frame not properly specified.
Testing Environment / Test Cases	0.05	**Excellent (100%)**	Testing Environment is formulated appropriately as a state of the art. All the possible Test cases are identified.
		Good (80%)	Testing Environment is formulated, lack of Justification / Coverage. Maximum no. of Test cases are identified.
		Average (60%)	Testing Environment is formulated. Justification / Coverage Minimum no. of Test cases are identified.
		Below Average (40%)	Testing Environment is not formulated. No Test cases are identified.
Technical Knowledge	0.05	**Excellent (100%)**	Extensive knowledge related to the project
		Good (80%)	Fair knowledge related to the project
		Average (60%)	Lacks of sufficient knowledge related to the project
		Below Average (40%)	Poor knowledge related to project
Presentation	0.10	**Excellent (100%)**	Contents of presentations are appropriate and well delivered. Demonstrates full knowledge by answering all questions with explanations and elaboration. Provides clear purpose and subject; pertinent examples, facts, and/or statistics; supports conclusions/ideas with evidence. Demonstrates strong enthusiasm about topic during entire presentation.

			Significantly increases audience understanding and knowledge of topic; convinces an audience to recognize the validity and importance of the subject. Proper eye contact with audience and clear voice with good spoken language.
		Good (80%)	Contents of presentations are mostly appropriate and delivered better answered all the questions without elaboration. Has somewhat clear purpose and subject; some examples, facts, and/or statistics that support the subject; includes some data or evidence that supports conclusions. Shows some enthusiastic feelings about topic. Raises audience understanding and awareness of most points. Clear voice with good spoken language but less eye contact with audience
		Average (60%)	Contents of presentations are appropriate but not well delivered. Is uncomfortable with information and is able to answer only rudimentary questions. Attempts to define purpose and subject; provides weak examples, facts, and/or statistics, which do not adequately support the subject; includes very thin data or evidence. Shows little or mixed feelings about the topic being presented. Raises audience understanding and knowledge of some points. Eye contact with only few people and unclear voice.
		Below Average (40%)	Contents of presentations are not appropriate and not well delivered. Does not have grasp of information and cannot answer questions about subject. Does not clearly define subject and purpose; provides weak or no support of subject; gives insufficient support for ideas or conclusions. Shows no interest in topic Presented. Fails to increase audience understanding of knowledge of topic.

			Poor eye contact with audience and unclear voice.
Demonstration	0.05	**Excellent (100%)**	Project demonstrated with output and proved the efficiency.
		Good (80%)	Project demonstrated with output but lack in proving the efficiency.
		Average (60%)	All modules are demonstrated but did not get the expected output.
		Below Average (40%)	Only few modules are demonstrated
Report / Thesis	0.05	**Excellent (100%)**	Exceptional introduction that grabs interest of reader and states background information, provocative question, topic and all subtopics in proper order; thesis exceptionally clear, arguable, well developed, and a definitive statement. Exceptionally researched with extreme detail, historically accurate with critical evidence from a wide variety of sources Exceptionally critical, relevant, consistent connections among arguments, analysis, subtopics, & thesis/topic; excellent, appropriate conclusions Exceptionally clear, logical, mature, thorough presentation and development of ideas that support thesis; excellent transition between paragraphs. Very concise, clear, with consistently proper grammar, spelling and paragraphing Proper detailed format always used consistently and correctly in both text and Works Cited. Well organized, very professional; all questions addressed in a knowledgeable and respectable manner; slides and/or handouts outstanding. Report / Thesis is very well organized by using appropriate advanced formatting, including shading, alignment tools,

			borders, special fonts, appropriate labels, appropriate column/row height & width.
		Good (80%)	Proficient introduction that states background information, provocative question, topic, thesis, and all subtopics in proper order; thesis is a clear and arguable statement of position. Well researched in detail with accurate & critical evidence from a variety of sources. Consistent connections made among analysis of evidence, subtopics, arguments & thesis / topic; good and generally appropriate conclusions Clear and logical presentation and development of ideas that support thesis; good transitions between paragraphs. Clear, with minimal errors in grammar, spelling and paragraphing. Consistent and correct format in both text and works Cited section Well thought out slides and/or handouts; professional presentation; almost all questions addressed in a professional manner. Report / Thesis is organized by using appropriate formatting, including shading, alignment tools, borders, special fonts, appropriate labels, appropriate column/row height & width
		Average (60%)	Adequate introduction that states topic, thesis and some of the subtopics; thesis is somewhat clear and arguable. Some aspects of paper is researched with some accurate evidence from limited sources Some connections made among analysis of evidence, subtopics, arguments & thesis / topic; limited or somewhat inappropriate conclusions.

			Somewhat clear and logical presentation and development of ideas; adequate transitions between paragraphs. Periodic errors in grammar, spelling and paragraphing. Sometimes inconsistent or incorrect use of citations in both text and Works Cited Acceptable – slides and/or handouts clear; good presentation skills; able to answer most questions. A part of Report / Thesis is organized, using standard formatting tools. Some labels or other important formatting tools are missing.
		Below Average (40%)	Weak introduction of topic and subtopics is weak and lacks an arguable position. Limited information on topic with lack of research, details or historically accurate evidence. Limited connections made among analysis of evidence, subtopics, counterarguments & thesis / topic; complete lack of or inappropriate conclusions Lacks clear and logical presentation and development of ideas; weak transition b/w ideas and paragraphs Inconsistent grammar, spelling and paragraphing throughout paper Very inconsistent or incorrect use of citations in both text and Works Cited section. Poorly organized; rambled; dwelt too long on less important aspects; unable to answer all questions; some slides difficult to read; typos/errors in slides. Report / Thesis is poorly organized Appropriate formatting such as appropriate labels & column/row widths & heights are not used.

Team Work	0.05	**Excellent (100%)**	The team worked well together to achieve objectives. Each member contributed in a valuable way to the project. All data sources indicated a high level of mutual respect and collaboration A clear procedure for making decisions is formally established by the group. Everyone is fully engaged with effective exchange of ideas.
		Good (80%)	The team worked well together most of the time, with only a few occurrences of communication breakdown or failure to collaborate when necessary. Members were mostly respectful of each other. A clear procedure for making decisions is informally established by the group. Everyone is engaged most of the time. The exchange of ideas is effective most of the time.
		Average (60%)	The team did not collaborate or communication well. Some members would work independently, without regard to objectives or priorities. A lack of respect and regard was frequently noted. A procedure for making decisions is established by the group, but it is not clear and/or it focuses on individuals. The group is engaged but can be distracted. Ideas are exchanged with encouragement.
		Below Average (40%)	The team did not collaborate and no communication. No members would work independently, without regard to objectives or priorities. No respect and regard was frequently noted. There is no decision-making process, decisions are made by individuals. The group is only engaged with encouragement or not all members are engaged. Ideas are not exchanged effectively.

Individual Roles Distribution (Individual Objectives in the project work)	0.05	**Excellent (100%)**	The team establishes and documents clear and formal roles/objective for each member and distributes the workload equally.
		Good (80%)	The group establishes clear and formal roles/objective for each member and distributes the workload equally.
		Average (60%)	The group establishes informal roles/objetive for each member. The workload could be distributed more equally.
		Below Average (40%)	The group does not establish roles/objective for each member and/or the workload is unequally distributed.
Individual Contributions (Towards the individual objectives in the project work)	0.05	**Excellent (100%)**	The individual objective of a team member is meets. The individual contributed in a valuable way to the project. The individual is also able to articulate the key performance criteria of successful teams and evaluate the group performance accordingly.
		Good (80%)	The individual objective of a team member is meets halfway through. The individual did not contribute as heavily as others but did meet all responsibilities. The individual is also able to identify some key performance criteria of successful teams and/or draw related connections the team performance
		Average (60%)	The individual objective of a team member is partially meets. The individual did not contribute as even marginally as others but did meet all responsibilities marginally. The individual is also able to identify some key performance criteria of successful teams and/or draw related connections the team performance for some extend.
		Below Average (40%)	The individual objective of a team member is not meets. The individual did not contribute to the project and failed to meet responsibilities. The individual does not identify key performance criteria of successful teams or draw inference to own experience.
Deliverables	0.05	**Excellent (100%)**	Delivers clear, comprehensive recommendations to stake holders that are well supported by project findings.

		Good (80%)	Delivers useful recommendations to the stake holders that are supported by project findings
		Average (60%)	Recommendations may not be useful to stake holders or are weakly supported by project findings.
		Below Average (40%)	Recommendations is not be useful to stake holders or not supported by project findings.
Publication, Patent, Funding, Competitions	0.05	Excellent (100%)	Paper published in the appropriate reputed Journals / Conference. Significant Steps have been evidenced for funding / Patents
		Good (80%)	Paper accepted for publication in the appropriate reputed Journals / Conference. Some steps have been evidenced for funding / Patents
		Average (60%)	Paper submitted for publication in the appropriate reputed Journals / Conference. Lack of Steps have been evidenced for funding / Patents
		Below Average (40%)	Appropriate reputed Journals / Conferences have been not identified. No Steps have been evidenced for funding / Patents / Publication
Peer Assessment	0.05	Excellent (100%)	The team members are assessing the other members in the team in the scale of 20%, 50%,80% and 100%
		Good (80%)	
		Average (60%)	
		Below Average (40%)	

* Publication / Patent / Funding /Awards in Competitions shall be given additional credits as 30% marks can be given as circulated earlier.

