

SEMESTER-V

SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CSH209B-T&P	COMPUTER ARCHITECTURE & ORGANISATION	CS	CORE	3	1	2	6	5
CSH311B-T&P	THEORY OF AUTOMATA & COMPILER DESIGN	CS	CORE	3	1	2	6	5
CSH303B-T&P	MOBILE COMPUTING WITH ANDROID	CS	ELECTIVE	3	0	2	5	4
CSH305B-T&P	NEURAL NETWORK & FUZZY LOGIC							
CSH314B-T&P	MACHINE LEARNING							
MOOC	NPTEL COURSES FROM MOOC							
EDS288 EDS289 EDS290	APPLIED PHILOSOPHY APPLIED PSYCHOLOGY APPLIED SOCIOLOGY	ED	ELECTIVE	1	0	2	3	2
MCS368	ENTREPRENEURSHIP	MC	ELECTIVE	2	0	0	2	2
MOOC	NPTEL COURSES FROM MOOC							
CDO331	PROFESSIONAL COMPETANCY ENHANCEMENT-III	CDC	CORE	6	0	0	6	1
RDO605	RESEARCH & INNOVATION-II	RESEARCH	CORE	0	1	0	1	1
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			18	3	8	29	19
Specialization Basket								
SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CSH323B-T&P	ADVANCED NEURAL NETWORK	CS	ELECTIVE	3	1	2	6	5
CSH337-T&P	DevOps Fundamentals	CS	ELECTIVE	3	1	2	6	5
CSH329B-T&P	NETWORK SECURITY	CS	ELECTIVE	2	0	3	5	3.5

Course Title/ Code	Computer Architecture & Organization (CSH209B-T) & (CSH209B-P)
Course Type:	Core
L-T-P Structure	(3-1-2)
Credits	5
Objectives	Students will be able to understand the design and working of various components constituting a computer system.

Course Outcome	Mapping
CO1: Describe General System Architecture, Instruction Set Architecture, Memory Hierarchy, various I/O techniques and concepts of parallelism.	Employability & Skill development
CO2: Design an efficient CPU with hardwired controlled & micro-programmed controlled methodologies by using set of specific instructions.	Employability
CO3: Design a memory module or an I/O module and analyze it's working.	Employability & Skill development
CO4: Compare the performance of a CPU organization and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.	Employability & Skill development
CO5: Apply concepts to develop an assembly level program for a given problem.	Employability

Section-A

Basic Computer Organization: Von Neumann concept – Store program control concept – Flynn's classification of computers (SISD, MISD, MIMD, SIMD) – Multilevel viewpoint of a machine: digital logic, micro architecture, ISA. Decimal, Binary, Octal and Hexadecimal number system, Binary arithmetic's, signed binary numbers, 1's & 2's Complement representation, Fixed and floating-point numbers; Boolean algebra and Logic gates – Combinational logic blocks (Adders, Multiplexers, Encoders, de-coder) – Sequential logic blocks (Latches, Flip-Flops, Registers, Counters).

Section-B

CPU and Instruction Set Architecture: Basics: Instruction Codes – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle – Types of Instructions – Instruction set formats (fixed, variable, hybrid). Processor Organization: General register organization – Stack organization –

Instruction formats – Addressing modes – Data transfer and Manipulation – Program control – Instruction set based classification of processors (RISC, CISC, and their comparison) – Design of accumulator logic.

Section-C

Memory Hierarchy & I/O Organization: The need for a Memory Hierarchy – Locality of reference principle – Memory parameters: access/ cycle time, cost per bit – Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types) – Auxiliary Memory – Cache memory (Associative & direct mapped & Set-associative Cache Organizations, Cache Coherence, I/O interface – Modes of transfer – DMA – Types of Interrupts – Input-Output and Interrupt.

Section-D

Micro programmed Control: Control Memory – Address sequencing – Micro program example – Design of control unit – Microinstruction sequencing – Implementation of control unit. Introduction to Parallelism: Goals of parallelism (Exploitation of concurrency, throughput enhancement) – Enhancing performance with pipelining – Amdahl's law – Instruction level parallelism (pipelining, super scaling –basic features) – Processor level parallelism (Multiprocessor systems overview).

List of Experiments:

1. To recognize various components of PC.
2. To understand the programming language MASM 8086.
3. To print a string with and without using macro.
4. To print the successor and predecessor of a character.
5. To print factorial of a no and Fibonacci series.
6. To print the reverse of a string and check whether it is palindrome or not by using macro.
7. To check whether a number is even, odd or prime using assembly code.
8. To find the largest and smallest number.
9. To print square and cube of first n natural numbers using assembly code.
10. To design a simple calculator.

Text Books:

1. Computer System Architecture by M. Mano, 2001, Prentice-Hall.
2. Computer Organization and Design, 2nd Ed., by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
3. Computer Architecture and Organization, 3rd Edi, by John P. Hayes, 1998, TMH.

Reference Book:

1. Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice-Hall Upper Saddle River, New Jersey
2. Computer Organization, 5th Edi, by Carl Hamacher, Zvonko Vranesic, 2002, SafwatZaky.
3. Structured Computer Organisation by A.S. Tanenbaum, 4th edition, Prentice-Hall of India, 1999, Eastern Economic Edition.

4. Computer Organisation & Architecture: Designing for performance by W. Stallings, 4th edition, 1996, Prentice-Hall International edition.

5. Computer Architecture- Nicholas Carter, 2002, T.M.H.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2										2	2
CO2	3	2	2										2	2
CO3	3	2	2	3	2			2	2				2	3
CO4	3		2		2			2					2	3
CO5	3	3	3		3			3	3				3	2

Course Title/ Code	Theory of Automata & Compiler Design (CSH311B-T) & (CSH311B-P)
Course Type	Core
L-T-P Structure	(3-1-2)
Credits	5
Objectives	Student will able to understand the principles and techniques of programming language translation.

Course Outcome		Mapping
CO1	Describe various types of Automata (FA, PDA, TM), Regular Expressions and Grammars	Employability & Skill development
CO2	Solve mathematical problems or human logic by using Automata Theory	Employability & Skill development
CO3	Describe the Pushdown automata and Turing machines and how they work.	Employability & Skill development
CO4	Analyze lexical, syntax and semantic analyzer of compiler phases	Employability
CO5	Analyze different techniques for intermediate code and machine code optimization.	Employability

Section-A

Finite Automaton: Finite State Systems, Representation of finite automaton, non-Deterministic finite automata (NFA), Deterministic finite automata (DFA), Equivalence of DFA and NFA. Removals of ϵ – moves from finite automata, Minimization of finite Automata, Regular Expressions: - regular expression, Equivalence of finite automata and Regular Expressions, Arden's theorem. The Pumping Lemma for Regular Sets, Closure properties of regular sets and regular language.

Section-B

Context free grammar: - Reduced forms, Chomsky Normal Form (CNF), Greibach Normal Form (GNF). Pushdown Automata: - NDPDA, DPDA, LBA. Turing Machines: - Deterministic and Non-Deterministic Turing Machines, universal Turing machine, Design of TM Chomsky hierarchy.

Section-C

Compilers and translators, structure of compiler. Lexical Analyzer: Lexical Analysis, recognition of tokens, Syntax Analysis: parsing, Parsing Technique: Top-down approach (Recursive Descent, Recursive Predictive and Non-Recursive Predictive Parsing Techniques). Bottom-Up approach: Shift- reduce parsing, operator precedence parsing, LR parsers, SLR, LALR and Canonical LR parser.

Section-D

Syntax Directed Translations: Syntax directed definition, construction of syntax trees, syntax directed translation scheme, and implementation of syntax directed translation, three address code, quadruples and triples. Code Optimization & Code Generation: Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables. Peephole optimization.

List of Experiment:

- Regular expression,
- Finite Automaton,
- Identify and remove Left Recursion
- Pushdown Automaton Lexical Analyzer
- First and Follow
- Parsing algorithm: SLR, CLR, and LALR,
- Optimization: common subexpressions
- dead code elimination
- Create basic block.

Text Books:

Compilers Principle, Techniques & Tools – Alfred V. AHO, Ravi Sethi& J.D.Ullman; - 1998 Addison Wesley.

Compiler Design by O.G. Kakde, 1995, Laxmi Publ.

Reference Books:

Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.

Course Outcomes	Program Outcomes											Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO1 2	PSO1	PSO2
CO1	3										3	3		3
CO2	3		3								3	3		3
CO3	3	3		3	3									3
CO4	3													3
CO5	3													2

Course Title/ Code	Mobile Computing with Android (CSH303B-T) & (CSH303B-P)
Course Type:	Elective
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students would be able to develop Android applications

Course Outcome	Mapping
CO1: Describe general programming knowledge to develop mobile applications and recall their skills of using Android software development tools.	Employability & Skill development
CO2: Demonstrate the understanding of the specific requirements, possibilities and challenges when developing for a mobile context and describe their ability to generalize software with reasonable complexity on mobile platform.	Employability & Skill development
CO3: Demonstrate the interaction between user interface and underlying application components and infrastructure	Employability & Skill development
CO4: Develop a prototype that can be evaluated with a specified user group and illustrate the deployment of app on various mobile API level.	Employability & Skill development
CO5: debug program/application running on mobile devices	Employability & Skill development
CO6: Demonstrate the ability to reflect over possibilities and demands in collaborative Android mobile application development	Employability & Skill development

Section-A

Get started with Kotlin: Kotlin basics, installing IntelliJ IDEA, understanding project structure in Kotlin, Kotlin functions, classes and inheritance, interface, lambdas, higher order functions, and extension functions. Android Introduction: Android ecosystem, building blocks, framework architecture, installing Android Studio and AVD, understanding project structure, android resources, building your first app.

Section –B

Android application UI and Architecture: Creating activities and fragments and their lifecycle, understanding Implicit and Explicit, Manifest File use. User interfaces and layouts (Linear, Relative, and Constraint), layout properties, data binding, creating navigation graphs, and navigating between screens in an Android app. Architecture: UI layers, persistence.

Section-C

Android Menu, Background operation and Testing: Component Event Handle, Component Focus, Threads, Menu: AppBar with Option menu, Contextual menu, Pop Menu, Sub menu, and menu via XML and Code, Dialog, Navigation: Back & Hierarchy, Array & Base Adapters. Custom List View, Grid View using adapters & Recycler View, Styles and Themes, Adaptive Layout and Resource. Testing using Testcase Class / Espresso. Background Operation: AsyncTask and AsyncTaskLoader, Broadcast Receivers, Service, Notification.

Section-D

DATABASES AND ANIMATIONS: Storing Options: Shared Preference, Internal & External Storage, SQLite, SQLite Operation, and Sharing Data between Applications with Content Providers and Content Resolver. Working with Cursors: Inserts, Update and delete. Reading and Updating Contacts, Reading Bookmarks. Graphics and Animation: Custom views, Canvas, animation APIs, Multimedia: Audio, Video. Permission, performance and Security. Firebase feature and App publish.

LIST OF EXPERIMENTS:

Installation and setup of java development kit (JDK), setup android Skeleton eclipse IDE, setup android development tools (ADT) plugins, create android virtual device.

Creating basic kotlin programs.

Create “Hello World” application. That will display “Hello World” in the middle of the screen using TextView Widget in the red color.

Create application for demonstration of android activity life cycle and Scroll View in Android.

Create an application for demonstration of Relative and Table Layout in android.

Create Registration page to demonstration of Basic widgets available in android.

Create sample application with login module. (Check username and password). On successful login, ChangeTextView “Login Successful”. And on failing login, alert user using Toast “Login fail.

Create login application where you will have to validate username and passwords till the username and password is not validated, login button should remain disabled.

Create an application to run Explicit Activity using Intent.

Create an application that will get the Text entered in Edit Text and display that text using Toast.

Create an application that will pass two numbers using TextView to the next screen, and on the next screen display the sum of that number.

Create an application to Demonstrate Dialog Box Control in Android.

Create an UI such that one screen has list of all the types of cars. On selecting any car name, next screen should show Car details like: name, launched date, company name using database connectivity.

Run audio file in the background of previous application.

Animate an image view when it is clicked.

Text Books:

Dawn Griffiths, David Griffiths, “Head First Kotlin”, O’Reilly Media, Inc., ISBN: 9781491996690

John Horton, “Android Programming with Kotlin for Beginners”, Packt Publishing, ISBN:9781789800883, 1789800889

Reference Book:

Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd (2011).

Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd(2009)

<https://google-developer-training.github.io/android-developer-fundamentals-course-concepts-v2/index.html>

<https://developer.android.com/courses/kotlin-android-fundamentals/toc>

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3		3	-	3	-	-	3	-	-	-	-	3	3
CO2	3		3	-	-	-	-	-	-	-	-	-	3	3
CO3	3	2	3	-	-	-	-	3	-	-	-	-	3	3
CO4	3	2	3	-	-	-	-	3	3	-	-	3	3	3
CO5	3	2	3	-	-	3	-	-	-	-	-	3	3	3
CO6	3	3	-	3	3	-	-	-	-	-	-		3	3

Course Title/Code	Neural Networks & Fuzzy Logic (CSH305B-T) & (CSH305B-P)
Course Type	Elective (Department)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	The student will learn and apply the basic concepts of neural networks and fuzzy logic.

Course Outcome	Mapping
CO1: Demonstrate the knowledge of basic concepts of neural networks and fuzzy theory.	Employability & Skill development
CO2: Demonstrate the understanding of the application areas of neural networks and fuzzy theory.	Employability & Skill development
CO3: Apply models of neural networks on computational problems.	Employability & Skill development
CO4: Apply mathematical elements of fuzzy theory on computational problems.	Employability & Skill development

Section-A

Biological Neurons: Introduction, working of the neurons relevant to ANN. Artificial Neural Networks: Model of an Artificial Neuron, Basic Terminology related to ANNs, Models of ANNs: Feedforward & Feedback networks; Types of Learning: Supervised, Unsupervised and Recurrent; Neural Network learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning rule, Widrow-Hoff learning rule, Correlation learning rule, Winner-take-all learning rule, Outstar learning rule.

Section-B

Perceptron Networks: Single Layer Perceptron Networks: Classification model, Features & Decision regions; training & classification using discrete perceptron, algorithm, single layer continuous perceptron networks for linearly separable classifications.

Multilayer Perceptron Networks: linearly non-separable pattern classification, Delta learning rule for multi-perceptron layer, Generalized delta learning rule, Error back-propagation training, learning factors, Examples.

Section-C

Self-Organizing Networks: Basic concepts, unsupervised learning of clusters.

Single layer feedback Networks: Basic Concepts, Hopfield networks, Training & Examples.

Associative memories: Linear Association, Recurrent Autoassociative memory: retrieval algorithm, storage algorithm; Bidirectional associative memory: Architecture, Association encoding & decoding, Stability.

Section-D

Basics of Fuzzy Logic Theory: Crisp and Fuzzy Sets, Basic Set Operations, Fuzzy Relations, properties of membership functions, types of membership functions: triangular, trapezoidal, Gaussian, Composition of Fuzzy Relations, Mathematical Similarities between Neural Networks and Fuzzy Logic Models. Extension Principle, Linguistic Values, Linguistic variables, Fuzzy Rules, Membership Function Formulation and Parameterization, Fuzzy Reasoning.

List of Experiments

Simple MATLAB programs to implement Neural Networks and generating activation functions used in neural networks.

MATLAB programs to implement

Single Layer Perceptrons for linearly separable classifications

Multilayer Perceptrons for linearly non-separable pattern classification

Problems based on Self Organizing Networks

Problems based on Back Propagation networks.

Problems based on Associative Memory.

Problems based on Hopfield Networks.

Given 3 fuzzy sets, A, B and C, write programs in MATLAB to implement the following:

$A \cap B$

$A \cap C$

$B \cap C$

$A \cup B$

$B \cup C$

$A \cup C$

$A \cup B \cap C$

$A \cap B \cap C$

Write MATLAB programs to verify the following for the union operation, where P, Q and R are three given fuzzy sets:

Commutative Law for the sets P and Q

Associative Law for the sets P, Q and R

Distributive Law for the sets P, Q and R

Text Books:

Jacek M. Zurada, “Introduction to Artificial Neural Systems”, Jaico Publishing House (15 copies available).
 “Fuzzy Sets and Fuzzy Logic: Theory and Applications”, by George J. Klir and Bo Yuan, 1995, Prentice Hall (24 copies available).

Reference Books:

Simon Haykin, “Neural Networks.... A comprehensive foundation”, Prentice Hall International, 2nd Edition 1999, ISBN 0-13-273350-1 (11 copies available).

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				2									
CO2	3	2	3		3								3	3
CO3	3	2	3		2				3	2				2
CO4	3	2	3		2				3	2	2			2

Course Title/ Code	Machine Learning (CSH314B-T) & (CSH314B-P)
Course Type:	Elective (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	To learn the concept of how to learn patterns and concepts from data To design and analyze various machine learning algorithms and techniques Explore supervised and unsupervised learning paradigms of machine learning To explore Deep learning technique and various feature extraction strategies.

Course Outcome		Mapping
CO1	Describe the basics of Machine Learning Algorithms.	Employability
CO2	Demonstrate the concepts of exploratory Data Analytics.	Employability
CO3	Apply machine learning techniques to perform predictive analytics	Employability & Skill development
CO4	Develop solutions to real life problems using ML Techniques.	Employability & Skill development

Section A

Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, © Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Section B

Unsupervised Learning

Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

Section C

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, and Random Forests). Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Section D

Scalable Machine Learning (Online and Distributed Learning)

A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

LIST OF EXPERIMENTS:

- Study and Implement Logic Regression
- Study and Implement k-mean clustering
- Study and Implement k-nearest neighbor classification
- Study and Implement the © Bayes learner
- Study and Implement the Decision Tree learners
- Study and implement the Ada boost algorithm
- Study and Implement PCA
- A minor project based on Pattern Recognition.

