KUMARAGURU COLLEGE OF TECHNOLOGY

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049

B.E., INFORMATION SCIENCE AND ENGINEERING

REGULATIONS 2018

CURRICULUM AND SYLLABI

I to VIII Semesters

Department of Information Science and Engineering

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

VISION

To create an ecosystem that empowers human intelligence through information science and engineering for sustainable development

MISSION

Nurture human capabilities in emerging areas with strong foundational knowledge, through a harmonious, stable, and dynamic process of synchronization with changing technology landscape

Build multidisciplinary network of competent people to solve global challenges by providing innovative, integrated, and impactful solutions

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The graduates of the program will be able to:

PEO1: Make appropriate decisions based on balanced information

PEO2: Perceive and deal dynamically with multiple dimensions of information

PEO3: Adopt inclusive approach in every aspect of information system, especially in dealing with personally identifiable information

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

PROGRAM OUTCOMES (POs)

Graduates of the Information Science and Engineering Undergraduate Program will have the ability to:

PO1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: 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 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: 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: 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: 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: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

PO10: 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: 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.

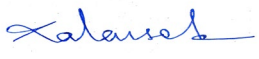
PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the Information Science and Engineering Undergraduate Program will have the ability to:

PSO1: Maximize the Utility of Information through Data Analytics.

PSO2: Assure the Security and Privacy of Information through appropriate Integration of People, Process and Technology dimensions.



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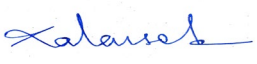
REGULATIONS 2018

B.E. INFORMATION SCIENCE AND ENGINEERING

CURRICULUM

Semester I										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAI1201	Linear Algebra and Calculus	Embedded - Theory & Lab	BS	3	0	2	0	4	
2	U18ENI1201	Fundamentals of Communication-I	Embedded - Theory & Lab	HS	2	0	2	0	3	
3	U18BTI1201	Computational Biology	Embedded - Theory & Lab	BS	3	0	2	0	4	
4	U18CSI1201	Structured Programming using C	Embedded - Theory & Lab	ES	3	0	2	0	4	
5	U18EEI1201	Basic Electrical and Electronics Engineering	Embedded - Theory & Lab	ES	3	0	2	0	4	
6	U18INI1600	Engineering Clinic -I	Project based course with lab	ES	0	0	4	2	3	
Total Credits									**22**	
Total Contact Hours/week									**30**	

Semester II										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAI2201	Advanced Calculus and Laplace Transforms	Embedded - Theory & Lab	BS	3	0	2	0	4	U18MAI1201
2	U18ENI2201	Fundamentals of Communication- II	Embedded - Theory & Lab	HS	2	0	2	0	3	
3	U18PHI2201	Engineering Physics	Embedded - Theory & Lab	BS	3	0	2	0	4	
4	U18CSI2201	Python Programming	Embedded - Theory & Lab	ES	2	0	2	0	3	
5	U18ISI2202	Digital Logic and Microprocessor	Embedded - Theory & Lab	PC	3	0	2	0	4	U18EEI1201
6	U18INI2600	Engineering Clinic – II	Project based course with lab	ES	0	0	4	2	3	U18INI1600
Total Credits									**21**	
Total Contact Hours/week									**29**	



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Semester III										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAT3102	Discrete Mathematics	Theory	BS	3	1	0	0	4	
2	U18ISI3201	Data Structures	Embedded - Theory & Lab	PC	3	0	2	0	4	
3	U18IST3002	Computer Architecture	Theory	PC	3	0	0	0	3	
4	U18ISI3203	Object Oriented Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
5	U18ISI3204	Database Management Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	
6	U18INI3600	Engineering Clinic –III	Project based course with lab	ES	0	0	4	2	3	U18INI2600
Total Credits									**22**	
Total Contact Hours/week									**28**	

Semester IV										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18MAI4201	Probability and Statistics	Embedded - Theory & Lab	BS	3	0	2	0	4	
2	U18IST4001	Design and Analysis of Algorithms	Theory	PC	3	0	0	0	3	U18ISI3201
3	U18ISI4202	Operating Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	U18IST3002
4	U18ISI4203	Software Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	U18ISI3203
5	U18IST4004	Artificial Intelligence	Theory	ES	3	0	0	0	3	
6	U18INI4600	Engineering Clinic –IV	Project based course with lab	ES	0	0	4	2	3	U18INI3600
Total Credits									**21**	
Total Contact Hours/week									**27**	

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Semester V										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18ISI5201	Computer Networks	Embedded - Theory & Lab	PC	3	0	2	0	4	
2	U18ISI5202	Big Data Technologies	Embedded - Theory & Lab	PC	3	0	2	0	4	U18ISI3204
3	U18IST5003	Social Media Marketing	Theory	HS	3	0	0	0	3	
4	U18ISE---	Professional Elective - I	Theory	PE	3	0	0	0	3	
5	U18ISE----	Professional Elective - II	Theory	PE	3	0	0	0	3	
6	U18OE----	Open Elective	Theory	OE	3	0	0	0	3	
7	U18INI5600	Engineering Clinic –V	Project based course with lab	ES	0	0	4	2	3	
Total Credits									**23**	
Total Contact Hours/week									**28**	

Semester VI										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18ISI6204	Machine Learning Techniques	Embedded - Theory & Lab	PC	3	0	2	0	4	
2	U18IST6002	Cryptography and Network Security	Theory	PC	3	0	0	0	3	U18ISI5201
3	U18ISI6203	Internet and Web Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
4	U18ISE---	Professional Elective – III	Theory	PE	3	0	0	0	3	
5	U18ISE----	Professional Elective - IV	Theory	PE	3	0	0	0	3	
6	U18OE----	Open Elective	Theory	OE	3	0	0	0	3	
Total Credits									**20**	
Total Contact Hours/week									**22**	

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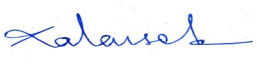
Semester VII										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18IST7001	Information Storage and Retrieval	Theory	PC	3	0	0	0	3	
2	U18ISI7202	Data Visualization	Embedded - Theory & Lab	PC	3	0	2	0	4	
3	U18ISE----	Professional Elective - V	Theory	PE	3	0	0	0	3	
4	U18ISE---	Professional Elective - VI	Theory	PE	3	0	0	0	3	
5	U18ISP7703	Project Phase - I	Project only Course	PW	0	0	0	6	3	
Total Credits									**16**	
Total Contact Hours/week									**20**	

Semester VIII										Pre-requisite
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	
1	U18ISP8701	Project Phase - II	Project only Course	PW	0	0	0	24	12	
Total Credits									**12**	
Total Contact Hours/week									**24**	

LIST OF MANDATORY COURSES										
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Semester
1	U18VEP1501	Human Excellence - Personal Values	Lab	HS	0	0	2	0	0	1
2	U18VEP2502	Human Excellence - Inter Personal values	Lab	HS	0	0	2	0	0	2
3	U18VEP3503	Human Excellence- Family Values	Lab	HS	0	0	2	0	0	3
4	U18CHT4000	Environmental Science and Engineering	Theory	MC	3	0	0	0	0	4
5	U18VEP4504	Human Excellence- Professional Values	Lab	HS	0	0	2	0	0	4
6	U18INT5000	Constitution of India	Theory	MC	2	0	0	0	0	5
7	U18VEP5505	Human Excellence- Social Values	Lab	HS	0	0	2	0	0	5
8	U18VEP6506	Human Excellence- National Values	Lab	HS	0	0	2	0	0	6
9	U18VEP7507	Human Excellence- Global Values	Lab	HS	0	0	2	0	0	7



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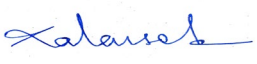
PROFESSIONAL ELECTIVES									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1	U18ISE0001	Image and Video Analytics	Theory	PE	3	0	0	0	3
2	U18ISE0002	Graphics and Multimedia	Theory	PE	3	0	0	0	3
3	U18ISE0003	Principles of Compiler Design	Theory	PE	3	0	0	0	3
4	U18ISE0004	Soft Computing	Theory	PE	3	0	0	0	3
5	U18ISE0005	IOT Architecture and Protocols	Theory	PE	3	0	0	0	3
6	U18ISE0006	Cloud Architecture and Computing	Theory	PE	3	0	0	0	3
7	U18ISE0007	Software Project Management	Theory	PE	3	0	0	0	3
8	U18ISE0008	Deep Learning	Theory	PE	3	0	0	0	3
9	U18ISE0009	Information Privacy	Theory	PE	3	0	0	0	3
10	U18ISE0010	Information Security Management	Theory	PE	3	0	0	0	3
11	U18ISE0011	Blockchain Technology	Theory	PE	3	0	0	0	3
12	U18ISE0012	Software security	Theory	PE	3	0	0	0	3
13	U18ISE0013	Product Management	Theory	PE	3	0	0	0	3
14	U18ISE0014	Financial and Business Analytics	Theory	PE	3	0	0	0	3
15	U18ISE0015	Data Mining	Theory	PE	3	0	0	0	3



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SEMESTER I

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U18MAI1201 **LINEAR ALGEBRA AND CALCULUS**

(Common to All branches)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

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

CO1: Identify eigenvalues and eigenvectors and apply Cayley Hamilton theorem.
CO2: Apply orthogonal diagonalisation to convert quadratic form to canonical form.
CO3: Solve first order ordinary differential equations and apply them to certain physical situations.
CO4: Solve higher order ordinary differential equations.
CO5: Evaluate the total derivative of a function, expand the given function as series and locate the maximum and minimum for multivariate function.
CO6: Determine Rank, Inverse, Eigenvalues, Eigenvectors of the given matrix, Maxima-Minima of the function and Solving Differential equations using MATLAB

Pre-requisites: Nil

CO/PO Mapping S-Strong, M-Medium, W-Weak													**PSO Mapping**	
COs	**PO**												**PSO**	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S			M				M	M		M	M	
CO2	S	S			M				M	M		M	M	
CO3	S	S			M				M	M		M	M	
CO4	S	S			M				M	M		M	M	
CO5	S	S			M				M	M		M	M	
CO6	S	S			M				M	M		M	M	

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENT

MATRICES 6 Hours

Rank of a matrix – Consistency of a system of linear equations - Rouche's theorem - Solution of a system of linear equations - Linearly dependent and independent vectors– Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem (excluding proof)

DIAGONALISATION OF A REAL SYMMETRIC MATRIX 6 Hours

Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

FIRST ORDER ORDINARY DIFFERENTIAL 11 Hours

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS 11 Hours

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients – Applications.

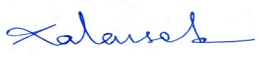
FUNCTIONS OF SEVERAL VARIABLES 11 Hours

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007
5. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008
6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai,2003



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7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus, Pearson education 12th Edition, 2015
8. P.Bali., Dr. Manish Goyal., Transforms and partial Differential equations, University Science Press, New Delhi, 2010
9. G.B.Thomas and R.L.Finney, Calculus and analytical geometry, 11th Edition, PearsonEducation, (2006)

LAB COMPONENT **30 Hours**

List of MATLAB Programmes:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse
3. Rank of a matrix and solution of a system of linear equations
4. Characteristic equation of a Matrix and Cayley-Hamilton Theorem.
5. Eigenvalues and Eigenvectors of Higher Order Matrices
6. Curve tracing
7. Solving first order ordinary differential equations.
8. Solving second order ordinary differential equations.
9. Determining Maxima and Minima of a function of one variable.
10. Determining Maxima and Minima of a function of two variables.

Theory:45	**Tutorial:0**	**Practical:30**	**Project:0**	**Total: 75 Hours**

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U18ENI1201 FUNDAMENTALS OF COMMUNICATION-I
(Common to all Branches of I Semester B.E/B/Tech Programmes)

L	T	P	J	C
2	0	2	0	3

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

CO1: Communicate in English with correct grammar
CO2: Communicate effectively (Oral and Written)
CO3: Use communication skills in the real world

Pre-requisites: Nil

CO/PO Mapping S-Strong, M-Medium, W-Weak													PSO Mapping	
COs	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										S		S	M	M
CO2		M		W		W			M	S		S	S	S
CO3		M		M		W			M	S		S	S	S

Assessment Methods:

Direct
1. Continuous Assessment of Skills 2. Assignment 3. Written Test 4. End Semester Examination
Indirect
1. Course-end survey

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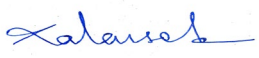
No	Topic	Hours
	MODULE I - 12Hours	
1.1	Parts of Speech	2
1.2	Subject Verb Agreement	2
1.3	Speak up (Self Introduction, JAM)	4
1.4	Writing sentences using 'Be-forms'	3
1.5	Test	1
	MODULE II - 12Hours	
2.1	Articles, Gerunds, Infinitives	2
2.2	Speak up (Greetings & Polite English)	4
2.3	Dialogue Writing	3
2.4	Skimming & Scanning	2
2.5	Listening Skills – I	1
	MODULE III - 12Hours	
3.1	Tenses & Voice	2
3.2	Sentences & its kinds	2
3.3	Speak up (Narration & Description)	4
3.4	Summarizing & Note-making	3
3.5	Listening Skills – II	1
	MODULE IV - 12 Hours	
4.1	Framing Questions – 4 types	2
4.2	Speak up (Role play)	4
4.3	Letter writing – Formal and Informal & Email Writing	3
4.4	Reading Comprehension & Cloze test	2
4.5	Listening Skills - III	1
	MODULE V - 12 Hours	
5.1	Degrees of Comparison	2
5.2	Clauses	2
5.3	Speak up (Power Point Presentation)	4
5.4	Writing (Picture perception)	3
5.5	Test	1
	Total	**60**

REFERENCES:

1. R S Aggarwal , "A Modern Approach to Non Verbal Reasoning" (English, Paperback,)
2. The Power of Words(Bloomsbury, UK, 2012, Hyacinth Pink)
3. Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary (By Norman Lewis)
4. Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hills Publications
5. S. P. Dhanavel, "English and Soft skills", Orient Black Swan Publishers
6. Hyacinth Pink , "Know Your Grammar: Trans.in Tamil & Malayalam – A Bilingual Approach", Bloomsbury, UK, 2012.



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U18BTI1201 **COMPUTATIONAL BIOLOGY**

L	T	P	J	C
3	0	2	0	4

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

CO1: Understand the basics of evolution

CO2: Learn the composition of cells and information storage and transfer in cells.

CO3: Obtaining an overview on the various biological systems and engineering problems

Pre-requisites: Nil

CO/PO Mapping S-Strong, M-Medium, W-Weak													PSO Mapping	
COs	PO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										S		S		
CO2		M		W		W			M	S		S	M	
CO3		M		M		W			M	S		S	M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 4. Model examination (lab component) 5. End Semester Examination (Theory and lab component)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

BASIS OF LIFE **9 Hours**

Origin of life–theory of evolution, Uniqueness of life on earth; Characteristics of living organisms, Tree of life classification –archaea, prokaryotes, eukaryotes.

INTRODUCTION TO BIOMOLECULES AND CYTOLOGY **12 Hours**

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Biomolecules (Carbohydrates, lipids and proteins, nucleic acids) – Functions; Cells and its organelles (plasma membrane, mitochondria, nucleus, Golgi apparatus) – structure and functions.

INFORMATION STORAGE AND TRANSFER **12 Hours**

Heredity and DNA; organization of DNA in cells; Genes and chromosomes; Central dogma of information transfer; transcription and Protein synthesis; Cell division and cell cycle. Mutation and cancer

ANALYSIS OF DNA AND PROTEIN SEQUENCES **12 Hours**

Basics of Sequence analysis -Pairwise sequence alignment, Basic Local Alignment Search Tool, Multiple sequence alignment, Molecular phylogeny and evolution, High throughput Gene expression analysis.

Theory: 45	Tutorial:0	Practical:0	Project:0	Total: 45 Hours

LAB COMPONENT CONTENTS

Lab Programme List:

1. Isolation and Quantification of DNA byuv-vis method (MS-Excel: Calculation using simple regression equation and analysis of Karl pearson correlation coefficient values)
2. Quantification of protein by colorimetry/ Uv-vis method (MS-Excel: Calculation using simple regression equation and analysis of Karl pearson correlation coefficient values)
3. Qualitative analysis of carbohydrates (glucose, sucrose and starch)
4. Separation of cell organelles using centrifugation [DEMO]

In silico-based Experiments:

1. Retrieval of data from public biological databases
2. Sequence alignment using EMBOSS tool (Percent similarity finding method)
3. Sequence alignment using k-tuple method (BLAST or FASTA(Database search method using percent similarity).
4. Phylogenetic analysis using EMBOSS/ BLAST tool (Clustering sequence using percent similarity).
5. Development of a simple sequence analysis tool

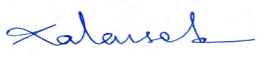
Theory : 45	Tutorial: 0	Practical : 30	Project : 0	Total : 75 Hours

REFERENCES:

1 Satyanarayan, U. & Chakrapani, U. Textbook of Biochemistry, (1999) Ed. June 2017.

2 Verma, P. S, Agarwal,V. K. Cell biology, genetics, molecular biology, evolution and ecology. S. chand & CompanyLimited, 2007.

3 Taylor,D.J, Green,N.P, Stout,G.W & Soper, Biological science (Vol.983). Cambridge, United Kingdom: Cambridge UniversityPress,1977.

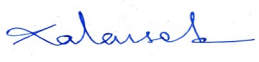


Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

4 Campbell, N. A., Mitchell,L. G., Reece, J. B, & Taylor, M. R. Biology: concepts & connections (No. QH308. 2 C35 1996). Benjamin/Cummings, 2000.

5 Rastogi, S. C., Rastogi, P., & Mendiratta, N. “Bioinformatics Methods And Applications: Genomics Proteomics and Drug Discovery3RdEd. PHI Learning Pvt.Ltd, 2008.

6 Fumento, M. “Bioevolution: how biotechnology is changing our world”. 2003.



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L	T	P	J	C
3	0	2	0	4

U18CSI1201 STRUCTURED PROGRAMMING USING C

(Common to CSE, ISE & IT)

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Acquire knowledge on different problem-solving techniques. [K2]
- **CO2:** Use appropriate data types and control structures for solving a given problem. [K3]
- **CO3:** Execute different array and string operations. [K3]
- **CO4:** Experiment with the usage of pointers and functions. [K3]
- **CO5:** Organize data using structures and unions. [K3]
- **CO6:** Demonstrate data persistency using files**.** [K3]

Pre-requisites :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M												
CO2	S	M												
CO3	S													
CO4	M		M									M		
CO5	M		M									M		
CO6			M											M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory Component) 2. Assignment (Theory Component) 3. Group Presentation (Theory Component) 4. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 5. Model examination (lab component) 6. End Semester Examination (Theory and lab component)
INDIRECT
1. Course-end survey

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

THEORY COMPONENT CONTENTS

STRUCTURED PROGRAMMING **7 Hours**

Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving.

AR RAYS AND STRINGS **11 Hours**

Introduction to C Programming – Operators and Expressions – Data Input and Output – Control Statements. Defining an array – Processing an array – Multidimensional Arrays Character Arithmetic – Defining a string – NULL character – Initialization of Strings – Reading and Writing Strings – Processing Strings –Searching and Sorting of Strings.

FUNCTIONS, STORAGE CLASSES **9 Hours**

Defining a function – Accessing a function – Function prototypes – Passing arguments to a function – Passing arrays to functions – Function with string - Recursion – Storage classes

POINTERS **9 Hours**

Pointer Fundamentals – Pointer Declaration – Passing Pointers to a Function – Pointers and one dimensional arrays – operations on pointers– Dynamic memory allocation

STRUCTURES, UNIONS AND FILES **9 Hours**

Structures and Unions: Defining a Structure – Processing a Structure – User defined data types (Typedef) – Unions

Files: Opening and Closing a Data File – Reading and writing a data file – Processing a data file – Unformatted data files – Concept of binary files – Accessing a file randomly using fseek

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours

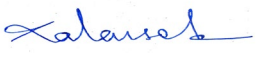
REFERENCES:

1. Byron S Gottfried, Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. Pradip Dey. Manas Ghosh, “Programming in C”, Oxford University Press, Second Edition, 2011.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Pearson Education, Second Edition, 2006.
4. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
5. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2011.

LAB COMPONENT CONTENTS

LIST OF EXPERIMENTS **30 Hours**

1. Writing algorithms, flowcharts and pseudo codes for simple problems.
2. Programs on expressions and conversions



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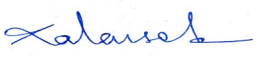
3. Programs using if, if-else, switch and nested if statements
4. Programs using while, do-while, for loops
5. Programs on one dimensional arrays, passing arrays to functions and array operations
6. Programs using two dimensional arrays, passing 2D arrays to functions
7. Programs using String functions
8. Programs using function calls, recursion, call by value
9. Programs on pointer operators, call by reference, pointers with arrays
10. Programs using structures and unions.
11. Programs on file operations and modes.
12. Working with text files, random files and binary files

Theory : 45	**Tutorial:0**	**Practical:30**	**Project:0**	**Total: 75 Hours**



Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

U18EEI1201	BASIC ELECTRICAL AND ELECTRONICSENGINEERING (Common to CSE,IT,ISE)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

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

CO1	Acquire basic knowledge on DC and AC circuits. [K2]
CO2	Understand the construction, working principle and applications of DC machines [K2]
CO3	Understand the construction, working principle and applications of AC machines and transformers.[K2]
CO4	Acquire basic knowledge on logic gates, semiconductor devices and their applications.[K2]
CO5	Identify electronic components and use them to design simple circuits.[K2]

Pre-requisites :Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M												
CO2	M	M												
CO3	M	M												
CO4	M	M											M	
CO5	M	M												

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory Component)
2. Assignment (Theory Component)
3. Group Presentation (Theory Component)
4. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component)
5. Model examination (lab component)
6. End Semester Examination (Theory and lab component)

INDIRECT

1. Course-end survey

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

THEORY COMPONENT CONTENTS

DC CIRCUITS — 9 Hours

Basic circuit elements and sources, Ohms law, Kirchhoff's laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis.

AC CIRCUITS — 9 Hours

Alternating voltages and currents – Single Phase Series RL, RC, RLC Circuits, Power in AC circuits –Power Factor.

ELECTRICAL MACHINES — 9 Hours

Construction, Working Principle and applications of DC generators, DC Motors, single phase Transformers, three phase and single phase induction motors.

SEMICONDUCTOR DEVICES AND CIRCUITS — 9 Hours

PN junction diode – Zener Diode – Half wave and Full wave rectifier-voltage regulators – Bipolar Junction transistors, JFET, MOSFET – characteristics

DIGITAL SYSTEMS — 9 Hours

Binary Number System – Logic Gates – Boolean algebra – Half and Full Adders -subtractor– Multiplexer – Demultiplexer-decoder-flip flops.

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours

LAB COMPONENT CONTENTS

LABORATORY EXPERIMENTS

1. Measurement of electrical quantities–voltage, current, power& power factor in RL, RC and RLC circuits.
2. Verification of Kirchoff's Voltage and Current Laws.
3. Verification of Mesh and Nodal analysis.
4. Load test on DC shunt motor.
5. Load test on single phase transformer.
6. Load test on single phase induction motor.
7. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EXNOR gates.
8. Full wave rectifier with and without filter.
9. Input and output Characteristics of BJT – CE configuration.
10. Characteristics of PN junction diode and Zener diode.