<u>**DEPARTMENTAL ELECTIVES**</u>

<u>**SEMESTER-III**</u>

COURSE TITLE	Advanced Java Programming			CREDITS	3
COURSE CODE	CSC4264	COURSE CATEGORY	CORE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Apply Java tools with JDK to analysis, programming and testing				1,2,3
2	implement the interface and to interchange these implementations seamlessly using collection framework				1,2,3
3	Perform practical implementations of GUI using AWT and SWING for creating user interfaces				1,2,3
4	develop client-server application to implement distributed applications				1,2,3
5	Evaluate server side technologies by using Applets and servlets to build dynamic web applications (analysis)				1,2,3
Prerequisites:					
MODULE 1: Tools and Multi-Threading					**9**
Java Tools-Javadoc, Javap, Jcmd, Jhat, Jdb, Jar-Manifest File. Exception Handling-Exceptions - exception hierarchy - throwing and catching exceptions– built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.					

Multi-Threading-Using Sleep, Thread Priority, Synchronization, Inter-Thread Communication. Garbage Collection-Hotspot's Garbage Collection, Tuning Memory Size. Collection Interfaces-Implementation, Algorithms, Counting Frequency.

Practical Component:

1. Java code for thread creation by extending the Thread class
2. Java code for thread creation by implementing the Runnable Interface
3. Java program to demonstrate exception TO demonstrate the runtime system searches th call stack to find appropriate exception handler.
4. Java program to demonstrate inter-thread communication using produce consume methods
5. Java code to illustrate standard input output streams
6. Java Program illustrating the Byte Stream to copy contents of one file to another file

MODULE 2: Generic Programming	9

Collection Framework and Generics- Methods and Constructors, Type Inference, Bounded Type Parameters, Wildcards, Type Erasure, Restrictions on Generics. Reflection-Classes, Class Members, Class Modifiers, Inheritance Hierarchy, Annotations, Field Modifiers, Method Modifiers, Arrays, Dynamic Proxy.

Practical Component:

1. Java Program to illustrate calling of parameterized constructor

2.Java Program to illustrate constructor overloading using same task for different types of arguments.

3.java program to demonstrate arrays to implement Number of indexes with equal elements in given range

4.java program to implement Smallest subarray with sum greater than a given value

5.Java program to illustrate different ways of calling a method

6.java program to demonstrate employee class whose objects are cloned

MODULE 3: AWT and Swing	9

Java Native Interface-Java Program with C/C++, Exception Handling in JNI.AWT Class Hierarchy, Layout, List, Event Handling, Swing, Containment Hierarchy. XML and DOM-Node Interface, Parsing XML, Java DTD Validation. Input/output Streams-Pipes, File I/O, Path Operations, File Attributes, Random Access files, Directories.

Practical Component:

1.Java AWT Program to create a canvas and mouse listener to the canvas

2.Java Program to handle window events

3.Java Program to implement event handling by anonymous class

4.Java Code to implement StAX parser

5.Java program to implement AWT List Program with ActionListener

6.Java program to implement AWT Canvas

MODULE 4: NETWORK PROGRAMMING	9

Java Networking Classes and Interfaces, URL Connection, Proxy Selector. Socket Programming-TCP and UDP Sockets, Multicast Sockets. Remote Method Invocation-Java RMI Interfaces and Classes, Callback, Dynamic Object Activation, Dynamic Class Download. Java Mail API-Secured SMTP, Multi-part MIME Message, IMAP Servers.

Practical Component:

1.Java program to illustrate Server-side implementation using Datagram Socket

2.A Java program for a Server using the constructor with port

3.Java Program demonstrates how to implement a UDP client program

4.Java program to implement the Search interface

5.Java program to send email using the MIME message

6.send email in Java through SMTP server provided by the host provider

MODULE 5: Applets and Servlets	**9**

Client Side Java, Applet Context Interface, Event Handling. Java XML-RPC, Soap Architecture, JAX-WS, Java Cryptography Architecture, SSL, RMI, XML-RPC. Servlet, Java Server Pages, Java Database Connectivity, Hibernate, Directory Interface, COBRA Architecture, Java Server Pages, AJAX.

Practical component:

1.Java Program to Retrieve Contents of a Table Using JDBC connection

2.Java program to sort contents of a table using JDBC

3.Java Program to Join Contents of More than one table & display in JDBC

4.Java Program to implement Echoing HTML Request Parameters using JSP

5.Java Program to implement JSP Page Directives

6.Java Program to implement SSLSocketClient

TEXT BOOKS

1.	Vaskaran Sarcar, "Interactive Object-Oriented Programming in Java", 2nd Edition, APress, 2020.
2.	Uttam K. Roy," Advanced Java Programming", Oxford university press, 2015.
3.	Naughton and H.Schildt, "Java 2-The complete reference", Fifth Edition McGraw Hill, 2007.

REFERENCE BOOKS

1.	Jim Keogh, "The Complete Reference J2EE", Tata McGraw Hill Edition, New Delhi, 2002.
2.	Marty Hall, Larry Brown, "Core Servlets and Java Server Pages", 2nd Edition, Pearson Education, 2004.

E BOOKS

1.	https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf
2.	https://www.tutorialspoint.com/java/java_tutorial.pdf
3.	https://books.goalkicker.com/JavaBook/

MOOC

1.	https://www.coursera.org/learn/object-oriented-programming-with-java
2.	https://www.edx.org/course/advanced-software-construction-in-java

COURSE TITLE	STREAM PROCESSING AND ANALYTICS			CREDITS	3
COURSE CODE	CSC4257	COURSE CATEGORY	PC	L-T-P-S	2-0-2- 0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Explain the need for stream processing	1,2
2	Comprehend the architectures of stream processing.	1,2,12
3	Explain and run Distributed Processing and Resilience Model	1,2,5,12
4	Design effective streaming solutions using Structured Streaming	1,2,3,5,12
5	Design effective streaming solutions using Spark Streaming	1,2,3,5,12

Prerequisites: Python programming

MODULE 1: INTRODUCTION TO STREAM PROCESSING MODEL	(6L+6P)

Fundamentals of Stream Processing: What Is Stream Processing? Examples of Stream Processing- Scaling Up Data Processing- Distributed Stream Processing- Introducing Apache Spark.

Stream-Processing Model: Sources and Sinks- Immutable Streams Defined from One Another- Transformations and Aggregations- Window Aggregations - Stateless and Stateful Processing- The Effect of Time.

Practical Component:
   a. Installing and configuring Apache Spark
   b. Installing and configuring the Scala IDE
   c. Installing and configuring JDK

MODULE 2: STREAMING ARCHITECTURES	(6L+6P)

Components of a Data Platform- Architectural Models- The Use of a Batch-Processing Component in a Streaming Application- Referential Streaming Architectures- Streaming Versus Batch Algorithms.

Apache Spark as a Stream-Processing Engine: Spark's Memory Usage- Understanding Latency- Throughput-Oriented Processing- Fast Implementation of Data Analysis.

Practical Component:
   a. Write your own Spark Streaming program, to count the number of words in text data received from a data server listening on a TCP socket
   b. Write a simple Spark Streaming program that prints a sample of the tweets it receives from Twitter every second.

MODULE 3: DISTRIBUTED PROCESSING AND RESILIENCE MODEL	(6L+6P)

Spark's Distributed Processing Model: Running Apache Spark with a Cluster Manager- Spark's Own Cluster Manager - Resilience and Fault Tolerance in a Distributed System- Data Delivery Semantics- Microbatching and One-Element-at-a-Time - Bringing Microbatch and One-Record-at a- Time Closer Together- Dynamic Batch Interval- Structured Streaming Processing Model. Spark's Resilience Model: Resilient Distributed Datasets in Spark - Spark Components - Spark's Fault-Tolerance Guarantees.

Practical Component:

    a. Create Spark RDD using parallelize with sparkContext.parallelize() method and using Spark shell

    b. Write a scripts in Spark to Read all text files from a directory into a single RDD

    c. Write a spark program to load a CSV file into Spark RDD using a Scala

    d. Write a Spark Streaming program for adding 1 to the stream of integers in a reliable, fault tolerant manner, and then visualize them.

MODULE 4: STRUCTURED STREAMING	(9L+9P)

Introducing Structured Streaming- The Structured Streaming Programming Model – Structured Streaming in Action – Structured Streaming Sources – Structured Streaming Sinks - Event Time– Based Stream Processing.