Text Books:

- [T1] Tom M Mitchell, Machine Learning, McGraw Hill Education
- [T2] Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
- [T3] Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: WileyInterscience, 2000. ISBN: 9780471056690.
- [T4] Tom M. Mitchell, Machine learning .ISBN – 9781259096952, McGraw-Hill Series, Edition – First

Reference Books:

- [R1] Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
- [R2] Introduction to Machine Learning – Ethem Alpaydin, MIT Press, Prentice hall of India.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3				3	3	3	3	3	
CO2	3	3		3	3				3	2	2	3	3	3
CO3	3	3	3	3	3				3	3	3	3	3	3
CO4	3	3	3		3	3			3	3	3	3	3	3

Course Title/Code	APPLIED PHILOSOPHY (EDS288)
Course Type	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2
Objectives	<p>To enable students to</p> <ul style="list-style-type: none"> - confront the philosophical problems implicit in the experience of self, others and the society. - read critically the philosophy of influential philosophers with respect to society, Science and success in life - understand and apply concepts and theories of moral philosophy. - reflect philosophically and ethically on their own personal, professional and civic lives. - formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal society.

Course Outcome	Mapping
CO1: Analyze the philosophical problems implicit in the experience of self, others and the society	Employability
CO2: Explain the philosophy of influential philosophers with respect to society, Science and success in life	Employability
CO3: Demonstrate the understanding of the concepts and theories of moral philosophy.	Employability & skill development
CO4: Reflect philosophically and ethically on one's own personal, professional and civic lives.	Employability & skill development
CO5: Formulate a philosophy of life or world-view consistent with the objectives of liberal society.	Employability

SECTION A

INTRODUCTION TO PHILOSOPHY: Philosophy: Meaning, Nature and Scope, Practical uses of Philosophy, Branches of Philosophy.

SECTION B

THOUGHTS OF PHILOSOPHERS AND THEIR IMPLICATIONS: General Philosophy of John Dewey, Swami Vivekananda and Rabindra Nath Tagore, Philosophy of life and success: Steve Jobs, N.R. Narayana Murthi, Dr. A.P.J. Abdul Kalam and Muhammad Yunus, Philosophy of Science and technology- Francis Bacon and Martin Heidegger.

SECTION C

PHILOSOPHICAL PERSPECTIVES OF SOCIO-POLITICAL SCENARIO IN INDIA: Nature of Democracy and its implications, Meaning and requirements of National Integration, Universal Human Rights

SECTION D

PHILOSOPHICAL PERSPECTIVES OF RELIGIOUS SCENARIO IN INDIA: Secularism—its nature and implications, Moral Philosophy of religion with special reference to Hinduism, Jainism, Buddhism, Islam, Christianity, Sikhism. Religious pluralism and religious tolerance.

List of Experiments:

Prepare and present a report on ‘philosophy of life’ from the perspective of a young adult.

Quiz and interactive sessions on various philosophical perspectives of contemporary philosophers.

Organization of and participation in street plays /dramas/ declamation/ debates/ any other suitable activity on any theme of Philosophical perspectives of Socio-Political scenario in India.

Group discussions on any suitable topics concerning contemporary society like aggression among youth, Over-ambitiousness in young generation, misuse of democracy, implications of secularism etc. and to reflect upon different viewpoints.

Preparation of quotation boards to display quotes of great philosophers in the college premises.

Picture interpretation and philosophical reflection on social themes like juvenile crime, begging in India, Social networking etc.

Readings from the autobiographies and other publications of great philosophers e.g. ‘Wings of Fire’ followed by discussion session.

Showing Videos on Unique personalities: life and philosophies followed by reflection exercises.

Any other suitable activity.

Reference Books and Readings:

Bhatia, K. & Bhatia, B. (1974) *The Philosophical and Sociological Foundations of Education*. Delhi: Doaba House.

Brubacher, John. S. (1969). *Modern Philosophies of Education*, New Delhi: Tata McGraw-Hill

Dewey, J. (1966). *Democracy in Education*, New York: Macmillan.

Ferre, F.(1995). *Philosophy of Technology*. University of Georgia Press.

Gandhi, M. K. (1956). *Basic Education*. Ahmedabad, Navajivan.

Goel, A. & Goel S. L. (2005). *Human values and Education*. New Delhi: Deep and Deep Publications Pvt. Ltd.

Palmer, Joy A. et.al. (2001). *Fifty major thinkers on education from confucious to Dewey*. New Delhi: Rutledge.

Rajput, J.S. (2006). *Human Values and Education*. New Delhi: Paragon Publications.

Walia, J.S. (2011). Philosophical, Sociological and Economic Bases of Education.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	-	-	2	-	-
CO2	-	-	-	-	-	-	-	3	2	-	-	2	-	-
CO3	-	-	-	-	-	-	-	3	2	-	-	2	-	-
CO4	-	-	-	-	-	-	-	3	2	2	-	2	-	2
CO5	-	-	-	-	-	-	-	3	2	2	-	2	-	2

Course Title/Code	Applied Psychology (EDS289)
Course Type	Elective
L-T-P Structure	(1-0-2)
Credits	2
Objectives	<ul style="list-style-type: none"> -To define psychology and its application across various fields. -To identify major attributes of Personality. -To conceptualize psychology in social and organizational settings. -To understand group dynamics. -To solve conflicts among the group.

Course Outcome	Mapping
CO1: develop critical thinking to understand the application of psychology CO2 identify the impact of Stereotyping, prejudice and discrimination in formation of attitude	Employability
CO2: identify the impact of Stereotyping, prejudice and discrimination in formation of attitude	Employability
CO3: Identify major attributes of Personality	Employability & skill development
CO4: Explain Social Psychology and able to solve conflicts among the group	Employability & skill development
CO5: Demonstrate group dynamics	Employability & skill development
CO6: Analyze organization Psychology and able to blend in work environment	Employability

Section A

PSYCHOLOGY: ATTITUDE FORMATION

Psychology: Meaning, nature, Role of psychology across multi-disciplinary aspects, Introduction: Stereotypes, Prejudice, and Discrimination, Introduction: Attitude, Formation of attitude, Aptitude

Section B

PERSONALITY AND PERSONALITY DEVELOPMENT

Definition of personality and its characteristics, Trait approach to personality (Big five theory of personality), Jung's Theory of personality

Section C

SOCIAL PSYCHOLOGY

Introduction to social identity, social cognition, and social influence, social conflicts and its resolutions, Group dynamics: Introduction, formation, types of groups, cooperation, competition, and conflict in groups.

Section D

ORGANIZATIONAL PSYCHOLOGY

Organizational Psychology: Definition, fundamental concepts and importance, Introduction to job satisfaction, work motivation, and Stress Management. Introduction to teamwork and its benefits.

References Books and Readings:

- Arrow, K. J. (1995). *Barrier to Conflict Resolution*. NY: W. W. Norton.
- Bandura, A., & Walters, R. H. (1963). *Social Learning and Personality Development*. New York: Holt, Rinehart, & Winston.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice- Hall, Inc.
- Baron, R. A., Byrne, D. (1997). *Social Psychology (8th Ed.)*. Boston, MA: Allyn & Bacon.
- Baron, R. A. (2001). *Psychology (5th ed.)*. London: Pearson.
- Cialdini, R. B. (2001). *Influence: Science and Practice (4th Ed.)*. Boston, MA: Allyn & Bacon.
- Feldman, R. S. (2008). *Essentials of Understanding Psychology*. New Delhi: Tata McGraw Hill.
- Friedkin, N. (1998). *A structural theory of social influence*. Cambridge: Cambridge University Press.
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LAB: (EDS289)

The Sentence Completion test to know the individual's personality and its related aspect.

A Self-concept Scale to explore the major aspect of personality will be conducted.

Multi variable Personality Inventory will be conducted to explore the dimensions of personality.

Eysenck Personality Test will be conducted

To know different facet of personality a Thematic Apperception Test will be conducted.

Socio-metric test will be conducted to know the individual's social acceptance and group structure.

To explore the dimensions of personality PIG Personality Test will be administered.

To explore the multiple intelligence of students My Preference test is being conducted

Administration of Cohen Perceived Stress to know the level of stress among students and recording of the strategies to cope with it.

A Career Aspiration Scale will be conducted to identify different areas of aspirations.

Self-Reflection Activity

Identify different stereotypes present in our Society and your views on them.

Write a brief note of any one attitude you desire to change and strategies to accomplish it.

Prepare a SWOT Analysis Chart to know your strengths, weaknesses, opportunities and threats.

A Brief account of your personality before and after the transaction of course content.

Any other suitable activities.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	-	-	-	2	-	-	-	2	2	2		2	-	-
CO2	-	-	-	-	-	-	-	2	2	2		2	-	-
CO3	-	-	-	-	-	-	-	2	2	2		2	-	2
CO4	-	-	-	-	-	-	-	2	2	2		2	-	2
CO5	-	-	-	-	-	-	-	2	2	2		2	-	-
CO6	-	-	-	-	-	-	-	2	2	2		2	-	2

Course Title/Code	APPLIED SOCIOLOGY (EDS290)
Course Type	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2
Objectives	<p>To know and understand about the fundamental concepts of sociology and its applications.</p> <p>To develop the analytical skills of students about ways in which social processes affect our everyday lives.</p> <p>To understand the impact of various processes of social change and assess their impact on society.</p> <p>To understand and analyze the social cultural dynamics that contribute to transformation of Indian reality</p> <p>To study the various contemporary issues of society.</p> <p>To develop basic research skills in area of sociology.</p>

Course Outcome	Mapping
CO1: analyze the social cultural dynamics that contribute to transformation of Indian Society	Employability
CO2: develop the necessary skills of social processes which affect our everyday lives.	Employability
CO3: Analyze various contemporary issues of society and able to provide solutions of social barrier and benefiting the masses.	Employability & skill development
CO4: develop basic research skills in the area of sociology and help to find possible solution of specific social barriers of the society	Employability & skill development

Section A

Introduction and Applications of Sociology:

Society, Community, Social Institutions, Social Groups, Introduction to Applied Sociology

Sociology and Social Processes

Sociology and Social Change

Sociology and Social Problems

Clinical Sociology

Section B

Sociological Processes:

Social Stratification, Social Mobility and their impact on society
Socialization, Agents of Socialization, Assessing the effects of Socialization
Social Movements: Concept, Impact of Environmental Movements in India: Chipko Movement, Narmada Bachao Andolan

Section C

Processes and Issues of Social Change:

Social Change: Westernization, Urbanization, Privatization, Globalization, Sustainable development
Issues in urban development-Population, poverty, unplanned growth and ecological issues

Conflict management:

Intergroup: Causes, Resolutions

Organizational Conflict, Conflict Management and Grievance Handling

Section D

Field Survey & Report Writing: Need, Meaning of Survey, Types of Survey, Steps in Conducting Survey, Data Collection Methods, Salient Features of Report Writing

List of Experiments:

- Showing Videos on the life and philosophies of Famous sociologists and to acquaint the students about their different theories
- Preparation of quotation board with the help of displaying the pictures and quotes of famous sociologists
- Choose a theme of your interest- for e.g., crime, technology environmental concerns or any other and look through the Sunday editorials of any national daily of the last 3 months to locate related articles.
- Role Play: Gender issues in everyday life, students will form small groups and present skits to address this issue creatively; this will be followed by discussions.
- Students may be given the assignment of taking pro-active role in initiating social change in a local field
- Visit a shopping mall and observe the interaction between employees and customers/visitors. Identify themes based on your observation and prepare a questionnaire based on this experience.
- Look at a set of published letters of Gandhi, Nehru, C.F. Andrews and Tagore etc. and identify key social issues that are discussed in the contents of the letters and prepare a report on it.
- Students will be asked to write a short essay on the pressures they feel of the experience in performing masculinity or femininity, Presentations and discussions based around the essays.
- Debate or discussion on “Is the family the site of love and care” or “Is the family democratic?”
- Discuss the impact of modernization, industrialization and globalization on the day-today life.
- Students may be asked to apply any applied research technique
- Design a survey on factors effecting marriage choices of young people.
- Any other suitable activity

References: Books and Readings

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- Young, K. (2001). Handbook of Social Psychology, London: Routledge and Kegal Paul Ltd.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1						-		2	2	2	-	2		
CO2						-		2	2	2	-	2		2
CO3				2		-		2	2	2	-	2		2
CO4				3		-		2	2	2	-	2		

Course Title/ Code	ENTREPRENEURSHIP (MCS368B)
Course Type:	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2
Objective	To explain concepts of. Entrepreneurship and build an understanding about business situations in which entrepreneurs

Course Outcome	Mapping
CO1: To identify and present the problem worth solving	Employability & Skill development
CO2: To prepare and present the Business Model /Lean Canvas	Employability & Skill development
CO3: To present your prototype/ Minimum Viable Product	Employability
CO4: To present your Potential Real Venture after working on the Team, Financials, Brand positioning and distribution channels.	Employability

SECTION-A

Decision to become an entrepreneur

Introduction to entrepreneurship- Defining entrepreneurship, characteristics of successful entrepreneurs, importance of entrepreneurship, Myths about entrepreneurs, corporate entrepreneurship, Self-Discovery & SWOT analysis, Effectuation –Meaning, five principles of effectuation, Defining a Start-up, 4 Ps of a Startup, Reasons of Start-up failure, Basic Model of entrepreneurial process.

SECTION-B

Opportunity discovery

Recognizing opportunities and generating Ideas, Validating the market need, identify problem worth solving using Jobs to be done (JTBD) methodology, design Thinking- Meaning, Design Thinking Values, Design Thinking Process, Double diamond approach in design thinking

SECTION-C

Customer and Solution-

Customer Vs. Consumer, different market types and their specific requirements, estimate the market size, identify your customer Segment (through STP), Switching costs and psychological biases, understanding Market research for startups, Customer profile, Value proposition Canvas- understanding the jobs, pains and gains.

SECTION-D

Business Model & Validation and Business Plan

Business Model- Concept, Elements of Business Model and Lean Approach, Lean canvas template, Blue Ocean Strategy, difference between Solution Demo and MVP, Business plan- definition and importance, components of Business plan- market, technical and financial, legal and ethical aspects in a Start-Up.

Text book:

Entrepreneurship: Successfully Launching New Ventures, 6th edition, Bruce R. Barringer and R Duane Ireland, Published by Pearson Copyright © 2019, 6th edition

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1		3	3				2		3	3		2		
CO2		3	3	3			2		3	3	3	2		
CO3		3	3	3			3		3	3		3		
CO4		3	3	3	3	3	3	3	3	3	3	3		

Course Title/ Code	Professional Competency Enhancement-III(CDO301)
Course Type:	Allied Core
L-T-P Structure	(6-0-0)
Credits	1
Objective	Students will become better in analytics, problem solving and reasoning

Course Outcome	Mapping
CO1: Students will describe basic knowledge about aptitude	Employability & Skill development
CO2: Students will be able to apply analytical reasoning to problem solving	Employability & Skill development
CO3: Students will demonstrate enhanced concentration & thinking ability and demonstrate a higher level of reasoning, numerical skills and speed	Employability & Skill development
CO4: Students will be able to solve aptitude problems quickly utilizing short cuts and will have the ability to quickly think on their feet.	Employability & Skill development

Section-A

Percentages

Increase & Decrease Concepts, Time Saver Tricks, Concepts of Population, Marks, Examinations & Exams.

Profit, Loss & Discount

Buying & Selling, Dishonest Dealers, Successive Discounts, Marked Price Concepts

Section-B

Ratio & Proportion

Combined Ratio, Division of Values, Proportion, Bags & Money and Partnership

Alligations or Mixtures

Rule of Alligation, Successive Replacement & Mixing

Section-C

Unit-5: Time & Work

Combined Work, Efficiency & Wages, Alternative, Changing Man Power

Pipes & Cisterns

Inputs & Leaks, Capacity of Tank

Section-D

Time, Speed & Distance

Average Speed, Relative speed, Trains, Boats & Streams, Circular Motion

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	2	-	-	2	-	2
CO2	2	2	-	-	-	-	-	-	2	-	-	2	-	2
CO3	2	2	2	-	-	-	-	-	2	-	-	2	-	2
CO4	2	2	2	-	-	-	-	2	2	3	-	2	-	2
CO5	2	2	2	-	-	-	-	2	2	3	-	2	-	2

Course Title/ Code	Research & Innovation-II (RDO601)
Course Type:	Research Type
L-T-P Structure	(0-1-0)
Credits	1
Objective	To apply the contextual knowledge of designing techniques and technologies in research.

Course Outcome	Mapping
CO1: The students will be able to apply the contextual knowledge to describe techniques and technologies	Employability
CO2: To analyze and interpret the research outcomes	Employability
CO3: To describe new techniques/technologies/methodologies	Employability & Skill development
CO4: To describe current research available in the literature	Employability & Skill development

SECTION-A

Unit-1 Setting up the simulation/experiment environment

- 1.1 To conceptualize simulation/verifying experimental set up
- 1.2 Measurements on experimental system/simulations of the model
- 1.3 Choosing the appropriate research methodology
- 1.4 Finding the resources for performing experiments/simulations

SECTION-B

Unit-2 Planning of experiments

- 2.1 Formulate experimental procedures with Modification of the experimental set-up, if required
- 2.2 Procurement of materials

SECTION-C

Unit-3 Execution of experiments/simulations

- 3.1 Conduct experiments/ build prototype
- 3.2 Tabulating and recording data
- 3.3 Analysis and interpretation of the data
- 3.4 Comparison of the results with other reported experiments
- 3.5 Interpretation of observations

SECTION-D

Unit-4 Documentation and presentation

- 4.1 Integration of relevant theory, findings in a structured way and draw appropriate conclusions
- 4.2 Review and modification of the draft
- 4.3 Seminar presentation
- 4.4 Communication to conference/Journal

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	2	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	2	3	-	-	-	-	-	2	3	3
CO3	3	3	3	3	2	3	-	-	-	-	-	2	3	3
CO4	3	-	3	3	3	-	2	-	-	3	-	3	3	3

Course Title/Code	Advanced Neural Networks (CSH323B-T) & (CSH323B-P)
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	The course objective is to help students learn, understand, and practice Deep Learning approaches.