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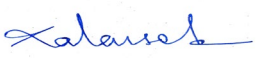
REFERENCES:

1. Mittle N., “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., “Applied Electronics”, S. Chand & Co., 2006.
3. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2017.
4. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
5. Mehta V K, “Principles of Electronics”, Third Edition, S.Chand & Company Ltd, 1994.
6. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
7. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

Theory : 45	**Tutorial : 0**	**Practical : 30**	**Project : 0**	**Total : 75 Hours**



Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

U18INI1600 **ENGINEERING CLINIC - I**

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

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

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M	W		S			S	M	
CO2											S		M	
CO3										S				

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As

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a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the first semester, students will focus primarily on IOT with C programming using Arduino.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory : 0 Hours	**Tutorial : 0**	**Practical : 60**	**Project : 30**	**Total : 90 Hours**

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U18VEP1501	PERSONAL VALUES (Mandatory course)	L	T	P	J	C
		0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Become an individual in knowing the self

CO 2: Acquire and express Gratitude, Truthfulness, Punctuality, Cleanliness &fitness.

CO 3: Practice simple physical exercise and breathing techniques

CO 4: Practice Yoga asana which will enhance the quality of life.

CO 5: Practice Meditation and get benefited.

CO 6: Procure Self Healing techniques for propagating healthy society

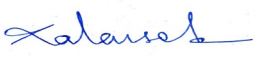
Pre-requisites : Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												M
CO2										S		
CO3						M						
CO4						S			M			
CO5										M		
CO6												S

COURSE ASSESSMENT METHODS

DIRECT
1. Group Activity / Individual performance and assignment 2. Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition



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Values through Practical activities: **30 hours**

1.Knowing the self : Introduction to value education - Need & importance of Value education – Knowing the self – realization of human life – animal instinct vs sixth sense.

2. Mental Health : Evolution of senses – functioning steps of human mind – Body and Mind coordination - Analysis of thoughts – moralization of desires– autosuggestions – power of positive affirmations. – Meditation and its benefits.

3.Physical Health: Physical body constitution– Types of food - effects of food on body and mind – healthy eating habits – food as medicine– self healing techniques.

4.Core value : Self love& Self care Gratitude - Happiness - Optimistic –Enthusiasm – Simplicity – Punctual - Self Control - Cleanliness & personal hygiene - Freedom from belief systems.

5.Fitness: Simplified physical exercises – Sun salutation - Lung strengthening practices: Naadi suddhi pranayama – Silent sitting and listening to nature – Meditation.

Theory:0	Tutorial:0	Practicals:30	Project:0	Total : 30 Hours

REFERENCES:

1. Know Yourself — Socrates – PDF format at www.au.af.mil/au/awc/awcgate/army/rotc_self-aware.pdf
2. Steps To Knowledge: The Book of Inner Knowing – PDF format at www.newmessage.org/wp-content/uploads/pdfs/books/STK_NKL_v1.5.pdf
3. Promoting Mental Health - World Health Organization – PDF format at www.who.int/mental_health/evidence/MH_Promotion_Book.pdf
4. Learning To Be: A Holistic And Integrated Approach To Values – UNESCO PDF format at www.unesdoc.unesco.org/images/0012/001279/127914e.pdf
5. Personality Development By Swami Vivekananda www.estudantedavedanta.net/Personality-Development.pdf

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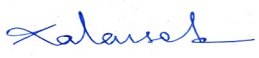
SEMESTER II



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U18MAI2201

ADVANCED CALCULUS AND LAPLACE TRANSFORMS
(Common to All branches)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Evaluate double and triple integrals in Cartesian coordinates and apply them to calculate area and volume.
- **CO2:** Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.
- **CO3:** Construct analytic functions of complex variables and transform functions from z-plane to w-plane and vice-versa, using conformal mappings.
- **CO4:** Apply the techniques of complex integration to evaluate real and complex integrals over suitable closed paths or contours
- **CO5:** Solve linear differential equations using Laplace transform technique
- **CO6:** Determine multiple integrals, vector differentials, vector integrals and Laplace transforms using MATLAB.

Pre-requisites: U18MAI1201 - Linear Algebra and Calculus

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S			M				M	M		M	M	
CO2	S	S			M				M	M		M	M	
CO3	S	S			M				M	M		M	M	
CO4	S	S			M				M	M		M	M	
CO5	S	S			M				M	M		M		M
CO6	S	S			M				M	M		M	M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 4. Model examination (lab component) 5. End Semester Examination (Theory and lab component)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENT

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian coordinates – Change of order of integration - Triple integration in Cartesian coordinates – Applications: Area as double integral and Volume as triple integral.

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and simple applications.

ANALYTIC FUNCTIONS **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs)– Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ – Bilinear Transformation

COMPLEX INTEGRATION **9 Hours**

Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series –Singularities – Residues –Residue theorem –Application of residue theorem for evaluation of real integrals – Contour Integration (excluding poles on the real axis).

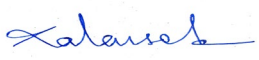
LAPLACE TRANSFORMS **9 Hours**

Definition - Properties: Superposition, Shift in t or Time Delay, Shift in s, Time Derivatives, Time Integral- Initial Value Theorem - Final Value Theorem - Transform of periodic functions - Inverse transforms - Convolution theorem – Applications: Solution of linear ordinary differential equations of second order with constant coefficients.

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
4. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008.
5. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.
6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai, 2003.
7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus Pearson education 12th ED, 2015.

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours



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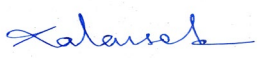
LAB COMPONENT **30 Hours**

List of MATLAB Programmes:

1. Evaluating double integral with constant and variable limits.
2. Area as double integral
3. Evaluating triple integral with constant and variable limits
4. Volume as triple integral
5. Evaluating gradient, divergence and curl
6. Evaluating line integrals and work done
7. Verifying Green's theorem in the plane
8. Evaluating Laplace transforms and inverse Laplace transforms of functions including impulse.
9. Heaviside functions and applying convolution.
10. Applying the technique of Laplace transform to solve differential equations.

Theory : 45	Tutorial : 0	Practical : 30	Project : 0	Total : 75 Hours



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L	T	P	J	C
2	0	2	0	3

U18ENI2201 FUNDAMENTALS OF COMMUNICATION – II

(Common to all branches of II Semester B.E/B/Tech Programmes)

Course Objectives:

1. To effectively use the basic language skills to imbibe technical language skills.
2. To hone written and spoken competencies leading to effective communication.
3. To comprehend, use and explain technical data and information.

Course Outcomes:

After the course the student will be able to:

CO1: Read, understand, and interpret material on technology.
CO2: Communicate knowledge and information through oral and written medium.
CO3: Compare, collate and present technical information according to the audience and purpose.

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				S					S	S		S	S	S
CO2				S					S	S			S	S
CO3				M					S	S		S	S	S

COURSE ASSESSMENT METHODS

Direct
1. Continuous Assessment of Skills 2. Assignment 3. Written Test 4. End Semester Examination
Indirect
1. Course-end survey

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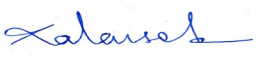
No	TOPIC	
	MODULE I	**12 Hours**
1.1	Introduction to Technical Writing Technical Definitions	2
1.2	Writing Instructions / Instruction Manual	2
1.3	Writing Recommendations	2
1.4	Speaking Activity I	6
	MODULE II	**12 Hours**
2.1	Process Writing	2
2.2	Review Writing I - Product	2
2.3	Review Writing II – Article	2
2.4	Speaking Activity II	6
	MODULE III	**12 Hours**
3.1	Interpreting and Transcoding Graphics	2
3.2	Types of Report / Writing a Report	2
3.3	Reading & Responding to texts	2
3.4	Speaking Activity III	6
	MODULE IV	**12 Hours**
4.1	Drafting a project proposal	2
4.2	Listening to technical talks	2
4.3	Preparing a survey Questionnaire	2
4.4	Speaking Activity IV	6
	MODULE V	**12 Hours**
5.1	Writing Memos, Circulars, Notices	2
5.2	Writing Agenda and Minutes	2
5.3	Inferential Reading	2
5.4	Speaking Activity V	6
	Total	**60 Hours**

REFERENCES:

1. Jewelcy Jawahar, Dr.P.Ratna , “Technical English Workbook”, VRB Publishers Pvt. Ltd.
2. Ashraf Rizvi , “Effective Technical Communication”, Tata McGraw Hills Publications.
3. Meenakshi Raman, Sangeeta Sharma, “Technical Communication – English Skills for Engineers”, Oxford Higher Education.



Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

U18PHI2201 **ENGINEERING PHYSICS**
(Common to AU, ECE, CE, MEC, ME,ISE)

L	T	P	J	C
3	0	2	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the principles of motion and rotation of a rigid body in the plane.
CO2: Enhance the fundamental knowledge in properties of matter and its applications relevant to various streams of engineering and technology.
CO3: To introduce the phenomenon of heat and account for the consequence of heat transfer in engineering systems.
CO4: To apply the concepts of electrostatics and dielectrics for various engineering applications.
CO5: To understand the basics of magneto statics.
CO6: To introduce and provide a broad view of the smart materials and Nano science to undergraduates.

Pre-requisites: High School Education

COs	Programme Outcomes (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		M									M		
CO2	S		M									M	M	
CO3	S		M									M		
CO4	S		M									M	M	
CO5	S		M									M		
CO6	S		M	M								M		

COURSE ASSESSMENT METHODS

Direct
1. Continuous Assessment Test I, II (Theory component) 2. Cooperative learning report, Assignment; Group Presentation, Project report, Poster preparation, 3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 4. Model examination (lab component) 5. End Semester Examination (Theory and lab component)
Indirect
1. Course-end survey

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

THEORY COMPONENT CONTENT

KINEMATICS & RIGID BODY MOTION — 9 Hours

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

PROPERTIES OF MATTER — 9 Hours

Hooke's Law Stress - Strain Diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio - Expression for bending moment and depression - Cantilever - Expression for Young's modulus by Non-uniform bending and its experimental determination.

HEAT — 9 Hours

Specific heat capacity, thermal capacity. Temperature rise. Coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Thermal stresses in composite structures due to non-homogeneous thermal expansion. Applications -The bimetallic strip. Expansion gaps and rollers in engineering structures. Thermal conductivity: differential equation of heat flow. Lee's disc apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Applications to refrigeration and power electronic devices.

ELECTROSTATICS & MAGNETOSTATICS — 9 Hours

ELECTROSTATICS : Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current - electric field intensity (D) - Electric potential - dielectrics - dielectric polarization - internal field – Clasious - Mosotti equation - dielectric strength - applications.

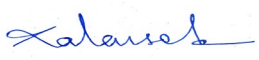
MAGNETOSTATICS: Maxwell's equation for magnetostatics - B in straight conductors, circular loop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law –Magnetic flux density (B).

NEW ENGINEERING MATERIALS AND NANO TECHNOLOGY — 9 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials: synthesis - Ball milling - Sol-gel - Electro deposition — properties of nano particles and applications. – Carbon Nano Tubes – fabrication by Chemical Vapour Deposition - structure, properties & applications.

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours



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REFERENCES:

1. Richard Wolfson, "Essential University Physics, Vols. 1 and 2", Pearson Education, Singapore, 2011.
2. Harbola M. K., "Engineering Mechanics", Cengage publications, New Delhi, Second Edition, 2009.
3. H. C. Verma, "Concepts of Physics - volume 1 and 2", Bharati Bhawan Publishers & Distributors, First edition, 2017.
4. W. H. Hayt and John A. Buck, "Engineering Electromagnetics, Tata McGraw Hill, New Delhi, Sixth Edition, 2014.
5. Joseph A. Edminister, "Theory and Problems of Electromagnetic Schaum's Outline Series", Tata McGraw Hill Inc., New Delhi, Fifth Edition, 2010.
6. Rajendran V, "Engineering Physics", Tata McGraw-Hill Education Pvt. Ltd., 2010.
7. Pradeep T, "Nano – the Essentials", McGraw-Hill Education, Pvt. Ltd., 2007.
8. Aparna Y, Venkateswara Rao T, "Laboratory Manual of Engineering Physics", V.G.S Publishers.
9. G.L. Squires, "Practical Physics", Cambridge University Press, Cambridge, 1985.
10. M.H. Shamos, "Great Experiments in Physics", Holt, Rinehart and Winston Inc., 1959.
11. A.C. Melissinos, "Experiments in Modern Physics", Academic Press, Newyark, 1966.

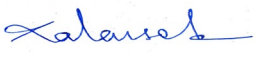
LAB COMPONENTS:

LIST OF EXPERIMENTS

1. Non-uniform bending – Determination of Young's modulus
2. Compound Pendulum – Determination of acceleration due to gravity
3. Spectrometer – Determination of wavelength of mercury source using grating
4. Air wedge - Determination of thickness of thin sheet
5. Semiconductor Laser:
    a. Determination of wavelength of laser
    b. Determination acceptance angle and numerical aperture of an optial fibre.
    c. Determination of particle size
6. Melde's string – Determination of frequency of a turing fork
7. Determination of band gap of a semiconductor
8. Ultrasonic interferometer – Determination of velocity of sound and compressibility of a liquid
9. Luxmeter – Determination of efficiency of solar cell
10. Lee's disc – Determination of thermal conductivity of a bad conductor

Experiments for Demonstration:

1. Hall effect
2. Hardness Test



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3. Four probe experiment

4. Hysteresis curve

Theory : 45	**Tutorial : 0**	**Practical : 30**	**Project : 0**	**Total : 75 Hours**

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L	T	P	J	C
2	0	2	0	3

U18CSI2201 **PYTHON PROGRAMMING**

(Common to All Branches)

COURSE OUTCOMES

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

CO1: Classify and make use of python programming elements to solve and debug simple logical problems.(K4,S3)
CO2: Experiment with the various control statements in Python.(K3,S2)
CO3: Develop Python programs using functions and strings.(K3,S2)
CO4: Analyze a problem and use appropriate data structures to solve it.(K4,S3)
CO5: Develop python programs to implement various file operations and exception handling.(K3,S2)

Pre-requisites :Nil

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

Cos	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1		S			M					M		M		M
CO2			M							M		M		
CO3			M							M		M	M	
CO4	S	S	M		M					M		M		
CO5			M							M		M		

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test, Assignment
3. Viva, Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENT

BASICS OF PYTHON PROGRAMMING 6 Hours

Introduction-Python Interpreter-Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON 6 Hours

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Conditional (if), alternative (if-else), chained conditional (if-elif-else)-Iteration-while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.

DATA STRUCTURES: STRINGS, LISTS and SETS **7 Hours**

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting, Sets-creating sets, set operations.

DATA STRUCTURES: TUPLES, DICTIONARIES **5 Hours**

Tuples-Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Nested Dictionaries.

FILES, MODULES, PACKAGES **6 Hours**

Files and Exception-Text files, reading and writing files, format Operator-Modules-Python Modules-Creating own Python Modules-packages, Introduction to exception handling.

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours

REFERENCES:

1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education,2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

ONLINE COURSES AND VIDEO LECTURES:

1. www.mhhe.com/kamthane/python
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
3. http://nptel.ac.in
4. https://www.edx.org/course/introduction-to-python-fundamentals-1
5. https://www.edx.org/course/computing-in-python-ii-control-structures-0
6. https://www.edx.org/course?search_query=Computing+in+Python+III%3A+Data+Structures

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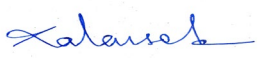
LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

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

Theory : 45	**Tutorial : 0**	**Practical : 30**	**Project : 0**	**Total : 75 Hours**



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U18ISI2202 **DIGITAL LOGIC AND MICROPROCESSOR**

L	T	P	J	C
3	0	2	0	4

Course Outcomes

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

CO1: Demonstrate how the logic gates and minimization techniques work [K3]

CO2: Design a combinational circuit for performing arithmetic functions [K5]

CO3: Analyze and study a few sequential circuits [K4]

CO4: Develop **p**rograming code with 8086 for the basic problems [K5, S1]

CO5: Perform **i**nterfacing of 8086 with peripherals [K3]

Pre-requisites :

1. U18EEI1201-Basic Electrical and Electronics Engineering

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**PSO Mapping**	
COs	**PROGRAMME OUTCOMES (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M	M		M							M		
CO2	S													
CO3	S				M									
CO4	S	M										M		
CO5		M										M	M	

Course Assessment methods

Direct
1. Internal Tests 2. End Semester Exam 3. Assignments
Indirect
1. Course-end survey

THEORY COMPONENT CONTENTS

COMBINATIONAL CIRCUITS **10 Hours**

Logic gates: NAND, NOR gate as universal building blocks -Simplification of four-variable Boolean equations using Karnaugh maps - Half adder, Full adder, Half subtractor, Full subtractor - 4-bit parallel adder and subtractor - 3-bit binary decoder – Decimal to BCD encoder – 8-to-1 multiplexer, 1-to-8 De-multiplexer

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SEQENTIAL LOGIC CIRCUITS **11 Hours**

Flip-flops: SR flip-flop, Edge-triggered flip-flops (SR,D,JK and T), 4-bit binary asynchronous and synchronous counter - Decade counter (asynchronous and synchronous) -Shift registers (SISO,SIPO,PISO,PIPO) - Ring counter

D/A AND A/D CONVERTERS **6 Hours**

Ladder type D/A converter - Dual slope A/D converter - Successive approximation A/D converter- case study of DAC0800 and ADC0809 chips

8086 MICROPROCESSOR ARCHITECTURE AND INSTRUCTION SET **12 Hours**

Pin diagram - CPU architecture - Memory segmentation - Internal operations - Addressing modes - Instruction formats - Data transfer instructions, Arithmetic instructions, Logical instructions, Branch-and-loop instructions – Interrupts: Software and Hardware interrupts

PERIPHERAL CHIPS **6 Hours**

8254 (Timer), 8257 (DMA), 8259 (PIC), 8251 (USART), 8279 (Keyboard -Display Interfaces)

Theory : 45	Tutorial : 0	Practical : 0	Project : 0	Total : 45 Hours

REFERENCES:

1. M. Morris Mano, Digital Logic and Computer Design, 5th Edition., Pearson Education, 2017.
2. Douglas V. Hall, Microprocessors and Interfacing, TMH
3. Thomas L. Floyd, “Digital Fundamentals”, Pearson Education, Inc, New Delhi, 2013.
4. Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family, PHI.
5. Barry B. Brey, Microprocessors and Peripherals, CBS Publishers & Distributors, Delhi
6. R.K. Gaur, Digital Electronics and Microcomputers Thomas L Floyd, Digital Fundamentals, Universal Books, New Delhi

LAB COMPONENT:

LIST OF EXPERIMENTS **30 HOURS**

I. Digital Electronics

1. Study of Logic Gates
2. Implementation of Logic Circuits
3. Adder and Subtractor

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4. Combinational Circuit Design

a)Design of Decoder and Encoder

b) Design of Code Converter

c)Design of multiplexers and de multiplexers

5. Sequential Circuit Design

a)Implementation of Shift registers, Serial Transfer

b) 4-bit Binary Counter

c)BCD Counter

II. Microprocessors

6. ALP Arithmetic programming

a) Write an ALP to find out factorial of a given hexadecimal number using 8086

Data: OAH, OFH, 1OH

b) Write an ALP to perform 16 bit arithmetic operations (ADD, SUB, MUL, DIV)

c) Write an ALP to generate the sum of first 'N' natural numbers using 8086 MP

7. Sorting and Data Movement

a) Write an ALP to order give set of hexadecimal numbers in ascending and descending order. Data: 0AH, 0FH, 0DH, 10H, 02H

b) Write an ALP to move block of data from locations 1200H-1205H to 2200H – 2205H

c) Write an ALP to reverse the given string of data: WELCOME

Theory : 45	Tutorial : 0	Practical : 30	Project : 0	Total : 75 Hours

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U18INI2600 **ENGINEERING CLINIC - II**

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

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

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisites: U18INI1600/Engineering Clinic-I

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M			S			S	M	
CO2											S		M	
CO3										S				

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of

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reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the second semester, students will focus primarily on Raspberry pi based controllers with Python programming Arduino.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory : 0 Hours	Tutorial : 0	Practical : 60	Project : 30	Total : 90 Hours

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U18VEP2502 **INTERPERSONAL VALUES**

(Mandatory course)

L	T	P	J	C
0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO 1: Develop a healthy relationship & harmony with others
CO 2: Practice respecting every human being
CO 3: Practice to eradicate negative temperaments
CO 4: Acquire Respect, Honesty, Empathy, Forgiveness and Equality
CO 5: Practice Exercises and Meditation to lead a healthy life
CO 6: Manage the cognitive abilities of an Individual

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										S		
CO2									S			
CO3											M	S
CO4						M						
CO5												M
CO6											M	

COURSE ASSESSMENT METHODS

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 hours**

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1. Introduction: Introduction to interpersonal values – Developing harmony with others – Healthy relationship – Need & importance of interpersonal values for dealing with others and team - Effective communication with others.

2. Maneuvering the temperaments: From Greed To Contentment - Anger To Tolerance - Miserliness To Charity – Ego To Equality - Vengeance To Forgiveness.

3. Core value : **Truthfulness -**Honesty –Helping–Friendship – Brotherhood – Tolerance – Caring & Sharing – Forgiveness – Charity –Sympathy — Generosity – Brotherhood - Adaptability.

4. Pathway to Blissful life :

Signs of anger – Root cause – Chain reaction – Evil effects on Body and Mind – Analyzing roots of worries – Techniques to eradicate worries.

5. Therapeutic measures: Spine strengthening exercises - Nero muscular breathing exercises - Laughing therapy - Mindfulness meditation.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 hours

REFERENCES:

1. Interpersonal skills tutorial (pdf version) - tutorialspoint www.tutorialspoint.com/interpersonal_skills/interpersonal_skills_tutorial.pdf
2. Interpersonal relationships at work - ki open archive - karolinska www. publications.ki.se/xmlui/bitstream/handle/10616/39545/thesis.pdf?sequence=1
3. Values education for peace, human rights, democracy – unesco www.unesdoc.unesco.org/images/0011/001143/114357eo.pdf
4. Maneuvering of six temperaments - vethathiri maharishi www.ijhssi.org/papers/v5(5)/f0505034036.pdf
5. The bliss of inner fire: heart practice of the six ... - wisdom publications - www.wisdompubs.org/sites/.../bliss%20of%20inner%20fire%20book%20preview.pd...

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SEMESTER – III

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U18MAT3102 **DISCRETE MATHEMATICS**

(Common to CSE/IT/ISE)

L	T	P	J	C
3	1	0	0	4

Course Outcomes:

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

CO1: Understand the concepts of set theory and apply them to situations involving inclusion and exclusion

CO2: Acquire the knowledge of relations, and analyze equivalence relations and their properties.

CO3: Understand and analyze the properties of different kinds of functions.