Practical Component:

    a. Develop a streaming application by- Connecting to a Stream, Preparing the Data in the Stream, Performing Operations on Streaming Dataset, creating a Query, Starting the Stream Processing and Exploring the data.

    b. Create a Structured streaming job by Initializing Spark, acquiring streaming data from sources, declaring the operations we want to apply to the streaming data and outputting the resulting data using Sinks.

    c. Create a small but complete Internet of Things (IoT)-inspired streaming program.

    d. Define the schema in Structured Streaming to handle the data at different levels.

    e. Create custom sinks to write data to systems not supported by the default implementations.

MODULE 5: SPARK STREAMING	(9L+9P)

Introducing Spark Streaming - The Spark Streaming Programming Model - The Spark Streaming Execution Model - Spark Streaming Sources - Spark Streaming Sinks - Time-Based Stream Processing- Working with Spark SQL – Checkpointing - Monitoring Spark Streaming- Performance Tuning.

Practical Component:

  (i) Develop any Spark Streaming application and do the following :

    a) Create a Spark Streaming Context,

    b) Define one or several DStreams from data sources or other DStreams

    c) Define one or more output operations to materialize the results of these DStream operations

    d) Start the Spark Streaming Context to get the stream processing going

TEXT BOOKS

1. Gerard Maas and François Garillot , "Stream Processing with Apache Spark: Mastering Structured Streaming and Spark Streaming", O'Reilly, 2019.

REFERENCE BOOKS

1. Henrique C. M. Andrade, Buğra Gedik and Deepak S. Turaga, "Fundamentals of Stream Processing: Application Design, Systems, and Analytics", Cambridge University Press, 2014.

2. Bryon Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st edition, 2014.

3.	Anindita Basak, Krishna Venkataraman, Ryan Murphy, Manpreet Singh, "Stream Analytics with Microsoft Azure", Packt Publishing, December 2017.
E BOOKS/SUPPORTING RESOURCES	
1.	https://github.com/stream-processing-with-spark
MOOC	
1.	https://www.edx.org/course/processing-real-time-data-streams-in-azure
2.	https://www.coursera.org/learn/big-data-integration-processing

COURSE TITLE	ADVANCED ANDROID APPLICATION DEVELOPMENT			CREDITS	3
COURSE CODE	CSC4265	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Create android services and notifications				1,2,3,4,5,6,8
2	Handle user events and Design accessible applications				1,2,3,4,5,6,8
3	Use different android APIs				1,2,3,4,5,6,8,10
4	Use Google APIs in Application development				1,2,3,4,5,6,8,10
5	Develop 3D applications				1,2,3,4,5,6,8

Prerequisites: Android Application development

MODULE 1: Advanced Android Application Design Principles   (6L+6P)

Threading and Asynchronous Processing - Working with Services - Leveraging SQLite - Application Databases - Building Android Content Providers - Broadcasting and Receiving Intents - Working with Notifications.

Practical Component:
1. Create an application that is able to receive a CALL_BUTTON intent action and, upon doing so, broadcast a custom Intent that displays a success Toast message.
2. Create a new Android application demonstrating how to use the NotificationListenerService class.

MODULE 2: Advanced Android User Interface Design Principles   (6L+6P)

Designing Powerful User Interfaces - Handling Advanced User Input - Designing Accessible Applications - Development Best Practices for Tablets, TVs, and Wearables

Practical Component:
1. Create an application that implements a split action bar.
2. Use the online documentation to create a list of the different input Type constants and their associated constant values.

MODULE 3: Leveraging Common Android APIs   (6L+6P)

Using Android Networking APIs - Using Android Web APIs - Using Android Multimedia APIs - Using Android Telephony APIs - Accessing Android's Hardware Sensors - Using Android's Optional Hardware APIs
Practical Component:

1. Create an application that may operate as the default SMS application if a user selects it as the default SMS application and that may operate as an SMS application if a user selects another application as the default SMS application.
2. Create an application that is capable of batching sensor events.

MODULE 4: Leveraging Google APIs	(6L+6P)

Using Location and Map APIs - Working with Google Cloud Messaging - An Overview of In-App Billing APIs for Android - Enabling Application Statistics with Google Analytics - An Overview of Google Play Game Services
Practical Component:

1. Use the Google Developer Console to create an API key for Google Maps Android API v2 and install and run the SimpleLocation application provided with this chapter.
2. Obtain an API key for the Google Cloud Messaging for Android service, download the sample applications from Google Code, and configure them to work with your API key. Then study the code to make sure you understand how the GCM service works.

MODULE 5: Drawing, Animations, and Graphics Programming with Android	(6L+6P)

Developing Android 2D Graphics Applications - Working with Animation - Developing Android 3D Graphics Applications - Managing User Accounts and Synchronizing User Data - Preparing for Future Android Releases

Practical Component:

1. Create an application that makes use of the Transition framework.
2. Create a simple OpenGL ES 3.0 application that displays a blue square.

TEXT BOOK	
1.	Joseph Annuzzi Jr. Lauren Darcey , Shane Conder, "Advanced Android Application Development", Fourth Edition, Addison-Wesley, 2014

REFERENCE BOOKS	
1.	Dawn Griffiths, David Griffiths," Head First Android Development: A Brain-Friendly Guide", O'Reilly, 2017
2.	Ian F. Darwin, Android Cookbook, O'Reilly; 1st edition (8 May 2012)

E BOOKS	
1.	https://www.pdfdrive.com/android-app-development-in-android-studio-javaandroid-edition-for-beginners-e60596566.html
2.	https://www.pdfdrive.com/introduction-to-android-application-development-android-essentials-e158728319.html

MOOC	
1.	https://developer.android.com/courses/advanced-training/overview
2.	https://www.udacity.com/course/advanced-android-app-development--ud855

SEMESTER-IV

COURSE TITLE	Advanced Computer Networks			CREDITS	3
COURSE CODE	CSC4283	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	50%			ESE	50%
LEARNING LEVEL	BTL-4				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Explain the Application layer protocols and Email transaction procedures				1,2,11,12
2	Understand the concepts of transport layer and flow control and develop a modified congestion control window system.				1,2,11,12
3	Describe the routing protocols used in IP and implement in real-time system.				1,2,11,12
4	Discuss different techniques used in Error detection and correction and design a home network along with WiFi and supporting network devices.				1,2,3,11,12
5	Illustrate different Multimedia Networking Applications and use the network management system in simulation tool.				1,2,6,7,8,9,11,12

Prerequisites: Basic Networking Concepts

MODULE 1: APPLICATION LAYER AND INTERNET (6+6)

Introduction to OSI Protocol suite, Application Layer Protocols-Services, The World Wide Web: HTTP-User-Server Interaction- Web Caches, File Transfer: FTP, Electronic Mail in the Internet – SMTP- POP3-Continuous Media Email, DNS - The Internet's Directory Service

Practical Components

1.Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands

2.Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS

MODULE 2: TRANSPORT LAYER AND FLOW CONTROL   (6+6)

Transport Layer Services and Principles, Socket Programming with TCP, Socket Programming with UDP, Multiplexing and Demultiplexing Applications, Connectionless Transport: UDP -Segment Structure -Checksum, Principles of Reliable Data Transfer, Pipelined Reliable Data Transfer Protocols, Connection-Oriented Transport: TCP - Flow Control- Round Trip Time and Timeout- TCP Connection Management, Principles of Congestion Control, TCP Congestion Control, Modeling Latency: Static Congestion Window - Dynamic Congestion Window.

Practical Components

1.Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address.

2. Integrate the DHCP server with a BOOTP demon to automatically

MODULE 3: NETWORK LAYER AND ROUTING   (6+6)

Routing Principles, Link State Routing Algorithm, Distance Vector Routing Algorithm, Circuit-switched routing, Hierarchical Routing - gateway router, Internet Protocol, IP Addressing, Routing table, Datagram Format, IP Fragmentation and Reassembly, ICMP: Internet Control Message Protocol, Routing in the Internet, Intra-Autonomous System Routing, Open Shortest Path First, Internal Gateway Routing Protocol, Inter-Autonomous System Routing- Routing Information Protocol, Inside a router. Multicast Routing

Practical Components

1.Configuration of IP addressing for a given scenario for a given set of topologies.

2. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols
b. RIP routing protocols
c. BGP routing
d. OSPF routing protocols
e. Static routes (check using netstat)

MODULE 4: LINK LAYER AND LOCAL AREA NETWORKS   (6+6)

The Data Link Layer: Introduction, Services, Error Detection and Correction Techniques- Parity Checks- Checksumming Methods - Cyclic redundancy check, Multiple Access Protocols and LANs-Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols, LAN Addresses and Address Resolution Protocol, Ethernet Protocols, Ethernet Technologies, Bridges and Switches, 802.11 LAN architecture

Practical Components

1. Simulation of Sliding-Window protocol
2. Simulation of Address Resolution Protocol
3. Configuration of switches, routers and Bridges

4. Connection with Wireless LAN and devices with simulators

MODULE 5: MULTIMEDIA NETWORKING AND NETWORK MANAGEMENT	(6+6)

Multimedia Networking Applications, Streaming Stored Audio and Video, Making the Best of the Best-Effort Service: An Internet Phone Example, RTP, Beyond Best Effort, Scheduling and Policing Mechanisms for Providing QoS Guarantees, Integrated Services, RSVP, Differentiated Services.