Course Outcome	Mapping
CO1: Demonstrate the understanding of neural networks.	Employability
CO2: Demonstrate the understanding of advance neural networks and preliminary deep learning approach	Employability
CO3: Apply advance neural networks algorithms to real world datasets	Employability
CO4: Evaluate the performance of learning algorithms	Employability & skill development
CO5: Design solutions to a range of real-world problems using learning techniques	Employability & skill development

SECTION-A

RNN: Gradient Descents, Recurrent Neural Network, Predicting the next character using RNNs, Hopfield Network, Gated Recurrent Unit (GRU), Bidirectional RNN

SECTION-B

Deep Learning: Introduction to Deep Learning, Introduction to TensorFlow, creating a Deep Learning Network using TensorFlow

SECTION-C

Boltzmann Machines: Introduction to Boltzmann Machines, Restricted Boltzmann Machines, Collaborative Filtering using Boltzmann Machines, Markov Random Fields, Deep Boltzmann Machine

SECTION-D

Deep Belief Networks: Introduction to Deep Belief Network, Stacking RBM to create Deep Belief Network, Wake Sleep Algorithm

SECTION-E

Modern Statistical Concepts: Learn about confidence intervals, define jackknife regression, explain graphical models, Describe better goodness of fit and yield metrics

List of Programs:

Build a perceptron model from Scratch

Write a program to visualize different activation functions and their derivative

Write a program for Hyperparameter Tuning and Optimization in TensorFlow

Write a program for simulation of Jackknife estimation of mean and median

Write a program for understanding different TensorFlow syntax and different operations.

Write a program to understand Keras in TensorFlow

Write a program for Linear Regression in TensorFlow

Write a program for Logistic Regression with TensorFlow

Write a program for Next character prediction using RNN in TensorFlow

Write a program for next character prediction using Bidirectional RNN in TensorFlow

Write a program for next word prediction using RNN in TensorFlow

Write a program for Collaborative Filtering using RBM in TensorFlow

Write a program for Classification using DBN

Write a program for A/B Testing using Bayesian Method in TensorFlow

Course Learning Outcomes (CLOs)

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

Understand Regression with TensorFlow

Learn Keras concepts

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	2										3	3
CO2	3	2	3	2									3	3
CO3	3	3	3	3									3	3
CO4	3	3	2	3	3				3		3	3	3	3

CO5	3	2	2										3	3
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Course Title/Code	VERSION CONTROL & AUTOMATION (CSH321B-T) & (CSH321B-P)
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	Student will be able to understand concept of DevOps and Test Automation.

Course Outcome	Mapping
CO1: Know the fundamentals and characteristics of DevOps and Test Automation that make is useful to solve real world problems	Employability
CO2: Demonstrate the understanding of Version Control System.	Employability
CO3: Implement the functionality of version control.	Employability & skill development
CO4: Design solutions to a range of complex real world problems using Version control and Test Automation	Employability & skill development

SECTION-A

Typical Toolkit of DevOps

DevOps: An Overview, Achieving DevOps, Continuous Practices, How does CI Work?, Continuous Integration Practices, Commit Code Frequently, Maintain a Single Source Repository, Don't commit code, Keep the Build Fast, Every Commit Should Build the Mainline, Fix Broken Builds Immediately, Write

Automated Developer Tests, Automated deployment helps, Benefits of Continuous Integration, Continuous Delivery, Continuous Delivery Process, Benefits of continuous delivery practices.

SECTION-B

Version Control System

Brief History of Version Control Systems, Basic Operations in a VCS, Examples of Version Control Systems, Concurrent Versions System (CVS), Subversion (SVN), Mercurial, Git, The Making – History of Linux and Git, Advantages of Git

SECTION-C

Version Control System vs Distributed Version Control System

Local Repository, Centralized Version Control System (CVCS), Distributed Version Control System (DVCS), Advantages of Distributed Version Control System, Private Workspace, Easier Merging, Easy to Scale Horizontally, Disadvantages of Distributed Version Control System, vs Distributed Version Control Systems, Comparison of CVCS and DVCS, Multiple Repositories Model, Multiple Repositories for Different Services, Resetting the Local Environment, Revert - Canceling out– the Changes

SECTION-D

DevOps Automation

The Software Delivery Pipeline, Overview of the Continuous Delivery Pipeline, Fully Automated Software Delivery Process, The Build Process, Automated build, Automated Test, Automated Deployment, Benefits of Automated Deployment, Automated Deployment and DevOps Adoption, Automated Deployment and DevOps Adoption, Overview of Rapid Application Development (RAD), Phases in RAD, Essential Aspects of RAD, Code generation, Categories of Code Generators

SECTION-E

Test Automation

Introduction to Test Automation, what to automate, Test Scenario, Test Case Design, Test Basis, Traceability Matrix

Automation Lab

Introducing Version Control System -Installing Gi– CLI on Linux, Mac & Windows

Setting up a Git Repository & Initialization

Cloning an Existing Repository

Introducing GitHub & Exploring GitHub

Fork and Push an Existing Repository

Working with Git- File States, Project Section, Workflow,

Working with Git Operations- git status, git add, git commit, git stage

Git Configuration Files - .gitattributes

Identifying Binary Files, Diffing Binary Files

Working with Git History

Merge Resolution in Git

Working with Git Branching

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	-	-	2	-	2	2	2
CO2	3	3	-	-	-	2	-	-	2	2	3	2	3	3
CO3	3	3	2	2	3	2	-	-	3	2	3	2	3	3
CO4	3	3	3	2	3	-	-	-	2	2	3	3	3	3

Course Title/ Code	Network Security(CSH323B-T & CSH323B-P)
Course Type	Elective
L-T-P Structure	(2-0-3)
Credits	3.5
Objectives	Students will have the understanding and hands on expertise to live network associated attack vectors and threats

Course Outcome	Mapping
CO1: Describe the theory of fundamental cryptography, encryption and decryption algorithms	Employability/S kill Development
CO2: Demonstrate various data encryption techniques	Employability/S kill Development
CO3: Implement Hashing, IDEA, AES algorithms and Digital Signature techniques	Employability/S kill Development
CO4: Analyze and design hash and MAC algorithms.	Employability/S kill Development

Section-A

Network Security: Related challenges, Different attacks vectors and network threats: DDOS, MITM, Packet Analysis, Port Forwarding, And Implementation of prevention from network attacks, Wireless Security: Wireless Attacks, WEP, WPS, WPA/WPA2, Attacking a Wireless network: Aircrack-ng, Airmo, Airodump, reaver etc. Improving Wireless Security, Access control: IAM, Control Mechanism, 2 Factor Authentication, Multifactor Authentication, Antivirus and antimalware software: AV Software Structure, AV database and AI, Stuxnet, Morris Worm, Mellissa Worm, Application security, Behavioural analytics, Cloud Security: Cloud Infrastructure, Common cloud platforms, Software as a service risk

Section-B

Data loss prevention: Data Vs Information, Information Systems, Threat related to information Systems, Data Recovery and Backup, Email security: Tradition Email Technology, SMTP, Email Encryption, Email Header, Analysing email headers, Firewalls: Fire wall definition Roles and Responsibility in any network, Statefull vs Stateless firewall, Intrusion prevention systems: Intrusion Detection vs Prevention methodology, Honeypots, Mobile device security: Mobile platforms threats, local storage, security policies, jail-breaking, rooting your device, mobile backdoors, Network segmentation, Security information and event management, Application and operating system security, Connected Web and Network Security.

Section-C

OSI vs TCP Model: Security Risks with respect to each layer supported protocols, Packet Analysis Fundamentals: Packet Analysis and Network Basics Tapping into the Wire, Introduction to Wireshark, Working with Captured Packets, Common Lower-Layer Protocols Common Upper-Layer Protocols Basic Real-World Scenarios Fighting a Slow Network Packet Analysis for Security Wireless Packet Analysis, HTTP vs HTTPS Traffic, SSL vs TLS versions, Socket Layer implementation and necessity, Traffic Relay Attacks, Introduction to Interceptors: Burpsuite, Zed Attack Proxy (ZAP) OWASP etc.

Section-D

Countermeasures and increasing network security: Hardware countermeasure, Behavioral countermeasures, Implementing Control Systems and Access Control listing, Countermeasures for Each Layer (Secure Multipurpose Internet Mail Extensions (S/MIME), Privacy Enhanced Mail (PEM), Secure Shell (SSH)), Types of Countermeasures (hi-tech, lo-tech, and no-tech), Optimum Countermeasure Portfolio Selection, From User-Land to Kernel-Land Attacks

LIST OF EXPERIMENTS:

Installation and Practice on dummy network images for security testing.

Practical's on Network Security Protocols

Analyze and solve CTF challenges for the network security.

Monitoring and Analysis of live network to understand the various protocols and packets exchange system.

Report network intrusion incident with POC.

Practical on Zed Attack Proxy: Monitoring and Analyzing Modified Packets

Books

Network Security Essentials Applications and Standards by William Stallings

Network Security: The Complete Reference by Roberta Bragg

Help Pages

Network Security:

<https://www.sans.org/reading-room/whitepapers/basics/network-security-guide-small-mid-sized-businesses-1539>

Cyber and Network Security: <https://www.nist.gov/itl/cyber-and-network-security>

Wikipedia Pages

Network Forensics: https://en.wikipedia.org/wiki/Network_forensics

Wireshark: <https://en.wikipedia.org/wiki/Wireshark>

Tool Web Sites

Wireshark: <https://www.wireshark.org/>

Network Miner: <https://www.netresec.com/?page=NetworkMiner>

Kali Linux: <https://www.kali.org/>

Web tutorials

Network Forensics: <https://www.lynda.com/Wireshark-tutorials/Network-Forensics/806160-2.html>

Geeksforgeeks: <https://www.geeksforgeeks.org/computer-network-tutorials/>

SANS: https://isc.sans.edu/presentations/first_things_first.html

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	-	-	-	2	2	-	-	2	-	2	3	2
CO2	3	3	3	2	2	2	3	2	-	2	-	3	3	2
CO3	3	3	3	2	3	3	3	2	-	3	-	3	-	2
CO4	3	2	-	-	-	2	2	-	-	2	-	2	3	3

SEMESTER-VI

SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CSH310B-T&P	COMPUTER GRAPHICS & MULTIMEDIA	CS	CORE	3	1	2	6	5
CSH204B-T&P	ANALYSIS & DESIGN OF ALGORITHMS	CS	CORE	3	1	2	6	5
CSH312B-T&P	ADVANCED ANDROID DEVELOPMENT	CS	ELECTIVE	3	0	2	5	4
CSH313B-T&P	DATA WAREHOUSE & DATA MINING							
CSH316B-T&P	DEEP LEARNING							
MOOC	NPTEL COURSES FROM MOOC							
CSW406B CSW407B CSW423B CSW308B	.NET USER EXPERIENCE DATA VISUALIZATION WITH TABLEAU ADVANCED JAVA	CS	ELECTIVE	0	0	2	2	1
MOOC	NPTEL COURSES FROM MOOC							
LWS325 PSE301-P MCS232	LAW RELATING TO INTELLECTUAL PROPERTY RIGHTS ESSENTIAL OF PEACE & SUSTAINABILITY INTRODUCTION TO FINANCE	LW/ED/MC	ELECTIVE	2	0	0	2	2
MOOC	NPTEL COURSES FROM MOOC							
CDO332	PROFESSIONAL COMPETANCY ENHANCEMENT-IV	CDC		6	0	0	6	1
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			17	2	8	27	18
Specialization Basket								
SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS	NO. OF CREDITS

							PER WEEK	
CSH324B-T&P	NATURAL LANGUAGE PROCESSING	CS	ELECTIVE	3	1	2	6	5
CSH322B-T&P	MODERN ARCHITECTURE PATTERNS	CS	ELECTIVE	3	1	2	6	5
CSH330B-T&P	VULNERABILITY ASSESSMENT AND PENETRATION TESTING	CS	ELECTIVE	1	0	4	5	3
CSO320B	SUMMER TRAINING POST 6TH SEMESTER							3

Detailed Syllabus
CSU01- Semester-VI

Course Title/ Code	Computer Graphics and Multimedia (CSH310B-T) & (CSH310B- P)
Course Type:	CORE (Department)
L-T-P Structure	3-1-2
Credits	5
Objectives	The student will be able to apply the Computer Graphics algorithms and techniques to generate graphical outputs and to examine applications of modeling, design and visualization.

Course Outcome		Mapping
CO1	Describe knowledge of basic primitives of computer graphics, multimedia building blocks and their application.	Employability & Skill development
CO2	Explain the concepts and techniques used in 2D and 3D graphics.	Employability
CO3	Demonstrate and examine interactive computer graphics Objects.	Employability & Skill development
CO4	Outline and illustrate digital portfolio and other independent and team projects.	Employability & Skill development
CO5	Apply and evaluate these techniques in real life scenarios.	Employability

Section-A

Introduction: Concepts and Application of Graphics, Display Devices: CRT, Raster, And Random, Flat Panel displays. Basics Primitives: Scan conversion, Point representation, Line representation: DDA, Bresenham's Line Algorithm (1stOctant, Integer, General), Circle representation: Generalized Circle generating Algorithm, Bresenham's Circle, Midpoint Circle. Filled area algorithms: Flood Fill, Boundary Fill, Scan Line Fill, Edge Fill.

Section-B

2-D Transformation: Basic Transformations (Translation, Rotation, Scaling, Reflection, Shearing), Matrix representation and Homogeneous Coordinates, Coordinate transformation, Composite transformations. 3-D Transformation: Basic Transformations, Matrix representation, Coordinate transformation, Composite transformations. Viewing and clipping: 2-D Viewing, Pipeline, Window to viewport mapping, Clipping: Point, Line and Polygon Clipping.

Section-C

3-D Projections- Parallel and Perspective. Hidden Surface removal: Introduction to hidden surface removal, Z-buffer Algorithm, Scanline Algorithm, Area subdivision method.

Representing Curves & Surfaces: Parametric representation, Bezier curve, B-Spline curve, Interpolation method. Illumination: Shading, Image manipulation, Illumination model, shading models for polygons, shadow, and transparency.

Section-D

Multimedia Fundamentals: Concepts, Application & Framework of Multimedia system, Multimedia devices. Multimedia building blocks: Using Text in Multimedia, Still Images: bitmap, vector drawing & 3-D drawing and rendering, Image file formats. Sound: Audio-Speech recognition, Digital Audio MIDI, Multimedia Authoring Tools. Compression Techniques: JPEG Compression, MPEG Compression, DVI. Animation: Introduction to Animation, Principle of Animation, Animation Types, Animation Tools.

LIST OF EXPERIMENTS:

Understanding of Basic Graphics Code.

Understanding of Basic Graphics Functions.

Line (); Cleardevice (); Closegraph (); Getx (); Gety (); Getmaxx (); Getmaxy (); Getpixel (); Putpixel (); Getcolor (); Getbkcolor (); Circle (); Rectangle (); Ellipse (); Arc (); Setcolor (); Setbkcolor (); Settext (); Outtext (); Outtextxy ();

Program to draw the shape of hut, flag, car.

Implement the DDA and Bresenham algorithm to draw a line.

Implement the Bresenham and midpoint algorithm to draw Circle.

Program to Change the Color and Design of Circle.

Program to implement the Flood Fill and Boundary Fill Algorithm.

To perform 2D transformations (translation, rotation, scaling, shearing, reflection).

To implement composite transformations and clipping algorithm.

To perform animations using C.

To study the introduction to Flash and Flash tools.

To apply animations on various objects using Frames.

To study the implementation of animations using layers and guided layers.

To implement motion tweening and shape tweening.

Text Books:

Computer Graphics by Donald Hearn and M.Pauline Baker, 2nd Edition, 1999, PHI edition, 1996.

An introduction, Villamil & Molina, Multimedia Mc Milan, 1997.

Reference Book:

Computer Graphics Principles and Practices second edition by James D. Foley, Andeiesvan Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addison Wesley.

Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition.

Mathematical Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition.

Multimedia: Making it work, Tay Vaughan, fifth edition, 1994, TMH.

Multimedia Systems by John .F. Koegel, 2001, Buford.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3			3							3	3	3
CO2	3	3		3	3							3	3	3
CO3	3	3	3	3	3				3				3	3
CO4	3	3	3	3	3				3	3	3		3	3
CO5	3	3	3	3	3				3		3	3	2	3

Course Title/ Code	Analysis and Design of Algorithms (CSH204B-T) & (CSH204B-P)
Course Type:	Core (Departmental)
L-T-P Structure	(3-1-2)
Credits	5
Objectives	To learn the ability to distinguish between the tractability and intractability of a given computational problem. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

Course Outcome	Mapping
CO1: Students will be able to understand time and space complexity of algorithms of different design strategies through examples	Employability & Skill development
CO2: Apply appropriate algorithmic design paradigm to solve real life problems	Employability & Skill development
CO3: Student should be able to analyze asymptotic performance of any algorithms	Employability & Skill development
CO4: Students will be able to gain understanding of solvable and unsolvable (concepts of P and NP class) problems and will have the ability to do the analysis to categorize the problem.	Employability & Skill development
CO5: Students will be able to gain understanding of solvable and unsolvable (concepts of P and NP class) problems and will have the ability to do the analysis to categorize the problem.	Employability & Skill development

Section-A

INTRODUCTORY CONCEPTS: Growth of Functions, Summations, Algorithm Design Paradigms, Characteristics of Algorithm, Comparing the performance of different algorithms for the same problem, asymptotic notation. Polynomial vs. Exponential running time. Disjoint Set operations, Linked List representation of disjoint sets, disjoint set forests.