CO4: Apply mathematical induction to prove mathematical facts, analyze and use the concept of permutation and combination and solve recurrence relations.

CO5: Evaluate the validity of logical arguments and construct simple mathematical proofs.

CO6: Determine whether given graphs are isomorphic and apply Dijkstra's algorithm to find the shortest path.

Pre-requisites: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**PSO Mapping**	
COs	Programme Outcomes(POs)													
	PO1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO1	PSO2
CO1	M	M											M	
CO2	M		S										M	
CO3													M	M
CO4	M		S										M	
CO5	S	S	S									S	M	
CO6	S	S	S									S	M	M

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II 2. Written Assignment, Offline quiz, Written tests-2 **3.** End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

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SET THEORY **9+3 Hours**

Algebra of sets – The power set – Ordered pairs and Cartesian product – principle of inclusion and exclusion.

Relations on sets –Types of relations and their properties - Equivalence relations –Relational matrix and the graph of relation – Operations on relations.

FUNCTIONS **7+2 Hours**

Functions –Type of functions – Injective, surjective and bijective functions –Composition of functions – Inverse functions –Permutation functions

COMBINATORICS **9+3 Hours**

Mathematical induction- The basics of counting–Permutations and combinations-Recurrence relations-Solving linear recurrence relations

LOGIC **11+4 Hours**

Propositions- Logical operators- Normal forms –Rules of inference-Consistency and inconsistency-Propositional logic- Proofs-Predicates- Quantifiers- Universe of discourse – Logical equivalences and implications for quantified statements-Rules of specification and generalization – Validity of arguments.

GRAPH THEORY **9+3 Hours**

Graphs- Types of graphs- Matrix representation of graphs- Graph isomorphism- Walk - Path- Cycles-Eulerian graphs -Hamiltonian graphs- Planar graphs- Euler formula- Shortest path algorithm: Dijkstra's algorithm

Theory : 45	Tutorial : 15	Practical : 0	Project : 0	Total : 60 Hours

REFERENCES:

1. Liu C.L, "Elements of Discrete Mathematics, Second Edition, McGraw Hill 1985.
2. Mott J.L, Kandel A. and Baker T.P.,"Discrete Mathematics for Computer Scientists and Mathematicians, Second Edition, Prentice Hall India, 1986.
3. J.P.Trembly, R. Manohar, Discrete Mathematical Structures with applications to Computer Science, TMHInternational Edition (Latest Edition).
4. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science, Prentice – Hall, Engle Cliffs, N. J.
5. Harary F, Graph Theory, Narosa, 1969.
6. Thomas H.C., A Leiserson C.E., Rivest R.L, Stein C.A., "Introduction to a Algorithms(2nd Edition),MIT press and McGraw-Hill.2001.

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U18ISI3201 DATA STRUCTURES

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Develop applications using stack and queue data structures [K5, S2]

CO2: Develop applications to retrieve records from database using hashing techniques [K5, S2]

CO3: Compare efficiency of various searching techniques using different tree data structures. [K4, S2]

CO4: Compare efficiency of various sorting techniques using different data structures. [K4, S2]

Pre-requisites :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING	
COs	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		M							M		M	M	
CO2	S		M							M		M	M	S
CO3		S		M									S	
CO4		S		M									S	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

INTRODUCTION **6 Hours**

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Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

STACKS AND QUEUES **10 Hours**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

LINKED LIST **10 Hours**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis

TREES **12 Hours**

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with Complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis. – Introduction to Graph – Graph Terminologies – Representation of Graphs

SORTING AND HASHING **7 Hours**

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

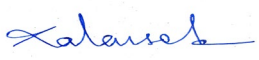
REFERENCES:

1. Ellis Horowitz, Sartaj Sahni ,"Fundamentals of Data Structures", Computer Science Press, Illustrated Edition.
2. M.A.Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education Asia, Fourth Edition, 2013.
3. R. G. Dromey, "How to Solve it by Computer", Pearson Education, Second Edition.

ONLINE COURSES AND VIDEO LECTURES:

1. http://users.cis.fiu.edu/~weiss/

2. http://nptel.ac.in/courses/10610206



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LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Implement the concepts of Stack, Simple Queue, Circular Queue and Priority Queue ADT using Arrays. [S2]
2. Implement Singly, Doubly and Circular Linked list. [S2]
3. Implement Stack and Queue ADT using Linked list. [S2]
4. Create program to perform tree traversals and other operations in a Binary Search Tree. [S1]
5. Create program to perform tree traversals and other operations in a Binary Search Tree. [S1]
6. Develop applications for Hashing. [S1]
7. Implement Sorting & Searching algorithms based on a given scenario. [S2]

Theory : 45	Tutorial : 0	Practical :30	Project : 0	Total : 75 Hours

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L	T	P	J	C
3	0	0	0	3

U18IST3002 COMPUTER ARCHITECTURE

Course Outcomes:

After successful completion of this course, the students should be able to

CO1	Identify the different addressing modes used in a processor	K3
CO2	Apply the knowledge of arithmetic operations in the design of a fast adder	K3
CO3	Classify the control units present in a processor.	K3
CO4	Analyze the various performance enhancement techniques of Cache memories.	K4
CO5	Point out how the pipeline processor improves performance of a computer.	K4

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**CO/PSO Mapping**	
COs	**PROGRAMME OUTCOMES (POs)**											**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M										M		
CO2	S		M									M		M
CO3	S									M				
CO4	S	S								M				
CO5		S	M							M				

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

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BASIC STRUCTURE OF COMPUTERS **7 Hours**

Functional Units - Basic Operational Concepts - Bus Structures - Performance - Memory Locations and Addresses - Memory Operations - Instruction and Instruction Sequencing - Addressing Modes - Basic I/O Operations.

ARITHMETIC UNIT **11 Hours**

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Positive Numbers - Signed Operand Multiplication - Fast Multiplication - Integer Division - Floating Point Numbers and Operations.

BASIC PROCESSING UNIT **9 Hours**

Fundamental Concepts - Execution of a Complete Instruction - Multiple Bus Organization - Hardwired Control – Microprogrammed Control – Microinstructions- Microprogram Sequencing-Wide Branch Addressing

MEMORY SYSTEM **8 Hours**

Basic Concepts - Speed, Size and Cost - Cache Memories - Performance Considerations - Virtual Memories-memory management requirements

PIPELINING AND I/O ORGANIZATION **10 Hours**

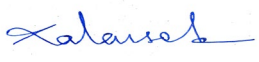
Basic Concepts - Data Hazards - Instruction Hazards – Influence on instruction sets - Data path and control considerations - Superscalar operation – Accessing I/O devices- Interrupts – Enabling and disabling interrupts-Handling multiple devices - Direct Memory Access.

Case study - ARM interrupt structure

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, McGraw-Hill, 2014.
2. Stallings, “Computer Organization and Architecture - Designing for Performance”, Ninth Edition, Prentice Hall, 2012.
3. David A.Patterson and John L.Hennessy, “Computer Organization and Design: The hardware/ software interface”, Fifth Edition, Morgan Kaufmann, 2014.
4. John P.Hayes, “Computer Architecture and Organization”, Third Edition, McGraw Hill, 2002.
5. https://onlinecourses.nptel.ac.in/noc18_cs29



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U18ISI3203 **OBJECT ORIENTED PROGRAMMING**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

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

CO1: Analyze a problem and identify classes, objects and the relationships among them.(K4,S3)

CO2: Develop applications using various types of Inheritance and Interfaces(K3,S2)

CO3: Develop applications or programs using exception handling and multithreading. (K3,S2)

CO4: Analyze an application and make use of object oriented concepts for its implementation. (K4,S3)

CO5: Develop programs using collections, files and streams in java.(K3,S2)

Pre-requisites :Nil

CO/PO/PSO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M							M		M		
CO2										M		M		M
CO3		M								M		M		M
CO4	S	S			M					M		M		
CO5										M		M		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment 3. Viva, Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND JAVA **7 Hours**

Introduction to OOP– Java Fundamentals -Data Types, Variables, and Arrays - Operators-Control Statements – Classes – Methods –Constructors- Garbage Collection.

INHERITANCE AND EXCEPTION HANDLING **10 Hours**

Inheritance –Packages and Interfaces - Exception Handling Fundamentals – Java's Built-in Exceptions-Creating new Exception subclasses.

POLYMORPHISM AND MULTITHREADING IN JAVA **10 Hours**

Polymorphism- Abstract classes and methods-Overloading-Overriding-final methods and classes – Multithreaded programming –The Thread class and the Runnable Interface-Creating multiple threads-Synchronization-Autoboxing and Annotations (Metadata).

STRING HANDLING AND COLLECTION FRAMEWORK **11 Hours**

String Constructors-String Operations-Generic classes and methods-The Collection Framework-Collections-List-Array List, LinkedList, Set-HashSet, Linked HashSet, Queue-Priority Queue, Map-HashMap, Sorted Map, Tree Map.

FILES AND STREAMS IN JAVA **7 Hours**

Files and streams –Byte Stream-I/O Stream, File I/O Stream, Byte Array I/O Stream-Character Stream-File Reader and Writer, Char Array Reader and Writer-Serialization.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

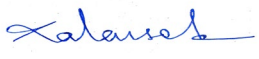
1. Herbert Schildt, "Java the Complete Reference", Tata Mc Graw Hills, Ninth edition ,2014.
2. Paul Deitel and Harvey Deitel, —"Java How to Program (Early Objects)", Pearson Prentice Hall, Tenth Edition, 2014.
3. Timothy Budd, —"An Introduction to Object-Oriented Programming", Pearson Education, Third Edition, 2008.
4. E.Balaguruswamy,"Programming with Java", TMH, Second Edition, 2009

ONLINE COURSES AND VIDEO LECTURES:

1. Herbert Schildt, "Java the Complete Reference", Eighth edition Tata Mc Graw Hills, 2011.

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS



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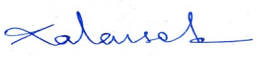
1. Develop simple programs in java using classes and methods.
2. Implement user defined Exception Handling.
3. Implement method overloading and method overriding in java
4. Develop java programs using inheritance and interfaces
5. Create Threads in java using Thread Class and Runnable Interface
6. Create an application using multiple threads
7. Develop programs using inbuilt methods of String class.
8. Implement collections like List, Set, Queue, Map in java.
9. Implement Input streams and Output streams in java.
10. Develop java programs to access and perform various operations in file contents.
11. Implement the given use case/project using various Object oriented concepts in java

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

ONLINE CLASSES AND VIDEO LECTURES:

1. https://www.javatpoint.com/java-tutorial



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U18ISI3204 **DATABASE MANAGEMENT SYSTEMS**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Construct ER Model for a given database application. [K3, S3]
CO2: Design relational schema using database design principles. [K3, S2]
CO3: Identify the Key Constraints for relations and devise queries using SQL. [K4, S3]
CO4: Apply indexing techniques to access and generate user reports for a database. [K3, S2]
CO5: Building Web Applications using PHP & MySQL. [K5, S3]
CO6: Illustrate the concepts for transaction processing and concurrency control for RDBMS. [K3,S2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													PSO	
COs	**PROGRAMME OUTCOMES (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M								M			S	M
CO2		M											S	M
CO3		S	M		S								S	S
CO4				S									M	M
CO5			M		S				M		M		S	S
CO6	S						S						M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc 3. End Semester Examination
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

INTRODUCTION TO DATABASE AND RELATIONAL MODEL 9 Hours

Introduction: Database applications, Purpose of database systems, Views of data, Database Development Life cycle, Architecture of DBMS. Overview of query processing.
Relational Databases: Relational model, Database schema, Keys, Formal Relational Query Languages

DATABASE DESIGN 9 Hours

Logical Database Design: Different approaches in Logical design, ER Modeling, ER notations, Steps in ER modeling. Physical database design: Converting ER Model to Relational Database Design, Normalization -Functional Dependency, 1NF,2NF,3NF (optional: multi-valued dependency and 4th Normal form).

STORAGE AND INDEXING 7 Hours

Storage and File structure: File Organization, RAID. Indexing: Concepts, Clustered and Non-clustered Indices, B-tree and B+-tree. Basics of Hashing (Static, Dynamic).

TRANSACTION MANAGEMENT 9 Hours

Transactions: Concept and purpose, ACID properties and their necessity. Transaction Schedules: Conflicts and Aborts, Serializability, Recoverability. Concurrency Control: lock-based protocols, 2-phase locking, Timestamp based protocols. Deadlock handling

Case Study: Open Source Relational DBMS

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill.2011.
2. R. Elmasri and S. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.
3. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, Second Edition, McGraw Hill, 2003.
4. Thomas M. Connolly and Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation and Management”, Fifth edition, Pearson Education, 2010.
5. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

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ONLINE CLASSES AND VIDEO LECTURES:

1. Infosys Foundation Program: Module 2
2. https://onlinecourses.nptel.ac.in/noc17_cs33/course
3. http://www.db-book.com
4. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design
5. http://www.iitg.ernet.in/awekar/teaching/cs344fall11/
6. www.w3schools.com/sql/

LAB COMPONENT:

DATABASE APPLICATION DEVELOPMENT

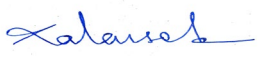
SQL: Database languages, Basic SQL query structure, specifying integrity constraints in SQL, SQL Built in functions , Set operations, Nested subqueries, Aggregation, Join expressions, Data base objects, Views. Functions, Procedures and Triggers.

Accessing Databases through programming language, Building Web Applications using PHP &MySQL.

LIST OF EXPERIMENTS: (Open Source RDBMS-MySQL/Maria DB/POSTGRES)

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Creating relational database to set various constraints
3. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
4. Creation of Views and Indexes.
5. Working on TCL,DCL commands
6. Creating relationship between the databases.
7. Building Web Applications using PHP & MySQL
8. Mini Project

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours



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U18INI3600 **ENGINEERING CLINIC - III**

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

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

CO1: Identify a practical problems and find a solution

CO2: Understand the project management techniques

CO3: Demonstrate their technical report writing and presentation skills

Pre-requisites: U18INI2600/Engineering Clinic-II

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	S	S	S	S	M			S			S	M	
CO2											S		M	
CO3										S			S	

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

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CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the third semester, students will focus primarily on Design project combining concepts learnt in Engineering clinics I and II.

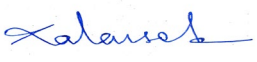
GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	Tutorial: 0	Practical: 60	Project: 30	Total: 90 Hours

U18VEP3503 **FAMILY VALUES**

L	T	P	J	C



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(Mandatory course)

0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Develop skills in maintaining the harmony in the family.
CO2: Create impulsive activities for healthy family
CO3: Be receptive to troubled Individuals
CO4: Gain healthy life by practicing Kundalini Yoga & Kayakalpa
CO5: Possess Empathy among family members.
CO6: Reason the life and its significance

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2.U18VEP2502 / INTERPERSONAL VALUES

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									S			
CO2							M					
CO3										M		
CO4												S
CO5						S						
CO6								M				

COURSE ASSESSMENT METHOD

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 hours**

1. Family system: Introduction to Family Values – elements of family values - Adjustment, Tolerance, Sacrifice - Family structure in different society – work life balance.

2. Peace in Family : Family members and their responsibility - Roles of parents, children, grant parents -. Respectable women hood

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3. Core value: Empathy: Unconditional love - Respect - Compassion - sacrifice–Care &share - helping – emotional support- hospitality – cleanliness

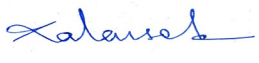
4. Blessing: Blessing - methods - Vibration effect - Benefits - Reason for misunderstanding in the Family and resolution through blessings.

5. Healthy Family: Good relationship with neighbors - Counseling - Simplified Kundalini Yoga - Kaya Kalpa Yoga

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 hours

REFERENCES:

1. Family - www.download.nos.org/331courseE/L-13%20FAMILY.pdf
2. Framework for action on values education in early childhood – unesco – pdf – www.unesdoc.unesco.org/images/0012/001287/128712e.pdf
3. True family values Third Edition - Tparents Home www.tparents.org/Library/Unification/Books/TFV3/_TFV3.pdf
4. Family values in a historical perspective - The Tanner Lectures on www.tannerlectures.utah.edu/_documents/a-to-z/s/Stone95.pdf
5. Problems of india's changing family and state ... - the United Nations - www.un.org/esa/socdev/family/docs/egm09/Singh.pdf



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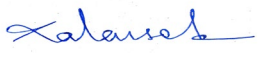
SEMESTER –IV



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U18MAI4201 **PROBABILITY AND STATISTICS**

(Common to CSE, IT, ISE)

L	T	P	J	C
3	0	2	0	4

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Compute correlation between variables, and predict unknown values using regression.
CO2: Understand and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.
CO3 : Perform hypothesis testing and interpret the results.
CO4 : Understand the principles of design of experiments and perform analysis of variance.
CO5: Sketch control charts and comment on the process control.
CO6: Apply the above concepts to solve problems using R Studio.

Pre-requisites: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**PSO Mapping**	
COs	Programme Outcomes(POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S			M				M	M		M	M	
CO2	S	S			M				M	M		M	M	M
CO3	S	S			M				M	M		M	M	M
CO4	S	S			M				M	M		M	M	
CO5	S	S			M				M	M		M	M	
CO6	S	S			M				M	M		M	M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) **6.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

CORRELATION AND REGRESSION **6 Hours**

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Correlation – Karl Pearson's Correlation coefficient – Spearman's Rank Correlation – Regression lines.

PROBABILITY AND RANDOM VARIABLES **12 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments-moment generating functions.

NORMAL DISTRIBUTION **5 Hours**

Normal distribution – Moments, Moment Generating functions and properties.

TESTING OF HYPOTHESIS **9 Hours**

Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit

DESIGN OF EXPERIMENTS **8 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

STATISTICAL QUALITY CONTROL **5 Hours**

Concept of process control - Control charts for variables: Mean and Range charts – Control charts for attributes: p, np, c – charts.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill, 3rd edition, 2008.
2. Gupta S. P, "Statistical Methods", Sultan Chand & Sons Publishers, 2014.
3. Johnson R. A., Miller & Freund's "Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
4. Gupta.S.C and Kapoor.V.K, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
5. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2012.
6. Gupta S.C, and KapurV.K "Fundamentals of Applied Statistics", Sultan Chand, New Delhi, 4th Edition, 2014.

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7. Charles Henry Brase and Corrinne Pellillo Brase "Understandable Statistics", D.C. Heath and Company, Toronto, 9th edition, 2007.

LAB COMPONENT :

LIST OF PROGRAMMES (Using R Studio) **30 Hours**

1. Introduction to R programming
2. Application of descriptive statistics – Mean, Median, Mode and standard deviation
3. Applications of Correlation and Regression
4. Application of Normal distribution
5. Application of Student – t test
6. Application of F test
7. Application of Chi-square test
8. ANOVA – one way classification
9. ANOVA - two way classification
10. Control charts for variables (mean and range chart)

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

U18IST4001 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Compare various graph traversal techniques(K4,S2)

CO2: Apply algorithm analysis techniques for a given algorithms(K3)

CO3: Examine algorithm design techniques for a given application(K4,S3)

CO4: Analyze different algorithms for solving a given problem (K4,S2)

CO5: Develop application using chosen algorithm technique (K5,S2)

Pre-requisites : U18ISI3201 – Data Structures

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO	
COs	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	S	M											M	
CO2	S												S	S
CO3	S	S	M	M						M		M	S	
CO4		S		M						M			S	S
CO5	S	S	M							M		M	M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment (Theory component) 3. Demonstration etc. (as applicable) (Theory component) 4. End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

GRAPH AND TREE ALGORITHMS 9 Hours

Introduction to graph – types of graphs - Graph representations - Traversal algorithms- Depth First Search (DFS) and Breadth First Search (BFS) - Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting.

INTRODUCTION 8 Hours

Fundamentals of algorithmic problem solving – Important problem types – Analysis framework - Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem – Algorithm visualization.

FUNDAMENTAL ALGORITHMIC STRATEGIES 9 Hours

Brute-Force: Sequential Search- Brute-Force string matching.

Divide and Conquer Method: Multiplication of large integers-Strassen's Matrix Multiplication.

FUNDAMENTAL ALGORITHMIC STRATEGIES 10 Hours

Greedy Technique: Job sequencing with deadlines - Knapsack problem,

Dynamic Programming: Traveling Salesman Problem - Optimal Binary Search Tree

FUNDAMENTAL ALGORITHMIC STRATEGIES 9 Hours

Backtracking: N-Queen's Problem -Graph colouring.
Branch and Bound: Assignment Problem - Traveling Salesman Problem.
Computability classes – P, NP, NP-complete and NP-hard.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press, Hyderabad, 2008.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India,New Delhi, 2007
4. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003.

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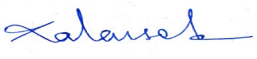
5. A.V.Aho, J.E. Hopcroft and J.D.Ullman, “The Design and Analysis of Computer Algorithms”,Pearson Education Asia, 2003.



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U18ISI4202 OPERATING SYSTEMS

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Apply the concepts of CPU scheduling and Process synchronization (K3,S2)
CO2: Experiment creation of different virtual machines in a hypervisor (K5, S3)
CO3: Simulate the principles of memory management (K3,S2)
CO4: Identify appropriate file system and disk organizations for a variety of computing scenario (K3)
CO5: Examine the features of various open source operating systems. (K4)

Pre-requisites: U18IST3002-Computer Architecture

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO	
COs	PROGRAMME OUTCOMES (POs)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	S	M	M							M		M		
CO2	S	S			S				M	M		M		
CO3	S	M								M				
CO4	S	M								M				M
CO5	S	S			M				M	M		M		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment (Theory component) 3. Demonstration etc. (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION AND PROCESS CONCEPT **9 Hours**

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Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – System Structures: Operating System Services – User and Operating System Interface – System Calls – Types of System Calls – System Programs. Process Scheduling – Operations on Processes – Inter-process Communication. Case Study: Kernel data structures for various open source operating systems.

MULTITHREADED PROGRAMMING AND PROCESS SCHEDULING **9 Hours**

Overview of threads – Multicore programming-Multithreading Models – Threading Issues - Basic Concepts of process scheduling – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Synchronization – The Critical-Section Problem – Peterson's Solution Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors- Case Study: Linux Scheduling.

DEADLOCK AND MEMORY MANAGEMENT STRATEGIES **9 Hours**

System Model – Deadlock Characterization – Methods for Handling Deadlock – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock. Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table- Segmentation.

VIRTUAL MEMORY MANAGEMENT AND FILE SYSTEM **9 Hours**

Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing

File Concept – Access Methods – Directory Structure – File Sharing – Protection.

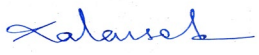
IMPLEMENTING FILE SYSTEMS AND SECONDARY STORAGE STRUCTURE **9 Hours**

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: Linux File system

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition, 2013.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of India Pvt. Ltd, 2010.
3. Harvey M. Deitel, "Operating Systems", Pearson Education Pvt. Ltd, Second Edition, 2002.
4. William Stallings, "Operating System", Pearson Education, Sixth Edition, 2012.