Introduction to Network Management, Infrastructure for Network Management, Internet Network Management Framework, ASN.1, Firewalls.

Practical Components

1. Simulation of Network management protocols
2. Simulation of RSVP

TEXT BOOKS	
1.	James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Wiley Publication, 2018.
REFERENCE BOOKS	
1.	Dayanand Ambawade, Deven shah and Mahendra Mehra, "Advance Computer Network",Wiley India, 2004.
2.	William Stallings, "High-Speed Networks and Internets, Performance and Quality of Service", Second Edition, Pearson, 2002.
E BOOKS	
1.	http://intronetworks.cs.luc.edu/current2/ComputerNetworks.pdf
MOOC	
1.	https://www.edx.org/course/introduction-to-networking

COURSE TITLE	IOT CLOUD AND DATA ANALYTICS			CREDITS	3
COURSE CODE	CSC4376	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Demonstrate the working of IoT	1,2,3,4,5,12
2	Identify the need of cloud computing for IoT	1,2,3,4,5,12
3	Apply Machine Learning Algorithms for IoT data	1,2,3,4,5,12
4	Predict and visualize output using Data Analytic tools	1,2,3,4,5,12
5	Identify the Vulnerability in connected networks	1,2,3,4,5,6,7,8,12
Prerequisites: Basic Network Concepts		
MODULE 1: INTRODUCTION TO IoT		**(6L+6P)**

Introduction to Internet of Things (IoT)- Concepts and definitions of IoT-History of IoT –IoT data vs big data- IoT Analytics lifecycle and Techniques-IoT complete Technology chain- Applications of IoT-Opportunities and challenges in IoT.

Practical Component:

1. Study of IoT simulators.
2. Simulate data collection using IoT simulators (IOTIFY/NETSIM)
3. Study of Hardware platforms Arduino/Raspberry pi/Node MCU
4. Implement sensor data collection using IoT gateways (Arduino/Raspberry pi/Node MCU)

MODULE 2: IoT and CLOUD	(6L+6P)

Cloud computing – Cloud service models – Cloud Deployment models – Need of cloud computing for IoT-Fog computing Vs Cloud Computing for IoT-IoT Cloud Platforms –Microsoft Azure IoT-Amazon Web Services IoT-IBM WATSON IoT-Google's cloud IoT.

Practical Component:

1. Develop your own Application that stores IoT data in open source IoT cloud platform analytic tools.
2. Study of Streaming IoT data in to Google cloud platform using Qwiklab environment.

MODULE 3: IOT AND MACHINE LEARNING	(6L+6P)

Principles and foundation of Artificial intelligence and IoT – Machine Learning Paradigms for IoT – Supervised learning for IoT-Linear regression-Logistic regression-SVM – Decision Tree -Naïve's bayes-Deep Learning for IoT-Neural Network.

Practical Component:

1. Write a program to implement the Linear regression for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
2. Build a decision tree classifier for weather prediction dataset. Compute the accuracy of the classifier, considering few test data sets.

MODULE 4: DATA ANALYTICS FOR IoT	(6L+6P)

Defining IoT Analytics - IoT Analytics challenges – IoT analytics for the cloud-Microsoft Azure overview– Designing data processing for analytics – Designing visual analysis for IoT data-Data science for IoT-Feature engineering with IoT data.

Practical Component:

1. Develop application for Smart Traffic that analyze the IoT data and predict the Traffic Jam.
2. Visualize the predicted output using Data Analytics tool.

MODULE 5: IoT SECURITY	(6L+6P)

Overview of IoT Security- security Threats in IoT- APIs in IoT-Authentication in IoT-Strategies for securing IoT-Public Key Cryptography.

Practical Component:

1. Implement pen test and identify the vulnerable device in your network using Kali Linux.
2. Implement Password Guess attack after identifying Vulnerable device using Kali Linux.

TEXT BOOKS

1.	Rajkumar Buyya, Amir Vahid Dastjerdi," Internet of Things: Principles and Paradigms", Elsevier,2016.
2.	R. Chandrasekaran," Essentials of Cloud computing", 2nd Edition, Chapman and Hall/CRC, 2015.
3.	Amita Kapoor, "Hands on Artificial intelligence for IoT", 1st Edition, Packt Publishing, 2019.
4.	David Etter," IoT Security: Practical Guide Book", CreateSpace Independent Publishing Platform, 2016.

REFERENCE BOOKS	
1.	John Soldatos, "Building Blocks for IoT Analytics", River Publishers,2016.
2.	John E. Rossman, "The Amazon way on IoT", Volume 2, John E. Rossman publication, 2016.

E-BOOKS	
1.	http://index-of.co.uk/Cloud-Computing-books/Essentials%20of%20cloud%20computing%20(2015).pdf
2.	https://www.iottechexpo.com/2018/11/iot/the-iot-analytics-lifecycle-from-generating-data-to-predicting-the-future-losant/

MOOC	
1.	https://www.coursera.org/learn/cloud-iot-platform
2.	https://www.udemy.com/course/iothacking1/

COURSE TITLE	STATISTICAL INFERENCE FOR DATA SCIENCE			CREDITS	3
COURSE CODE	CSC4358	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Perform exploratory analysis on the datasets	1, 2, 3, 5
2	Understand the various distribution and sampling	1, 2, 3, 5
3	Perform Hypothesis Testing on datasets	1, 2, 3, 5
4	Apply statistical inference for Regression	1, 2, 3,4, 5
5	Apply statistical inference for Classification	1, 2, 3,4, 5

Prerequisites: Python for Data Science/ R for Data Science

MODULE 1: EXPLORATORY ANALYSIS	**(6L+6P)**

Elements of Structured, Estimates of Location - Mean, Median, Mode, Outliers, Estimates of Variability- Standard Deviation, Z-Score, Frequency Table and Histograms, Correlation

Practical Component:

1. Rainfall prediction data set – draw correlation between the features

2. Find the outliers in the Housing Price dataset

Book Pages: Chapter 1

MODULE 2: DATA SAMPLING AND DISTRIBUTION	(6L+6P)

Normalization, Sampling Data-Simple Random sampling, Stratified, Cluster Sampling, Sampling Error/Bias. Bootstrapping, Central Limit Theorem, Confidence intervals, Normal distribution, Binomial distribution, Poisson distribution

Practical Component:

1. For a given dataset, display a chosen feature using different mean values

2. Display the confidence interval of a chosen feature based on a sample

Book Pages: Chapter 2

MODULE 3: HYPOTHESIS	(6L+6P)

A/B Testing, Hypothesis Tests- null, one-way, two-way, P-value, Type 1 & 2 errors, t-tests, multiple testing, degrees of freedom, ANOVA, Chi-Square Tests, Power and Sample Size

Practical Component:

1. Perform t-test on a feature in a dataset

2. Create Boxplots for different groups of a feature

Book Pages: Chapter 3

MODULE 4: REGRESSION AND PREDICTION	(6L+6P)

Simple Linear Regression, Multiple Linear Regression, Confidence and Prediction Intervals, Categorical Variables, Multicollinearity, Polynomial Regression

Practical Component:

1. Create a Linear Regression model for a dataset and display the error measures

2. Chose a dataset with categorical data and apply linear regression model

Book Pages: Chapter 4

MODULE 5: CLASSIFICATION	(6L+6P)

Naive Bayes, Discriminant Analysis, Logistic Regression, Evaluating Classification Models, Strategies for Imbalanced Data

Practical Component:

1. Apply Naïve Bayes algorithm on a dataset and estimate the accuracy

2. Apply Logistic Regression algorithm on a dataset and estimate the accuracy

Book Pages: Chapter 5

TEXT BOOKS	
1.	Bruce, Peter, and Andrew Bruce. Practical statistics for data scientists: 50 essential concepts. " O'Reilly Media, Inc.", 2017.

REFERENCE BOOKS	
1.	Dodge, Yadolah, ed. Statistical data analysis and inference. Elsevier, 2014.
2.	Ismay, Chester, and Albert Y. Kim. Statistical Inference via Data Science: A Modern Dive into R and the Tidyverse. CRC Press, 2019.

E BOOKS	
1.	https://leanpub.com/LittleInferenceBook

MOOC	

1.	https://www.coursera.org/learn/statistical-inference https://www.datacamp.com/community/open-courses/statistical-inference-and-data-analysis

SEMESTER – V

COURSE TITLE	BLOCKCHAIN TECHNOLOGY			CREDITS	3
COURSE CODE	CS4373	COURSE CATEGORY	D E	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Build a bitcoin payment system.				1,2,3
2	Building their own Cryptocurrency and perform Auctions in Ethereum				1,2,3
3	Create and deploy projects using Web3j.				1,2,3
4	Implement an ICO on Ethereum				1,2,3
5	Use Swarm and IPFS for distributed storage.				1,2,3,4

Prerequisites:

MODULE 1: BUILDING A BITCOIN PAYMENT SYSTEM   (6L+6P)

The emergence of blockchain and cryptocurrency-What is blockchain? - Interact with the blockchain- Types of blockchains: Classification of blockchains, Building A Bitcoin payment system: Getting started with Bitcoin, Building a payment gateway.