Section-B

Divide and Conquer method: Recurrence relations: Solving Recurrence by substitution method, recurrence tree, master method; Binary search algorithm and its analysis. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, Counting Sort, Bucket Sort and Bubble sort with analysis of their running times. Strassen's matrix multiplication

Section-C

Greedy Method: Activity Selection Problem, knapsack problem, job sequencing with deadlines, minimum spanning trees, single source shortest paths, all pairs shortest path. Dynamic Programming: General method, optimal binary search trees, 0/1 knapsack, the traveling salesperson problem, Matrix chain multiplication, longest common Subsequence and their analysis.

Section-D

Backtracking and Branch & Bound: General method, 8 queen's problem, graph coloring, Hamiltonian cycles, Vertex Cover Problem, analysis of these problems. Branch and Bound: Method, 0/1 knapsack and traveling salesperson problem, efficiency considerations, NP hard and NP Complete: NP Hard graph Problems, Cooks theorem

LIST OF EXPERIMENTS:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
2. Implement a Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements.
3. A. Obtain the Topological ordering of vertices in a given digraph.
b. Compute the transitive closure of a given directed graph using Wars hall's algorithm.
4. Implement 0/1 Knapsack problem using Dynamic Programming.
5. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
6. Find Minimum Cost Spanning Tree of a given undirected graph using Krystal's algorithm.
a. Print all the nodes reachable from a given starting node in a digraph using BFS method.
b. Check whether a given graph is connected or not using DFS method.
7. Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d.
For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$.
A suitable message is to be displayed if the given problem instance doesn't have a solution.
8. Implement any scheme to find the optimal solution for the Traveling Salesperson problem.
9. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
10. Implement All -Pairs Shortest Paths Problem using Floyd's algorithm.
11. Implement N Queen's problem using Back Tracking.

Text Books:

1. Fundamental of Computer algorithms, Ellis Horowitz and SartajSahni, 1978, Galgotia Publ.,
2. Introduction To Algorithms, Thomas H Cormen, Charles E Leiserson And Ronald L Rivest: 1990, TMH

Reference Books:

1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
Writing Efficient Programs, Bentley, J.L., PHI
3. Introduction to Design and Analysis of Algorithm, Goodman, S.E. &Hedetnieni, 1997, MGH.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3											2		
CO2	3			2	2							2	3	3
CO3	3	3	2	3	2							3	3	3
CO4		3	3	2	3							3	3	3
CO5	3	2										2		3

Course Title/ Code	Advanced Android Development (CSH312B-T) & (CSH312B-P)
Course Type:	Elective
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students would be able to develop advance android application.

Course Outcome		Mapping
CO1	Describe general programming knowledge to develop android mobile applications and recall acquired skills of using Android studio, AVD development tools.	Employability
CO2	Describe specific requirements, possibilities, and challenges when developing for a mobile context and describing their ability to create applications with localization of different language support.	Employability & Skill development
CO3	Demonstrate the interaction of user and with android application to create fragment on or over activity, creating application widget for home screen, sensor data.	Employability & Skill development
CO4	Apply a plan to carry out design work including developing a prototype that can be evaluated with a specified user group and illustrating the deployment of the app on various mobile API levels.	Employability & Skill development
CO5	Develop an application for GPS service, multimedia files and justify their ability to debug program/application running on android mobile devices.	Employability
CO6	Demonstrate the ability to reflect over possibilities and demands in collaborative Advanced Android mobile application development.	Employability & Skill development

Section-A

Fragment: Creating a fragment and its layout, adding a fragment to an activity, Fragment lifecycle, Communication between a Fragment and an Activity. App widgets: creating widget to an app, updating the widget provider-info. Sensors: Discovering sensors and sensor capabilities, sensor configuration. Device orientation and rotation. Motion and position sensor.

Section-B

Performance: Good performance, performance test, frame rate, minimize overdraw, Garbage collection, Memory leak and memory churn, memory profiler tool, Network and battery best practices, Optimizing images and serializing data. Localization: Understanding language and locale settings, using the Translation Editor, Formatting date and time, numbers, currencies.

Section-C

Location: Places: Using the place-picker UI, Getting the device's current place, using the place-autocomplete service. Mapping: Google Map objects, Map types, Configuring the initial map state, Lite mode, Map style.

Section-D

Custom views: Creating and drawing the custom view, using custom view in a layout, using property accessories and modifiers. Canvas: Canvas object, creating and drawing canvas object, drawing shapes and text, Transformations, Clipping, saving and restoring a canvas. Animation: View animation, Property animation, Drawable animation, Physics-based animation.

LIST OF EXPERIMENTS:

Lab: Creating a Fragment with a UI and communication with a fragment

Lab: Building app widgets

Lab: Working with sensor data

Lab: Working with sensor-based orientation

Lab: Using the profile GPU Rendering tool

Lab: Using the Debug GPU Overdraw and Layout Inspector tools

Lab: Using the Systrace and dumpsys tools, memory profiler tool

Lab: Using resources for languages

Lab: Using the device location

Lab: Using the places API

Lab: Adding a Google Map to your app

Lab: Creating a custom view from scratch and View subclass

Lab: Creating and drawing a canvas object

Lab: Creating property animations

Text Books:

Advanced Android Application Development by Joseph Anuzzi (Jr.), Lauren Darcey, Shane Conder, Addison-Wesley.

<https://developers.google.com/training/courses/android-advanced>

Android Developer Advance – Concepts by Developed by Google Developer Training

Reference Book:

Professional Android 2 Application Development by Reto Meier, Wiley.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	2	-
CO2	-	3	-	3	-	-	2	-	2	-	-	-	-	2
CO3	-	-	2	-	-	-	2	3	2	-	3	-	2	-
CO4	-	3	-	-	3	2	-	-	3	3	-	-	2	-
CO5	-	-	2	-	-	3	-	3	-	2	3	-	-	2
CO6	2	-	-	3	2	-	-	-	-	-	-	3	-	-

Course Title/ Code	Data Warehousing and Data Mining (CSH313B-T) & (CSH313B-P)
Course Type:	ELECTIVE (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	The student will be able to design and represent multi-dimensional models and obtain business intelligence from them.

Course Outcome		Mapping
CO1	Describe the basic knowledge of data warehouse, data mining and Data Decision.	Employability & skill development
CO2	Illustrate the types of Data warehouses.	Employability
CO3	Differentiate different types of database systems.	Employability & skill development
CO4	Apply analytical processes to handle data warehousing issues	Employability & skill development
CO5	Describe the classification of data mining systems.	Employability

Section-A

Introduction to data ware house and decision making: Need for data warehousing, Escalating Need for strategic information, Decision making, failures of past decision-support systems, operational versus decision-support systems, data warehousing – the only viable solution. Applications of Data ware house: Operational System and Business Intelligence.

Data ware house: Data warehouse definition, types of data warehouses and data marts, types of data marts, ETL process, 3 – Tier data warehouse architecture, Meta data, role of meta data repository in data warehouse, distributed and virtual data warehouses.

Section-B

Multidimensional Data Model: Difference between Database System and Data Warehouse, Multidimensional data model, Facts, Dimensions, Measures, Data cubes, Schemas for Multidimensional Database (Stars, snowflakes and fact constellations) defining schemas. OLAP Technology: Starnet query

model, Concepts Hierarchies, Partitioning strategies, OLAP operations: Slice, Dice. Roll up, Drill down, Pivot etc., Types of OLAP servers: ROLAP, MOLAP, HOLAP. Data warehouse implementation: Computation of data cubes, Partial Materialization, Indexing OLAP data, and Efficient Processing of OLAP queries. Tuning and testing of data warehouse.

Section-C

Data Mining: Data mining definition & task, KDD versus data mining, Data Mining Applications, Data preprocessing, Classification of data mining systems, Data mining task primitives, data mining techniques, Data mining query languages. Data mining techniques: Mining frequent Patterns, Association, and correlation.

Section-D

Classification & Prediction: Decision tree knowledge discovery, Bayesian Classification, Neural Networks (MLP) & Support Vector Machines (SVM). Classification Accuracy and error measures, evaluating the accuracy of Classifier.

Clustering Analysis: K-means and K-Medoids, outlier analysis. Mining complex data object: (Spatial databases, Multimedia databases, Time series and Sequence data mining Text Databases and mining Word Wide Web).

LIST OF EXPERIMENTS:

To generate a data table in MS Access and perform various tasks on the data.

To Implement Pivot Table, Report Generation for the table data.

To study /implementation of various task on data using MS Excel.

To implement Pivot Chart, Pivot table of a given Data in table using MS Excel.

Introduction to data mining tool.

To implement Classification.

To Implement Association rule.

To implement Clustering.

To study PDI (Pentaho Data Integration) IDE.

To Create new repository in PDI and performing various tasks.

Text Books:

Data Warehousing In the Real World; Sam Anahory & Dennis Murray; 1997, Pearson No. of copies in the Library.

Data Mining- Concepts & Techniques; Jiawei Han & Micheline Kamber- 2001, Morgan Kaufmann. No. of copies in the Library.

Data Mining Techniques; Arun Pujari; 2001, University Press; Hyderabad. No. of copies in the Library.

Reference Book:

Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons, 2003. No. of copies in the Library.

Sam Anahony, “Data Warehousing in the real world: A practical guide for building decision support systems”, John Wiley, 2004.

W. H. Inmon, “Building the operational data store”, 2nd Ed., John Wiley, 1999.

Mattison R., Web Warehousing and Knowledge Management, Tat McGraw-Hill .

Ponniah P., Data Warehousing, Wiley.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3			3						3	3	3	3
CO2	3	3	2	3	3							3	3	3
CO3	3	3	3	3	3					3		3	3	2
CO4	3	3	3	3	2				3		3	3	3	3
CO5	3	3	3	3	3				3		3	3	3	3

Course Title/ Code	Deep Learning (CSH316B-T) & (CSH316B-P)
Course Type:	ELECTIVE (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	The course objective is to help students learn, understand, and practice Deep Learning approaches.

Course Outcome		Mapping
CO1	To present the mathematical, statistical and computational challenges of building neural networks.	Employability & skill development
CO2	To study the concepts of deep learning.	Employability
CO3	To introduce dimensionality reduction techniques.	Employability & skill development
CO4	To enable the students to know deep learning techniques to support real-time applications.	Employability & skill development
CO5	To examine the case studies of deep learning techniques.	Employability

Section A

INTRODUCTION : Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

DEEP NETWORKS : History of Deep Learning- A Probabilistic Theory of Deep Learning Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks-Convolutional Networks- Generative Adversarial Networks (GAN), Semisupervised Learning

Section B

Activation functions and parameters Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters v/s Hyper-parameters

Auto-encoders & Regularization Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization

Section C

Deep Learning Models Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

OPTIMIZATION AND GENERALIZATION : Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

Section D

Deep Learning Applications Image Processing, Natural Language Processing, Speech recognition, Video Analytics

CASE STUDY AND APPLICATIONS : Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection-Bioinformatics- Face Recognition- Scene Understanding Gathering Image Captions

List of Experiments:

1. Classification and regression algorithms.
2. Naive Bayes learning algorithm
3. K-Means Clustering.
4. Artificial Neural Network (with back-propagation).
5. Decision Trees.
6. Recursive induction of decision trees
7. Random Forest.
8. Reinforcement learning

Text books:

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	2										3	3
CO2	3	3	3	2									3	3
CO3	3	3	3	3									3	3
CO4	3	3	2	3	3				3		3	3	3	3
CO5	3	2	2										3	3

Course Title/ Code	.NET (CSW406B)
Course Type:	Elective
L-T-P Structure	(0-0-2)
Credits	1
Objective	Students shall be able to understand (A) database driven web application concepts using (B) C#, ASP.NET and Microsoft SQL Server and (C) analyse the different scenarios and requirements in order to (D) design and develop websites.

Course Outcome	Mapping
CO1: Code solutions using .NET Framework and develop Console Applications.	Employability
CO2: Describe the basic structure of a C# .NET project and demonstrate the use of the integrated development environment (IDE).	Employability
CO3: Create applications using Microsoft Windows Forms and ADO.Net.	Employability & Skill development
CO4: Solve queries of databases using SQL Server	Employability & Skill development
CO5: Deploy ASP.NET web applications using ADO.NET.	Employability/Skill

Section –A

Introduction to C#: C# Overview, data types, type conversions, Decision making, Loops, Encapsulation, Arrays, Strings, Structures, Exception Handling.

Section –B

Introduction to window forms, Form controls, User defined controls, ADO.NET-connected and disconnected architecture, Connection of form with database: Insert, Delete, Update, Retrieve.

Section-C

Introduction to .NET Technology & Various Control: Overview of .NET Framework, tools available in tool box of the web form, Simple application using web controls, Simple application using custom controls. Master Page, Content Pages and Validating User Input: Implementation of the master page and add the same master page in the main project, Create the various form of specific application and embed the data in the project, implementation of various validations for controls using scripting language

Section –D

Concepts of Database Access and Database Handling: Creating tables in the database, database connectivity, and Display records by using database, Insertion and deletion of records from the database, View and searching the data on web form. Server Control and Tracing in ASP.NET: Using server control, Adding Event Procedure to web server control, Tracing in ASP.NET web application, Remote debugging.

Deploying a Web Project: Preparing a Website for Deployment, publishing a website, moving database to a remote server, Build real life application with reports.

Text Books:

1. Beginning ASP.NET in C# by Wrox
2. Professional ASP.NET 2.0by BillEvjen

Reference Books:

1. Beginning ASP.NET by ImarSpaanjaars
2. Visual C# 2008: How to ProgrambyPaul J. Deitel, Harvey M. Deitel Prentice Hall, 2009

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	3	-	3	-	-	-	2	-	-	-	-	-
CO2	3	2	2	-	3	-	-	-	2	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	3	2	3	3	3	2
CO4	3	2	3	-	3	-	-	-	3	-	-	-	-	-
CO5	3	3	3	-	3	-	-	-	3	2	3	3	3	2

Course Title/ Code	User Experience (CSW407B)
Course Type:	Elective (Departmental)
L-T-P Structure	(0-0-2)
Credits	1
Objectives	Students will be able to learn the ability to design good interface. To make clear distinction between good design and better design.

Course Outcome	Mapping
CO1: Students will be able to comprehend and apply the foundational fundamentals of user experience design	Employability
CO2: Students will be able to analyze and evaluate the elements that make a great user experience.	Employability
CO3: Students will be able to recognize how the elements of user experience work together.	Employability
CO4: Students will be able to demonstrate how strategy is an element of user experience.	Employability & Skill development
CO5: Students will be able to design a user interface in a way that supports and enhances the cognitive and affective processes that learning involves.	Employability & Skill development

Section A

HCI: Introduction to HCI, Goals of System Engineering, Goals of User-Interface Design, Usability of Interactive Systems Motivations for Human Factors in Design, Guidelines, Principles and Theories, Conceptual, Semantic, Syntactic and Lexical Model, GOMS (Goals, Operators, Methods, and Selection) and Keyboard-level model, HCI, Object-Action Interface Model. Interaction Styles: Introduction to interaction Devices, Keyboards and Function Keys, Pointing Devices, Speech and Auditory Interfaces, Speech Recognition, Image and Video Displays, Printers, Response Time and Display Rate with Respect to Display, Goals of Collaboration, Asynchronous and Synchronous Interfaces, Face-to-Face Interfaces.

SectionB

Design Processes: Three Pillars of Design, Development Methodologies, Ethnographic Observation, Participatory Design, Scenario Development, Expert Reviews.

Tools and Testing: Usability Testing and Laboratories, Acceptance Testing, Evaluation during Active Use, Specification Methods, Interface Building Tools, Evaluation Tools.

Section C

Direct Manipulation (examples, explanations), Visual Thinking and Icons, 3D Interfaces, Virtual Reality, Introduction to Menu Selection, Form Fill-in and Dialog Boxes, Task Related Organizations, Fast Movement through Menus, Item Presentation Sequences, Response Time and Display Rate, Data Entry with Menus, Menu Layout, Command-Organizational Strategies, Naming and Abbreviations, Command Menus, Natural language in Computing.

Section D

Presentation Design Issues: Error Messages, Display Design, Individual-Window Design, Multiple Window Design and Coordination by Tightly-coupled Windows, Color.

Information Search & Visualization: Introduction, Search in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interfaces, Information Visualization, OAI Model for Website Design.

LIST OF EXPERIMENTS:

1. Introduction to PENCIL Tools and its Controls.
2. To study the process of creating an animation with 2D objects, motion and sound.
3. To draw the Path and resizable shapes.
4. To draw the images and special constraints for Dimension and Handle.
5. Using external SVG.
6. Drawing sketchy lines.
7. Designing a model for website development.
8. Designing a User Interface.
9. Creating a PENCIL based Presentation with UI Controls.
10. Project based on PENCIL.