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ONLINE COURSES AND VIDEO LECTURES:

1. http://nptel.ac.in

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Develop programs for process creation and communication.
   To write simple shell programs.
   Creation of process and child process
   Demonstration of inter-process communication
   Creation of Zombie and Orphan process
   Creation of threads
2. Demonstration of shared memory concept
3. Simulation of the CPU scheduling algorithms
4. Demonstration of Semaphores
5. Implementation of Producer-Consumer problem
6. Simulation of Bankers algorithm for deadlock avoidance
7. Creation of virtual machine in a hypervisor

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

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U18ISI4203 **SOFTWARE ENGINEERING**

L	T	P	J	C
3	0	2	0	4

Course Outcomes (CO):

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

CO1	.Design a application using UML modeling	**[K4,S2]**
CO2	Test the given application with various test case using a testing tool	**[K4,S2]**
CO3	Create a application with all the stages of software engineering lifecycle	**[K5,S3]**
CO4	Apply project management and change management	[K3]

Prerequisite : U18ISI3203 – Object Oriented Programming

CO/PO Mapping (S/M/L indicates strength of correlation) S-Strong, M-Medium, L-Less													**CO/PSO MAPPING**	
COs	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	M	S								M				
CO2	M	M	S						M	M		M		
CO3	M		M						M	M	M	M		M
CO4	M										S	M		M

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment, Mini Project and Group Presentation. 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) **6.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

INTRODUCTION TO SOFTWARE ENGINEERING AND UML **9 Hours**

The Nature of Software -Software Engineering Failures- Software Engineering - Software Process Structure - Software Lifecycle Models - Agile Development - Scrum - Prototyping- Modeling with UML -Modeling Concepts

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PROJECT MANAGEMENT AND REQUIREMENTS ANALYSIS **9 Hours**

Project Organization Concepts - Project Communication Concepts - UML Activity Diagram- Requirements Elicitation - Usability - Requirement Analysis - UML Use Case Diagram - UML Analysis Object Class Diagram

DESIGN **9 Hours**

System Design Concepts-System Design Activities: From Objects to Subsystems- Patterns - Architectural Patterns - UML Component and Deployment Diagram - Object Design - Design Patterns - UML Class and Communication Diagram

MAPPING MODELS TO CODE & TESTING **9 Hours**

Mapping Models to Code- Overview of Mapping - Mapping Concepts- Mapping Activities - Managing Implementation-Testing- Overview of Testing- Testing Concepts-Faults, Erroneous States, Failures-Test Cases- Test Stubs and Drivers- Corrections-Testing Activities- Component Inspection – Usability Testing-Unit Testing-Integration Testing-System Testing-Managing Testing-Planning Testing-Documenting Testing-Assigning Responsibilities-Regression Testing-Automating testing

MANAGING CHANGE **9 Hours**

Rationale Management- Overview of Rationale - Rationale Concepts- Rationale Activities: from Issues To Decisions-Managing Rationale- Configuration Management Concepts- Configuration Management Activities - Managing Configuration management

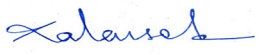
Theory: 45	**Tutorial:0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Bernd Bruegge & Allen H. Dutoit, “Object-Oriented Software Engineering”, Third Edition, 2014.
2. R.S. Pressman, “Software Engineering – A Practitioner‟s Approach”, Eighth Edition, McGraw Hill International Edition, 2015
3. Ivar Jacobson, “Object-Oriented Software Engineering”, Pearson Education, Revised Edition 2009.
4. Stephen R.Schach, “Object-Oriented Classical Software Engineering”, Mcgraw Hill, Eighth Edition 2010.
5. S. Thangasamy, “Essentials of Software Engineering”, Wiley India, First Edition, 2012.
6. Yogesh Singh, “Object-Oriented Software Engineering”, 2012.
7. M. Blaha and J. Rumbaugh, “Object Oriented Modeling and Design with UML”, Second Edition, Prentice-Hall India, 2007.

LABORATORY CONTENT:

To choose a real use case-based software development project, design, develop and test the software system with following milestones.
Milestones:



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1. Identify a application and model it using UML Use-Case Diagrams.(Star UML/ArgoUML/….)
2. Software Requirement Specification & UML Analysis Object Design Diagram
3. Module Description, Design & UML Component Diagram
4. Detailed Design & UML Deployment Diagram
5. Implementation & UML Object Design Class Diagram
6. Testing (Selenium tool/SonarQube/ …..)

Theory: 45	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 75 Hours**

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U18IST4004 **ARTIFICIAL INTELLIGENCE**

L	T	P	J	C
3	0	0	0	3

Course Outcomes (CO):

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

CO1	Develop solutions for problems using various Artificial Intelligence concepts.	**[K5,S3]**
CO2	Design applications using PROLOG for making inferences	**[K4,S2]**
CO3	Demonstrate usage of planning and decision making	**[K3]**
CO4	Apply the concepts of learning using Tensor Flow and any other programming language.	**[K4,S2]**

Pre-requisites: Nil

CO/PO Mapping (S/M/L indicates strength of correlation) S-Strong, M-Medium, L-Less													**CO/PSO MAPPING**	
COs	**PO**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	S	M		S	S			S	M		M	S	M
CO2	S	S	S		M				M	M		M	M	M
CO3	S	M								M		M		
CO4	S	S	S		M				M	M		M	M	M

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment, Mini Project and Group Presentation. 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) **6.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

INTRODUCTION AND PROBLEM SOLVING **9 Hours**

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Definitions of AI - Intelligent Agents. Problem solving by searching: Problem-solving agents- Example problems – Search for solutions Uninformed search strategies – Informed search strategies – Heuristic functions.

LOGIC **9 Hours**

Logical agents: Knowledge-based agents – The Wumpus world. Logic – Propositional logic: A very simple logic-Propositional theorem proving. First order logic: Representation – Syntax and semantics of first order logic – Using first order logic-PROLOG basics - Inference in first order logic: Propositional versus first order inference– Unification and lifting – Forward chaining – Backward chaining – Resolution.

PLANNING AND DECISION MAKING **8 Hours**

Classical Planning: Definition – Algorithms for planning as state-space search-Planning graphs – Other classical planning approaches. Making simple Decisions-Combining beliefs and desires under Uncertainty-Utility theory-Utility functions-Multi-attribute utility functions-Decision networks- The value of information-Decision theoretic expert systems.

LEARNING **10 Hours**

Quantifying uncertainty: Acting under uncertainty - Probability basics – Bayes' Rule and its use. Probabilistic reasoning: Representing knowledge in uncertain domain- The semantics of Bayesian networks. Forms of learning- Supervised learning - Learning decision trees - Reinforcement Learning.

ANN AND DEEP LEARNING **9 Hours**

Introduction to artificial neural networks, Perceptrons, Multi-layer feed forward network, Application of ANN - Deep feed forward networks – Convolution Neural networks – Applications-Use of Tensorflow.

Theory: 45	**Tutorial : 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar.B.Nair, "Artificial Intelligence", Tata Mc Graw Hill, Third Edition , 2009
3. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
4. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002
5. David L. Poole, Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents" , Cambridge University Press, 2010.
6. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", An MIT Press Book, 2016.
7. Li Deng , Dong Yu, "Deep Learning: Methods and Applications", Now Publishers, 2014.

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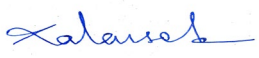
ONLINE COURSE AND VIDEO LECTURES:

1.http://aima.cs.berkeley.edu
2. http://www-formal.stanford.edu/jmc/whatisai/
3.http://nptel.ac.in/courses/106106126/4
4. https://www.coursera.org/specializations/deep-learning#courses
5. https://www.coursera.org/specializations/machine-learning-tensorflow-gcp
6. https://www.deeplearningbook.org/



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U18INI4600 **ENGINEERING CLINIC - IV**

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

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

CO1: Identify a practical problems and find a solution

CO2: Understand the project management techniques

CO3: Demonstrate their technical report writing and presentation skills

Pre-requisites: U18INI3600/Engineering Clinic-III

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M			S			S	M	
CO2											S		M	
CO3										S				S

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

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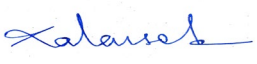
The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the fourth semester, students will focus primarily on Reverse engineering project to improve performance of a product.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	**Tutorial: 0**	**Practical: 60**	**Project: 30**	**Total: 90 Hours**



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U18CHT4000 ENVIRONMENTAL SCIENCE AND ENGINEERING
(Common to All branches) (Mandatory Course)

L	T	P	J	C
3	0	0	0	0

COURSE OUTCOMES

After successful completion of this course, the students would be able to

CO1: Analyze the impact of engineering solutions in a global and societal context.

CO2: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems.

CO3: Highlight the importance of ecosystem and biodiversity.

CO4: Consider issues of environment and sustainable development in his/her personal and professional undertakings.

CO5: Paraphrase the importance of conservation of resources.

CO6: Play an important role in transferring a healthy environment for future generations.

Pre-requisites : Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		M					S		M			
CO 2						M				M		
CO 3							M					
CO 4						M	S					
CO 5							S					
CO 6							S					M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment 3. Group presentation
INDIRECT
1. Course-end survey

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THEORY COMPONENT CONTENTS

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES — 14 Hours

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and overutilization of surface and ground water, conflicts over water, dams – benefits and problems – Water conservation, rain water harvesting, watershed management.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, case studies.

Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Wasteland reclamation – Role of an individual in conservation of natural resources.

ECOSYSTEMS AND BIODIVERSITY — 9 Hours

ECOSYSTEM: Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Food chain, Food web, Energy flow in the ecosystem and Ecological pyramids – Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

BIODIVERSITY: Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Bio geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION — 8 Hours

Definition – Causes, effects and control measures of: (a) Air pollution – Organic and inorganic pollution – cyclone separator, electrostatic precipitator (b) Water pollution (c) Heavy metal pollution (d) Noise pollution (e) Thermal pollution (f) Nuclear hazards – Role of an individual in prevention of pollution – Pollution case studies – Solid waste and hazardous Management: Causes, effects and control measures

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from factories, small scale and large scale industries – Waste minimization – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7 Hours**

From Unsustainable to Sustainable development – Urban problems related to energy – Resettlement and rehabilitation of people; its problems and concerns, case studies – Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Human Rights.

HUMAN POPULATION AND THE ENVIRONMENT **7 Hours**

Population growth and explosion – Welfare Program – Environment and human health – Communicable disease – Role of Information Technology in Environment and human health – Case studies.

Theory : 45	Tutorial : 0	Practical:0	Project: 0	Total: 45 Hours

REFERENCES:

1. G. Tyler Miller and Scott Spoolman, 'Environmental Science', Fourteenth Edition, Brooks Cole, 2012.
2. Gilbert M. Masters and Wendell P. Ela, 'Introduction to Environmental Engineering and Science', Third Edition, Pearson Education, 2013.
3. Bharucha Erach, 'The Biodiversity of India', Mapin Publishing Pvt. Ltd., Ahmedabad, 2002.
4. Trivedi R.K and P.K.Goel, 'Introduction to Air Pollution', Techno-Science Publications, 2003.
5. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 1996.
6. Cunningham, W.P.Cooper and T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publication House, Mumbai, 2001.
7. Wager K.D., 'Environmental Management', W.B. Saunders Co., Philadelphia, USA, 1998.
8. Colin R. Townsend, Michael Begon and John L. Harper, 'Essentials of Ecology', Third Edition, Blackwell Publishing, 2008.

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U18VEP4504	PROFESSIONAL VALUES (Mandatory Course)	L	T	P	J	C
		0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO 1: Develop the ethical values in both professional and personal life
CO 2: Develop ability to take decision to reinforce professional life
CO 3: Rational in professional skills required for diverse society
CO 4: Excel in ingenious attitude to congregate professional life
CO 5: Research into the professional stand
CO 6: Spruce an Individual with decorum to achieve professional life

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2.U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES

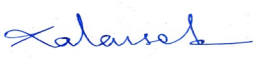
CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								S				
CO2				M								
CO3			S									
CO4												S
CO5								M				
CO6										M		

COURSE ASSESSMENT METHODS

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 hours**



Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

1.Professional skills With Values: Positive Attitude, Adaptability, Responsibility, Honesty and Integrity, Self Esteem, & Self Confidence

2.Building Innovative work cultures: Creative thinking, Critical thinking, Conflict Resolution, Problem Solving, & Decision making

3.Professional Work Ethics: Types of Ethics, Etiquette, personality Grooming, Emotional quotient, Human Dignity, Safety & Role of Professional in Social Responsibility

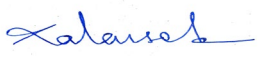
4.Engineering Ethics: Engineering Council of India - Objectives - Code of Ethics - Social responsibility -Professional Quality - Ethical issues - Effects - Strategy – Corruption, Consequences, Cures

5.Case studies in engineering ethics: Discussion of case studies relating to Public safety, health, welfare, Quality of product, Improper conduct by management, Product responsibility, Intellectual property

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 hours

REFERENCES:

1. Learning to do sourcebook 3 - UNESCO-UNEVOC -PDF
   www.unevoc.unesco.org/fileadmin/user_upload/pubs/LearningToDo.pdf
2. Declaration of professional values and ethical standards
   www.garda.ie/Documents/User/declarationvalues.pdf
3. karma yoga - swami vivekananda
   www.vivekananda.net/PDFBooks/KarmaYoga.pdf
4. Professional ethics in engineering - sasurie college of engineering
   www.sasurieengg.com/.../ge2025%20professional%20ethics%20in%20engineering.
5. Engineering ethics case study; challenger
   www.ucc.ie/en/processeng/staff/academic/ebyrne/.../pe1006pptnoteslect7.pdf



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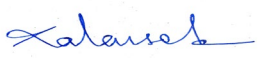
SEMESTER V



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U18ISI5201 COMPUTER NETWORKS

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Summarize the functionality and protocols operating in each layer of OSI reference model. [K3]

CO2: Compare network topology, devices and transmission medium. [K4]

CO3: Analyze error control, flow control and routing protocols. [K3]

CO4: Analyze IP, TCP and UDP header formats. [K4]

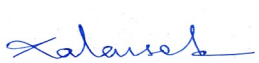
CO5: Analyze Network traffic characteristics and congestion control mechanism. [K5]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S									M				M
CO2	S	S	M	S						M		M		
CO3	S	M	M	M	M				M	M		M		
CO4	S	S		S	M					M		M		M
CO5	S	S		S	S			M	M	M		M		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey



Curriculum Coordinator

HoD/ISE

BoS Chairperson

THEORY COMPONENT CONTENT

DATA COMMUNICATIONS **8 Hours**

Data Communication – The OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media – Networking devices – Network Topologies.

DATA LINK LAYER **8 Hours**

Encoding - Error Detection – Reliable Transmission – MAC protocols – CSMA/CD – CSMA/CA.

NETWORK LAYER **11 Hours**

Circuit Switching – Packet Switching – Bridges and LAN Switches: Spanning Tree algorithm – Internetworking – IPv4 - Subnetting – IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).

TRANSPORT LAYER **11 Hours**

UDP – TCP – Congestion Control and Resource Allocation: TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service: Integrated Services – Differentiated Services – Network Traffic Analysis.

APPLICATION LAYER **7 Hours**

Domain Name System – Electronic Mail (SMTP, MIME, IMAP) – File Transfer (FTP) – WWW (HTTP).

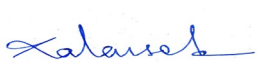
Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth edition, Morgan Kaufmann Publishers Inc., 2011.
2. William Stallings, “Data and Computer Communications”, Tenth edition, Pearson Education, 2013.
3. Behrouz A Forouzan, “Data Communications and Networking”, Fifth edition, Tata McGraw–Hill, New Delhi, 2013.
4. James F. Kurose, Keith W. Ross, “Computer Networking, A Top–Down Approach Featuring the Internet”, Sixth edition, Pearson Education, 2012.

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.coursera.org/specializations/computer-communications#courses
2. https://nptel.ac.in/courses/106105080/



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3. https://nptel.ac.in/courses/106105081/

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Develop client server based TCP applications using UNIX socket programming functions.
2. Develop client server based UDP applications using UNIX socket programming functions.
3. Simulation of data link and network layer protocols.
4. Performance analysis of TCP and UDP protocol using simulation tool.
5. Performance analysis of routing protocols using simulation tool.
6. Demonstrate the working of network tools such as Ping, TCPDump, Traceroute, Netstat, IPconfig.
7. Analyze the network traffic using Wireshark tool/Packet tracer tool.

Theory:45	Tutorial:0	Practical:30	Project:0	Total:75 Hours

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L	T	P	J	C
3	0	2	0	4

U18ISI5202 **BIG DATA TECHNOLOGIES**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the importance of big data processing and its application [K2]
CO2: Gain an understanding of what insights big data can provide by modelling, integrating, and processing big data [K3]
CO3: Understand the core tools used to wrangle and analyze big data [K4]
CO4: Apply appropriate techniques to solve fundamental problems in Big Data [K3]

Pre-requisites: U18ISI3204 – Database Management Systems

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M				M							M	M
CO2	M	M		S	M	M				M			S	
CO3	M		S	M	S				M				S	
CO4		M	M	S	M		M	M					M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

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BIG DATA FOUNDATIONS **8 Hours**

Introduction to Big Data: Big Data era, What makes big data valuable, Where Does Big Data Come From?, Machine Generated Data , Advantages, The Unstructured Challenge, Structured but Siloed, Combining with other Data Types, Integrating Diverse Data - **Characteristics of Big Data:** Characteristics of Big Data, Five V's of Big data, The Sixth V

DATA MODELLING **10 Hours**

Big Data Modelling: Introduction to Data Models, Data Model Structures -Data Model Operations, Data Model Constraints, Introduction to CSV Data, What is a Relational Data Model?, What is a Semi structured Data Model?, Exploring the Relational Data Model of CSV Files, Exploring the semi structured, Data Model of JSON data - **Data Modelling Types:** Vector Space Model, Graph Data Model, Other Data Models - **Working With Data Models :** Data Model vs. Data Format, What is a Data Stream? , Why is Streaming Data different?, Understanding Data Lakes

PROCESSING BIG DATA **9 Hours**

Pipelines: Big Data Processing Pipelines, Some High-Level Processing Operations in Big Data Pipelines, Aggregation Operations in Big Data Pipelines, Typical Analytical Operations in Big Data Pipelines, Overview of Big Data Processing Systems, The Integration and Processing Layer – Introduction to Apache Spark, Getting Started with Spark, Wordcount in Spark

HADOOP ECO SYSTEM & DATA MODELLING **10 Hours**

Hadoop Basics: Hadoop Stack Basics, The Apache Framework: Basic Modules, Hadoop Distributed File System (HDFS), The Hadoop "Zoo", Hadoop Ecosystem Major Components - **Introduction to the Hadoop Stack:** Overview of the Hadoop Stack, The Hadoop Distributed File System (HDFS) and HDFS2, MapReduce Framework and YARN, The Hadoop Execution Environment, YARN, Tez, and Spark, Hadoop Resource Scheduling, Hadoop-Based Applications, Introduction to Apache Pig, Introduction to Apache HIVE, Introduction to Apache HBASE

HADOOP DISTRIBUTED FILE SYSTEM (HDFS) **8 Hours**

HDFS Architecture: Overview of HDFS Architecture, The HDFS Performance Envelope, Read/Write Processes in HDFS, HDFS Tuning Parameters, HDFS Performance and Robustness, Overview of HDFS Access, APIs, and Applications, HDFS Commands - **Introduction to Map/Reduce :** Introduction to Map/Reduce, The Map/Reduce Framework, A MapReduce Example: Wordcount in detail, MapReduce: Intro to Examples and Principles, MapReduce Example: Joining Data, MapReduce Example: Vector Multiplication, Computational Costs of Vector Multiplication

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics" Wiley, First Edition, 2015.
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

ONLINE COURSES AND VIDEO LECTURES:

1. Big Data Specialization: https://www.coursera.org/learn/big-data-introduction
2. Big Data Specialization: https://www.coursera.org/learn/big-data-management
3. Big Data Specialization: https://www.coursera.org/learn/big-data-integration-processing
4. Hadoop Platform and Application Framework : https://www.coursera.org/learn/hadoop/home/info

30 Hours

LAB COMPONENT CONTENTS:

1. Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, Fully distributed
2. Implement the following file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm
4. Implement a Map Reduce Program to analyze time-temperature statistics and generate report with max/min temperature
5. Perform Joining data with streaming in Hadoop using Map Reduce
6. Collect, aggregate and transport large amount of streaming data from Twitter data using Apache Flume
7. Perform simple join using Mapper in Spark
8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes
9. Verify, Sparse and perform advance join of data using spark

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

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U18IST5003 **SOCIAL MEDIA MARKETING**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Identify and describe the different social media services, tools, and platforms.[K3]

CO2: Demonstrate understanding and evaluate new tools and social media platforms[K3]

CO3: Develop skills in using the predominant social media tools for business marketing.[K5]

CO4: Discover innovative uses for social media in a variety of business areas and processes [K4]

CO5: Develop a strategic plan for identifying opportunities for using social media.[K5]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S									M		M	M	
CO2	S	S			S					M		M	M	M
CO3	S		S							M		M	M	M
CO4	S									M		M	M	
CO5	S	S	S		S	S			M	M	S	M	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Group Presentation, Case Study, Online Quiz 3. Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

UNDERSTANDING FACEBOOK AND LEVERAGING FACEBOOK FOR MARKETING
8 Hours

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Chairperson

Introduction to basic FB Terminologies-Creating a powerful personal profile for business-Marketing applications of Face book- Fundamentals of creating and maintaining fan pages- Creating groups for marketing-Face book marketing checklist-Basics of Sentimental analysis

INTRODUCTION TO TWITTER AS A MARKETING TOOL **10 Hours**

Setting up a Twitter profile- Fundamental of Twitter: Tweet, direct messages, replies and Trending topics -Managing your Twitter experience- Fundamentals of Tweet Deck-Managing multiple Twitter accounts-Tweet management- Twitter Grader- Twitter Counter-Tweet burner- Twitter marketing checklist- Tree induction techniques.

FUNDAMENTALS OF YOUTUBE FOR CREATING COMPELLING ONLINE PRESENCE 10 Hours

Fundamentals of video marketing- Creating a YouTube channel- Creating your own Internet TV channel for marketing

USING LINKEDIN FOR MARKETING **8 Hours**

LinkedIn for B2b marketing- creating a profile in LinkedIn Powerful corporate searches and connections - Recommendations and testimonials.