Practical Component:
1. Run a bitcoin client.
2. Synchronize the blockchain
3. Set up a Regtest environment
4. Build a payment request URI

MODULE 2: CRYPTOCURRENCY AND AUCTIONS IN ETHEREUM   (6L+6P)

Building Your Own Cryptocurrency- Compiling Bitcoin from source- New cryptocurrency – Readercoin: Cloning Bitcoin, Readercoin rebranding- Peer-to-Peer Auctions in Ethereum: Introduction to Ethereum, Building an auction DApp: Auction description, Auction contract in Solidity- Contract code analysis-Enumerations, Arrays, Mappings, Structures, Functions, Modifiers, Inheritance.

Practical component:
1. Prepare your build system and Building Bitcoin Core.
2. Write Hello World smart contract in a higher programming language (Solidity).
3. Solidity example using arrays and functions.

MODULE 3: BLOCKCHAIN-BASED FUTURES SYSTEM	(6L+6P)

Project presentation- Futures smart contract: Block chain oracles- Web3j: Setting up the Web3J-Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract

Practical component:
1. Create a Maven project using Web3j.
2. Construct and deploy your contract (Use deploy method)

MODULE 4: BLOCKCHAINS IN BUSINESS AND CREATING ICO	(6L+6P)

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance-Blockchain-as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and Testing the code.

Practical Component:
1. Implement an ICO on Ethereum.

MODULE 5: DISTRIBUTED STORAGE IPFS AND SWARM	(6L+6P)

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontend using IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup, The web page

Practical component:
1. install IPFS locally on our machine, initialize your node, view the nodes in network and add files and directories
2. install Swarm and run any test file.

TEXT BOOKS	
1.	Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.

REFERENCE BOOKS	
1.	Andreas M. Antonopoulos , "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015
2.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press (2016).

E BOOKS	
1.	https://www.velmie.com/practical-blockchain-study
MOOC	
1.	https://www.udemy.com/course/build-your-blockchain-az/

COURSE TITLE	SOCIAL NETWORK ANALYTICS			CREDITS	4
COURSE CODE	CSC4364	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Understand a social network analysis	1,2,5
2	Understand the Web data and semantics in social network applications	1,2,5,12
3	Model and aggregate the social network data	1,2,5,12
4	Develop social–semantic applications	1,2,5,12
5	Evaluate the social network extraction with case studies	1,2,3,5,12

Prerequisites : Web Technology and Networks

MODULE 1: SOCIAL NETWORK ANALYSIS.	(6L+6P)

Network analysis- Development of Social network analysis- Key concepts and measures in network analysis -The global structure of networks - The macro-structure of social networks - Personal networks.

Practical Component:

To Searching for the keyword Paris using the geographic search of Flickr.

Suggested Readings:

Semantic Web

MODULE2:WEB SEMANTICS IN SOCIAL NETWORK APPLICATIONS	(6L+6P)

Electronic sources for network analysis - Electronic discussion networks - Blogs and online communities - Web-based networks - Knowledge Representation on the Semantic Web - Ontologies and their role in the Semantic Web Ontology languages for the Semantic Web - The Resource Description Framework (RDF) and RDF Schema - The Web Ontology Language (OWL) - Comparison to the Unified Modelling Language (UML) - Comparison to the Entity/Relationship (E/R) model and the relational model - Comparison to the Extensible Markup Language (XML) and XML Schema.

Practical Component:

Identify the features in web pages that can be used for social network extraction.

Suggested Readings:

Web data and semantics

MODULE 3: MODELLING AND AGGREGATING SOCIAL NETWORK DATA	(6L+6P)

State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Representing identity - On the notion of equality - Determining equality - Reasoning with instance equality - Evaluating smushing

Practical Component

a. Add data to a Sesame repository using the web interface

b. Query data through the web interface of Sesame and display the results.

Suggested Readings:

Sesame repository

MODULE 4:DEVELOPING SOCIAL-SEMANTIC APPLICATIONS	(6L+6P)

Building Semantic Web applications with social network features - The generic architecture of Semantic Web applications -Sesame – Elmo – GraphUtil - The features of Flink - System design – open academia: distributed, semantic-based publication management - The features of open academia - System design.

Practical Component: (Algorithm Implementation)

1. Creating and write out a FOAF profile Using Elmo.

Suggested Readings:

ELMO

MODULE 5: EVALUATION OF SOCIAL NETWORK ANALYSIS	(6L+6P)

Evaluation of web-based social network extraction - Data collection - Preparing the data - Optimizing goodness of fit - Comparison across methods and networks - Predicting the goodness of fit - Evaluation through analysis - Semantic-based Social Network Analysis in the sciences - Data acquisition - Representation, storage and reasoning- Visualization and Analysis – Results - Descriptive analysis - Structural and cognitive effects on scientific performance .

Practical Component: (Algorithm Implementation)

1. Collect personal and social data using a custom-built online survey system which an online survey offers several advantages compared to a paper questionnaire

2. Draw the Histogram for the number of web pages per individual.

Suggested Readings:

Evaluation of Social network analysis

TEXT BOOKS	
1.	Peter Mika , Social Networks and the Semantics Web",Springer, 2007

REFERENCE BOOKS	
1.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

E-BOOK

1	http://www.asecib.ase.ro/mps/Social%20Networks%20and%20the%20Semantic%20Web%20[200 7].pdf
MOOC	
1.	https://www.coursera.org/learn/social-network-analysis

COURSE TITLE	INTELLIGENT DATABASE SYSTEMS			CREDITS	3
COURSE CODE	CSC4365	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Understand the concepts of Intelligent database.	1,2,3
2	Make study of the Database installation then create the database with user and apply SQL.	1,2,3,5
3	Understand the concepts of knowledge-based systems and apply with AI	1,2,3,5,12
4	Design and create the small applications	1,2,3,5,12
5	Analyse and Implement for various real-time applications in Intelligent Database System	1, 2, 3, 4, 5, 9,11,12

Prerequisites: Database Management System

MODULE 1: INTRODUCTION TO IDBS	(6L+6P)

Informal definition of the domain - General characteristics of IDBSs - Data models and the relational data model - A taxonomy of intelligent database systems - Guidelines for using intelligent database systems.

Practical Component:
  (a) Install the LAMP
  (b) Configure and setup the Connection between back end & Front End.

MODULE 2: SEMANTIC DATA MODELS	(6L+6P)

Nested and semantic data models – Introduction - The nested relational model - Semantic models - Hyper-semantic data models - Object-oriented approaches to semantic data modeling - Object-oriented database systems - Basic concepts of a core object-oriented data model - Comparison with other data models - Query languages and query processing - Operational aspects – Systems - The ODMG standard - The object-relational data model - Java and databases – Conclusions - Active database systems - Basic concepts – Issues – Architectures - Research relational prototypes—the Starburst Rule System - Commercial relational approaches.

Practical Component:

    (a) Design & create the DB user in database.

    (b) Using SQL - create sample DB for Language –DDL, DML and DCL.

    (c) Create sample java/PHP pages with database access.

MODULE 3: KNOWLEDGE-BASED SYSTEMS- AI CONTEXT	(6L+6P)

Characteristics and classification of the knowledge-based systems – Introduction - The resolution principle - Inference by inheritance – Conclusion - Deductive database systems - Basic concepts - DATALOG language - Deductive database systems and logic programming systems—differences - Architectural approaches - Research prototypes - Updates in deductive databases - Integration of deductive database and object database technologies - Constraint databases - Conclusions.

Practical Component:

1. Working on basic commands on datalog

2. Practice on projection and Selection in datalog

3. Write a program that uses $\underline{+}$ and - from racket/base as external queries using DATALOG language

MODULE 4: ADVANCED KNOWLEDGE-BASED SYSTEMS	(6L+6P)

Introduction - Architectural solutions - The 'general bridge' solution - Extending a KBS with components proper to a DBMS - The 'tight coupling' approach – Conclusion - Advanced solutions: Introduction - A 'knowledge level' approach to the interaction with an IAS- TELOS - a language for implementing very large 'integral approach' systems- The CYC project - Other projects based on a 'conceptual representation' approach - Lexical approaches to the construction of large KBs.