Text Books:

1. Schneiderman, Ben and Catherine Plaisant, Designing the User Interface (DTUI), Fifth edition, (Addison-Wesley, 2010)
2. Dix, Alan, Janet Finlay, Gregory D Abowd, Russell Beale, Human-Computer Interaction (HCI), Third edition (Pearson, 2004)

Reference Book:

1. Bill Buxton, Sketching User Experiences: Getting the Design Right and the Right Design (Interactive Technologies) , Elsevier, 2007.
2. Bill Moggridge, Designing Interactions, MIT Press, 2008.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 1	PO 2	PO 6	PO 1	PO 2	PO 9	PO 1	PO 2	PO1 2	PO1	PO2
CO1	2	2	-	2	2	-	-	-	-	-	-	-	2	-
CO2	3	2	2	-	2	2	-	-	-	-	-	-	-	-
CO3	3	2	-	2	2	-	-	-	-	-	-	-	3	3
CO4	3	2	2	-	-	2	-	-	-	-	-	-	-	3
CO5	3	3	-	-	3	2	-	-	-	-	-	-	3	-

Course Title/ Code	DATA VISUALIZATION USING TABLEAU(CSW423B)
Course Type	Elective
L-T-P Structure	(0-0-2)
Credits	1
Objectives	To model and design an object oriented system.

Course Outcomes	Mapping
CO1- To learn visual perception, visual representation of data, Gestalt principles, information overloads. (Knowledge)	Skill Development
CO2- To create visualization reference model and Design of visualization applications in real life problems. (Comprehension & Applications)	Employability
CO3- Students will learn about 3D visualization of data and apply on real life problems. (Analysis)	Employability
CO4- Apply the concepts of Recent trends in various perception techniques for a given problem. (Application)	Employability

Section-A

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

Section-B

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Section-C

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents. Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization.

Section-D

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations. Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Reference Book:

WARD, GRINSTEIN, KEIM, Interactive Data Visualization: Foundations, Techniques, and Applications.
Natick : A K Peters, Ltd. E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	-	3	3	-	-	-	-	-	-	-	3	2
CO3	3	3	2	3	3	-	-	-	-	-	-	-	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	-	3	3

Course Title/ Code	Advanced Java (CSW308B)
Course Type	Core (Department)
L-T-P Structure	(0-0-2)
Credits	1
Objectives	Students will be able to design/Create GUI desktop applications and web applications with database connectivity along with client server architecture and frameworks for solving real life problems.

Course Outcome	Mapping
CO1: Demonstrate programming in Core Java, Swing, Java Database Connectivity API (JDBC)	Employability & Skill development
CO2: Describe the program structure in Client Server network Communication, RMI, JavaBeans	Employability & Skill development
CO3: Classify the various functionalities of Java Servlet	Employability & Skill development
CO4: Compare static and dynamic content by using Java Server Pages	Employability & Skill development
CO5: Analyze the different database problems by using Java Framework: Struts	Employability
CO6: Create new technological heights in Java for own selves	Employability

Section-A

GUI Application: Review of Java Basic Features (OOPS concepts, data types), Event Handling: Delegation event model, event interfaces & classes, Swing: Swing containers, Layout Manager, Swing Components (Jlabel, JFrame, JPanel, Swing buttons, Jlist, JComboBox, Jradio buttons, JTextField, Jtable, Jtree), Swing Menu. JAR files

Java Database Connectivity: Connectivity model, java.sql package, JDBC Exception classes, Database connectivity steps, Data manipulation and navigation, creating database applications.

Section-B

Java Generic: type parameters, methods and classes, Lambda expression with single or multiple parameters, Collection framework: Collection interface and methods, List, Queue, Set & Map –interfaces and classes, Iterator, ListIterator & Enumeration interface.

Networking: Networking basics, Client/server model, Socket programming using Socket and ServerSocket class, InetAddress class, URL & URLConnection class, create networking applications.

Section-C

Java Servlets: Lifecycle & Architecture, ServletConfig, ServletContext, Sharing information among servlet, GenericServlet, ServletRequest, and ServletResponse, HttpServletRequest, HttpServletResponse and HttpServlet, Request-response, headers, GET, POST.

Session Management: Hidden form fields, Cookies, session tracking, HttpSession, Exception handling and error pages.

Section-D

Java Server Pages: Introduction, Architecture, Lifecycle, JSP implicit object, JSP syntax: directives, scripting element, standard action elements, Model View Controller (MVC), Data Sharing among JSP pages.

Frameworks in Java Struts: Introduction to the Apache Struts, MVC Architecture, Struts Architecture, How Struts Works? Introduction to the Struts Controller, Introduction to the Struts Action Class, Using Struts Action From Class, Using Struts HTML Tags, Introduction to Struts Validator Framework, Client Side Address Validation in Struts, Custom Validators Example, Developing Application with Struts Tiles.

LIST OF EXPERIMENTS:

GUI using Swings
Event Handling in GUI application
Java Database Connectivity (JDBC)
Java Generic program
Java Collection program
Networking and Socket Programming
Servlet application
JSP application
Struts framework

Text Books:

Core Java, Volume II: Advanced Features 9th Edition by Cay Horstmann
Java: The Complete Reference, Ninth Edition
Advanced Java Programming by Uttam K. Roy (Oxford university)

Reference Book:

O'Reilly Series for JSP and Servlets
O'Reilly Series for Swings and AWT

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3				2				3	
CO2	3	3	3	2	3								3	
CO3	3	3	3		3				2				3	
CO4	3	3	3	2	3				2				3	
CO5	3	3	3	2	3				2				3	
CO6	3	2	2			3	3	3	2	3	3	3	3	

Course Title/ Code	Law Relating to Intellectual Property Rights (LWS325)
Course Type:	Elective
L-T-P Structure	(2-0-0)
Credits	2
Objectives	The objective of this paper is to orient students to legal studies. The paper focuses on generally about law and legal system.

CO STATEMENT	Mapping
CO1: Understand the basics of Intellectual Property Rights	Employability
CO2: Categorize different types of intellectual properties	Skill development
CO3: Recognize the crucial role of intellectual property in different industries.	Employability
CO4: Understand the procedural aspect pertaining to application and grant of patent, trademark, geographical indication etc.	Skill development

Section A

Introduction to IPRs and Trademark and Trade Secrets (Contact Hours 4)

Introduction to various types of IPR Laws

Protection of Trademarks under Trademarks Act – Basic legal Framework

Trade Secrets and protection thereof

Section B

Protection of Copyright, Traditional Knowledge, Design and Integrated Circuits (Contact hours 4)

Legal Framework relating to Copyright protection in India

Protection of Industrial Designs under Designs Act

Protection of integrated circuits

Section C

Law relating to Patents (Contact Hours - 4)

Legal framework for registration and protection of patents and related rights

Section D

IT Law and Cyber Offences and other IPRs (Contact Hours – 4)

Introduction to Information Technology Act, 2002

Cyber Offences

Geographical Indicators and PPVFBR

Tutorial activities 1 Hr/Week

Statutes and Case Laws

Case studies from India and abroad

Course Outcomes	Program Outcomes													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	2	-	-	-	2		2	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	-	-

Course Title/ Code	Essentials of Peace and Sustainability (PSE301)
Course Type:	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2

Course Objective

To make participants understand the philosophical underpinnings of “Peace” at Self, Society, Nation and Global level. The course aims at sensitizing participants on aspects of building and maintaining Peace in World through Sustainable Development and creating a mindset to acknowledge the importance of Peace through Collaborative and sustained efforts in personal, social, economic and governance. The course develops sound concepts which participants are made to apply through a series of Projects, Assignments, Group Work and Seminars and helps participants’ growth into “Ambassadors of World Peace as Digital Professionals and sensitive Global Social beings”.

Course Outcome	Mapping
CO1: Understand the basic concept of Peace and Sustainability	Employability & Skill development
CO2: Understand and apply thoughts on Peace	Employability & Skill development
CO3: Identify the challenges of peace	Employability & Skill development
CO4: Analyze the situation and solve problem	Employability

Section A

Basic understanding of Peace and Sustainability:

Concept of Peace and Approaches to Peace

Understanding peace from different perspective: Self, Local Community, National and Global.

Concept of Sustainability and Sustainable Development Goals (2030) as drivers of sustainable, health and social initiatives

Why Sustainability

Assignment:

Document analysis of Sustainable development goals agenda

Creative expression based on sustainable development goals

Section B

Understanding thoughts on Peace:

Study of relevant extracts from the writings of Indian thinkers: Gandhi, Tagore, Sri Aurobindo, Vivekananda

Western thinkers: Russell, Iqbal, Dalai Lama, Nelson Mandela
(Please follow Annexure A-reading references)

Assignment:

Panel discussion by students

Discussion forums on different aspects of Peace

Section C

Understanding challenges to peace

Challenges to peace-stress, conflicts, crimes, terrorism, violence and wars

Ongoing conflicts in the political, economic, socio-cultural and ecological sphere at national and international level

Impact of media- The use of perspective, symbols, stereotypes, and rhetoric in analyzing communication and representation of contentious issues in television and other modern media.

Assignment:

Case study analysis

Section D

Peaceful and Sustainability conscious individual

Being “Peace Ambassador”

Role of self in reducing prejudices, biases and stereotypes, nurturing positivity, making choices in response to crises in personal, social and professional life

(These topics should be covered through games and activities)

Developing Core competencies and life skills: Negotiation Rational thinking, System thinking, conflict resolution

(These topics should be covered through workshops)

Cultivating the skills necessary for peace: Introspection and reflective thinking, Mediation, Dialogue

(These topics should be covered through experiential learning through training and practices)

Assignment

Reflective journaling

Being Sustainability conscious individual

3As of Sustainable development goals-oriented initiatives: Awareness, Appreciation, Action

Power of One

Role of Organizations, NGO and Government

Role of technology –Digital literacy and media literacy

Assignment

Project –Students will choose one of the sustainable development goals. Decide the initiative to achieve the goal, execute the initiative. Write a summary report on it and present in symposium.

Some of the suggested areas (But not limited to)

Gender stereotyping

Gender equality

Quality education

Carbon footprints

Ecological footprints
 Water crisis
 Waste water management
 Climate change
 Biodiversity

Annexure A: Reading material

Mahatma Gandhi (Brute Force and Passive resistance)

https://www.mkgandhi.org/hindswaraj/chap16_bruteforce.htm

https://www.mkgandhi.org/hindswaraj/chap17_passiveresistance.htm

Tagore (‘Civilization and Progress’ and ‘Nationalism in India’)

<http://tagoreweb.in/Render/ShowContent.aspx?ct=Essays&bi=72EE92F5-BE50-40D7-8E6E-0F7410664DA3&ti=72EE92F5-BE50-4A47-2E6E-0F7410664DA3>

<http://www.swaraj.org/tagorecivilization.htm>

Sri Aurobindo (‘The Ideal of Human Unity’)

<http://www.collectedworksofsriaurobindo.com/index.php/readbook/03-the-turn-towards-unity-its-necessity-and-dangers-vol-the-ideal-of-human-unity>

Russell (‘Knowledge and Wisdom’)

<https://russell-j.com/1073-KW.HTM>

Iqbal (‘Is Religion Possible’)

<http://www.allamaiqbal.com/works/prose/english/reconstruction/07.htm>

Dalai Lama (‘Universal Responsibility’)

<https://www.lamayeshe.com/article/global-community-and-need-universal-responsibility>

Nelson Mandela (‘Alternative politics truth and reconciliation’)

http://www.africa.upenn.edu/Govern_Political/Mandel_100.html

Work of Swami Vivekananda

Sustainable development goals

<https://sustainabledevelopment.un.org/sdgs>

<https://www.un.org/sustainabledevelopment/peace-justice/>

Sustainable development goals in action by countries, groups and individuals

<https://undg.org/wp-content/uploads/2016/12/SDGs-are-Coming-to-Life-UNDG-1.pdf>

<https://www.un.org/sustainabledevelopment/be-the-change/>

<https://sdgsinaction.com/>

<https://sustainabledevelopment.un.org/partnerships/goodpractices>

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2		-	-	3	3	3	3	2	2	-	2		2
CO2	2		-	-	2	3	3	3	2	2	-	2		2

CO3	2	2	-	-		3	3	3	2	2	-	2		2
CO4	2	3	-	3		3	3	3	3	3		2		2

Course Title/ Code	Introduction to Finance (MCS232)
Course Type:	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2
Objective	To Provide an in-depth view of the process in financial management of the firm

Course Outcome	Mapping
CO1: To take an overview of financial management and its need to take financial decisions.	Employability & Skill development
CO2: To understand financial statements and distinguishes between profit & loss and Balance sheet of different business organizations.	Employability & Skill development
CO3: To identify the different sources of long-term finance and differentiate amongst equity, preference and Debt	Employability & Skill development
CO4: To elaborate and apply various techniques of capital budgeting and analyses cost of capital and capital structure	Employability

SECTION-A

Introduction to Finance; Forms of Business Organization; Overview to financial statements, Balance Sheet, Profit and Loss Account, Cash Flow Statement.

SECTION-B

Financial Analysis and Planning; Financial Ratios, Break Even Analysis Sources of Long-term Finance – Equity Capital, Preference Capital, Terms Loans, Debentures; Raising Long term Finance.

SECTION-C

Time Value of Money, Capital Budgeting- Techniques of Capital Budgeting, Net Present Value and Payback Period; Capital Structure and Cost of Capital.

SECTION-D

Working Capital: Introduction, Components of Current Assets and Current Liabilities, Operating Cycle, Estimation of Working Capital; Operating Income , Earning Before Interest and Tax (EBIT).

Suggested Readings:

Pandy, I.M., Financial Management, Vikas Publishing House, New Delhi

Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi

Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, Financial Management, Pearson Education

Chandra, Prasanna, Financial Management, TMH, New Delhi

Van Horne, James C., Financial Management and Policy, Prentice Hall of India

Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.

Kishore, R., Financial Management, Taxman's Publishing House, New Delhi

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	2	2	2		2
CO2	-	-	-	-	-	-	-	-	-	-	2	2		-
CO3	-	-	-	-	-	-	-	-	-	-	2	2	-	2
CO4	-	-	-	-	-	-	-	-	-	-	3	3		-

Course Title/ Code	PROFESSIONAL COMPETANCY ENHANCEMENT-IV(CDO302)
Course Type:	Allied Core
L-T-P Structure/Credits	(6-0-0)
Credits	1

Course Outcome	Mapping
CO1: Students will be able to apply the short tricks on geometry & calculation problems.	Employability
CO2: Students will be able to solve problems on Modern Mathematics & Numbers.	Employability
CO3: Students will be able to solve data related problems.	Employability & Skill development
CO4: Students will be able to demonstrate their vocabulary and grammar to solve complex questions	Employability & Skill development
CO5: Students will be able to write formal text with accuracy and ease	Employability & Skill development
CO6: Students will be able to demonstrate speed reading	Employability & Skill development

SECTION-A

Quantitative Aptitude

Modern Math

Permutation and Combination

Principal of counting and basic formulas

Arrangements, Selection and Selection + Arrangement.

Linear/Circular arrangements, Digits and Alphabetic Problems and Applications.

Probability

Events and Sample Space, Basic Formulas.

Problems on Coins, Cards and Dices.

Conditional Probability, Bayes' Theorem and their Applications.

Advanced Math

Mensuration 1- Areas

Different types of Triangles and their area and perimeter.
Different types of Quadrilaterals and their area and perimeter.
Circumference and Area of Circle, Area of Sector and length of Sector.
Mixed Figures and their Applications.

Mensuration 2- Surface Areas and Volumes

Problems on Cubes & Cuboids, Cone, Cylinder and Sphere.
Prism and Pyramid.
Mixed Figures and their Applications.

SECTION-B

ALGEBRA:

Linear and Quadratic equations.
Inequalities.
Integral Solutions and Max and Min values
Professional Writing
Profiling on Social Sites: LinkedIn, Facebook, Instagram
Cover Letter/Emails
Resume Writing

SECTION-C

Group Discussions
Dos and Don'ts of a Group Discussion
Roles played in a Group Discussion
Tips for Cracking a Group Discussion

SECTION-D

Managing Interviews
Developing the employability mindset
. Preparing for Self –Introduction
Researching the employer
Portfolio Management
Answering Questions in an Interview

Text Books/Reference Books:

Quantitative Aptitude : R S Aggarwal, S Chand & Company Pvt Ltd
Quantitative Aptitude for CAT: Arun Sharma
Verbal Ability and Reading Comprehension: MVN Enterprises

Weblinks:

<http://www.indiabix.com/aptitude/questions-and-answers/>
<http://www.indiabix.com/non-verbal-reasoning/questions-and-answers/>

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO1 2	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	2	-	-	2	-	2
CO2	2	2	2	-	-	-	-	-	2	-	-	2	-	3
CO3	2	3	2	-	-	-	-	-	2	-	-	2	-	3
CO4	2	2	3	-	-	-	-	-	2	2	-	2	-	2
CO5	2	-	-	-	-	-	-	-	2	2	-	2	-	2
CO6	-	-	-	-	-	-	-	-	3	2	-	2	-	2

Course Title/Code	Natural Language Processing (CSH324B-T) & (CSH324B-P)
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	The course objective is to help students learn, understand, and practice Natural Language Processing & Deep Learning approaches.