UNDERSTANDING CONTENT MARKETING AND USING BLOGS TO BUILD AND ENGAGE AUDIENCE **9 Hours**

Basics of inbound marketing-Webinars and tele- seminars-Podcasting basics- creating blogs and building a following White papers and info graphics- Fundamentals of content curation

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total:45Hours**

REFERENCES:

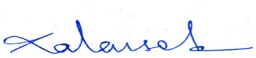
1. Liana Li Evans, "Social Media Marketing :Strategies for Engaging in Facebook, Twitter & Other Social Media", Que Press; Ed 2010
2. Andrew Macarthy," 500 Social Media Marketing Tips: Essential Advice, Hints and Strategy for Business: Facebook, Twitter, Pinterest, Google+, YouTube, Instagram, LinkedIn, and More!" ,Springer 2017
3. Ann Handley, "Content Rules: How to Create Killer Blogs, Podcasts, Videos, Ebooks, Webinars (and More) That Engage Customers and Ignite Your Business ",Johnwiley and sons,2012
4. Barker, "Social Media Marketing: A Strategic Approach" ,Cengage; 1 edition 2013

ONLINE COURSES AND VIDEO LECTURES:

1. Introduction to Social Media Analytics-https://www.coursera.org/learn/social-media-analytics-introduction
2. Foundations of Marketing Analytics Specialization – https://www.coursera.org/specializations/marketing-analytics
3. Social Network Analysis- https://www.coursera.org/learn/social-network-analysis
4. Computational Social Science Specialization- https://www.coursera.org/specializations/computational-social-science-ucdavis
5. https://learndigital.withgoogle.com/digitalunlocked

Curriculum Coordinator **HoD/ISE** **BoS Chairperson**

6. http://www.digitalvidya.com/blog/best-social-media-marketing-books-2016-top-10/



Curriculum Coordinator **HoD/ISE** **BoS**
Chairperson

U18INI5600 **ENGINEERING CLINIC – V**

L	T	P	J	C
0	0	4	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the web application vulnerabilities and methods to patch them. [K2]
CO2: Deploy defense for buffer overflow attacks [K2]
CO3: Analyze password cracking strategies. [K4]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**CO/PSO Mapping**	
COs	**PROGRAMME OUTCOMES (POs)**											**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	S	S	S	S	M	W		S			S		S
CO2											S			S
CO3										S				S

COURSE ASSESSMENT METHODS:

DIRECT
4. Project reviews 50% 5. Workbook report10% 6. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

Injection Web App Attacks and Their Defences: Command Injection-Review Code to Detect Pattern to Defend Command Injection - Apply Security Design Pattern to Defend Command Injection Attack - **Hack SQL Databases and Patch Web Apps with SQL Injection Vulnerabilities**: SQL Injection Attacks - Patching Web App with SQL Injection Vulnerability-Hacking Methodology-Demystify New OS/PL Will Not Have Injection Vulnerabilities-Escalate Privileges via Deploying Trojan - Escalate Privileges by Bringing in Sophisticated Trojan-**Memory Attacks and Defences:** Security in Memory Systems and Virtual Memory Layout-Variables Allocation in Virtual Memory Layout - Buffer Overflow-Buffer Overflow Défense - **Penetration Testing:** Vulnerability Scanning with Nessus -

Vulnerability and WannaCry Ransomware - Penetration Testing with Kali Linux - Metasploit Framework – Keylogging -Remote VNC Server Injection.

GUIDELINES:

1. Practical based learning carrying credits.
2. Each Group consist of 5-6 students.
3. Groups can select to work on a specific task, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students must display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of case study.

Theory:0	**Tutorial:0**	**Practical:60**	**Project:30**	**Total:90 Hours**

REFERENCES:

1. Hacking and patching: https://www.coursera.org/learn/hacking-patching

U18INT5000 **CONSTITUTION OF INDIA**
(Mandatory course)

L	T	P	J	C
2	0	0	0	0

COURSE OUTCOMES

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

CO 1: Gain Knowledge about the Constitutional Law of India
CO 2: Understand the Fundamental Rights and Duties of a citizen
CO 3: Apply the concept of Federal structure of Indian Government
CO 4: Analyze the Amendments and Emergency provisions in the Constitution
CO 5: Develop a holistic approach in their life as a Citizen of India

Pre-requisites : Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2
CO1						M			W			S		M
CO2						S		S				M	M	
CO3									M	S		W		
CO4								W	M			M		
CO5						M		M				S		

COURSE ASSESSMENT METHODS

DIRECT
1. Group Activity / Quiz/ Debate / Case studies 2. Class test / Assignment
INDIRECT
1. Course End Survey

THEORY COMPONENT CONTENTS:

MODULE.1: INTRODUCTION TO INDIAN CONSTITUTION 4 Hours

Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution – Salient features and characteristics of the Constitution of India

MODULE.2: FUNDAMENTAL RIGHTS 8 Hours

Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation

MODULE.3: FEDERAL STRUCTURE **8 Hours**

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India

MODULE.4: AMENDMENT TO CONSTITUTION **6 Hours**

Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India

MODULE.5: EMERGENCY PROVISIONS **4 Hours**

National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India

Theory: 30	Tutorial:0	Practical:0	Project:0	Total: 30 Hours

REFERENCES:

1. Constitution of India - Ministry of Law & Justice – PDF format awmin.nic.in/coi/coiason29july08.pdf
2. Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material - www.constitution.org/cons/india/const.html
4. Parliament of India – PDF format- download.nos.org/srsec317newE/317EL11.pdf
5. The Role of the President of India – By Prof.Balkrishna
6. Local Government in India – E Book - Pradeep Sachdeva https://books.google.com/books/.../Local_Government_in_In...

U18VEP5505 **SOCIAL VALUES**
(Mandatory Course)

L	T	P	J	C
0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO 1: Understand the transformation from self to society
CO 2: Acquire knowledge about disparity among Human Beings
CO 3: Realize the new ethics in creating a more sustainable Society
CO 4: Develop skills to manage challenges in social issues
CO 5: Acquire the skills for Management of Social work & Holistic Society
CO 6: Validate the social liabilities at dissimilar situations

Pre-requisites : Nil

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**	
COs	**PSOs**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO 12**	**PSO 1**	**PSO 2**
CO1						S							M	
CO2							S							
CO3								M						
CO4											S			
CO5												S		M
CO6									M					

COURSE ASSESSMENT METHODS

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 Hours**

1. Self and Society: Relation between self and society – Different forms of society - Elements of Social structures – Realization of Duties and Responsibilities of Individual in the Society

2. Social Values: Tolerance – Responsibility – Sacrifice – Sympathy - Service – peace- nonviolence - right conduct- Unity – forgive – dedication – Honest

3. Social issues: Disparity among Human beings- Poverty-Sanitation -corruption- un employment-superstition – religious intolerance & castes – terrorism.

4. Emerging Ethics for Sustainable Society: Unison of Men in Society - Positive Social Ethics - Cause and Effect - Ensuring an Equitable Society- Effect of Social Media in society - development of Education and Science in the Society

5. Social Welfare: Social welfare Organization - Programme by Government and NGO's - Benefits of Social Service - Balancing the Family and Social Life – Development of Holistic Society

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

REFERENCES:

1. Social Problems in India - ForumIAS.com – PDF discuss.forumias.com/uploads/File upload/.../711b18f321d406be9c79980b179932. pd...

2. Investing in Cultural Diversity And Intercultural Dialogue: UNESCO ... www.un.org/en/events/culturaldiversityday/pdf/Investing_in_cultural_diversity.pdf

3. Indian Society and Social Change - University of Calicut www.universityofcalicut.info/SDE/BA_sociology_indian_society.pdf

4. Culture, Society and the Media - E-classwww.eclass.uoa.gr/.../MEDIA164/.../%5BTony_Bennett,_James_Curran,_Michael_G

5. Social welfare Administration - IGNOU www.ignou.ac.in/upload/Bswe-003%20Block-2-UNIT-6-small%20size.pdf

SEMESTER VI

U18ISI6204 **MACHINE LEARNING TECHNIQUES**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understanding basic concepts and techniques of Machine Learning [K2]
CO2: Analyze the regression and classification techniques[K4]
CO3: Be able to create solutions to real world problems using Machine Learning [K5]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				M	M								S	M
CO2	M	M			M		M						S	
CO3	S	M	S	S	M	M		M			M		M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

MACHINE LEARNING FOUNDATIONS 9 Hours

Introduction: Machine learning algorithms, Types of Machine Learning, Supervised Learning, Unsupervised Learning, ML Process, Performance Metrics, Confusion Matrix, Data features

SUPERVISED LEARNING - REGRESSION 9 Hours

Linear Regression with One Variable : Model Representation ,Cost Function, Gradient Descent, Gradient Descent for Linear Regression - **Linear Regression with Multiple Variables:** Multiple Features, Gradient Descent for Multiple Variables, Feature Scaling, Learning Rate, Features and Polynomial Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models -**Non-Linear Regression**

SUPERVISED LEARNING – CLASSIFICATION **9 Hours**

Introduction to Classification : K-Nearest Neighbor, Evaluation Metrics in Classification - **Decision Trees:** Building Decision Trees **-Logistic Regression:** Introduction to Logistic Regression , Logistic regression vs Linear regression , Logistic Regression Training - **Support Vector Machine**

LOGISTIC REGRESSION & REGULARIZATION **9 Hours**

Hypothesis Representation, Decision Boundary, Cost Function , Simplified Cost Function and Gradient Descent , Advanced Optimization , Multiclass Classification: One-vs-all - **Regularization:** The Problem of Overfitting, Cost Function, Regularized Linear Regression, Regularized Logistic Regression

UNSUPERVISED LEARNING - CLUSTERING **9 Hours**

Unsupervised Learning: Introduction, K-Means Algorithm, Optimization Objective, Random Initialization, Choosing the Number of Clusters - **Dimensionality Reduction:** Data Compression, Principal Component Analysis Problem Formulation, Principal Component Analysis Algorithm, Choosing the Number of Principal Components

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Ethem Alpaydin, “Introduction to Machine Learning”, Second Edition, MIT Press, 2013
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine learning and Pattern Recognition Series, 2014.

ONLINE COURSES AND VIDEO LECTURES:

1. Machine Learning : https://www.coursera.org/learn/machine-learning/home/welcome
2. Machine Learning for all: https://www.coursera.org/learn/uol-machine-learning-for-all
3. Machine Learning with python : https://www.coursera.org/learn/machine-learning-with-python
4 Machine Learning with big data : https://www.coursera.org/learn/big-data-machine-learning

LAB COMPONENT CONTENTS:

1. Download a simple dataset from https://archive.ics.uci.edu/ml/index.php and do the imputation process using basic statistics
2. Write a Program to implement Linear Regression (Scikit) involving single variable and multiple variables and analyze the house price prediction.
3. Write a Program to implement Logistic Regression by plotting the decision boundary and use it to classify spam mail
4. Use a sample dataset and with help of Support Vector Machine, classify the subject whether it has cancer or not

5. Implement KNN algorithm using the balanced iris data set for multiclass classification and predict the flower species
6 Using Principal component Analysis as Dimensionality reduction component implement Logistic Regression for detecting credit card frauds
7. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
8. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

Theory: 45	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 75 Hours**

L	T	P	J	C
3	0	0	0	3

U18IST6002 CRYPTOGRAPHY AND NETWORK SECURITY

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze various security attacks and select appropriate security mechanisms for designing various security services [K4]
- **CO2:** Understand the mathematical foundations of cryptography [K2]
- **CO3:** Trace the design of modern block ciphers from basic building blocks[K4]
- **CO4:** Appreciate how one-way function and other mathematical hard problems are used to construct solutions for message integrity and authentication [K3]
- **CO5:** Discover how cryptographic algorithms are used to build network security protocols [K4]
- **CO6:** Identify appropriate mechanisms for providing system security [K3]

Pre-requisites: U18ISI5201 – Computer Networks

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	M	S					M					S
CO2	S	M											M	S
CO3	S	M	S											S
CO4	S		M											S
CO5	S	M		S					M	M				S
CO6	M	M							S	S				S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignments / Mini Projects / Group Presentations/ Case Studies, involving analysis of security of any information system / domain, and using security mechanisms to deliver security services **3.** End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

FOUNDATIONS OF SECURITY AND CRYPTOGRAPHY **9 Hours**

Computer Security Concepts: The OSI Security Architecture- Security Attacks- Security Services- Security Mechanisms- A Model for Network Security

Introduction to Cryptography: Codes and Ciphers- Cryptanalysis- Modern Guiding Principles in Cryptography- Types of Cryptanalytic Attacks- Frequency Analysis of Monoalphabetic Ciphers, Examples- Multi-Character Frequency Analysis- Key Length Determination in Polyalphabetic Cipher- Example of Cracking a Vigenere Cipher

Integer Foundations: Divisibility, Primes, GCD- Modular Arithmetic- Multiplicative Inverses- Extended Euclidean Algorithm

Modular Exponential: Square-and-Multiply- Euler's Totient Theorem- Euler's Totient Function- Discrete Logarithms

SYMMETRIC CRYPTOGRAPHY 9 Hours

Classical Ciphers:

Substitution: Alphabet- Substitution and Caesar Cipher- Modulo Operation- Monoalphabetic Cipher- Natural Language Redundancy- Polyalphabetic Cipher and Vigenere Cipher Transposition**:** Rail Fence Cipher- Permutation Cipher- Permutation Cipher Security- Product Cipher

Modern Cipher:

Block Cipher and DES**:** Block Cipher vs. Stream Cipher- Ideal Block Cipher- Feistel Cipher- DES overview- DES Round Function- DES Subkey Generation- DES Security- Double-DES and Meet-in-the-Middle Attack-Triple DES - Finite Fields and Advanced Encryption Standard (AES)

Block Cipher Operation Modes: ECB, CBC, CFB, OFB, CTR, XTS-AES

HASHING AND ASYMMETRIC CRYPTOGRAPHY 9 Hours

Hash Function: Cryptographic Hash Function usage- attack of Hash Functions- Properties- Secure Hash Functions (SHA)

Approaches to **Message Authentication**- Message Authentication Codes – HMAC

Asymmetric Cryptography: Asymmetric Encryption for Message Confidentiality

Digital Signature – DSS - Cipher Requirements and Trapdoor One - Way Function

RSA Algorithm**:** Prime Factorization Problem - RSA Encryption and Decryption - RSA Key Setup - Example - security

Diffie-Hellman Key Exchange**:** Discrete Logarithm - Primitive Root of a Prime Integer - Discrete Logarithm Problem - Diffie-Hellman Key Exchange Overview- Protocol - Man-in-the-Middle Attack - El Gamal Encryption

NETWORK SECURITY 10 Hours

Key Distribution and Management: Key Distribution Approaches- Key Hierarchy and Decentralized Key Distribution – Public - Key Authority- Public-Key Certificate and Public-Key Infrastructure (PKI)- Elliptic curve cryptography

Wireless Network Security: Wireless Security- Mobile Device Security- IEEE 802.11 Wireless LAN Overview- Security

Electronic Mail Security: Pretty Good Privacy (PGP)- S/MIME- Domain Keys Identified Mail (DKIM)

Transport-Level Security: Web Security Issues- Secure Sockets Layer (SSL)- Transport Layer Security (TLS)- HTTPS- Secure Shell (SSH)

IP Security: Overview- Policy- Encapsulating Security Payload- Combining Security Associations- Internet Key Exchange- Cryptographic Suites

SYSTEM SECURITY **8 Hours**

Malicious Software: Types of Malicious Software- Viruses- Worms- SPAM, Trojans**.** Payload**:** System Corruption- Attack Agent – Zombie, Bots. Information Theft – Keyloggers, Phishing, Spyware, Stealthing – Backdoors, Rootkit**-** Countermeasures- Distributed DoS Attacks

Intruders: Intruders- Intrusion Detection- Password Management

Firewalls: Need- Characteristics- Types of Firewalls- Firewall Basing- Firewall Location and Configurations

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. William Stallings, "Network Security Essentials: Applications and Standards", Pearson Education 6th edition (2018)
2. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017
3. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw Hill, 2008
4. Bruce Schneie, "Applied Cryptography: Protocols, Algorithms and Source Code in C" Special Edition, Kindle Edition ,30 March 2015

ONLINE COURSES AND VIDEO LECTURES:

1. Introduction-applied-cryptography Specialization: https://www.coursera.org/specializations/introduction-applied-cryptography
2. Classical Cryptosystems and Core concepts: https://www.coursera.org/learn/classical-cryptosystems
3. Mathematical Foundations for Cryptography: https://www.coursera.org/learn/mathematical-foundations-cryptography
4. Cryptographic Hash and integrity Protection: https://www.coursera.org/learn/cryptographic-hash-integrity-protection
5. Symmetric Cryptography: https://www.coursera.org/learn/symmetric-crypto
6. Asymmetric Cryptography and key management: https://www.coursera.org/learn/asymmetric-crypto

U18ISI6203 **INTERNET AND WEB PROGRAMMING**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Develop front end application using HTML5 and CSS3 [K5]
CO2: Enhance interactivity and perform validation using Java Script [K5]
CO3: Design responsive webpages using Bootstrap [K5]
CO4: Develop server-side application using Node JS and MongoDB [K5]
CO5: Understand essential functionalities like user authentication and services like Backend as a Service. [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		S						M					
CO2		S			M								M	M
CO3		S		S	S						M			
CO4			S	M									M	S
CO5	M	M			S						M			S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

FRONT-END DEVELOPMENT USING HTML5 AND CSS3 **9 Hours**

HTML5: Basic Tags and Syntax, Semantic Tags, Template Page, Images, Hyperlinks, Multimedia, Tables, Frame and Forms -**Validation and accessibility:** Accessibility, Validating the Site, Wave, Funkify, Hosting the Site -**CSS3**: Basics of Cascading Style Sheets, Colors, Styling the Text, Box Model, Styling Links and Lists, Advanced Selectors, Browser Capabilities, Pseudo Classes and Elements, Transitions.

JAVA SCRIPT **9 Hours**

JavaScript: Basic elements, DOM Review with Object Oriented Programming, Input and Output, Data Types and Variables, Operators and Expressions, Functions, Arrays and Looping, Iteration, Flow of Control, Validating Form, Data- Form, Validation, Compare two inputs, Checkbox and Radio buttons, Event Handling.

STYLE WITH RESPONSIVE DESIGN USING BOOTSTRAP **8 Hours**

Style with Responsive Design: Basic Concepts, Testing Existing Sites, Benefits of Responsive Design, Fluid Measurements, Media Queries, Wire Frames, Breakpoints, Responsive Navigation -**Use Existing Frameworks**: Frameworks, Introduction to Twitter Bootstrap, Bootstrap Breakpoints, Getting Started with Twitter Bootstrap, Bootstrap Grid System, Bootstrap Navigation, Experiment, Responsive Images, Bootstrap Tables.

SERVER-SIDE DEVELOPMENT USING NODE JS AND MONGODB **10 Hours**

Node JS: Introduction to Full-Stack Web Development, Node.js and NPM, Node Modules, Call back and Error Handling, Networking Essentials, Node and the HTTP Module, Introduction to Express, Brief Representational State Transfer (REST) -**MongoDB:** Express Generator, MongoDB Environment, Create and Database, Create and Drop Collection, Read and Write Operations, Node and MongoDB, Callback Hell and Promises, Mongoose ODM, REST API with Express, MongoDB and Mongoose.

AUTHENTICATION AND BACKEND AS A SERVICE **9 Hours**

Basic Authentication: Cookies, Tea, and error, Express Sessions, Passport, Token Based Authentication, User Authentication with Passport and JSON Web Token, Mongoose Population -**Backend as a Service (BaaS):** HTTPS and Secure Communication, Uploading Files, Cross-Origin Resource Sharing-, Auth and User Authentication -**ConFusion:** Integrating the Angular Client and Server, Integrating the React Client and Server, Backend as a Service-Firebase.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. P. J. Deitel, H. M. Deitel, “Internet World Wide Web. How to Program”, Fifth Edition Pearson Education,2011.
2. Randy Connolly Ricardo Hoar, “Fundamentals of Web Development”, Second Edition, Pearson Education, 2018.
3. Brad Dayley,Brendan Dayley and Caleb Dayley, “ Node.js, MongoDB and Angular Web Development”, Second Edition, Pearson Education,2018.

4. Simon Holmes, Clive Herber, “Getting MEAN with Mongo, Express, Angular, and Node” Second Edition, Manning Publications,2019.
5. Amos Q. Haviv, “MEAN Web Development Master real-time MEAN web application development and learn how to construct a MEAN application using a combination of MongoDB, Express, AngularJS, and Node.js” Packt Publishing, 2014.

ONLINE COURSES AND VIDEO LECTURES:

1. Specializations web-design: https://www.coursera.org/specializations/web-design#courses
2. Introduction to HTML-5: https://www.coursera.org/learn/html?specialization=web-design
3. Introduction to CSS3: https://www.coursera.org/learn/introcss?specialization=web-design
4 Interactivity with JavaScript: https://www.coursera.org/learn/javascript?specialization=web-design
5 Advanced Styling with Responsive Design: https://www.coursera.org/learn/responsivedesign?specialization=web-design
6 Introduction to Server-side Development: https://www.coursera.org/learn/server-side-nodejs
7 https://www.w3schools.com/whatis/whatis_fullstack.asp

LAB COMPONENT CONTENTS: 30 Hours

1. Develop a webpage using HTML.
2. Apply style specification in HTML page using CSS.
3. Develop a HTML form and validate it using Java script.
4. Demonstrate exception handling using Java Script.
5. Develop a style Responsive Design using: Bootstrap
6. Configure Server-side Development
7. Server-side Development using Node JS and MongoDB
8 User Authentication using Cookies/Passport/Web Token
9 React Application using Firebase as BaaS
10 Configuring HTTPS and Secure Communication

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

Lab Resources:
1. https://docs.mongodb.com/manual/tutorial/getting-started/

U18VEP6506 **NATIONAL VALUES**
(Mandatory Course)

L	T	P	J	C
0	0	2	0	0

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO 1: Acquire knowledge on the Cultural Heritage of India
CO 2: Know the great Indian personalities and follow their trail
CO 3: Understand the specialty of democracy
CO 4: Disseminate our Nation and its values to propagate peace
CO 5: Contribute with their energy and effort for a prosperous India
CO 6: Propagate the youth and the contribution for development of our Nation

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES
5. U18VEP5505 / SOCIAL VALUES

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PSO												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1						S								M
CO2									M				M	
CO3							M							
CO4								S						
CO5											S			
CO6												M		

COURSE ASSESSMENT METHODS

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 Hours**

1. Cultural Heritage of India: Indian Unity in Diversity – Universalism - Languages and Literatures - Religion and Philosophy - Art and Architectures.

2. Great Indian Leaders: Ancient rulers - Freedom fighters - Social reformers -Religious and Spiritual leaders - Noble laureates -Scientists – Statesman.

3. Largest Democracy: Socialist -Secular - Democratic and Republic – special features of Indian constitution – Three pillar of Indian democracy - Fundamental rights – Duties of a citizen – centre state relationship.

4. India's Contribution to World peace: Nonaligned Nation – Principle of PanchaSheela – Mutual respect, non-aggression, non-interference, Equality and cooperation – Role of India in UNO -Yoga India's gift to the world.

5. Emerging India: World's largest young work force - Stable Economic development - Labor market & Achievement in space technology – Value based Social structure. Emerging economic superpower.