Practical Component:

3. Implement the techniques to manage knowledge-based systems.

MODULE 5: APPLICATIONS IN IDBS	(6L+6P)

Introduction - Temporal databases - Basic concepts - Temporal data models - Temporal query languages – Ontologies -Ontology theoretical foundations - Environments for building ontologies - Structured, semi-structured and unstructured data - Multimedia database - Semi-structured data - Mediators – Motivation – Architecture - Application of mediators to heterogeneous systems – Proposals - Multi-Agents systems - Main issues in designing a multi-agent system - Open problems. Internet indexing and retrieval - Basic indexing methods - Search engines or meta-searchers - Internet spiders - Data mining - Data mining tasks - Data mining tools - Medical and legal information systems - Medical information systems - Legal information systems – Conclusions.

Practical Component:

1. Implement the temporal databases.

2. Design and develop a project using medical information system.

TEXT BOOKS

1.	Elisa Bertino, Barbara Catania, GianPieroZarri, "Intelligent Database Systems",Collection ACM Press.

REFERENCE BOOKS

1.	Ngoc ThanhNguyen, RadoslawKatarzyniak,and Shyi-MingChen (Eds.), "AdvancesinIntelligent Information andDatabase Systems ", Springer, 2010.

E BOOKS	
1.	https://www.eyrolles.com/Informatique/Livre/intelligent-database-systems-9780201877366/

MOOC	
1.	https://www.coursera.org/learn/database-management

SEMESTER – VI

COURSE TITLE	SAS PROGRAMMING			CREDITS	3
COURSE CODE	CSC4380	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Use various components of an INPUT statement to process raw data files in SAS.	1,2,3,5
2	Remember how to Create and Manipulate the temporary and permanent data sets contents from the data set values.	1,2,3,4,5
3	Perform data processing using conditional processing & iterative processing and looping.	1,2,3,4,5
4	Use SAS functions to manipulate character data, numeric data, arrays and SAS date values	1,2,3,4,5
5	Apply the SAS Output Delivery System to prepare detailed reports and Generate summary.	1,2,3,4,5,12

Prerequisites: Basic computer skills

MODULE 1: INTRODUCTION TO SAS & DATA STEP PROCESSING	(6L+6P)

What is SAS – Writing Your First SAS Program - Reading Raw Data from External Files – Introduction - Reading Data Values Separated by Blanks - Specifying Missing Values with List Input - Reading Data Values Separated by Commas from CSV files -Using an alternative Method to Specify an External File - Reading Data Values Separated by Delimiters Other Than Blanks or Commas - Specifying INFILE Options with the DATALINES Statement - Reading Raw Data from Fixed Columns—Method 1: Column Input - Reading Raw Data from Fixed Columns—Method 2: Formatted Input - Using a FORMAT Statement in a DATA Step versus in a Procedure - Using Informats with List Input.

Practical Component:

3. Installation of SAS software.
4. Write a Simple Program to Read Raw Data and Produce a Report.
5. A distributor of athletic shoes is putting all its shoes on sale at 20 to 30% off the regular price. The distributor has two data files, one with information about each type of shoe and one with the discount factors. The first file contains one record for each shoe with values for style, type of exercise (running, walking, or cross-training), and regular price. The second file contains one record for each type of exercise and its discount. Find the sale price, and combines the two data files.

MODULE 2: SAS DATA SETS, LABELS AND FORMATS   (6L+6P)

Creating Permanent SAS Data Sets - SAS Libraries—The LIBNAME Statement - Why Create Permanent SAS Data Sets? -Examining the Descriptor Portion of a SAS Data Set Using PROC CONTENTS - Listing All the SAS Data Sets in a SAS Library Using PROC CONTENTS - Viewing the Data Portion of a SAS Data Set Using PROC PRINT -Using a SAS Data Set as Input to a DATA Step -Creating Labels and Formats - Reading and Writing Data from an Excel Spreadsheet.

Practical Component:
3. Use a DATA step to create a SAS data set from an existing SAS data set.
4. Write a Simple Program to perform PROC PRINT using a SAS Data Set as Input to a DATA Step.
5. Using the SAS Output Delivery System to Convert a SAS Data Set to an Excel Spreadsheet.
6. Listing All the SAS Data Sets in a SAS Library Using PROC CONTENTS.

MODULE 3: PERFORMING CONDITIONAL PROCESSING & ITERATIVE PROCESSING: LOOPING
                                   (6L+6P)

Introduction - Performing Conditional Processing - If-else, if-else with do statement, Select When - Performing Iterative Processing: Looping – Do-loop Statement - Managing SAS Dataset using set statement - Working with Dates -How SAS Stores Dates - Reading Date Values from Text Data - Demonstrating a Date Constant - Computing the Current Date - Extracting the Day of the Week, Day of the Month, Month, and Year from a SAS Date.

Practical Component:
3. Perform the various conditional processing statements.
4. Perform the various Looping operations.
5. Create SAS date values by using the functions MDY, TODAY, DATE, and TIME. Extract the month, year, and interval from a SAS date value by using the functions YEAR, QTR, MONTH, and DAY.
6. Merging Two Data Sets with Different BY Variable Names and variable Data type.

MODULE 4: SAS FUNCTIONS   **(6L+6P)**

Working with Character Functions - Numeric Functions - Combining data set-one to one reading, concatenation and merge - Array-single and multi-dimensional array

Practical Component:
4. Generating Random Numbers.
5. Perform the various string operations.
6. Perform Loading the Initial Values of a Temporary Array from a Raw Data File.
7. Using a Multidimensional Array for Table Lookup.

MODULE 5: PRESENTING AND SUMMARIZING THE DATA   **(6L+6P)**

Descriptive statistics-Proc means and proc freq - Proc report-column, define, headline, head skip, compute, order and group - Proc tabulate, Proc - Proc printto, proc import and proc export - Introducing the Output Delivery System

Practical Component:

3. Using the SAS Data Set College, compute the mean, median, minimum, and maximum and the number of both missing and nonmissing values for the variables Class Rank and GPA. Report the statistics to two decimal places perform the above using PROC FORMAT statements.

4. Using the SAS data set College, create a summary data set call it Class_Summary containing the n, mean, and median of Class Rank and GPA for each value of School Size Use the AUTONAME option to name the variables in this data set.

5. Do the following by using PROC MEANS – use the SAS data set College, create four summary data sets containing the number of nonmissing and missing values and the mean, minimum, and maximum for Class Rank and GPA, broken down by Gender and School Size.

TEXT BOOK	
1.	Ron Cody, " Learning SAS by Example: A Programmer's Guide " ,2nd Edition. Cary, NC: SAS Institute Inc,2018.

REFERENCE BOOKS	
1.	Geoff Der , Brian S. Everitt, " Geoff Der , Brian S. Everitt, " A Handbook of Statistical Analyses using SAS ", 5th Edition, October 2012, SAS Institute.
2.	Geoff Der , Brian S. Everitt, " A Handbook of Statistical Analyses using SAS ", 2nd Edition, Library of Congress Cataloging-in-Publication Data,2002.

E BOOKS	
1.	https://support.sas.com/content/dam/SAS/support/en/books/learning-sas-by-example-a-programmers-guide-second-edition/71442_excerpt.pdf
2.	https://www.sas.com/storefront/aux/en/splsb/65423_excerpt.pdf
3.	https://www.dermepi.eu/wpcontent/uploads/2017/04/Little.SAS_.Book_.A_Primer.Third_.Edition.pdf

MOOC	
1.	https://www.coursera.org/courses?query=sas

COURSE TITLE	SMART SENSOR TECHNOLOGIES			CREDITS	3
COURSE CODE	CSC4277	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					

1	Analyse the sensors available in IoT based on application requirement and the Sensing methods	1,2,3,12
2	Create a Real-time application by choosing appropriate sensors for Temperature monitoring.	1,2,3,4,5,12
3	Interfacing different types of Sensors with MCU	1,2,3,4,5,12
4	Infer Wireless Sensing, RF Sensing and RF MEMS	1,2,3,4,12
5	Design a real-time application for landslide monitoring and hazard mitigation	1,2,3,4,5,12

Prerequisites: Electronic Devices and Circuits

MODULE 1: BASICS OF SENSORS   **(6L+6P)**

Introduction- Sensor Vs Transducer, Nature of Sensors, Sensor Output Characteristics, Sensing Technologies, Digital Output Sensors.

Practical Component:

1. Case study on various sensors and its working
Simulate a smart home with various smart devices

MODULE 2: APPLICATION SPECIFIC SENSORS   **(6L+6P)**

Occupancy and motion detectors: ultrasonic – microwave – capacitive detectors- optical presence sensor, Light Detectors: Photo diodes – photo transistor – photo resistor- CCD and CMOS image sensors, Temperature Sensors: thermos-resistive sensors – thermoelectric contact sensor

Practical component:

1. Study the Temperature sensor and simulate an experiment to monitor temperature.
2. Simulation of Industrial automation

MODULE 3: SENSOR WITH MICROCONTROLLER   **(6L+6P)**

Introduction, Amplification and Signal Conditioning, Integrated Signal Conditioning, Digital Conversion, MCU Control, MCUs for Sensor Interface, Techniques and Systems Considerations, Sensor Integration

Practical Component:

1. Simulation of Air Quality monitoring
2. Simulation of Autonomous vehicles using Cyber Physical Systems.

MODULE 4: WIRELESS SENSING   **(6L+6P)**

Wireless Data and Communications, Wireless Sensing Networks, Industrial Wireless Sensing Networks, RF Sensing, Telemetry, RF MEMS, Complete System Consideration.