Course Outcome	Mapping
CO1 To demonstrate the basic concepts and techniques of Deep Learning.	Employability
CO2 Demonstrate the understanding of pre-processing in NLP.	Employability
CO3 Apply deep learning in NLP applications.	Employability
CO4 Analyze the performance of NLP use cases in various real-world problems	Employability & Skill development
CO5 Design Solutions to a range of complex real world problems using NLP techniques.	Employability & Skill development

SECTION-A

Natural Language Processing

Introduction to Natural Language Processing

Types of NLP systems, how computer understands text, Terminologies used in NLP, Steps Involved in NLP, Steps involved in preprocessing, Pipeline of NLP Problems o Challenges in NLP

SECTION-B

Words & Vectors

Concepts of words and vectors, Techniques of converting words to numbers, GloVe Word Embeddings, Word2Vec and its types, such as Skip Gram, Model and Continuous BOW o Advanced word vectors, limitations of CBOW and Skip Gram

SECTION- C

Processing Techniques

Word window classification, Dependency parsing, Constituency parsing o Machine translation, Attention, End to end models for speech processing, Deep learning for speech recognition, Tree recursive neural networks o RNN for language odeling, Dynamic neural network for question answering

SECTION-D

Case Studies

Smart Home Services Provider Uses Natural Language Generation to Create Highly Personalized Website Copy, Online Education Company Improves Customer Support with Autosuggestion of Macros, Using Natural Language for Health care Summaries, Microsoft Gets the Pulse of Customer Sentiment with Natural Language Processing

List of Programs

- Text Classification using Word Embeddings.
- Find Synonyms and antonyms using Word Embeddings.
- Introduction to Topic Modelling.
- Converting a Foreign Language to English using Machine Translation(German to English).
- Twitter Sentiment Analysis.
- Explaining Lemmatization, PoS Tagging,
- Stemming and Tokenization using an Example.
- Understanding Dependency Parsing in a given sentence.
- Perform Speech to Text Conversion using PyAudio and Google Speech Recognition.
- Creating Custom Speech Recognition Corpus.
- Introduction to Dynamic Memory Network.
- Dialog Generation using Deep Learning.
- Course Learning Outcomes (CLOs):On completion of this course, the students will be able to: -
- Understand the sentiment analysis
- Learn text classification concepts

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2			2								2	3
CO2	3	2		3	2								3	2
CO3	2	2	3	2	2			2	2				2	2
CO4	2	2	3	2	2			2	3	2	2		2	2
CO5	2	2	3	3	3	2		2	3		2	3	2	2

Course Title/Code	Modern Architecture Patterns (CSH322B-T) & (CSH322B-P)
Course Type:	Elective
Credits	5
L-T-P Structure	3-1-2
Objective	Upon completion of this course the student will attain knowledge of envisioning architecture, creating and analyzing architecture.

Course Outcome	Mapping
CO1 Student would be able to Recall the role of analyzing architectures.	Employability
CO2 Student would be able to Explain the concepts of the architecture and build the system from the components.	Employability
CO3 Student would be able to Apply his knowledge for creating an architecture for given application.	Employability & Skill Development
CO4. Student would be able to Classify creational and structural patterns.	Employability & Skill Development
CO5 Acquire Solid foundation in the field of designing and documenting software architecture.	Employability & Skill Development

SECTION-A

Introduction to Software Architecture:

Software architecture: Overview, Stakeholders, Stakeholders' Areas of Concern, Software Architecture: Definition, Architecture Description, ISO/IEC/IEEE 42010, Architecture Structural Description, Architecture Behavioral Description, Benefits, Architectural Patterns, Architectural Style Vs. Architectural Pattern,

SECTION-B

Introduction to Design Patterns

Design Pattern: Overview, Design Pattern Discovery, Elements, Documenting Design Pattern, Design Pattern: Benefits, Criticisms, Design Pattern Classifications, Creational Patterns, Structural Pattern, Behavioral Patterns, Architectural Patterns Vs. Design Pattern, Anti Patterns, Anti Pattern Vs. Bad Habit, God Object, Anti Patterns in Object Oriented Programming (OOP)

SECTION-C

Architectural Patterns

Layered Pattern, Layers, Use Cases, Layered Pattern: Advantages, Layered Pattern: Disadvantages, Event-driven Pattern: Definition, Components, Use Cases, Advantages & Disadvantages

SECTION-D

Microkernel & Microservices

Microkernel Pattern: Definition, Components, Use Cases, Advantages & Disadvantages, Microservices (MS): Definition, MS: Architecture, MS Principles: Single Responsibility, MS Principles: Loose Coupling, Domain Driven Design, Principles: Service Discovery, Fault Tolerance/Circuit Breaker, Automation, Use Cases, Advantages & Disadvantages, Space-Based Architecture, Use Cases, Advantages & Disadvantages

SECTION-E

Design Patterns

Creational Design Patterns, Factory pattern, Builder Pattern, Prototype Pattern, Singleton Pattern, Structural Design Patterns, Adapter Pattern, Bridge Pattern, Composite Pattern, Decorator Pattern, © Pattern, Flyweight Pattern, Proxy Pattern, Behavioural Design Patterns, Command Pattern, Iterator Pattern, Mediator Pattern, Memento Pattern, Observer Pattern, Observer Pattern, template pattern, Visitor Pattern

Modern Architecture Patterns Lab

Create a Java Project

Introduction to the Course

Creational Design Patterns- Factory Pattern, Abstract Factory Pattern

Builder Pattern, Prototype Pattern

Singleton Pattern

Structural Design Patterns- Adapter Pattern, Bridge Pattern

Composite Pattern, Decorator Pattern

Façade Pattern, Flyweight Pattern, Proxy Pattern

Chain of responsibility Pattern

Behavioural Design Patterns – Command Pattern, Iterator Pattern, Mediator Patter

Memento Pattern, Observer Pattern

Strategy Pattern, Template Pattern, Visitor Pattern

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	-	2	3	-	-	-	-	-	-	-	-	2	-
CO3	-	-	-	2	-	-	-	-	-	2	-	3	-	2
CO4	-	-	-	2	2	-	-	-	3	-	-	2	2	2
CO5	-	-	-	-	-	-	-	-	-	2	3	3	-	2

Course Title/ Code	Vulnerability Assessment and Penetration Testing (CSH330B-T&CSH330B-P)
Course Type	Elective
L-T-P Structure	(1-0-4)
Credits	5
Objectives	Students will have the understanding of core concept of VAPT with practical implementation

Course Outcomes:	Mapping
CO1: To impart understanding of basic VAPT Process, vulnerability assessment tools, information gathering and buffer overflows.	Employability
CO2: To impart understanding of client-side, web application attacks, password & hashing, penetration testing, network penetration testing by using Nmap.	Employability
CO3: To understand the WAPT, social engineering penetration testing, and wireless penetration testing. Also perform cloud and database security PT with the help of SQLMap, sqlninja. Introduction to tools like, sqlmap, shodan and Aircrack-ng suite.	Employability & Skill development
CO4: To integrate the learned and applied concepts of smartphone penetration testing framework, phase of exploitation, and escalating an attack with exploitation.	Employability & Skill development

Section-A

What is VAPT: VAPT Process Vulnerability Assessment Tools, Cyber Security Foundation, Essential Tools and Commands, Information Gathering: Active and Passive Ways, Vulnerability Scanning and Assessment, Buffer Overflows: Different Machine Perspective

Section-B

Client Side and Web Application Attacks, Password and Hashing: Generating and Cracking, John The Ripper, hashcat, hashkiller, Bypassing Antivirus Software, Penetration Testing, Network Penetration Testing: Nmap, Nessus, Web Application Penetration testing

Section-C

Web Application Penetration testing, Social Engineering Penetration Testing, Wireless Penetration Testing, Introduction to tools like, sqlmap shodan Aircrack-ng suite, Cloud Penetration Testing, Database Security and Penetration Testing: SQLMap, sqlninja

Section-D

Smartphone Penetration Testing Framework, Phase of Exploitation: Pre-Exploitation vs Post-Exploitations, Escalating an Attack with Exploitation: Metasploit framework guide, Cybersecurity Technologies: Introduction to Cryptography, Threat and Vulnerability Assessment

LIST OF EXPERIMENTS:

Lab Setup for the Vulnerability Assessment and Penetration Testing.

Practical's on Reconnaissance

Practical's on Scanning Various Targets

Practical's on Gaining Access

Practical's on Maintaining Access

Take walkthrough different retarded and live machines with vulnerabilities.

Solve CTF challenges with respect to information security.

Challenges to get root level access of the system and bypass it.

Practical's on Bypassing Firewall with the Help of Flagged TCP Packets

Text Books:

Penetration Testing: A Hands-On Introduction to Hacking by Georgia Weidman

Basic Security Testing with Kali Linux 2 by Daniel W. Dieterle.

Help Pages

<https://www.kali.org>

Wikipedia Pages

Vulnerability Assessment: https://en.wikipedia.org/wiki/Vulnerability_assessment

Penetration Test: https://en.wikipedia.org/wiki/Penetration_test

Tool Web Sites (Tools may vary or added as per current situation)

<https://www.kali.org>

<https://www.zaproxy.org>

<https://nmap.org>

<https://www.metasploit.com>

<https://www.wireshark.org>

<https://www.openwall.com/john/>

<https://github.com/vanhauser-thc/thc-hydra>

<https://portswigger.net/burp>

Web tutorials

<https://www.opensourceforu.com/2017/06/basics-vulnerability-assessment-penetration-testing/>

<https://www.cybrary.it/course/advanced-penetration-testing/>
https://www.tutorialspoint.com/penetration_testing/index.htm

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2	1						1	3	
CO2	2	2	2		2	2		2					3	
CO3	3	3	2		3	2		2				2	3	
CO4	2	2	2		2	2		3	2	2	2	1	2	2

SEMESTER-VII

SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CSH408B-T&P	MOBILE APP. ANALYTICS	CS	ELECTIVE	3	0	2	5	4
CSH414B-T&P	INFORMATION RETRIEVAL							
CSH403B-T&P	IMAGE PROCESSING							
MOOC	NPTEL COURSES FROM MOOC							
ECH403B-T&P MEH403B-T&P	WIRELESS SENSOR NETWORK/ OPERATION RESEARCH	EC/ME	ELECTIVE	3	1	2	6	5
MOOC	NPTEL COURSES FROM MOOC							
CSW317B CSW207	SOFTWARE TESTING AGILE TECHNOLOGIES IMAGE EDITING & ANIMATION	CS	ELECTIVE	0	0	2	2	1
MOOC	NPTEL COURSES FROM MOOC							
CSH401B-T&P	PROGRESSIVE WEB APPLICATIONS	CS	ELECTIVE	3	0	2	5	4
CSH402B-T&P	BIG DATA							
CSH315B-T&P	N/W SECURITY & CRYPTOGRAPHY							
CSH404B-T&P	CLOUD COMPUTING							
CSH307B-T&P	SOFTWARE PROJECT MANAGEMENT							
CSH423B-T&P	INTRODUCTION TO BLOCKCHAIN TECHNOLOGY							
MOOC	NPTEL COURSES FROM MOOC							
CHS234 ECS306B	ENVIRONMENTAL ETHICS & SUSTAINABLE DEVELOPMENT E-WASTE MANAGEMENT	CH/EC	ELECTIVE	1	0	2	3	2
MOOC	NPTEL COURSES FROM MOOC							

	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)			1 0	0	8	21	16
Specialization Basket								
SUBJECT CODES	SUBJECT NAME	OFFERING DEPT.	COURSE TYPE (Core/Elective)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CSH416B- T&P	COMPUTER VISION & DATA VISUALIZATION	CS	ELECTIVE	3	1	2	6	5
CSH422B- T&P	VIRTUALIZATION - CONTAINERS/CLOUD	CS	ELECTIVE	3	1	2	6	5
CSH420B- T&P	MALWARE ANALYSIS AND REVERSE ENGINEERING	CS	ELECTIVE	2	0	3	5	3.5

Detailed Syllabus**CSU01- Semester-VII**

Course Title/ Code	Mobile App Analytics (CSH408B-T) & (CSH408B-P)
Course Type	Hard (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students would be able to analyze market for the mobile application and calculating revenue.

Course Outcome	Mapping
CO1: Understand how to improve the process of application functionality and revenue by applying continuous improvement process and various revenue models.	Employability
CO2: Will be able to demonstrate and configure web and mobile application on Google Analytics and Firebase platform to analyses user activity.	Employability & Skill development
CO3: Will be able to build new reports using metrics and dimensions on Google Analytics platform.	Employability & Skill development
CO4: Will be able to plan an event tracking using Tag manager tool.	Employability & Skill development
CO5: Will be able to analyze the performance of website using A/B testing on different versions of page(s) by setting up flow experiment in Google Optimize platform.	Employability
CO6: Will be able to evaluate the analytics data from demo or real-time application using various report filters on Data Studio platform.	Employability

Section-A

Introduction to Mobile App Analytics: Defining Web Analytics :- Quantitative and Qualitative Data ,The Continuous Improvement Process ,Measuring Outcomes ; Marketing and analysis tools, App revenue models, Starting with a measurement plan:- Gather Business Requirements , Analyze and Document Website Architecture, Create an Account and Configure Your Profile , Configure the Tracking Code and Tag Pages ,Tools to set up tracking- The Mobile Tracking Code , App Tracking , The (Very) Old Tracking Code: urchin.js.

Section-B

Attracting New Users: Create Additional User Accounts and Configure Reporting Features, Creating a Google Analytics Account :-Creating Additional Profiles ,Access Levels , All About Profiles :- Basic Profile

Settings, Profile Name, Website URL, Time Zone, Default Page; Acquisition channels, Acquisition reports, High-value users, Segmentation and user attributes.

Section-C

Measuring behavior: Behavior reports overview, Reporting and Analysis Tools ,Juice Concentrate , Google Analytics Report Enhancer , Keyword Trends in Google Analytics, Screen tracking, Event tracking:- Getting Started with Event Tracking , Pulling It All Together , Implementation , Reporting ,Tracking a Distributed Object, Tracking Email – Email Messages to Complete Conversion Activities, Custom dimensions and metrics tracking:- Custom Variable Implementation ,Custom Variable Reporting ,Segmenting Members from Nonmembers , Custom Variables for E-Commerce , Custom Variables for Publishers, Enhanced Ecommerce tracking:- How It Works , Implementation , Common E-Commerce Problems ,Using E-Commerce Tracking on Non-E-Commerce Sites.

Section-D

Increasing revenue: Identifying roadblocks to revenue, Re-engaging existing users, Remarketing to new and existing users

List of Experiments

Study of various tools for analytics research

Introduction to Google Analytics tool

Setting up web tracking code.

Decide how to add tracking

Add tracking using Google Tag Manager

Add the tracking code directly to the site

Text Books:

Google Analytics by Jerri L. Ledford, Joe Teixeira, Mary E. Tyler, Wiley.

Google Analytics by Justin Cutroni, O'Reilly.

Reference Book:

Sams Teach Yourself Google Analytics in 10 Minutes by Michael Miller.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	-	-	-	3	2	3	2	3	3	3
CO2	2	3	2	3	-	-	-	-	2	2	2	2	3	2
CO3	-	-	-	-	2	-	2	-	2	2	3	2	2	2
CO4	3	2	2	-	-	2	2	2	3	3	3	3	2	3

CO5	2	3	3	3	3	3	3	3	3	3	3	3	3	2
CO6	3	2	2	-	-	-	-	-	2	-	3	3	2	3

Course Title/ Code	Information Retrieval (CSH414B-T) & (CSH414B-P)
Course Type	Elective (Departmental)
L-T-P Structure	(3-1-2)
Credits	5
Objectives	Student will be able to Model, Represent and Retrieve the information from web.

Course Outcome	Mapping
CO1: Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular McAleavy engineering problems	Employability & Skill development
CO2: Students would be able to understand concepts related to information retrieval models, retrieval performance evaluation.	Employability & Skill development
CO3: Students would be able to Apply different indexing techniques in data Base systems	Employability & Skill development
CO4: Students would be able to Analyze language models.	Employability
CO5: Acquire Solid foundation in the field of Information retrieval and Language model	Employability

Section-A

Knowledge representation – Basics of Propositional logic- Predicate logic-reasoning using first order logic-unification-forward chaining-backward chaining-resolution- -Production rules-frames-semantic networks- scripts.

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

Section-B

Information Retrieval Modeling- Information retrieval – taxonomy-formal characterization classic information retrieval-set theoretic model-algebraic model-probabilistic model structured text retrieval models-models for browsing-. Retrieval performance evaluation keyword-based querying-pattern matching-structural queries-Query operations.

Section-C

Index construction: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes Index compression: Statistical properties of terms in information retrieval, Heaps’ law: Estimating the number of terms, Zipf’s law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression.

Ontology Development- Description logic-taxonomies-Topic Maps-Ontology-Definition expressing ontology logically-ontology representations-XML-RDF-RDFS-OWL-OIL ontology development for specific domain-ontology engineering-Semantic web services

Parallel and distributed IR- multimedia IR- data modeling-query languages-. Web Searching Basics-Characterizing the Web-Search Engines-Web crawling and in dexex-link analysis

Section-D

Language models, Finite automata and language models, Types of language models, Multinomial distributions over words, the query likelihood model, using query likelihood language models in IR, Estimating the query generation probability, Language odeling versus other approaches in IR, Naïve bayes-vector space classification-support vector machines and machine learning on documents-flat clustering hierarchical clustering

List of Experiments:

Rapid Miner tool will be explored in the lab.

Text Books:

Elain Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 3rd Edition, 2003.

Reference Books:

Stuart Russell-Peter Norvig, “Artificial Intelligence – A modern Approach”, Pearson Education, 2nd Edition, 2003. (Unit I)

Michael c.Daconta,leo J. Obart and Kevin J Smith,”Semantic Web – A guide to the future of XML,Web Services and Knowledge Management”, Wiley Publishers 2003.