Theory : 0	**Tutorial:0**	**Practical :30**	**Project:0**	**Total:30 Hours**

REFERENCES:

1. Cultural heritage of India - SCERT Kerala
   www.scert.kerala.gov.in/images/2014/HSC.../35_Gandhian_Studies_unit-01.pdf
2. Learning to do: values for learning and working together – UNESCO-
   www.unesdoc.unesco.org/images/0014/001480/148021e.pdf
3. India after gandhi.pdf - RamachandraGuha - University of Warwick
   www2.warwick.ac.uk/fac/arts/history/students/modules/hi297/.../week1.pdf
4. India's contribution to the rest of the world - YouSigma
   www.yousigma.com/interesting facts/indiasgifttotheworld.pdf
5. India as an emerging power - International Studies Association
   web.isanet.org/Web/Conferences/.../11353cac-9e9b-434f-a25b-a2b51dc4af78.pdf

SEMESTER VII

U18IST7001	INFORMATION STORAGE AND RETRIEVAL	L	T	P	J	C
		3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Set-up different cloud storage options [K3]
CO2: Analyze current environment and plan migration to cloud [K4]
CO3: Understand the foundations of NLP techniques for text access and retrieval [K2]
CO4: Evaluate an Information Retrieval Systems [K5]
CO5: Understand Information Retrieval and Feedback model [K2]
CO6: Understand the underlined technologies of a web search engine [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M			M								S	
CO2	S	S			M				M	M			S	M
CO3	M				M								S	
CO4	M				S				M	M			S	M
CO5	M								M				S	
CO6					M				M				S	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc **3.** End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

CLOUD STORAGE **7 Hours**

Introduction – Overview of cloud – Infrastructure – Compute Services – Creating a Web server – Networking and Storage

MIGRATION **11 Hours**

Introduction – Migration preparation and business planning – Portfolio discovery and Planning – Design, Migration and Application validation – Operate –Cloud adoption framework-Hybrid environments – Scaling considerations – High Availability – Considerations with migrating DB vs

Applications – VM import and VM on AWS – Introduction AWS migration hub – AWS application discovery service – Amazon EFS, Amazon EBS, & Amazon S3 – Storage – AWS Snowball & AWS Snowmobile – AWS Storage Gateway and AWS DataSync – AWS DMS Overview – Core Features – Schema Conversion – Amazon Aurora (Serverless) – AWS Direct Connect & Amazon Route 53

TEXT RETRIEVAL **9 Hours**

Natural Language Content Analysis – Text Access – Text Retrieval Problem – Text Retrieval Problem – Overview of Text Retrieval Methods – Vector Space Model – Basic Idea – Vector Space Retrieval Model – Simplest Instantiation – Vector Space Model – Improved Instantiation – TF Transformation – Doc Length Normalization – Implementation of TR Systems – System Implementation – Inverted Index Construction – System Implementation – Fast Search

EVALUATION OF TR SYSTEMS **9 Hours**

Basic Measures – Evaluating Ranked Lists – Multi-Level Judgements – Probabilistic Retrieval Model – Basic Idea – Statistical Language Model – Query Likelihood Retrieval Function – Statistical Language Model – Smoothing Methods

WEB SEARCH **9 Hours**

Introduction – Web Crawler – Web Indexing – Link Analysis – Learning to Rank – Future of Web Search – Recommender Systems: Content-Based Filtering

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Michael Wittig, Andreas Wittig, “Amazon Web Services in Action”, Manning Publications Co, Second Edition, 2019
2. Jeff Armstrong, “Migrating to AWS: A Manager’s guide”, O’REILLY Media Inc, 2020
3. Bhaskar Mitra, Nick Craswell, “An Introduction to Neural Information Retrieval”. United States, Now Publishers, 2019
4. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, “Introduction to Information Retrieval”, Cambridge University Press, 2009

ONLINE COURSES AND VIDEO LECTURES:

1. AWS Fundamentals: Going Cloud-Native- https://www.coursera.org/learn/aws-fundamentals-going-cloud-native
2. AWS Fundamentals: Migrating to the Cloud- https://www.coursera.org/learn/aws-fundamentals-cloud-migration
3. AWS Fundamentals Specialization- https://www.coursera.org/specializations/aws-fundamentals

4. Text Retrieval and Search Engines- https://www.coursera.org/learn/text-retrieval
5. Data Mining Specialization- https://www.coursera.org/specializations/data-mining

L	T	P	J	C
3	0	2	0	4

U18ISI7202 **DATA VISUALIZATION**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand foundational visualization concepts.[K2]
CO2: Apply visualizations principles to enhance data visualization[K3]
CO3: Analyze and apply essential design principles to data exploration and visualization[K4]
CO4: Create and design appropriate charts, tables, maps and dash boards. [K6]
CO5: Effectively tell a story based on real data. [K6]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						W								
CO2	S			S									M	
CO3		S	S			M					M		S	
CO4			S		S								S	
CO5									S	S		S	M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

VISUALIZATION FUNDAMENTALS 7 Hours

Introduction to data visualization-Need for data visualization and its definition-Tools for Visualizing Data-Methods of visualizing data-Overview of modern visualization tools-Introduction to Basic chart types: bar chart-line chart-Tree map-Making dashboard-basics of visualization.

DATA VISUALIZATION FOR HUMAN PERCEPTION **10 Hours**

Introduction-The Human Brain and Data Visualization-Cognitive vs Perceptual Design Distinction-Introduction of Effective and Ineffective Visuals-Types of Visualizations and its examples-Practicing Good Ethics in Data Visualization-Ineffective Visuals and improvements-Visual Perception and Cognitive Principles-Cognitive Load and Clutter-Principles of Visual Perception-Strategic Use of Contrast-Pre-Attentive Attributes of Visualizations-Color as a Pre-Attentive Attribute-De-Cluttering.

DESIGN AND EXPLORATORY ANALYSIS **10 Hours**

Introduction-Gestalt Principle: Proximity-Leveraging Pre-Attentive Attributes-Accessible Visualizations-Aesthetics-Design and Exploratory Analysis Introduction-Exploratory and Explanatory Analysis definition-Case Study: Anscombe's Quartet-Identifying Outliers-Constructing a Control Chart-Design For Purpose-Data, Relationships, and Design-Static Versus Interactive Visualizations-Multiple, Connected View, Language, Labelling, and Scales-Visual Lies and Cognitive Bias

VISUAL ANALYTICS AND DASHBOARD **9 Hours**

Basics of Visual Analytics-Introduction to Charting-Charts-Colors, Shapes, and Sizes-Dual Line Charts-Bar Charts, Line Graphs, Pie Charts-Scatter Plots, Gantt Charts, Bubble Charts-Histograms, Bullet Charts, Heat Maps and Highlight Tables-Dates-Discrete vs. Continuous Dates-Basics of table calculations-Maps-Preproduction and Dashboard: Introduction to Planning and Preproduction for Visualizations-A Design Checklist-understanding Stakeholders-Prioritizing, Optimizing, and Designing -Dashboard Design-Dashboard Design Principles-Hierarchies, Actions, Filters, and Parameters- Creating Dashboards

STORYTELLING AND PROJECT **9 Hours**

The Story of the data-The Art of Storytelling (Past, Present, and Future)-Storytelling and the Human Brain-Bringing Data to Life-Emotion Modulators-Framing and Format - Framing, Conventions, and Priming-False Narratives and Data Storytelling-Preparation of the Story Points=Setting Up the Story-Creating Points in the Story - Data visualization Project-Save Workbooks-Design Checklist-Gathering resources-Preparing Your Data for Import-Primary Types of Connections-Connecting and Merging Multiple Data Sources-Exploratory and Explanatory Analysis-Identifying Outliers-Constructing a Control Chart-Conducting Visual Analytics-Key Metrics, Indicators, Decision Triggers-Dashboard and Storytelling with Data.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Colin Ware and Kaufman M,, Visual thinking for design‖, Morgan Kaufmann Publishers, 2008.
2. Chakrabarti, S, “Mining the web: Discovering knowledge from hypertext data “, Morgan Kaufman Publishers, 2003.
3. Ben Fry, “Visualizing data”, O‘Reily, 2007.

ONLINE COURSES AND VIDEO LECTURES:

1. Fundamentals of Visualization with Tableau : https://www.coursera.org/learn/data-visualization-tableau?specialization=data-visualization

2. Essential Design Principles for Tableau: https://www.coursera.org/learn/dataviz-design?specialization=data-visualization
3. Visual Analytics with Tableau : https://www.coursera.org/learn/dataviz-visual-analytics?specialization=data-visualization
4. Creating Dashboards and Storytelling with Tableau: https://www.coursera.org/learn/dataviz-dashboards?specialization=data-visualization
5. Data Visualization with Tableau Project: https://www.coursera.org/learn/dataviz-project
6. Data Visualization with Tableau Specialization: https://www.coursera.org/specializations/data-visualization

LAB COMPONENT CONTENTS: **30 Hours**

1. Create a basic visualization using Google Sheets.
2. Demonstrate proper use of the design principles used: "pop-out" or "pre-attentive" attributes, Gestalt Principles, cognitive load and clutter, and static or interactive format.
3. Analyze customer's purchases and how much the company is profiting from each customer by create a scatter plot
4. Create a table showing total sales by product category, broken down by Year and Month -sales spotlight.
5. Create a dual layer map showing total profit by postal code, colorized by profit ratio, and sized by total sales.
6 Provided any dataset, create a dashboard consisting of at least 2 KPIs.
7. Create a story consisting of at least three story points and must explicitly answer the business question(s) in the project .
8. Create a project with the concepts of design, chart, dashboard and storytelling.

Theory: 45	Tutorial: 0	Practical: 30	Project: 0	Total: 75 Hours

U18ISP7703 **PROJECT PHASE-I**

L	T	P	J	C
0	0	0	6	3

COURSE OUTCOMES

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

CO1	Identify and define the problem statement	K 2
CO2	Prepare the software requirement/product specification	K3
CO3	Identify the appropriate problem solving methodology / process	K4
CO4	Implement Solution / Develop Product	K3
CO5	Analyze and Evaluate the experimental results	K5
CO6	Demonstrate Solution / Product and submit documentation	K3

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	S	S	M	M	M	M	S	S	S	S	M	S	S
CO2	S	M	M	M					M	M			S	S
CO3		M			M			M	S		M		S	S
CO4	S	M		M				S	M				S	S
CO5	M		M	S	M			M	M				S	S
CO6								M	M	M	M	M	S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Project reviews 2. End semester viva voce
INDIRECT
1. Course-end survey

U18VEP7507 **GLOBAL VALUES**
(Mandatory Course)

L	T	P	J	C
0	0	2	0	0

COURSE OUTCOMES

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

- **CO 1:** Aware of the concept of Universal Brotherhood and support the organizations which are working for it
- **CO 2:** Follow the path of Ahimsa in every aspect of their life
- **CO 3:** Uphold the Universal declaration of Human Rights
- **CO 4**: Understand the unequal distribution of wealth in the World and bestow their effort towards inclusive growth
- **CO 5:** Sensitize the environmental degradation and work for the sustainable development
- **CO 6:** Amalgamate harmony through Non-violence and edify the nation headed for Upholding development

Pre-requisites :

1. U18VEP1501 / PERSONAL VALUES
2. U18VEP2502 / INTERPERSONAL VALUES
3. U18VEP3503 / FAMILY VALUES
4. U18VEP4504 / PROFESSIONAL VALUES
5. U18VEP5505 / SOCIAL VALUES
6. U18VEP6506 / GLOBAL VALUES

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							M							
CO2								S						M
CO3									M					
CO4						S							M	
CO5											M			
CO6												S		

COURSE ASSESSMENT METHODS

DIRECT
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
INDIRECT
1. Mini project on values / Goodwill Recognition

VALUES THROUGH PRACTICAL ACTIVITIES: **30 Hours**

1. Universal Brotherhood: Meaning of Universal Brotherhood- Functioning of Various organization for Universal human beings -Red Cross, UN Office for Humanitarian Affairs – Case study on humanitarian problems and intervention - Active role of Students/Individual on Universal Brotherhood.

2. Global Peace, Harmony and Unity: Functions of UNO - Principal Organizations - Special organization – Case study relating to disturbance of world peace and role of UNO – Participatory role of Students/Individual in attaining the Global peace and Unity.

3. Non-Violence: Philosophy of nonviolence- Nonviolence practiced by Mahatma Gandhi – Global recognition for nonviolence - Forms of nonviolence - Case study on the success story of nonviolence– Practicing nonviolence in everyday life.

4. Humanity and Justice: Universal declaration of Human Rights - Broad classification - Relevant Constitutional Provisions– Judicial activism on human rights violation - Case study on Human rights violation– Adherence to human rights by Students/Individuals.

5. Inclusive growth and sustainable development : Goals to transform our World: No Poverty - Good Health - Education – Equality - Economic Growth - Reduced Inequality –Protection of environment – Case study on inequality and environmental degradation and remedial measures.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

REFERENCES:

1. Teaching asia-pacific core values of peace and harmony – UNICEF www.unicef.org/.../pdf/Teaching%20Asia-Pacific%20core%20values.pdf

2. Three-dimensional action for world prosperity and peace- IIM Indore - www.iimidr.ac.in/.../Three-Dimensional-Action-for-World-Prosperity-and-Peace-Glo...

3. My non-violence - MAHATMA GANDHI
   www.mkgandhi.org/ebks/my_nonviolence.pdf

4. Human rights and the Constitution Of India 8th ... - India Juris
   www.indiajuris.com/uploads/.../pdf/l1410776927qHuman%20Rights%20080914.pdf

5. The Ethics of Sustainability – Research Gate
   www.researchgate.net/file.PostFileLoader.html?id...assetKey..

SEMESTER - VIII

U18ISP8701 **PROJECT PHASE-II**

L	T	P	J	C
0	0	0	24	12

COURSE OUTCOMES

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

CO1	Identify a real-life or impactful research problem	K2
CO2	Prepare the software / product requirement specification.	K2
CO3	Form an appropriate team, develop a collaborative process	K3
CO4	Implement Solution / Develop Product	K3
CO5	Analyze, interpret, and justify the experimental results	K4
CO6	Demonstrate solution and submit documentation	K3

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO /PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	M	M	M	M	S	S	S	S	M	S	S
CO2	S	M	M	M					M	M			S	S
CO3		M		M	M			M	S	M	M		S	S
CO4	S	M		M				S	M			M	S	S
CO5	S		M	S				S	M				S	S
CO6								M	M	M	M	M	S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Project reviews 2. End semester viva voce
INDIRECT
1. Course-end survey

PROGRAMME ELECTIVES

L	T	P	J	C
3	0	0	0	3

U18ISE0001 **IMAGE AND VIDEO ANALYTICS**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Understand the purpose of computer vision and operations that can be applied to them [K2]
- **CO2:** Build key point detector using CNN [K6]
- **CO3:** Detect an object like face using Deep CNN [K4]
- **CO4:** Design computer vision architectures for video analysis [K4]
- **CO5:** Predict entire image using image segmentation and synthesis [K3]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M			M								S	
CO2	M	M			M					M			S	
CO3		S			M				M				S	
CO4		S			M				M				S	
CO5		M			M				M				S	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc **3.** End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

COMPUTER VISION **9 Hours**

Introduction – Digital Images – Structure of Human Eye and Vision – Color Models- Image processing goals and tasks – Contrast and brightness correction – Image Convolution – Edge Detection

UNDERSTANDING CONVOLUTIONS AND IMAGE CLASSIFICATION **9 Hours**

Understanding Convolutions: CNN Model Parameters – Working with pooling layers – Implementing CNNs with Tensorflow
Image classification: AlexNet, VGG and Inception architectures – ResNet- Fine-grained Image recognition – Detection and Classification of facial attributes –- Content-based image retrieval – Computing semantic image embeddings using CNN – Employing indexing structures for efficient retrieval of semantic neighbors – Face verification – Facial key points regression – convolution features for visual recognition.

OBJECT DETECTION **9 Hours**

Introduction – Sliding windows – HOG-based detector – Detector training – Viola-Jones Face detector – Attentional Cascades And Neural – Region-Based Convolutional Neural – From R-CNN to Fast R – Faster R-CNN – Region-Based Fully-Convolutional Network – Single Shot detector.

OBJECT TRACKING AND ACTION RECOGNITION **9 Hours**

Introduction to Video Analysis – Optical flow –- Deep learning in optical flow estimation – Visual object tracking – Multiple object tracking – Action Recognition – Action classification – Action localization.

IMAGE SEGMENTATION AND SYNTHESIS **9 Hours**

Image segmentation – Deep learning models for image segmentation – Human pose estimation as image segmentation – Style transfer – Generative adversarial networks – Image transformation with neural networks – Image segmentation and synthesis

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image processing”, Pearson International Edition, Fourth Edition, 2018
2. Rajalingappaa Shanmugamani, “Deep Learning for Computer Vision”, O’REILLY, 2018.
3. Debjyoti Paul and Charan Puvvala, “Video Analytics using Deep Learning: Building Applications with Tensorflow, Keras and YOLO”, Apress, First Edition, 2020

ONLINE COURSES AND VIDEO LECTURES:

1. Deep Learning into Computer Vision : https://www.coursera.org/learn/deep-learning-in-computer-vision
2. Advanced Machine Learning Specialization : https://www.coursera.org/specializations/aml
3. Image Understanding with TensorFlow on GCP: https://www.coursera.org/learn/image-understanding-tensorflow-gcp
4. Advanced Machine Learning with TensorFlow on Google Cloud Platform Specialization: https://www.coursera.org/specializations/advanced-machine-learning-tensorflow-gcp

U18ISE0002 GRAPHICS AND MULTIMEDIA

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Illustrate graphics input and output primitives.[K3]

CO2: Construct 2D and 3D geometric transformations on objects.[K5]

CO3: Summarize the graphics modeling process.[K3]

CO4: Apply the techniques of multimedia, compression, communication and authoring.[K3]

CO5: Design a simple application with animation.[K5]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING	
COs	**PROGRAMME OUTCOMES (POs)**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S									M		M		
CO2	S	S								M		M		
CO3	S									M		M		M
CO4	S									M		M	M	
CO5	S	S			S	S			M	M	S	M	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II
2. Assignment, Group Presentation, Online Quiz
3. Mini Project
4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

2D PRIMITIVES 9 Hours

Elements of pictures created in Computer Graphics – Graphics input primitives and devices – Output Primitives – Line, Circle and Ellipse drawing Algorithms – Attributes of output primitives

2D GEOMETRIC TRANSFORMATIONS 9 Hours

Two Dimensional Geometric Transformations – 2D Viewing – Window-Viewport Transformations – Line, Polygon, Curve and Text Clipping algorithms – 2D Geometric Transformations-Case study

3D CONCEPTS 9 Hours

Three Dimensional Object Representation – Polygons, Curved Lines, Splines, Quadric Surfaces - 3D affine transformations - Parallel and perspective projections – Visualization of data sets – Viewing – Visible Surface Identification - Color Models- Case study

MULTIMEDIA BASICS AND 3D MODELLING **9 Hours**

Introduction and Definitions – Applications – Elements – Animations –Definition of Modelling -Surface Modelling- Object cloning-Object Editing-3D Procedural Modelling- Modelling with Polygons-Building Simple scenes-Building complex scenes- Modelling with NURBS

MULTIMEDIA APPLICATION DESIGN **9 Hours**

Types of Multimedia systems - Virtual Reality Design - Components of Multimedia system - Distributed Application Design Issues - Multimedia Authoring and User Interface - Hypermedia Messaging - Distributed Multimedia Systems

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Donald Hearn, M. Pauline Baker, "Computer Graphics", Prentice Hall, 1998
2. Donald Hearn, M. Pauline Baker, "Computer Graphics (C version)" Second edition, Prentice Hall ,2002
3. Donald Hearn, M. Pauline Baker and Warren Caritthers, "Computer Graphics with OpenGL", Fourth edition, Prentice Hall, 2010.
4. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", First Edition, Pearson Education, 2004.
5. PrabhatK. Andleigh, Kiran Thakrar," Multimedia Systems Design", PHI, 2013.
6. Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2012.
7. F.S. Hill, "Computer Graphics using OpenGL", Third Edition, Pearson Education, 2006.

TOOLS:

1. https://en.wikibooks.org/wiki/GIMP
2. https://docs.gimp.org/2.8/en/gimp-tools.html
3. https://www-uxsup.csx.cam.ac.uk/pub/doc/suse/suse9.0/userguide-9.0/ch23s02.html
4. https://en.wikipedia.org/wiki/Hypermedia#Development_tools

ONLINE COURSES AND VIDEO LECTURES:

1. Interactive Computer Graphics - https://www.coursera.org/learn/interactive-computer-graphics
2. Fundamentals of Graphic Design - https://www.coursera.org/learn/fundamentals-of-graphic-design
3. http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-837-computer-graphics-fall-2003/
4. https://nptel.ac.in/courses/106106090/

U18ISE0003 PRINCIPLES OF COMPILER DESIGN

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Interpret the different phases of the compiler and experiment the scanner using Lex tool [K3].

CO2: Construct various parser and execute the same using tools. [K5].

CO3: Break down the given expression into intermediate code [K4].

CO4: Translate given intermediate code to target code.[K3]

CO5: Identify various types of optimizations that can be applied to an intermediate code [K3]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S		S		S							M		
CO2	M	M										M		
CO3	S	S										M		
CO4		L										M		L
CO5	S	S										M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Group Presentation, Online Quiz 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION 9 Hours

Introduction: Language Processors- The Structure of a Compiler
Lexical Analysis: The Role of the Lexical Analyzer- Input Buffering- Specification of Tokens- Recognition of Tokens- The Lexical-Analyzer Generator: LEX

SYNTAX ANALYZER 9 Hours

The Role of the Parser- Error-Recovery Strategies- Top Down Parsing- Bottom-Up Parsing: SLR, CLR, LALR- The Parser Generator YACC

INTERMEDIATE CODE GENERATION **9 Hours**

Variants of syntax trees- Three address codes – Types and Declarations – Translation of expression- Type checking - Control flow-Back patching-Switch statements-Intermediate code for procedures

CODE GENERATION **9 Hours**

Issues in the design of code generation – Target language-Addresses in target code- Basic Blocks and Flow Graphs- Optimization of Basic Blocks – A simple Code generator – Peephole optimization

CODE OPTIMIZATION AND RUN-TIME ENVIRONMENTS **9 Hours**

Machine-Independent Optimizations: The Principal Sources of Optimization - Loops in Flow Graphs

Run-Time Environments: Storage organization- Stack allocation space- Access to non-local data on the stack-Heap management

Optimizing for Parallelism - Basic Concepts

Simple exercises using LEX and YACC tools

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Alfred V. Aho et al “Compilers Principles, Techniques and Tools”, Second Edition, Pearson Education, 2007.
2. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003.
3. Fischer C.N. and LeBlanc R.J. “Crafting a Compiler with C”, Benjamin Cummings, 2003.
4. Bennet J.P. “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill, 2003.
5. HenkAlblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
6. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.