Practical Component:

1. Simulation of Commercial building automation
2. Simulation of road safety Sensing

MODULE 5: SMART APPLICATIONS AND SYSTEM REQUIREMENTS   **(6L+6P)**

Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements.

Practical component:

1. Simulation of Motion sensor for landslide monitoring and hazard mitigation
2. Case study on wearable sensors

TEXT BOOKS	
1.	Frank, Randy, "Understanding smart sensors", Artech House integrated microsystems series, 3rd Edition, 2013.
2.	Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", 5th Edition, Springer, 2016

REFERENCE BOOKS	
1.	Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 16-Nov- 2018.
2.	Henry Leung, Subhas Chandra Mukhopadhyay, "Intelligent Environmental Sensing", Springer, 22-Jan-2015.

E BOOKS	
1.	https://www.sciencedirect.com/topics/engineering/smart-sensors
1.	https://www.azosensors.com/article.aspx?ArticleID=1289

MOOC	
1.	https://www.coursera.org/learn/internet-of-things-sensing-actuation
2.	https://www.udemy.com/course/sensors-sensor-fundamentals/

COURSE TITLE	CYBER FORENSIC ANALYTICS			CREDITS	3
COURSE CODE	CSC4381	COURSE CATEGORY	DE	L-T-P-S	2-0-2- 0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				
CO	COURSE OUTCOMES				PO
Upon completion of this course, the students will be able to					
1	Outline the Cyber crime and its types.				1,2,5
2	Explore the Cyber Forensics Techniques				1,2,5,12
3	Use the Cyber Investigation Techniques				1,2,5,12
4	Explore the Cyber Evidence Management Techniques				1,2,5,12
5	Outline the Cyber Laws in India				1,2,3,5,12
Prerequisites : Nil					

MODULE 1: CYBER CRIME	(12)

Cyber Space – Cyber Crime – Criminal Behaviour – Jurisdictional Concerns - Jurisprudential Inconsistency – eCash Security – Prepaid Cards – Stored Values Cards – Mobile Payments – Internet Payment Services - Cyber stalking - Cyber extortion – Cyber terrorism - Cyber warfare –Cyber weapons -ATM frauds – Phreaking – Internet Gambling

Practical Component:

1. Key logger
2. Email Fraud

Suggested Readings:

Telecommunication Fraud - Software piracy

MODULE 2: CYBER FORENSICS	(12)

Digital device – Hard disk –Disk characteristics - Disk imaging - Data Carving – Techniques - commercial piracy - soft lifting – Steganography – Network components - Port scans - Wireshark - pcap analysis - Trojans and Backdoors – Botnets - DoS – DDoS Attacks - Honey Pots – Malware – Virus and Worms

Practical Component:

1. Pcab file Analysis – Case Study
2. Network Port Scan – Forensics

Suggested Readings:

Active and Passive Sniffing

MODULE 3: CYBER INVESTIGATION	(12)

Concepts of Investigation - cyber investigation, Network Investigation - Investigating audit logs - Investigating Web attacks - Investigating Computer Intrusions - Profiling – Cyber Criminal profiling – Stylometric Techniques – Warranted searches – Warrantless searches – Undercover Techniques

Practical Component:

1. Investigating Audit Logs
2. Investigating Web attacks

Suggested Readings:

Surveying and preserving digital crime scene

MODULE 4: EVIDENCE MANAGEMENT	(12)

Evidence – Digital Evidence - Types – physical evidence – Real evidence – Circumstantial evidence – network evidence - Evidence collection – Evidence Analysis - Contextual Information –Evidence Management – pre search activities – On Scene activities – Report Preparations

Practical Component:

1. Digital Evidence Analysis
2. Network Analysis

Suggested Readings:

Investigative Reconstruction with Digital Evidence

MODULE 5: CYBER LAWS AND AUTHORITIES	(12)

Information Technology Act 2000 – Digital signature - Electronic Governance - Secure electronic records - Regulation of certifying authorities – CERNTin - Electronic signature certificates - Penalties compensation - Future Trends and Emerging Concerns

Practical Component:

1. Digital Signature

Suggested Readings:

IPR Laws

TEXT BOOKS	
1.	Marjie T. Britz, "Computer Forensics and Cyber Crime", Pearson, 2013.
2.	Garima Tiwari, "Understanding Laws– Cyber Laws And Cyber Crimes", Lexis Nexis, 2014.

REFERENCE BOOKS	
1.	Chuck Easttom, Jeff Taylor, "Computer Crime, Investigation, and the Law", Course Technology, 2018.
2.	Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Eoghan Casey, 2018.

E-BOOK	
1	http://index-of.es/Miscellanous/LIVRES/Syngress.Cyber.May.2014.ISBN.0128007435.pdf
2.	http://index-of.es/Miscellanous/LIVRES/Syngress.Cyber.May.2014.ISBN.0128007435.pdf

MOOC	
1.	https://www.coursera.org/lecture/cyber-conflicts/introduction-to-cybercrime-and-fundamental-issues-xndSq

SEMESTER – VII

COURSE TITLE	HIGH DIMENSIONAL DATA ANALYSIS			CREDITS	3
COURSE CODE	CSC4465	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-3				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Outline the classical High Dimensional problems.	1,2,5
2	Explore the Principal component analysis and canonical correlation	1,2,5,12
3	Use the Factors and grouping techniques.	1,2,5,12
4	Explore the non-Gaussian analysis.	1,2,5,12
5	Outline the Feature selection and principal component analysis.	1,2,3,5,12

Prerequisites : Data Analytics	
MODULE 1: CLASSICAL METHODS	**(6L+6P)**

Classical method- Multi variant and High dimensional problems – Visualization – Multi variant Random vector and data- Multi dimensional data

Practical Component: (Algorithm Implementation)

1. Partial least square solution
2. Discriminant adaptive nearest neighbour Rule

Suggested Readings:

High Dimensional data.

MODULE2: DISCRIMINANT ANALYSIS	**(6L+6P)**

Visualizing principal component analysis – Properties of principal component - Standardized data and high dimensional data - Asymptotic results - Number of components and regression - Canonical correlation analysis -Population - sample and properties of canonical correlation, Asymptotic consideration - Canonical correlation and regression

Practical Component:(Algorithm Implementation)

1. Principal Component Discriminant Analysis
2. Discriminant Analysis with Variable Ranking

Suggested Readings:

Visualizing principal component.

MODULE 3: FACTORS AND GROUPING	**(6L+6P)**

Norms proximities, features, and dualities - Vectors and matrix norms, measure of proximity - Features and feature maps, dualities of X and X Transpose - Cluster analysis - Hierarchal agglomerative clusters -3k means clustering, -Principal component and cluster analysis- Factor Analysis, population k factor model - Sample k factor model - Multidimensional scaling, classical scaling, metric scaling and non-metric scaling.

Practical Component:(Algorithm Implementation)

1. Hierarchical Agglomerative Clustering
2. Mode and Cluster Tracking.

Suggested Readings:

Factor Scores and Regression

MODULE 4:NON-GUASSIAN ANALYSIS	**(6L+6P)**

Factor Analysis - Population k factor model – Sample k factor model - Multidimensional scaling - Towards non Gaussianity - Independent component Analysis -Projection pursuit -Kernal and more independent component methods.

Practical Component:(Algorithm Implementation)

2. The Gap Statistic
3. Non-Gaussian Directions from Structure Removal and Fast ICA

Suggested Readings:

Gaussianity and Independence

MODULE 5: FEATURE SELECTION	**(6L+6P)**

Introduction-Independent component and feature selection -Variable Ranking and statistical learning - Sparse principle component analysis – Consistency of principle component analysis as dimension grows.

Practical Component:(Algorithm Implementation)

3. Sparse Principal Components from Rank One Approximations
4. Sparse Principal Components Based on Variable Selection

Suggested Readings:

Sparse Principle Component Analysis.