Christopher D. Manning,PrabhakarRaghavan and HinrichSchutze, “Introduction to Information Retrieval”, Cambridge University press, 2008.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	2	-	-	2	-	-	3	2	2	-	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	3

CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	2	3
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	2	3
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	2	3

Course Title/ Code	Image Processing (CSH403B-T) & (CSH403B-P)
Course Type	Elective (Departmental)
Credits	4
L-T-P Structure	(3-0-2)
Objective	The course objective is (A)to help students learn the basic concepts, (B)understand the image computing, and (C) image restoration procedures and (D) image compression procedures.

CO	CO STATEMENT	Mapping
CO1	Study the fundamental concepts of an image processing system.	Employability & Skill development
CO2	Understand standard methods to image creation and demonstrating.	Employability
CO3	Evaluate the techniques for image enhancement and image restoration.	Employability & Skill development
CO4	Categorize various compression techniques.	Employability & Skill development
CO5	Interpret image segmentation and representation techniques.	Employability
CO6	Develop and evaluate solutions to real life problems using image processing techniques.	Employability

Section-A

Overview to Digital Image Processing: The nature of Digital Image Processing and Applications, Fundamentals Steps in Image Processing, Elements of Digital Image Processing Systems.

Image Sampling and Quantization: Some basic relationships like Neighbors, Connectivity, Distance Measures between pixels, Linear and Non-Linear Operations.

Image Enhancement in the Spatial Domain: Histogram Processing, Arithmetic and Logic operations, Smoothing and Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Section-B

Filtering in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain, Smoothing and Sharpening Frequency Domain Filters.

Image Restoration: Introduction and types of Image Degradation, Noise Modeling- Noise Category base on distribution, correlation, source and nature. Image Restoration in the presence of Noise Only- Mean Filters, Order Static Filters.

Image Restoration Techniques: Unconstrained, Constrains, iterative and Blind image Restoration Methods.

Section-C

Image Compression: fundamentals of compression, coding redundancy, Lossy and lossless compression algorithms, Spatial and temporal redundancy, Image compression models. Some basic compression methods.

Image Segmentation: Detection of Discontinuities, Edge and boundary detection, Types of Edge detector, Region Oriented and Motion based segmentation.

Section-D

Image Representation and Description: Introduction, Boundary Representation & Descriptors, Component Labeling & regional descriptors, Introduction to Morphological operators with examples.

Object Recognition: Patterns and Pattern Classes, Decision-Theoretic Methods, Structural Methods.

List of Experiments (Using MATLAB or ImageJ Tools):

- Convert an RGB image of size 256X256 pixel's into greyscale and binary image.
- Implement the spatial image enhancement functions on a bitmap image –Mirroring (Inversion).
- Implement the spatial image enhancement functions on a bitmap image –Rotation (Clockwise).
- Implement (a) Gaussian Low Pass Filter (b) Butterworth High Pass Filter (c) Gradient and Laplacian filters
- Implement (a) Harmonic Mean Filter (b) Yp- Mean Filter (c) Median Filter.
- Implement Smoothing and Sharpening of an eight-bit color image
- Implement (a)Wavelet transformation Algorithm (b) Graham's Scan Algorithm
- Implement (a) Edge Detection using Canny, Prewitt, and Sobel operators
- Display an image size of 512X512 and its histogram
- Perform shrinking and cropping of an image
- Perform blurring and de-blurring operation on an image(256X256).
- Removal of Poisson, Salt and Pepper noise.
- Implement a function for image segmentation using second order derivative.
- Implement a function for image morphology using Morphological tools such as dilation, erosion and imfill operators.
- Implement a function for Image Restoration Model for representing the color and methods of processing the color plane.
- Implement a code to detect contour of an input image of size 512X512.

Text Books:

Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson, 2008.

S. Sridhar, "Digital Image processing", 2nd edition, Oxford 2016.

A.K. Jain, "Fundamental of Digital Image Processing", PHI, 1989.

Reference Books:

Bernd Jahne, “Digital Image Processing”, 5th Ed., Springer, 2002.

William K Pratt, “Digital Image Processing: Paks Inside”, John Wiley & Sons, 2001.

Lavanya Sharma, “Object Detection with Background Subtraction”, LAP LAMBERT Academic Publishing, SIA OmniScriptum Publishing, 2018.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	-	-	3	-	-	-	-	-	-	-	-	-	1
CO3	-	-	3	2	-	-	-	-	-	-	-	-	-	2
CO4	-	-	-	-	2	2	-	-	2	-	-	-	2	-
CO5	-	-	-	-	-	-	-	2	2	-	2	-	3	2
CO6	-	-	3	-	-	-	-	-	-	2	3	2	2	2

Course Title/ Code	WIRELESS SENSOR NETWORK (ECH403B-T) &(ECH403B-P)
Course Type:	Elective (Departmental)
L-T-P Structure	(3-1-2)
Credits	5
Objectives	Students will be able to implement communication network using wireless sensors.

Course Outcome	Mapping
CO1: Design wireless sensor network system for different applications under consideration and understand various challenges and constraints for the same	Employability
CO2: Familiarize with the architectures, functions, and performance of wireless sensor networks systems and platforms.	Employability
CO3: Understand the hardware details of different types of sensors and select right type of sensor	Employability & Skill development
CO4: Handle special issues related to sensors like power handling energy conservation and security challenges	Employability & Skill development
CO5: Explore various protocols for WSN	Employability
CO6: wireless sensor networks for a given application and understand emerging research areas in the field of sensor networks	Employability

SECTION-A

Introduction and Overview of WSN: Definitions and Background Sensing and Sensors – Challenges and Constraints- Energy, Self-Management, Wireless Networking, Decentralized Management, Design Constraints, Security, Other Challenges Applications: Structural Health Monitoring, Traffic Control

SECTION-B

Architecture: Basic sensor network architectural elements, Single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture, Sensor network scenarios, Optimization goals and figures of merit, Gateway concepts.

SECTION-C

NODE AND NETWORK MANAGEMENT: Power Management, Local Power Management Aspects, Dynamic Power Management Time Synchronization, Time Synchronization Protocols, Localization, Security

SECTION-D

ADHOC NETWORKS AND ROUTING PROTOCOLS: Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

List of Experiments

1. Use CISCO packet tracer to explore the devices on the network and then add additional wired and wireless sensor devices.
2. Realize the Communication between the nodes and Gateway.
3. Design a smart home network, analyze and control the Communication between the end devices.
4. Design a smart home network with both wired and wireless devices and explore the data transfer between the end devices.
5. Design a gate control mechanism using RFID.
6. Design and analyze a smoke detection system using various sensors.
7. Control the end devices through microcontroller.
8. Integration of sensors through Arduino.
9. Introduction to LORA kits.10. Design mini projects related to various applications of WSN.

Text Books

Fundamentals of WSN Walteneus Dargie and Christian Poellabauer Wiley Publications

Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks: Technology, Protocols, and Applications”, John Wiley & Sons.

Holger Karl, Andreas Willig, “Protocols and architectures for wireless sensor networks”, John Wiley & Sons.

Reference Books

Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks; An Information Processing Approach”, Elsevier.

C. S. Raghavendra, Krishna M. Shivalingam, Taieb Znati, “Wireless sensor networks”, Springer Verlag.

H. Edgar, Jr. Callaway, “Wireless Sensor networks, Architectures and Protocols”, CRC Press

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	
CO1	3	3	2	3	3								3	3	3
CO2	3	3	3	3									2	2	3
CO3	3	3	3	2									2	2	3
CO4	3	3	3	3	3								3	3	3
CO5	3	3	3	2	3								2	2	2
CO6	3	3	3	2	3		2						2	3	2

Course Title/ Code	OPERATION RESEARCH BY OPTIMISING TECHNIQUE (MEH403B)
Course Type	OPEN ELECTIVE
L-T-P Structure	3-1-2
Credits	5
Objective	To equip the students with the concepts of operations research required for solving the mathematical problems and their applications.

Course Outcome	Mapping
CO1: Will able to apply concept of forecasting techniques	Employability & Skill development
CO2: Analysis deterministic and probabilistic inventory model	Employability
CO3: Be able to design and solve simple models of CPM and Transportation model	Employability & Skill development
CO4: Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.	Employability

Section A

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements.

Facility Design: Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; assembly line balancing; materials handling systems.

Production Planning and Inventory Control: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; concept of JIT manufacturing system;

Section B

Inventory: functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

Linear programming: problem formulation, simplex method, duality and sensitivity analysis;

Section C

Transportation and assignment models; network flow models, simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time-cost trade-off, resource leveling.

Section D

Quality Management: Quality – concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000; design of experiments – Taguchi method.

Management Information System: Value of information; information storage and retrieval system database and data structures; knowledge-based systems.

LIST OF EXPERIMENTS:

1. To prepare a case study for producing a product on shop floor covering areas of PPC, design, Methods Engineering, Operations and Quality Control.
2. To prepare a project report for calculating the total cost (direct and indirect cost) of a product being developed for manufacturing.
3. To prepare a flow chart identifying main steps to be followed by methods engineering in manufacturing a product.
4. To prepare a bar chart for producing a generator/turbine identifying the main sub-assemblies along with their completion schedule.
5. To prepare a document for quality policy, quality systems and procedures required to be followed in the manufacture of a turbine/generator.

TEXT BOOK & REFERENCES:

1. Production Systems: Planning, Analysis and Control by J.L. Riggs
2. Production, Planning and Inventory Control by S. Narasimhan, D. W. McLeavey, and P. J. Billington
3. Operation Research by D.S.Heera, S. Chand Publication

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	2	2	3	2	2	2	-	2	2	2	3	2	-
CO2	3	2	3	2	3	2	2	-	2	2	2	3	2	-
CO3	3	2	3	2	2	2	2	-	2	2	2	2	2	-
CO4	3	2	2	2	3	2	2	-	2	2	2	2	3	-

Course Title/ Code	Software Testing (CSH405B-T) & (CSH405B-P)
Course Type:	Domain Elective (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Student will be able to implement software testing skills to test any given software based on the requirements specification.

CO	CO STATEMENT	Mapping
CO1	Describe software testing and infer mastery of the testing techniques.	Employability
CO2	Demonstrate the fundamental characteristics of good test case design and apply contemporary testing principles and techniques.	Employability
CO3	Apply Test Driven Development (TDD) to help construct software without code smells by choosing manual and automated testing approaches.	Employability & Skill development
CO4	Utilize the learnt principles and techniques of software testing to evolve further.	Employability & Skill development

Section-A

INTRODUCTION: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, V Model.

CODE TUNING TECHNIQUES: Use of Correct Data Type, ordering statements in switch, stop testing in a loop when result is known, minimizing array references, Jamming and Un-switching of Loops, Minimizing Computations in loop.

FUNCTIONAL TESTING TECHNIQUES: BLACK BOX TESTING: Exploratory Testing, Logic Coverage: Interface Testing, Boundary Value Analysis, Robustness Testing, Worst Case Testing, Equivalence Class Testing.

Section-B

FUNCTIONAL/STRUCTURAL TESTING TECHNIQUES: Decision Table based Testing, Cause Effect Graphing Technique, and White box testing, Basis Path Testing, DD Paths and Cyclomatic Complexity.

STRUCTURAL TESTING TECHNIQUES: WHITE BOX TESTING: Graph Matrices, Data Flow Testing, Mutation Testing, Unit Testing, Integration Testing.

REDUCING THE NUMBER OF TEST CASES: Regression Testing, Regression Test Process, Selection of Regression Tests, Prioritization Guidelines, Slice based testing.

Section-C

OBJECT ORIENTED TESTING: Issues in OO Testing, Class Testing: Random Testing, Class Testing: Partition based Testing, Object Oriented Integration and System Testing, System Testing.

DEBUGGING AND DEFECT TRACKING REPORT: Debugging Techniques, debugging through Code Inspection, Debugging using Logs, Debugging using IDE, Creating Defect Tracking Reports.

TEST MANAGEMENT: Test Planning, Test Management, Test Automation, Testing Tools, Static vs. Dynamic Testing Tools.

Section-D

TEST AUTOMATION USING SELENIUM: INTRODUCTION:

Why Selenium? Selenium Vs other tools (HP etc.), Selenium Components, Selenium RC vs Web driver, Selenium Core, Selenium IDE, Remote Control (Selenium1), Web driver (Selenium2), Grid, Locators & types, Test Automation, Getting started with Selenium IDE, Useful Tools for Writing Test Cases Firefox Add-ons, Basic Html Theory.

TEST AUTOMATION USING SELENIUM: RECORDING TESTS:

Selenium Commands – SELENESE, Pattern Matching, Element Locators, Selenium RC Overview, Install and Run Selenium RC, Recording and Playing Back Test Cases, Test Case Verification, Working with Test Suites, Test Case HTML Reports.

TEST AUTOMATION USING SELENIUM: RECORDING TESTS: The Eclipse IDE, running a Test Using the Junit Export from Selenium-IDE, Running a Test Using the TestNG Export from Selenium-IDE, Data Driven Testing using TestNG.

Text Books:

William Perry, “Effective Methods for Software Testing”, John Wiley & Sons, New York, 1995.

Louise Tamres, “Software Testing”, Pearson Education Asia, 2002.

CemKaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Second Edition, Van Nostrand Reinhold, New York, 1993.

David Burns, “SELENIUM 2 TESTING TOOLS : BEGINNER’S GUIDE”, Packt Publishing.

Reference Books:

K.K. Aggarwal&Yogesh Singh, “Software Engineering”, 2nd Ed., New Age International Publishers, New Delhi, 2005.

Boris Beizer, “Software Testing Techniques”, Second Volume, Second Edition, Van Nostrand Reinhold, New York, 1990.

AdityaGarg, “A Practitioner’s Guide To Test Automation Using Selenium”, 1st Edition, McGraw Hill Education (India) Private Limited.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3												
CO2	3	3	3		3									
CO3	3	3	3		3				3	3	3	3	3	3
CO4	3	3	3		3				3	3	3	3	3	3

Course Title/ Code	Agile Technologies (CSW317B)
Course Type	Elective
L-T-P Structure	(0-0-3)
Credits	1
Objectives	To introduce the practical applications of agile software development tools.

Course Outcome	Mapping
CO1: Students should be able to describe Agile Methodology with two frameworks: SCRUM, Extreme Programming (XP) and Test-Driven Development (TDD) Practice of XP and other Agile Models: Feature Driven Development and Lean Software Development.	Employability
CO2: Students should be able to apply TDD approach using Junit Tool in IDE Eclipse and Git for Software Configuration Management in Agile Software Development	Employability & Skill development
CO3: Students should be able to design Use Cases, Agile Stories, Acceptance tests for Agile Stories, User Interface with Specification by Example approach, Product Backlog out of Requirement Analysis and task breakdown structure for Agile stories based on Agile Story Estimation.	Employability & Skill development
CO4: Students should be able to apply the approach of Continuous Integration & Continuous Development with Jenkins & Mavens tools for Agile software design & development in iterative way and approach of Behavior Driven Development for acceptance tests required for End-to-End Testing with Cucumber tool	Employability
CO5: Students should be able to perform Agile Process Management, Project Management, Backlog Management using Agile ant Tool through release planning, Agile story estimation, Agile project effort and progress tracking through Burn down Charts creation.	Employability & Skill development

Section-A

Agile Programming Tools: UNIX, Eclipse, Git, junit, Processes: Stories, End-to-end Testing, Unit Testing, TDD, Refactoring. Reading: Scrum, Extreme Programming, Features Driven Development, Lean Software Development

Section-B

Agile Design Tools: Use Cases, PowerPoint Design, Requirements/Story Extraction, Test Case Management. Processes: Use cases to Design, Design to Backlog, Backlog to Tasks, End to End Testing, Estimation

Section-C

Agile Architecture/Design and Continuous Integration Tools: Jenkins, Maven, Cucumber. Processes: Scrum, Architecture, Iterative Refinement, Agile Design.

Section-D

Agile Process Management Tools: Agilefant. Processes: Agile Process Management, Estimation, Burn-down, Release Planning, Multi-team coordination, Distributed teams

List of Experiments

Test Driven Development on Eclipse using junit
Software Configuration Management using Git
Backlog development from use cases and user interface designs using Specification by Example
End-to-end/Acceptance tests using Cucumber
Continuous Integration using Jenkins
Agile Process Management using Agilefant.

Text Books:

Robert C. Martin, Clean Code: A Handbook of Agile Software Craftsmanship, available at <http://www.it-ebooks.info/book/1441/>.

Reference Links:

Agile software development, http://en.wikipedia.org/wiki/Agile_software_development
Scrum, http://en.wikipedia.org/wiki/Scrum_%28software_development%29
Extreme Programming, http://en.wikipedia.org/wiki/Extreme_programming
Feature-drive development, http://en.wikipedia.org/wiki/Feature-driven_development
Lean Software development, http://en.wikipedia.org/wiki/Lean_software_development
Test-driven development, http://en.wikipedia.org/wiki/Test-driven_development
Unit testing, http://en.wikipedia.org/wiki/Unit_testing
Specification by example, http://en.wikipedia.org/wiki/Specification_by_example
Behavior-driven development, http://en.wikipedia.org/wiki/Behavior-driven_development
Code refactoring, http://en.wikipedia.org/wiki/Code_refactoring
User Experience, http://en.wikipedia.org/wiki/User_experience

Tool Web Sites:

Ubuntu, <http://www.ubuntu.com/desktop>
Eclipse, <https://eclipse.org/users/>

jUnit, <http://junit.org/>
 Git, <http://git-scm.com/>
 Jenkins, <https://jenkins-ci.org/>
 Ant, <http://ant.apache.org/>
 Maven, <https://maven.apache.org/>
 Cucumber, <https://cukes.info/>
 Fitnesse, <http://www.fitnesse.org/>
 Agilefant, <http://agilefant.com/>

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	2	-	3	-	-	-	-	-	-	2	3	3
CO3	3	3	2	2	2	-	-	-	2	2	-	-	3	3
CO4	3	-	3	-	3	-	-	-	2	-	-	3	3	3
CO5	3	2	2	-	3	-	-	-	2	2	2	3	3	3

Course Title/ Code	Image Editing & Animation (CSW207B)
Course Type:	Elective
L-T-P Structure	(0-0-3)
Credits	1
Objectives	The students will learn the skills to edit an image & create animation.