ONLINE COURSES AND VIDEO LECTURES:

1. https://nptel.ac.in/courses/106108113/
2. https://www.udacity.com/course/compilers-theory-and-practice--ud168

U18ISE0004 SOFT COMPUTING

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1	Describe soft computing techniques and their roles in building intelligent machines	**K1**
CO2	Analyze various fuzzy models in developing fuzzy inference systems to be appropriate with specific real time problems	**K2**
CO3	Use genetic algorithms to combinatorial optimization problems	**K3**
CO4	Apply specific unsupervised and supervised neural networks to find approximate solutions to real world problem	**K2**
CO5	Present the feasibility of applying a soft computing methodology for specific problem	**K2**

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**	
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1					S								M	
CO2	S	M	M	M	M		M						S	S
CO3	S	M	M	M	M		M						S	
CO4	S	M	M	M	M		M						S	
CO5	S	S	S	M	S									M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment, Mini Project and Group Presentation. 3. Demonstration (as applicable) (Theory component) 4. End Semester Examination (Theory)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO SOFT COMPUTING 8 Hours

Introduction to Soft Computing- Soft Computing vs. Hard Computing-Various types of Soft Computing Techniques-Applications of Soft Computing.

FUZZY SET THEORY 10 Hours

Fuzzy Sets – Basic Definition and Terminology – Fuzzy set operators- Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Fuzzy Modeling - Case study of fuzzy inference system in data analysis.

OPTIMIZATION TECHNIQUES **10 Hours**

Introduction to optimization techniques - Genetic Algorithms - Selection - Genetic operators- Crossover and Mutation– Binary coded GA – Real coded GA - Particle Swarm Optimization – Ant Colony Optimization - Case study of genetic algorithm application in data analysis.

NEURAL NETWORKS **9 Hours**

McCulloch-Pitts neuron – hebb network – adaptive linear neuron, multiple adaptive linear neuron, RBF, Time Delay Neural Networks - associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative autoassociative memory network & iterative associative memory network –unsupervised learning networks - Kohenen networks- Hebbian networks.

.

HYBRID SYSTEMS **8 Hours**

Hybrid Systems: Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, Research orientation of soft computing techniques. Case studies on Hybrid systems in Information retrieval/Analytics/Decision support systems.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing- A Computational Approach to Learning and Machine Intelligence”, Pearson Education, First edition, 2015. Chapters 2, 3,4,9,11
2. Rajasekaran, Sanguthevar, and GA Vijayalakshmi Pai. Neural networks, fuzzy logic and genetic algorithm: synthesis and applications. PHI Learning Pvt. Ltd., 2003. (Genetic algorithm)
3. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, Wiley India Pvt Ltd, 2011.
4. George J.Klir and, Bo Yuan, Fuzzy sets and Fuzzy Logic: Theory and Applications, Pearson Education, First Edition, 2015. (Case studies in Fuzzy systems)
5. Zimmermann, Hans-Jürgen. Fuzzy set theory—and its applications. Springer Science & Business Media, 2011.
6. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Education., 2007.
7. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 2008.

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.geeksforgeeks.org/fuzzy-logic-introduction/
2. https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-641j-introduction-to-neural-networks-spring-2005/
3. https://www.tutorialspoint.com/artificial_neural_network/index.htm
4. http://www.myreaders.info/00_Soft_Computing.pdf
5. https://www.coursera.org/learn/mind-machine-artificial-intelligence

U18ISE0005 IOT ARCHITECTURE AND PROTOCOLS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Appreciate the evolution and applications of IoT [K2]

CO2: Evaluate the available sensors for an application and understand circuits [K5]

CO3: Analyze different options for Embedded systems and understand the concept of MGC Architecture [K4]

CO4: Analyze different connectivity and network protocol option and choose the appropriate one for a given application [K4]

CO5: Deploy IoT devices that are integrated with services such as IoT Core, IoT Device Management and IoT Analytics[K3]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
COs	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S							M		M		
CO2	S	S								M		M		
CO3	S	M										M	M	
CO4		S	M				M					M	M	
CO5	S		S		M							M		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignments / Mini Projects / Group Presentations/ Case Studies 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

MOTIVATION AND APPLICATIONS 9 Hours

Importance of IoT. Motivating Applications of IoT:
Smart Cities - Smart Waste Management, Smart Street Lights, Smart Street Parking, Security without Surveillance, Connected Vehicles. **Healthcare** - Baby Monitoring, Elderly Monitoring, Mood Enhancing, Disease Treatment and Progression Monitoring, Enhance Adherence, Challenges. **Agriculture** - Precision Agriculture, Connected Livestock, Food Safety**. Manufacturing and Logistics** - Smart Manufacturing-Smart Packaging, Smart Label-Home Automation.

SENSORS AND CIRCUITS **9 Hours**

Sensor – Introduction, Terminology, Behaviour, Selection, Circuits – Overview and Applications, Battery Issue and Energy Management, Wireless Link, Digital and Analog – Digital Computing, Analog to Digital Interfaces

EMBEDDED SYSTEMS AND IOT ARCHITECTURE **10 Hours**

Embedded Systems – Overview, Technology Drivers, Energy, Microcontrollers, Software Connectivity and Networking - **IoT Architectures** – embedded System, Gateway and Cloud (MGC) Architecture

CONNECTIVITY AND NETWORKING **7 Hours**

Introduction, Connectivity Challenges in IoT, Energy Harvesting Transmitters, Massive Multiple Access, Computation vs Communication

AWS IOT: DEVELOPING AND DEPLOYING AN INTERNET OF THINGS **10 Hours**

Introduction to AWS IoT-IoT on AWS-IoT Core Services-IoT Registry-IoT Rules-IoT Shadows-Using the AWS APIs and SDKs with IoT-MQTT/HTTP/Web sockets-IoT Security- Computing on the Edge-AWS IoT Greengrass-AWS Deeplens-IoT Analytics

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press) .
2. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons Ltd., UK, 2014
3. Agus Kurniawan, “Learning AWS IoT: Effectively manage connected devices on the AWS cloud using services such as AWS Greengrass, AWS button, predictive analytics and machine learning” Packt publishing, 2018.
4. ArshdeepBahga and Vijay Madisetti ,"Internet of Things: A Hands-on Approach", (Universities Press)
5. David Boswarthick, Omar Elloumi and OlivierHersent, “M2M Communications: A Systems Approach”, John Wiley & Sons Ltd, UK, 2012

ONLINE COURSES AND VIDEO LECTURES:

1. Introduction to Internet of Things: https://online.stanford.edu/courses/xee100-introduction-internet-things
2. AWS: IOT Developing and Deploying an Internet of things: https://www.coursera.org/learn/aws-iot-developing-and-deploying-an-internet-of-things
3. Internet of things and AI Cloud Specialization: https://www.coursera.org/specializations/internet-of-things

U18ISE0006 **CLOUD ARCHITECTURE AND COMPUTING**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand fundamental distributed computing concepts for cloud computing. [K2]
CO2: Differentiate between different cloud deployment and service models [K4]
CO3: Identify appropriate virtualization technology [K3]
CO4: Select suitable architecture for an application context. [K3]
CO5: Understand different technology options for cloud applications. [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		M												M
CO2				S					M			M		
CO3		M			M									
CO4						M					M			
CO5				S				M						

COURSE ASSESSMENT METHODS

DIRECT
7. Continuous Assessment Test I, II (Theory component)
8. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
9. End Semester Examination (Theory component)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

EVOLUTION OF CLOUD COMPUTING 9 Hours

Orientation Towards cloud computing - The need for cloud computing - New Aspects of Clouds - Economics of Clouds - **Distributed system:** Introduction to MapReduce, MapReduce Scheduling, MapReduce Fault -Tolerance, **Membership**: Introduction, Failure Detectors, best failure detector, Probabilistic Failure Detector, Dissemination and suspicion - Grid Applications - Grid Infrastructure - **P2P Systems** : Introduction to P2P Systems, Example (Napster/Gnutella/FastTracker and

BitTorrent/Chord/Failures in Chord/Pastry/Kelips) - Cloudonomics – Bigdata - Software defined architecture

CLOUD COMPUTING MODELS **9 Hours**

Cloud deployment models : Private, Public, Hybrid cloud - **Cloud service models**: IaaS, PaaS, SaaS, Enterprise-as-a-Service (EaaS), Database-as-a-Service (DBaaS), Disaster Recovery-as-a-Service (DRaaS) - Benefits and challenges of cloud computing - Next generation Cloud Applications.

VIRTUALIZATION **9 Hours**

Role of virtualization in enabling the cloud computing - Benefits of virtualization - Virtual Machine Monitor/Hypervisor - **Types of virtualization**: Full Virtualization, Para-virtualization - Virtual Machine Basics - Virtualization implementation levels - Server virtualization - Storage virtualization – Hardware Devices – Backup and recovery techniques - **Cloud scalability**: Introduction , Types of scalability, Auto scaling

CLOUD ARCHITECTURE **9 Hours**

Components of Cloud computing Architecture: Front-end platform, Back-end platform - Cloud-based delivery – workload distribution architecture - Resource Pooling Architecture - Dynamic Scalability Architecture - Elastic Resource Capacity Architecture -Service Load Balancing Architecture - Cloud Bursting Architecture - Hypervisor Clustering Architecture - Rapid Provisioning Architecture - Storage Workload Management Architecture

CLOUD APPLICATIONS **9 Hours**

OS Virtualization: Introduction, Example (Xen/Vserver/Solaris Zones/OpenVZ/ Linux Containers) - **Containers**: example (Docker/ Kubernates/JVM) - **Iaas**: Openstack, Amazon, Azure, Google, Serverless Architecture - **MaaS**: Introduction, Juju - **PaaS**: Google App Engine, Salesforce - **Storage service: example (**Ceph/Hive/Tez/Swift/S3/EBS/Glacier/ FES/DropBox cloudAPI)

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. RajkumarBuyya, Christian Vecchiola, S.TamaraiSelvi, 'Mastering Cloud Computing", TMGH,2013.
2. Matthew Portnoy, Virtualization Essentials, Sybex Publication, 2nd Edition, 2016.
3. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, 'Cloud Computing Concepts, Technology & Architecture' , The printice hall service technology series from Thomas Erl, Prentice hall, Pearson Education, 2013.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media, First Edition, 2010
5. Kuldeep Chowhan, "Hands-On Serverless Computing", Packt Publishing, 2018.
6. Letha Hughes Etzkorn, "Introduction to Middleware: Web Services, Object Components, and Cloud Computing", First Edition, Kindle Edition, CRC Pres,2017.
7. Barrie sosin SK Y, Cloud Computing Bible, Wiley, 2011.

ONLINE COURSES AND VIDEO LECTURES:

1. Cloud Computing Specialization : https://www.coursera.org/specializations/cloud-computing
2. Cloud Computing Concepts - Part 1 : https://www.coursera.org/learn/cloud-computing/home/welcome
3. Cloud Computing Applications Part 1: Cloud Systems and Infrastructure : https://www.coursera.org/learn/cloud-applications-part1/home/welcome
4. www.servicetechbooks.com/cloud
5. https://www.oreilly.com/library/view/cloud-architecture-patterns/9781449357979/
6. Cloud Computing Concepts – Part2 : https://www.coursera.org/learn/cloud-computing-2/home/welcome
7. Cloud Computing Applications, Part 2 : https://www.coursera.org/learn/cloud-applications-part2

U18ISE0007 SOFTWARE PROJECT MANAGEMENT

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1** Understand software project planning and management.[K1]
- **CO2** Select appropriate project approach for problem at hand. [K2]
- **CO3** Categorize risk and do risk assessment [K3]
- **CO4** Identify resource requirements and schedule resources. [K3]
- **CO5** Evaluate Cost and Contract management. [K3]
- **CO6** Measure and Enhance software quality. [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M								M	M	M			
CO2		M	S						M	M			M	
CO3		S							M	M				S
CO4		M							M	M				
CO5	S							M			M			
CO6	M							M					M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT 9 Hours

Introduction, the state of IT project management, context of project management, need of project management, project goals, project life cycle and IT development, extreme project management, PMBOK. Project Definition –Contract Management – Activities Covered by Software Project Management – Overview of Project Planning –Stepwise Project Planning

PROJECT PLANNING **9 Hours**

Introduction, project management process, project integration management, the project charter, project planning framework, the contents of a project plan, the planning process, The Work Breakdown Structure (WBS), the linear responsibility chart, multidisciplinary teams. Selection of an Appropriate Project Approach – Software Effort Estimation – Activity Planning

RISK MANAGEMENT AND RESOURCE ALLOCATION **9 Hours**

Risk Management: Risk – Categories of Risk – A Framework for Dealing with Risk – Risk Identification – Risk Assessment – Risk Planning – Risk Management – Evaluating Risks to the Schedule –Monte Carlo Simulation – Critical Chain Concepts.
Resource Allocation: The Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths - Publishing the Resource Schedule – Cost Schedules – The Scheduling Sequence

MONITORING AND CONTROL AND MANAGING CONTRACTS **9 Hours**

Monitoring and Control: Creating the Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Change Control.
Managing Contracts: The Supply Process – Types of Contract – Stages in contract **Placement:** – Typical Terms of a Contract – Contract Management –Acceptance

SOFTWARE QUALITY **9 Hours**

Managing People and Organizing Teams - Software Quality– Practical Software Quality Measures – Product versus Process Quality Management – External Standards – Techniques to Help Enhance Software Quality – Quality plans

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Bob Hughes, Mike Cotterell, “Software Project Management” Tata McGraw Hill, Fifth Edition, 2010.
2. Walker Royce, “Software Project Management– A Unified Framework “, Pearson Education, 2004.
3. Jack T. Marchewka, Information Technology Project Management, 3rd edition, Wiley India, 2009
4. Jalote, Software Project Management in Practice, Pearson Education, 2002
5. S. J. Mantel, J. R. Meredith and et.al., Project Management Core Text Book, John Wiley India, 2011

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.coursera.org/learn/it-project-management
2. https://ocw.mit.edu/courses/engineering-systems-division/esd-36-system-project-management-fall-2012/lecture-notes/
3. http://www.mhhe.com/engcs/compsci/pressman/student/olc/cases.mhtml

U18ISE0008 **DEEP LEARNING**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the major technology trends driving Deep Learning [K2]
CO2: Build, train and apply fully connected deep neural networks [K5]
CO3: Effectively use the common neural network techniques [K3]
CO4: Appropriately pick hyper parameters [K3]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S		M		M		S	M			M	M	M	M
CO2		S		S	M	M			M	M	S		S	
CO3	M	M	M		M				M				M	
CO4		M		M										

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

DEEP LEARNING FOUNDATION 9 Hours

Introduction: Neural network, Supervised Learning with Neural Networks, Importance of Deep Learning - **Neural Networks Basics:** Binary Classification, Logistic Regression, Logistic Regression Cost Function, Gradient Descent, Derivatives, Computation graph, Derivatives with a Computation Graph, Logistic Regression Gradient Descent, Gradient Descent on m Examples, Vectorization

SHALLOW NEURAL NETWORKS **8 Hours**

Shallow Neural Networks: Neural Networks Overview, computing a Neural Network's Output, Vectorizing across multiple examples, Explanation for Vectorized Implementation, Activation functions, Non-linear activation functions , Derivatives of activation functions, Gradient descent for Neural Networks

DEEP NEURAL NETWORKS **10 Hours**

DNN: Deep L-layer neural network, Forward Propagation in a Deep Network
Getting your matrix dimensions right, Deep representations, Building blocks of deep neural networks, Forward and Backward Propagation, Parameters vs Hyperparameters, DNN and brain

KEY ASPECTS OF DEEP LEARNING **10 Hours**

Setting up ML Application: Train / Dev / Test sets, Bias / Variance, Basic Recipe for Machine Learning – **Regularization:** Regularization & overfitting, Dropout Regularization, Understanding Dropout, Other regularization methods,
Normalization : Normalizing inputs, Vanishing / Exploding gradients, Weight Initialization for Deep Networks, Numerical approximation of gradients – Gradient checking, **Optimization:** Mini-batch gradient descent, Understanding mini-batch gradient descent, Adam optimization algorithm, Learning rate decay, The problem of local optima

HYPERPARAMETER TUNING AND BATCH NORMALIZATION **8 Hours**

Hyperparameter Tuning: Tuning process, using an appropriate scale to pick hyperparameters, Hyperparameters tuning in practice: Pandas vs. Caviar , Normalizing activations in a network - **Batch Normalization:** Fitting Batch Norm into a neural network, Batch Norm work, Batch Norm at test time, SoftMax Regression, Training a SoftMax classifier, Deep learning frameworks – TensorFlow

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning”, First Edition, MIT Press, 2016.
2. Nikhil Buduma and Nicholas Lacascio, “Fundamentals of Deep Learning”, First Edition, O.Reilly, 2017

ONLINE COURSES AND VIDEO LECTURES:

1. Deep Learning Specialization: https://www.coursera.org/learn/neural-networks-deep-learning
2. Deep Learning Specialization: https://www.coursera.org/learn/deep-neural-network

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

L	T	P	J	C
3	0	0	0	3

U18ISE0009 **INFORMATION PRIVACY**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the foundational principles for privacy [K2]
CO2: Analyze the implications of privacy compliance requirements to IT from relevant national and international regulations and standards [K4]
CO3: Analyze the privacy threats and impacts and perform risk assessment [K4]
CO4: Appreciate Privacy by Design Principles and apply it in business processes [K3]
CO5: Apply privacy enhancing technologies in information systems [K3]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	S	S	W		S	S	S						S
CO2						M	M						M	S
CO3		S											M	S
CO4	S		S											S
CO5	S		S											S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) **2.** Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, (Mini / Group) Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

FOUNDATIONAL PRINCIPLES FOR PRIVACY **9 Hours**

Introduction to Privacy: Alan Westin's Four States of Privacy, Helen Nissenbaum's Contextual Integrity, Daniel Solove's Taxonomy of Privacy, Ryan Calo's Harm Dimensions - Privacy, security and data governance - The data life cycle - Online issues in privacy -Case Study: Technology challenges for privacy.

REGULATIONS AND STANDARDS IMPACTING PRIVACY IN IT **8 Hours**

Principles, Guidelines and Frameworks: The Fair Information Practice Principles (FIPPs), OECD's Guidelines on the Protection of Privacy and Transborder Flows of Personal Data,NIST Framework - **Standards**: ISO/IEC 27701 - **Regulations**: PIPEDA, EU DPD, GDPR, Hongkong's Personal Data Ordinance, National: India's Privacy Data protection bill 2018 - **Regulations based on domain**: HIPPA, Principles of Interactive advertisement Bureau-PCI DSS- CALOPPA-COPPA-e Privacy Directive.

PRIVACY RISK ASSESSMENT **10 Hours**

Privacy threats and violations: Information collection, Information processing, Information dissemination, Invasions, Decisional inference through dark patterns - **Privacy harms**: subjective and objective - **Risk analysis**: FAIR method, organizational risk, domain redux - **Quantifying risk**: computing the risk of exposure.

PRIVACY BY DESIGN **9 Hours**

Foundational principles - Challenges of principles - **The Privacy by Design Process:** requirements engineering for privacy, understanding quality attributes, identify information needs, High level design, Low Level Design and Implementation, Imposing controls, Testing and validation - **Integrating Privacy by Design into the Business**

PRIVACY ENHANCING TECHNOLOGIES **9 Hours**

Data Oriented Strategies: Separate, minimize, abstract, hide – **Techniques**: Encryption, Aggregation, De-identification, Identity and access management, Authentication -
Process Oriented Strategies: Informing the Individual, User Control, Policy and Process Enforcement, Demonstrate Compliance.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. An Introduction to Privacy for Technology Professionals, Travis D. Breaux , IAPP, 2020 (Primary Text 1)
2. Strategic Privacy by Design R. Jason Cronk, IAPP, 2018 (Primary Text 2)
3. Privacy in Technology Standards and Practices for Engineers and Security and IT Professionals, JC Cannon, IAPP, 2014

4. ISO/IEC 27701 PIMS: https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RE3uDwE
5. Privacy Design Strategies (The little blue book) by Jaap-Henk Hoepman, Jan 2020 available at: https://www.cs.ru.nl/~jhh/publications/pds-booklet.pdf
6. The Data Protection Bill, 2018, India, available at: https://www.meity.gov.in/writereaddata/files/Personal_Data_Protection_Bill,2018.pdf
7 NIST Privacy Framework, 2020, available at: https://www.nist.gov/privacy-framework
8 BSI Topics: BSI Home for Industry Reports, Research, Blogs and News. The British Standards Institution. 2020
9 Finneran Dennedy , Michelle et al. The Privacy Engineer's Companion: A Workbook of Guidance, Tools, Methodologies, and Templates ApressOpen.
10 Herold, Rebecca. Privacy Professor. Rebecca Herold and Associates, LLC. 2020
11 Stallings, William. Information Privacy Engineering and Privacy by Design: Understanding Privacy Threats, Technology, and Regulations Based on Standards and Best Practices, 1st Edition. Addison- Wesley Professional. 2019
12 Wheeler, David M. et al. The IoT Architect's Guide to Attainable Security and Privacy. Auerbach Publications. 2019

ONLINE COURSES AND VIDEO LECTURES:

1. Data Privacy Fundamentals, offered by Northeastern University, through Coursera: https://www.coursera.org/learn/northeastern-data-privacy
2. Privacy Law and Data Protection, offered by University of Pennsylvania, through Coursera: https://www.coursera.org/learn/privacy-law-data-protection
3. Privacy and Standardisation Specialization, offered by EIT Digital, through Coursera: https://www.coursera.org/specializations/privacy#courses

L	T	P	J	C
3	0	0	0	3

U18ISE0010 INFORMATION SECURITY MANAGEMENT

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the key requirements of Security and how knowledge of many domains is needed to manage security [K2]
CO2: Assess the threats and vulnerabilities for effective security management [K4]
CO3: Identify the importance and functions of Governance, Risk Management, and Compliance [K4]
CO4: Define and describe the components of a cybersecurity contingency planning [K2]
CO5: Develop an Information Security Management System [K6]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S											S
CO2	S	M	M		M									S
CO3	S	S			M									S
CO4			M					S			M			S
CO5	S	M			M									S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Case Study, Mini Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

INTRODUCTION TO INFORMATION SECURITY AND DOMAINS 9 Hours

Introduction: Security Tools & Attacks, Key Terms, Security Threats, Vulnerability Assessments, Roles in Security, Cybersecurity Program, Security, Challenges, Critical Thinking

Types of actors and their motives: Hacking organizations- various types of attacks, services, Mechanisms-Internet Security Threats. **Key Security Concepts:** CIA Triad –Confidentiality, Integrity, Availability, Non - Repudiation

Overview of Information Security Domains: Authentication and Access Control, Software Development Security, Business Continuity and Disaster Recovery Planning, Cryptography, Information Security Governance and Risk Management, Legal, Regulations, Investigations, and Compliance, Operations Security, Physical and Environmental Security, Security Architecture and Design, Telecommunications and Network Security

INFORMATION SECURITY MANAGEMENT FOUNDATIONS 10 Hours

Source of Threats: Threats, Compromises to IP, Deviations in QoS, Espionage / Trespass, Forces of Nature, Human Error or Failure, Information Extortion, Sabotage /Vandalism, Software Attacks, Technical Hardware Failures

Managing Vulnerabilities in Information Assets: Vulnerabilities in Information Assets, Vulnerability Assessment, Tools and Techniques, Vulnerability Remediation Strategies, Configuration and Change Management

Understanding the Introduction security Program: The Cybersecurity Personnel and the Security Department-Cybersecurity Programs: Policies, Guidelines and Standards, Continuous Improvement Programs

GOVERNANCE RISK AND COMPLIANCE 10 Hours

Management of Information security: Introduction, Positioning, Information security Personnel: Roles and Responsibilities, Information security & Personnel Issues- GRC Approach

Governance and Planning: Information security Governance- Strategic Planning, Planning for Contingencies

Risk Management: Overview- Risk Management, Models and Methodologies, Preparation for Risk Management, Risk Assessment, Risk Treatment

Policy: Information security Policy- Issue- System Specific Security- Developing and Implementing Effective security Policy- Measuring Success- Performance Measures- Measurements- Implementing Performance Measures Program- Law and Regulation in Cybersecurity: Law and Regulation, Key Security Laws, Privacy Laws- Indian,US and International Security Laws and Standards

INCIDENT RESPONSE, DISASTER RECOVERY AND BUSINESS CONTINUITY 9 Hours

Contingency Planning: Methodology, Business Impact Analysis- Strategies - Data Backup and Recovery, Real-Time Protection, Server Recovery, and Application Recovery.