TEXT BOOKS	
1.	Inge Koch , Analysis of Multivariate and High-Dimensional Data",Cambridge University Press ,2014

REFERENCE BOOKS	
1.	Fatemeh Emdad, SeyedZekavat , "High Dimensional Data Analysis: Overview, Analysis, and Applications, VDM Verlag, 2008

E-BOOK	
1	https://www.cambridge.org/core/books/analysis-of-multivariate-and-highdimensional-data/2BF8DE949E18E3A68001976784087816

MOOC	
1.	https://www.edx.org/course/high-dimensional-data-analysis

COURSE TITLE	CONDITIONAL MONITORING TECHNIQUES FOR DATA SCIENCE			CREDITS	3
COURSE CODE	CSC4466	COURSE CATEGORY	CORE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
	Upon completion of this course, the students will be able to	
1	Understand the fundamentals of condition monitoring techniques	1,2,3
2	Apply the conditional monitoring technique to identify the faults	1,2,3
3	Know the role of Networks in Condition monitoring	1,2,3
4	Apply for Transfer Bushings	1,2,3
5	Investigate the online condition monitoring	1,2,3

Prerequisites:

MODULE 1: INTRODUCTION	(6L+6P)

Theory of condition Monitoring- Stages of condition Monitoring- Data and Strategies used for condition Monitoring-Data preprocessing Techniques-Data Acquisition System-Fourier Transform-Model Properties-Pseudo model Energies-Fractal Dimension-MFCC- Kurtosis Wavelet Transform- Principal component Analysis

Practical component:
1. Practice on data preprocessing
2. Experimentation on Data Acquition

MODULE 2: MULTILAYER PERCEPTRON   (6L+6P)

Mathematical Framework-Multifold Cross validation Method-Applications to Cylindrical Shells-Bayesian Approaches to Conditional Monitoring-Neural Networks- Sampling Methods-Fault Identification of Cylindrical Shells.

Practical component:
1. Implement the Bayesian Approach for structural and health Monitoring
2. Develop the Model based on failure detection for cylindrical shells

MODULE 3: NETWORK APPROACH TO CONDITION MONITORING (6L+6P)

Committee of Networks-Bayes Optimal Classifier-Bagging-Boosting-Stacking-Evolutionary Committees-Theoretical Background-Theory of committee of Networks-Gaussian Mixture Models and Hidden Markov models for Condition Monitoring-Fuzzy system for Condition Monitoring

Practical component:
1. Apply the condition monitoring techniques for Machine tool with Gaussian mixture model
2. Analyze the Use of Fuzzy Logic for Condition Monitoring of Motor Driven Machineries

MODULE 4: ROUGH SETS FOR CONDITION MONITORING (6L+6P)

Rough Sets—Discriminative Methods-Rough set Formulation-Optimized Rough Sets-Application to Transfer Bushings-Condition Monitoring with incomplete Information-Genetic Algorithm-Missing Entry Methodology-Dynamics

Practical component:
1. Develop the system for On-line Condition Monitoring and Diagnosis for Power Transformers
2. Apply the Genetic algorithms for feature selection in machine condition monitoring

MODULE 5: CONDITION MONITORING USING SVM   (6L+6P)

Features-Feature Extraction-Classification Techniques-Support Vector Machine -Extension Neural Networks-On-line Condition monitoring using ensample learning-Ensample Methods-Learn++ On-line Method-Multi layer perceptron- Experimental Investigation.

Practical component:
1. Build a Model for On-line Condition monitoring using ensample learning
2. Investigate the On-line Method for conditional monitoring using Multi-layer perceptron

TEXT BOOKS

| 1. | Tshilidzi Marwala,"Condition Monitoring Using Computational Intelligence Methods: Applications in Mechanical and Electrical Systems", Publisher : Springer; 2012th edition ISBN-10 : 1447161343. |

REFERENCE BOOKS

| 1. | A. Davies,"Handbook of Condition Monitoring Techniques and Methodology, Springer Science & Business Media, 1998, ISBN 978-94-011-4924-2. |

2.	Amiya Ranjan Mohanty,” Machinery Condition Monitoring Principles and Practices”, CRC Press July 2017, ISBN 9781138748255.
E BOOKS	
1.	http://www.str-tn.org/handbook_of_condition_monitoring_techniques_and_methodology.pdf
2.	https://pdfsu.club/lib.php?q=handbook-of-condition-monitoring-techniques-and-methodology&ref=climber.uml.edu.ni
MOOC	
1.	https://www.classcentral.com/course/swayam-machinery-fault-diagnosis-and-signal-processing-9867
2.	https://onlinecourses.swayam2.ac.in/nou21_me10/preview

COURSE TITLE	IMAGE ANALYTICS			CREDITS	3
COURSE CODE	CSC4467	COURSE CATEGORY	DE	L-T-P-S	2-0-2-0
CIA	60%			ESE	40%
LEARNING LEVEL	BTL-4				

CO	COURSE OUTCOMES	PO
Upon completion of this course, the students will be able to		
1	Infer the basics and fundamentals of digital image processing and Apply the various techniques for intensity transformations functions. Implement Color image Smoothing and Sharpening.	1,2,3,4, 12
2	Illustrate Morphological operation and Apply Some Basic Morphological Algorithms.	1, 2, 3, 4, 5,9,11, 12
3	Apply image segmentation techniques such as Optimum Global Thresholding using Otsu's Method, Active Contours: Snakes and Level Sets for various real-time applications.	1, 2, 3, 4, 5,9,11,12
4	Analysis various Feature Extraction methods and Implement for various real-time applications.	1, 2, 3, 4, 5, 9,11,12
5.	Apply and Analysis various Image Pattern Classification methods such as Minimum-Distance Classification, Optimum (Bayes) Statistical Classification, and Deep Convolutional Neural Network.	1, 2, 3, 4, 5, 9,11,12
Prerequisites: Digital Signal Processing		
MODULE 1: DIGITAL IMAGE FUNDAMENTALS		**(6L+6P)**

Introduction – Fundamental steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – Mathematical Tools Used in Digital Image Processing. Some Basic Intensity Transformation Functions: Image Negatives, Log Transformations, Power-Law Transformations -

Histogram Processing. Color Fundamentals - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters.

Practical Component: Use Python/ MATLAB

1. Apply various intensity transformations functions.
2. Computing and plotting image histograms and use standard image processing toolbox Spatial filters.
3. Implement color image Smoothing and Sharpening.

MODULE 2: MORPHOLOGICAL IMAGE PROCESSING	(6L+6P)

Morphological Image Processing: Fundamentals - Erosion and Dilation - Opening and Closing – Hit or Miss Transform - Some Basic Morphological Algorithms – Morphological Reconstruction – Grayscale Morphology

Practical Component: Use Python/ MATLAB

1. Implement Morphological operations.
2. Implement Morphological Reconstruction.
3. Implement Grayscale Morphology.

MODULE 3: IMAGE SEGMENTATION	(6L+6P)

Introduction - Point, Line, and Edge Detection – Thresholding: Foundation, Basic Global thresholding, Optimum Global Thresholding using Otsu's Method, Multiple Thresholds, Variable Thresholding – Segmentation by Region Growing and by Region Splitting and Merging – Image Segmentation: Active Contours: Snakes and Level Sets.

Practical Component: Use Python/ MATLAB

1. Implement Optimum Global Thresholding using Otsu's Method.
2. Implement Image segmentation by Region Growing, Splitting and Merging
3. Implement Image Segmentation by Active Contours using anyone method Snakes and Level Sets.

MODULE 4: FEATURE EXTRACTION	(6L+6P)

Background - Representation – Boundary Preprocessing – Boundary Feature Descriptors: Some Basic Boundary Descriptors, Shape Numbers, Fourier Descriptors, Statistical Moments - Regional Feature Descriptors: Some Basic Descriptors, Topological and Texture Descriptors, Moment Invariants – Principal Components as Feature Descriptors – Whole-image Features Object – Scale-Invariant Feature Transform (SIFT).

Practical Component: Use Python/ MATLAB

1. Implement Boundary Feature Descriptors
2. Implement Topological and Texture Descriptors
3. Implement Scale-Invariant Feature Transform (SIFT)

MODULE 5: IMAGE PATTERN CLASSIFICATION	(6L+6P)

Background -Patterns and Pattern Classes – Pattern Classification by Prototype Matching: Minimum-Distance Classifier, Using Correlation for 2-D prototype matching, Matching SIFT Features, Matching Structural Prototypes - Optimum (Bayes) Statistical Classifiers - Neural Networks and Deep Learning: Background - The Perceptron -   Multilayer Feedforward Neural Networks - Deep Convolutional Neural Networks

Practical Component: Use Python/ MATLAB

1. Implement Minimum-Distance Classification Algorithm.
2. Implement Optimum (Bayes) Statistical Classification Algorithm.
3. Implement Deep Convolutional Neural Network.

TEXT BOOKS	
1.	Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", 4th Edition, Pearson, 2018.

REFERENCE BOOKS	
1.	Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
2.	Anil K.Jain, "Fundamentals of Digital Image Processing", Person Educaiton, 2003.

E BOOKS	
1.	https://www.academia.edu/19746149/ Digital_Image_Processing_3rd_Edition_Instructors_Manual_Rafael_C._Gonzalez
2.	https://www.academia.edu/18324189/Digital_image_processing_using_matlab_gonzalez
3.	https://pdfs.semanticscholar.org/15bd/427a1a5f9bc57a7f67fb1b1fc85c5bb39f46.pdf

MOOC	
1.	https://www.coursera.org/learn/digital
2.	https://www.udemy.com/topic/digital-image-processing/
3.	https://www.edx.org/course/image-processing-and-analysis-for-life-scientists