Incident Response: Planning, Detection and Containment, Recovery

Disaster Recovery: Overview- Planning- Disaster Classifications- Planning for Disasters- Disaster Preparation

Business Continuity: Planning- Timing and Sequence- Crisis Management

DEVELOP INFORMATION SECURITY PLAN 7 Hours

Introduction about the projects: Developing the Information Security Program- Staffing Establish a risk management program- Information security policy portfolio of the organization- Contingency planning program- Information security governance program

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. James M. Stewart, Mike Chapple, Darril Gibson, "CISSP $(ISC)^2$ Certified Information Systems Security Professional Official Study Guide" Sybex; 7 Edition 2015
2. Adam Gordon (Editor), "Official $(ISC)^2$ Guide to the CISSP CBK, Fourth Edition ($(ISC)^2$ Press), Auerbach Publications 2015
3. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Sixth Edition, Cengage Learning, 2017

ONLINE COURSES AND VIDEO LECTURES:

1. Cyber Security and Its Ten domain : https://www.coursera.org/learn/cyber-security-domain
2. Introduction to cybersecurity tools & cyber attacks: https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks
3. The Foundations of Cybersecurity:https://www.coursera.org/learn/foundations-cybersecurity
4. The GRC Approach to Managing Cybersecurity: https://www.coursera.org/learn/grc-approach-to-managing-cybersecurity
5. Managing Cybersecurity Incidents and Disasters: https://www.coursera.org/learn/managing-cybersecurity-incidents-and-disasters
6. Road to the CISO – Culminating Project Course: https://www.coursera.org/learn/road-to-ciso#syllabus
7. Managing cybersecurity specialization: https://www.coursera.org/specializations/managing-cybersecurity

U18ISE0011 **BLOCKCHAIN TECHNOLOGY**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand foundational concepts of blockchain and how cryptography is applied. [K2]
CO2: Understand the basic concepts of bitcoin and how it works in practice. [K2]
CO3: Comprehend the crucial role of mining in bitcoin and analyze ways to improve its anonymity[K4]
CO4: Design, code, deploy and execute a smart contract. [K3]
CO5: Trace the evolution of Hyperledger fabric services and the broader blockchain ecosystem. [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)											PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S													S
CO2	S	S										S		S
CO3				M					M				M	M
CO4		S	S	M									M	S
CO5		S	S			M			M			S		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

BLOCKCHAIN FOUNDATIONS 9 Hours

Blockchain Defined: Bitcoin & Blockchain-Blockchain Structure, Basic Operations-**Ethereum Blockchain**: Smart Contracts, Ethereum Structure, Ethereum Operations, Incentive Model-**Algorithms & Techniques:** Public-Key Cryptography, Hashing, Hash Pointers and Data Structures, Digital Signatures , Public Keys as Identities, Transaction Integrity-**Trust Essentials:** Decentralized Systems-Consensus Protocol-Robustness-Forks

BITCOIN BASICS **9 Hours**

Bitcoins: Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations & Improvements-**Store and Use Bitcoins**: Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees.

BITCOIN MINING AND ANONYMITY **9 Hours**

Bitcoin Miners: The Task of Bitcoin Miners, Mining Hardware, Energy Consumption & Ecology, Mining Pools, Mining Incentives and Strategies, The Task of Bitcoin Miners, Mining Hardware, Energy Consumption & Ecology, Mining Pools, Mining Incentives and Strategies- **Anonymity**: Anonymity Basics, How to de-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash

SMART CONTRACTS **9 Hours**

Smart Contract Basics: Its need, Smart Contracts Defined, Processing Smart Contracts, Deploying Smart Contracts, **Solidity:** Structure, Basic Data Types & Statements, Specific Data Types, Data Structures, Access Modifiers & Application-**Developing Smart Contracts**: Time Elements, Validation & Test, Client Applications, Shared Rules & Trust.

DECENTRALIZED APPLICATIONS (DAPPS) AND BLOCKCHAIN PLATFORMS **9 Hours**

Decentralized Applications (Dapps): Blockchain Server, Dapp Defined, Ethereum APIs - **Design Improvements:** Solidity Features, Event Handling, oraclize - **Permissioned Blockchain:** Linux's Hyperledger, Fabric Services, Fabric Model & Functions-Composer- Alternative Decentralized Solutions- Interplanetary File System, Hashgraph.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Andreas Antonopoulos," Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media Inc 2018
2. Henning Diedrich "Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations", Wildfire Publishing., 2016.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. "Bitcoin and cryptocurrency technologies: a comprehensive introduction",Princeton University Press, 2016.

ONLINE COURSES AND VIDEO LECTURES:

1. Blockchain Basics:https://www.coursera.org/learn/blockchain-basics
2. Bitcoin and Cryptocurrency Technologies:https://www.coursera.org/learn/cryptocurrency
3. Smart Contracts-https://www.coursera.org/learn/smarter-contracts

4. Decentralized Applications (Dapps):https://www.coursera.org/learn/decentralized-apps-on-blockchain
5. Blockchain Platforms:https://www.coursera.org/learn/blockchain-platforms
6. Blockchain Specialization:https://www.coursera.org/specializations/blockchain

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U18ISE0012 **SOFTWARE SECURITY**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the need for software security by survey of current vulnerabilities and attacks. [K2]
CO2: Differentiate between traditional and secure software requirements and design. [K4]
CO3: Understand secure coding best practices and methods of analyzing. [K2]
CO4: Understand the importance of security testing and how it impacts the quality of software. [K2]
CO5: Understand the importance of secure installation, deployment and manage security incidents. [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M											M	S
CO2		S		M								M		S
CO3			S		S								M	S
CO4		S			S				M					S
CO5		M	S											S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

MOTIVATION FOR SOFTWARE SECURITY 10 Hours

Introduction to software security-**Low-level security**: Attacks and exploits, Memory Layout, Buffer Overflow, Code Injection, Other Memory Exploits, Format String Vulnerabilities -**Defenses Against Low-Level Attacks**: Memory Safety, Type Safety, Avoiding Exploitation, Return Oriented Programming, Control Flow Integrity, Secure Coding -**Web security Attacks and defenses**: Web

Basics, SQL Injection, Session Hijacking, Cross-Site Request Forgery, Web 2.0 Cross-site Scripting, Web-based State Using Hidden Fields and Cookies.

SECURE SOFTWARE REQUIREMENTS AND DESIGN **9 Hours**

Requirements: Internal and External, Functional, Operational -**Secure Software Design:** Threat Modeling, Security Requirements, Avoiding Flaws with Principles -**Design Category**: Favor Simplicity, Trust with Reluctance, Defense in depth, Monitoring, Top Design Flaws.

SECURE SOFTWARE IMPLEMENTATION AND ANALYSIS **9 Hours**

Declarative versus Imperative Security: Vulnerability Lists with example, Source Code and Versioning, Development and Build environment -**Program Analysis:** Introduction of Static Analysis, Flow Analysis, Adding Sensitivity, Context Sensitive Analysis -**Flow Analysis:** Scaling it up to a Complete Language and Problem Set, Challenges and Variations, Basic Symbolic Execution with history, Search, Rise of Solvers and Systems.

SECURE SOFTWARE TESTING AND ACCEPTANCE **9 Hours**

Testing for Security and Quality Assurance: Functional Testing, Nonfunctional Testing, Security Testing -**Bug tracking**: Defects-Errors and Vulnerabilities, Attack Surface Validation -**Types of Testing**: Introduction of Penetration Testing, Pen Testing, Fuzzing -**Software Acceptance**: Pre-Release and Pre-Deployment, Risk Acceptance, Exception Policy, Sign-off Post-Release, Validation and Verification.

SOFTWARE DEPLOYMENT, OPERATIONS, MAINTENANCE, AND DISPOSAL **8 Hours**

Installation and Deployment: Bootstrapping, Key Generation, Access, Configuration Management, Elevated Privileges, Hardening, Platform change, Release Management -**Operations and Maintenance**: Monitoring, Metrics, Audits-Service agreement, Problem Management, Root Cause Analysis, Vulnerability Tracking, Change Management, Backup, Recovery and Archiving, Software Disposal.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. Mano Paul, "OFFICIAL $(ISC)^2$ Guide to the Certified Secure Software Lifecycle Professional", CBK- CRC Press Eighth Edition, 2018.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, "Security in Computing" Pearson- Fifth Edition, 2015
3. Mathias Payer, "Software Security-Principles, Policies, and Protection", v0.35, April 2019.
4. Douglas A. Ashbaugh, "Security Software Development: Assessing and Managing Security Risks", 1st Edition,2008.

ONLINE COURSES AND VIDEO LECTURES:

1. Software Security : https://www.coursera.org/learn/software-security
2. Web application security testing with owasp zap: https://www.coursera.org/projects/web-application-security-testing-with-owsap-zap

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3	0	0	0	3

U18ISE0013 **PRODUCT MANAGEMENT**

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand product lifecycle and explain the value of process, requirements, planning, and monitoring in producing better software. [K2]

CO2: Apply techniques to elicit and express software requirements from client interactions. [K3]

CO3: Apply techniques required to break down and map requirements into plans that will ultimately drive software production. [K3]

CO4: Apply metrics and reviews to track and improve product progress and software quality. [K3]

CO5: Develop a product prototype. [K5]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M					M					M	M	
CO2		S		S									M	
CO3			S	M					S				S	
CO4				S							M		M	
CO5					S	S							S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

SOFTWARE PRODUCT MANAGEMENT **8 Hours**

Product Life Cycle Management: Introduction, Stages, Growth-Maturity, Decline and Challenges, New Product Development Stages -**Software product Management**: The Role of a Software Product Manager, Project Success, Motivation of Agile, Agile Manifesto, Delivering Working Software, Flexible Design, Collaborative Communication, Need for Process, Requirements, Planning and Monitoring.

CLIENT NEEDS AND SOFTWARE REQUIREMENTS **9 Hours**

Client Needs: Requirement Activities, Types of Requirements, User Requirements, Functional and Non-Functional Requirements, Controlling Scope, Requirements and Design -**User Interaction:** Restaurant Scenario, User Considerations, Involving Clients, Use Cases, Wireframes, Storyboards -**Writing Requirements:** Agile Requirements, User Stories, Acceptance Tests, Product Backlog, Story Maps -**Quality Requirements:** Criteria for User Stories.

AGILE PLANNING FOR SOFTWARE PRODUCTS **9 Hours**

Agile Planning: Uncertainty Space, Work Breakdown Structure, Estimates, Targets, and Commitments - **Project Planning**: Story Points, Velocity Estimates, Time Boxing, Gantt Charts, Release Plans -**Iteration Planning**: Estimating Task Time, Task Dependencies, CPM Chart, PERT Chart, Iteration Planning -**Risk Planning**: Anti-Patterns, Team, Development, Management, Individual Developers, Common Causes of Failure, Risk Assessment, Risk Strategies, Contingency, Mitigation.

REVIEWS AND METRICS FOR SOFTWARE IMPROVEMENTS **9 Hours**

Right Product: Introduction to Monitoring, Sprint Review Meeting, User Studies, Industry Examples-**Done Right:** Review Techniques, Monitoring Issues, Goal, Question, Metric (GQM), Desirable Properties of Metrics, Defect Analysis -**Managed Right**: Daily Scrum, Challenges, Velocity, Release Burndown Chart, Changing Requirements, Iteration Burndown Chart - **Project Retrospectives**: Retrospectives Issues, Sprint Retrospective.

PRODUCT PROTOTYPE DEVELOPMENT **10 Hours**

Product Prototype: Guidelines Capstone project, Development Team Meeting, Time Estimates
Product Manager Job Posting, Decision Tree, Meeting the Client, Expert Advisor Meeting, Task Breakdown Meeting, Project User Stories, Size Estimates and Dependencies, Prioritization Template-**Decision Tree:** Prioritization Meeting-**Risk Assessment**: Release Planning, Project Release Plan, Standup Meeting, Client Demo and Backlog Refinements, Sprint Retrospective, Acceptance Tests.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Hans-Bernd Kittlaus, Samuel A. Fricker, “Software Product Management The ISPMA-Compliant Study Guide”, 2017.
2. Greg Cohen, “Agile Excellence for Product Managers A Guide to Creating Winning Products with Agile Development Teams”, 2010.
3. Aswin Pranam, “Product Management Essentials Tools and Techniques for Becoming an Effective Technical Product Manager”, 2018.

4. Timo Wagenblatt, “Software Product Management Finding the Right Balance for Your Product Inc”, 2019.
5. Allan Kelly, “The Art of Agile Product Ownership A Guide for Product Managers, Business Analysts, and Entrepreneurs”, 2019

ONLINE COURSES AND VIDEO LECTURES:

1 Product lifecycle management: https://productlifecyclestages.com/plm-software-the-complete-guide/
2 Specializations-product-management: https://www.coursera.org/specializations/product-management
3 Introduction to Software Product Management: https://www.coursera.org/learn/introduction-to-software-product-management?specialization=product-management
4 Client Needs and Software Requirements: https://www.coursera.org/learn/client-needs-and-software-requirements?specialization=product-management
5 Agile Planning for Software Products: https://www.coursera.org/learn/agile-planning-for-software-products?specialization=product-management
6 Reviews & Metrics for Software Improvements: https://www.coursera.org/learn/reviews-and-metrics-for-software-improvements
7 Software Product Management Capstone: https://www.coursera.org/learn/software-product-management-capstone
8 New product development: https://www.coursera.org/learn/new-product-development

U18ISE0014 FINANCIAL AND BUSINESS ANALYTICS

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COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand different types of analytics and frameworks for data driven decision making [K2]
CO2: Describe methods for understanding and predicting customer behaviour [K2]
CO3: Understand how data analytics can be used to profitably match supply with demand in various business settings [K2]
CO4: Understand how and when hard data is used to make soft-skill decisions about hiring and talent development [K2]
CO5: Understand how data is used to assess what drives financial performance and to forecast future financial scenarios [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M					M						M	M	
CO2								M						
CO3		M						M					M	
CO4				M			M				S			
CO5		M										M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. End Semester Examination (Theory component) 4. Mini Project / Unit-wise project / Course- End project
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

7 Hours

INTRODUCTION TO BUSINESS ANALYTICS

Introduction to Business Analytics – the need for analytics – The science of data driven decision making– Descriptive, Predictive, Prescriptive Analytics – Big data Analytics – Web and Social Media Analytics – Machine Learning Algorithms – Framework for data driven decision making – Analytics Capability building – Challenges in data driven decision making and future

CUSTOMER ANALYTICS **8 Hours**

Descriptive Analytics - Descriptive data collection - Net promoter score and self-reports – survey design - Passive Data collection – media planning – casual data collection – Introduction to predictive analytics - Asking predictive questions – Regression analysis – Probability Models – Implementation of the models – Results and predictions- Model Extensions - Surprising Applications - Machine Learning - Customer-Based Corporate Valuation (CBCV) - Introduction to Prescriptive customer Analytics – Using the Data to Maximize Revenue – Parameters of the Model – Market structure – Competition and Online Advertising Models – Introduction to Application to Analytics – The Future of Marketing is Business Analytics

OPERATION ANALYTICS **12 Hours**

The News vendor Problem – Moving Averages – Trends, Seasonality – Wrap-up, Apparel Industry – How to Build an Optimization Model – Optimizing with Solver – Network Optimization Example– Solver in Google Sheets – Comparing Decisions in Uncertain Settings – Simulating Uncertain Outcomes in Excel – Interpreting and Visualizing Simulation Output – Decision Trees – Using Simulation with Decision Trees – Using Optimization Together with Simulation

PEOPLE ANALYTICS **9 Hours**

Introduction to People Analytics - People Analytic in Practice – Performance Evaluation : the Challenge of Noisy Data – Chance vs Drafting Sportsmen – Finding Persistence : Regression to the Mean – Extrapolating from Small Samples – The Wisdom of Crowds : Signal Independence – Process vs. Outcome – Summary of Performance Evaluation – Staffing Analytics Overview – Hiring: Predicting Performance , Fine-tuning Predictors, Using Data Analysis to Predict Performance – Analyzing Promotibility - Optimizing Movement within the Organization – Attrition : Understanding and Reducing Turnover – Turnover : Predicting Attrition – Collaboration Networks: Describing, Mapping and Evaluating Collaboration Networks, Measuring outcomes - Intervening in Collaboration Networks – Talent Analytics : The Importance of Context – Interdependence – Self-fulfilling Prophecies – Reverse Causality –Prescriptions : Navigating the Challenges of Talent Analytics

ACCOUNTING AND FINANCIAL ANALYTICS **9 Hours**

Financial statement Introduction - Ratio Analysis (Company description) : DuPont Analysis – Profitability and Turnover Ratios – Liquidity ratios – Forecasting – Overview of earnings management – Revenue recognition red flag : Revenue before cash collection - after cash collected - Expense recognition red flags : Capitalizing Vs. Expensing – Reserve accounts and delaying write - offs – Connecting numbers to non-financial performance measures – Linking non-financial metrics to financial performance: overview – steps to Linking non-financial metrics to financial performance – setting targets – comprehensive examples

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. U.Dineshkumar, “Business Analytics: The Science Data-Driven Decision, Making”, Wiley, 2017.
2. Peter Fader, “Wharton executive essentials - Customer centricity focus on the right customers for strategic advantage”, Wharton digital press, second edition, 2012.
3. Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence: A Managerial Perspective on Analytics”, Pearson, 3rd Edition, 2017.

ONLINE COURSES AND VIDEO LECTURES:

1. Business Analytics Specialization : https://www.coursera.org/specializations/business-analytics
2. Customer Analytics : https://www.coursera.org/learn/wharton-customer-analytics/home/welcome
3. Operation Analytics: https://www.coursera.org/learn/wharton-operations-analytics/home/welcome
4. People Analytics: https://www.coursera.org/learn/wharton-people-analytics/home/welcome
5. Accounting Analytics: https://www.coursera.org/learn/accounting-analytics/home/welcome
6. https://youtu.be/QHQo606fgxQ
7. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2701093
8. http://knowledge.wharton.upenn.edu/article/can-people-analytics-help-firms-manage-people-better-est-in-people-analytics
9. http://www.bloomberg.com/news/videos/2015-11-11/google-s-using-workplace-data-to-build-a-better-employee
10. https://www.sas.upenn.edu/~baron/papers.htm/judg.html
11. http://misweb.cbi.msstate.edu/~COBI/faculty/users/jvardaman/files/files/AllenAMP.pdf
12. http://knowledge.wharton.upenn.edu/article/cade-massey-management-numbers

U18ISE0015 **DATA MINING**

L	T	P	J	C
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COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand NLP techniques and text representation [K3]
CO2: Understand mixture models and apply them for analysing topic from text [K3]
CO3: Perform text clustering and categorization [K3]
CO4: Analyze sentiment and mine opinion from text [K3]
CO5: Understand pattern discovery concepts, approaches and evaluation measures [K2]

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping	
Cos	PROGRAMME OUTCOMES (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		M					M						
CO2		M					M						M	
CO3		M			S									
CO4						M			M	M			M	
CO5		M	M	M										

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) **3.** End Semester Examination (Theory components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENT

7 Hours

NLP AND TEXT REPRESENTATION

Introduction to Text Mining and Analytics - Overview Text Mining and Analytics - Natural Language Content Analysis - Text Representation - Word Association Mining and Analysis - Paradigmatic

Relation Discovery. Syntagmatic Relation Discovery: Entropy - Conditional Entropy - Mutual Information.

TOPIC MINING AND ANALYTICS **9 Hours**

Motivation and Task Definition - Term as Topic- Probabilistic logic model - Overview of Statistical Language Models - Mining One Topic - Mixture of Unigram Language Models - Mixture Model Estimation – Expectation - Maximization Algorithm - Probabilistic Latent Semantic Analysis (PLSA) - Latent Dirichlet Allocation (LDA).

TEXT CLUSTERING AND CATEGORIZATION **10 Hours**

Text Clustering: Motivation, Generative Probabilistic Models, Similarity-based Approaches, Evaluation - Text Categorization: Generative Probabilistic Models, motivation, methods, Discriminative Classifier, Evaluation.

OPINION MINING AND SENTIMENT ANALYSIS **10 Hours**

Motivation - Sentiment classification - Ordinal Logistic Regression - Latent Aspect Rating Analysis - Text-Based Prediction - **Contextual Text Mining**: Motivation, Contextual Probabilistic Latent Semantic Analysis, Mining Topics with Social Network Context, Mining Casual Topics with Time Series Supervision.

PATTERN DISCOVERY CONCEPTS, APPROACHES AND MEASURES **9 Hours**

Introduction to Pattern Discovery. Frequent Patterns and Association Rules. Compressed Representation: Closed Patterns and Max-Patterns – The Downward Closure Property of Frequent Patterns – The Apriori Algorithm – Extensions or Improvements of Aprior – Mining Frequent Patterns By Exploring Vertical Data Format – FPGrowth : A Pattern Growth Approach – Mining Closed Patterns - Limitation of the Support-Confidence Framework – Interestingness Measures : Lift and $\chi 2$ – Null Invariance Measures – Comparison of Null -Invariant Measures.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES:

1. C. Zhai and S. Massung, Text Data Management and Analysis: A Practical Introduction to Information Retrieval and Text Mining. ACM and Morgan & Claypool Publishers, 2016.
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Third Edition, Elsevier,2012.
3. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Education, First edition,2007.
4. K.P. Soman, Shyam Diwakar and V. Aja, "Insight into Data Mining Theory and Practice", Eastern Economy Edition, Prentice Hall of India, 2006.
5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Third Edition, Prentice Hall of India, 2014.

ONLINE COURSES AND VIDEO LECTURES:

1. Data Mining Specialization: https://www.coursera.org/learn/data-patterns?specialization=data-mining
2. Data mining Specialization – Text Mining and Analytics : https://www.coursera.org/learn/text-mining/home/welcome
3. Data mining Specialization – Pattern Discovery in Data Mining: https://www.coursera.org/learn/data-patterns/home/welcome