Course Outcome	Mapping
CO1: Demonstrate the major regions of the Photoshop workspace and understand the function of each.	Employability
CO2: Apply the concept of Layers in Photoshop	Employability
CO3: Describe the fundamentals and underlying theories of Multimedia and animation.	Employability & Skill development
CO4: Develop 2D/3D animations, film-making, visual effects for the creative media.	Employability & Skill development

Section-A

Understanding Photoshop: Images & Types of Images, Image Size and Resolution, creating a Digital Collage, Working with Files, Rulers and Guides, Changing Print Size of an Image. Working with Colors, Selections, Shapes and Painting, Adjusting Monitor Display, converting between Color Modes, Softening and Refining Selections, Saving, Loading, Deleting, Moving, Copying Pasting and Extracting Selections, Drawing with Pen Tool, Creating Brush, Filling and Stroking Selection and Layers. Transforming and Typing: Rotating, Cropping, and Flipping Images, Transforming Objects, Retouching and Liquefying, Leading and Kerning, Type Selection, Pasteurization, Text Wrapping.

Section-B

Working with Layers: Creating and Deleting Layers, Selecting, Grouping and Linking Layers, Moving Copying and Locking Layers, Merging Layers: Layer Effects and Styles, Adjustment and Fill Layers, Masking Layers. Designing Web Pages: Creating Slices, Image Maps, Rollover and Animation, Creating Slices for Rollovers, Applying and Creating Rollover Styles, Animation Twining, Working with Layers, and Optimizing Images.

Section-C

Flash: Introduction, Overview of tool, symbols, Simple Animation using Shape, Motion, Guided Tweening and Frame by Frame Animation, Layers, Text Effect, Fade in- Fade out, Zooming Effect, Alpha Ripple Effect, Photo Effects: Simple photo effect, motion photo masking, Special Effect: outline effect, shape effect, onion peel effect, shading effect, masking. Flash Animation Using Text and Voice.

Section-D

Basics of Flash: Assigning Actions: Working with Actions Toolbox, working with the Script Navigator, working with the Script Pane, Working with Formatting, Using Code Hinting, Help Panel. Coding, Working with Strings, Numbers and Booleans, Casting Data, Declaring and Naming Variables, Working with Operators, Using Comments: Working with Statements, Control statements, Array, Functions Introduction to Action Script Coding- Variables and its scope in flash, working with data type variables, Arithmetic operations with numbers and string data type, Conditional Logic: If Else, Switch Cases, Loops, Arrays and Functions. Event Handler.

List of Experiments:

Controlling your image and workflow using Photoshop.
Implementation of 2-D transformation using Photoshop.
Design a project using Masking, Image Manipulation and Layer Effects.
Create a Frame-by-frame animation.
Implementing the concept of layers.
Motion & Shape Tweening.
Guided Motion Tweening Concept.
Working with the Flash effects.
Create a simple animation in Flash with Action script.
Create a Form using Action Script.
Design the web page using Action Script.
Animated Project.

Text Books:

- “Photoshop CS2-In Simple steps” by Shalini Gupta
- “Micromedia Flash 8 Bible” by Robert

Reference Book:

Vikas Gubta & Kogent Solutions Inc.: Multimedia and Web Design.

Paul Marino: 3D Animation and Film making Using Game engines.

- Antony Bolante: Adobe After effects 5 for windows After Indian edition 2002 Published by G.C. Jain for Techmedia.
- Arena Animation: Image Editing using Photoshop.
- Arena Animation: Animation using Flash.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	2	-	-	-	2	2
CO2	3	-	2	-	2	-	-	-	2	-	-	-	3	2
CO3	2	-	2	-	2	-	-	-	2	2	-	-	2	2
CO4	3	2	2	-	-	2	-	2	2	2	2	2	2	3

Course Title/ Code	Progressive Web Applications (CSH401B-T) & (CSH401B-P)
Course Type:	Elective (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students would be able to develop progressive web applications.

CO	CO STATEMENT	Mapping
CO1	Demonstrate the understanding of identifying general programming knowledge to develop progressive web application and recall application development of native apps as compare to progressive web apps.	Employability
CO2	Demonstrate the understanding of the specific requirements of using Service worker, and lighthouse tool. And, use of promises to handle offline app features.	Employability
CO3	Demonstrate the interaction of user with progressive web application to handle fetch api, caching of information within app, and handle user database with IndexedDB and Live data.	Employability & Skill development
CO4	Classify the plan and carry out a design work including developing a prototype that can be evaluated with a specified user group and illustrate the deployment of progressive web app on various platforms.	Employability & Skill development
CO5	develop applications for push notification, payment api and justify progressive web app task automation with Gulp tool.	Employability & Skill development
CO6	Have the ability to reflect over possibilities and demands in use and development of Progressive web app and analysis using Google analytics tool on PWA apps.	Employability

Section-A

Introduction to Progressive Web App Architectures: Components, PWA Architecture pattern, migrating existing site to PWA, Application Shell, Create and build App shell. Service Worker: Introduction, Service worker lifecycle, Events in service worker. Lighthouse: PWA Analysis Tool, running Lighthouse as Chrome extension and command line.

Section-B

Offline application: Why and How, promises: Introduction, using promise, states of promise, use promise, and Promise chains. Fetch API: Making a request, Reading the response object, Custom request, Cross-origin request. Caching: Cache API in the service worker, serving files from the cache.

Section-C

Indexed DB: Introduction, opening database, working with object stores and with data, fetch all data, using database versioning. Live data: Storing data with Indexed DB and storing assets in the cache interface. Gulp

tool: set up gulp, creating tasks and automation. Automate creation of service worker with sw-precache and sw-toolbox.

Section-D

Push Notification: Introduction and terminology, Notification API, Push API, Web Push Protocol. Payment Request API: Introduction, how and using payment request API. Google Analytics: adding analytics to site, dashboard, Analytics and service worker, Offline analytics.

LIST OF EXPERIMENTS:

Lab: Scripting the Service Worker

Lab: Auditing with Lighthouse

Lab: Responsive Design and Images

Lab: Promises

Lab: Fetch API

Lab: Caching Files with Service Worker

Lab: IndexedDB

Lab: Gulp setup

Lab: Integrating Web Push

Lab: Integrating Analytics

Lab: E-commerce project

Text Books:

Beginning Progressive Web App Development: Creating a Native App Experience on the Web by Dennis Sheppard, Apress.

<https://developers.google.com/web/progressive-web-apps/>

Progressive Web Apps ILT – Concepts by Developed by Google Developer Training

Reference Book:

Building Progressive Web Apps: Bringing the Power of Native to the Browser, By Tal Ater, O'Reilly.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	2	-
CO2	3	3	-	3	-	-	2	-	2	-	-	-	-	2
CO3	2	-	2	-	-	-	2	3	2	-	3	-	2	-
CO4	3	3	-	-	3	2	-	-	3	3	-	-	2	-

CO5	2	-	2	-	-	3	-	3	-	2	3	-	-	2
CO6	2	-	-	3	2	-	-	-	-	-	-	3	-	-

Course Title/ Code	BIG DATA(CSH402B-T) & (CSH402B-P)
Course Type:	ELECTIVE (Departmental)
L-T-P Structure	3-0-2
Credits	4
Objectives	Student will be able to do Big Data Programming and Analytics using Hadoop.

CO	CO STATEMENT	Mapping
CO1	Express the fundamentals of big data Frameworks that makes it useful to solve real world problems	Employability
CO2	Demonstrate the understanding of big data programming using Hadoop	Employability
CO3	Apply the knowledge to perform big data analytics using NoSQL Databases	Employability & Skill development
CO4	Analyze the performance of various frameworks for Python	Employability & Skill development
CO5	Design solutions to a range of complex real-world problems	Employability & Skill development

Section-A

Introductory Concepts (Digital Data and Big Data): Digital Data Basics, Types of Digital Data (Structured, Semi-Structured, Unstructured), Introduction to Big Data, Why Big Data? Dimensions of Big Data, Challenges with Big Data, Big Data Stack, Scaling Problems. Big data processing tools (AWS).

Hadoop overview: Brief history of Hadoop, Hadoop 1.0 vs. Hadoop 2.0, Hadoop Components, High level architecture of tools (Compression).

Section-B

Big data programming using Hadoop: Hadoop Distributed File System: Architecture, Daemons related to HDFS, working with HDFS command, Special features of Hadoop, Introduction to functional programming, How Map Reduce Works, MapReduce on YARN, Map Reduce Joins, Map Reduce Work Flows. HDFS and Hadoop Ecosystem.

Section C

Big Data Analytics: Analytics 1.0, Analytics 2.0, Analytics 3.0, Traditional BI vs. Big Data Environment, Big Data technology Landscape, NoSQL Databases, NoSQL Vs. RDBMS, New SQL.

Section-D

Frameworks: APACHE HIVE: History of HIVE, HIVE architecture, Hive Primitive Data Types and Collection Types, Hive File Formats, Hive Query Language – Statements DML, Fundamentals of APACHE PIG & HBASE, Business Intelligence on Hadoop.

LIST OF EXPERIMENTS:

To Install and set up of Hadoop along with Start up and shut down process

Introduction to (Hadoop Distributed File System) labs

Loading data

Viewing the cluster contents

Getting data out of the cluster

To write basic map reduce program

Driver code

3Mapper

Reducer

To Creating Input and Output formats in Map Reduce Jobs

Text Input format

Key value input format

Sequence file input format

To implementing Latin commands on pig/ How to use basic pig commands

Introduction to processing data with Hive

Creating tables with Hive

Managing hive table data location and lifetime

Loading data into hive tables

Partitioning the data

Querying tables with Hive QL

Text Books:

Tom White “ Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.

Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Businesses, Wiley Publications, 2013.

Reference Book:

Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Publishing, 2012.

AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.

Pete Warden, “Big Data Glossary”, O’Reilly, 2011.

Paul Zikopoulos , Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.

Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3										2	3	
CO2	3	3		3	2							2	3	
CO3	3	3	2	3	3					2		3	3	3
CO4	3	3	3	3	3				3	3	3	3	3	3
CO5	3	3										2	2	

Course Title/ Code	Network Security and Cryptography (CSH315B-T) & (CSH315B-P)
Course Type:	Elective (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Prerequisite	Computer Networks
Objectives	Students will be able to understand different security methods and issues and will be able to secure their data from attacks.

Course Outcome		Mapping
CO1	Describe the theory of fundamental cryptography, encryption and decryption algorithms	Employability
CO2	Demonstrate various data encryption techniques	Employability & Skill development
CO3	Implement Hashing and Digital Signature techniques	Employability & Skill development
CO4	Demonstrate the understanding of various security methods.	Employability
CO5	Compare and contrast real time security threats	Employability

Section-A

INTRODUCTION: Need of security, Security approaches, Principles of Security, Types of attacks, Encryption, Decryption, Symmetric and asymmetric key cryptography, Diffie-Hellman key exchange algorithm and man in the middle attack, programs that attack, Introduction to Steganography.

Section-B

Cryptographic techniques and authentication: Substitution and transposition techniques, DES (Data Encryption Standard), Double DES and Meet in the middle attack, Tripple DES, AES (Advanced Encryption Standard), IDEA (International Data Encryption Algorithm), RSA algorithm, Digital signature, Knapsack algorithm, Authentication and authorization, Authentication techniques: What you know, what you have, what you are, Mutual authentication, Reflection attack.

Section-C

Message Digest and internet security protocols: Introduction to Message Digest, Requirements of message digest, Birthday attack, MD5, SHA (Secure Hash Algorithm), SSL (Secure Socket layer), TSP (Time Stamping Protocol), SSL (Secure Socket Layer), SET (Secure Electronic Transaction).

Section-D

Advanced security: Firewalls, IP security, VPN (Virtual Private Network), Denial of Service (DOS) attack, electronic money, Single Sign On (SSO)

Case study of Phishing and Pharming attack, Case study of unbreakable codes.

LIST OF EXPERIMENTS:

- Exercise to perform passive attacks.
- Exercise to perform active attacks.
- Exercise to Encrypt and decrypt a text using DES
- Exercise on substitution techniques.
- Exercise on transformation techniques.
- Exercise on authentication techniques.
- Exercise to create message digest.
- Exercise to break unbreakable codes.

Text Books:

KahateAtul, “Cryptography and Network Security”, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.
 Stallings William, “Cryptography and Network Security”, Pearson Education Inc.

Reference Book:

Forouzan Behrouz A.,”Cryptography and Network Security”,McGraw Hill Companies Inc., New York.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3							3	2	3	2
CO2	3	3	3	3							3	3	3	3
CO3	3	3		3							3		3	3
CO4	3	3		3				3				3		

CO5	3	3		3		3		3				3		
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Course Title/ Code	Cloud Computing (CSH404B-T) & (CSH404B-P)
Course Type:	Elective (Departmental)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students will be able to learn the concepts, techniques and implementation of clouds.

CO	CO STATEMENT	Mapping
CO1	Describe fundamental ideas behind Cloud Computing, the evolution of the paradigm and its applicability.	Employability
CO2	Analyze the key dimensions of the current and future challenges of Cloud Computing	Employability
CO3	Analyze the assessment of the economics, financial, and technological implications for selecting cloud computing for an organization.	Employability & Skill development
CO4	Develop cloud application and assess Cloud security, the risks involved, its impact	Employability & Skill development
CO5	Demonstrate the understanding to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.	Employability

Section-A

Overview of Cloud Computing: Brief history and evolution – History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.

Working with Private Cloud: Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Private Cloud Building blocks

namely Physical Layer, Virtualization Layer, Cloud Management Layer, Challenges to private Cloud, Virtual Private Cloud. Implementing private cloud (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft)

Section-B

Working with Public Clouds: Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service. Implementing public cloud (one out of AWS, Windows Azure, IBM or Rackspace).

Application Development: Service creation environments to develop cloud-based applications. Development environments for service development; Amazon, Azure, Google App.

Section-C

Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud-based services.

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges. Inter Cloud Resource Management System – Resource Provisioning and platform Deployment- Global Exchange of Cloud Resources.

Future directions in Cloud Computing: Future technology trends in Cloud Computing with a focus on Cloud service models, deployment models, cloud applications, and cloud security. Migration paths for cloud, Selection criteria for cloud deployment. Current issues in cloud computing leading to future research directions.

Section-D

Business Clouds: Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud)

Programming Cloud IT Model: Parallel and Distributed Programming Paradigms, Twister and Iterative MapReduce, Hadoop Library from Apache- Mapping Applications – Programming Support of Google App Engine, Cloud Software Environments – including Eucalyptus, Open Nebula, OpenStack, Aneka and Cloud Sim.

LIST OF EXPERIMENTS:

Creation of EC2 Instance on Amazon.

Implementation of Load Balancing.

Deployment of various services on Amazon.

Design, development and implementation of a given business application.

Management of one application using multi-cloud management.

Text Books:

A Practical Approach Cloud Computing: By Anthony T Velte, Toby J Velte, Robert C Elsenpeter.

Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra and Geoffrey Fox, Morgan Kaufmann, 2011.

Reference Book:

Cloud computing: Implementation, management and security By Rittinghouse, John, W.

Cloud Computing Bible, By Barrie Sosinsky, Wiley, 2011.

Cloud Computing Architected: Solution Design Handbook by Rhoton, John.

Cloud Security, A comprehensive Guide to Secure Cloud Com © by Krutz, Ronald L.; Vines, Russell Dean

Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, 2011

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3								3	2
CO2	3	3	3	3	3								3	3
CO3	3	3	3	3			3						2	3
CO4	2	3	2	3	3					2	3		3	3
CO5	3	3	3	3	3	3		3	3	3		3	2	3

Course Title/ Code	Software Project Management (CSH307B-T) & (CSH307B-P)
Course Type:	Elective (Department)
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Student would be able to define and develop a software product from requirement gathering to implementation. The course focuses on the fundamentals of management of a software project.

Course Outcome	Mapping
CO1: Describe the principles and components of software project management and its application in real life.	Employability & Skill development
CO2: Apply techniques for requirement, policies and decision making for effective resource management.	Employability & Skill development
CO3: Apply project evaluation techniques for estimating cost, benefit, schedule and risk.	Employability
CO4: Devise a framework for planning project management activities.	Employability
CO5: Apply the tools and techniques used in project monitoring and control, managing people and enhancing software quality.	Employability & Skill development

Section-A

Introduction to Software Project Management (SPM): Definition of a Software Project (SP), SP Vs. other types of project's activities covered by SPM, categorizing SPs, project as a system, management control, requirement specification, information and control in organization, Project Management Tools & Techniques, Project success factors, role of project manager.

Stepwise Project planning: Introduction, selecting a project, identifying project scope and objectives, identifying project infrastructure, analyzing project characteristics, identifying project products and activities, estimate efforts each activity, identifying activity risk, allocate resources, review/ publicize plan.

Section-B

Project Evaluation & Estimation: Cost benefit analysis, cash flow forecasting, cost benefit evaluation techniques, risk evaluation. Selection of an appropriate project; Choosing technologies, choice of process model, structured methods, rapid application development, water fall-, V-process-, spiral- models. Prototyping, delivery. Albrecht function point analysis, COCOMO Model.

Activity planning & Risk Management: Objectives of activity planning, project schedule, projects and activities, sequencing and scheduling activities, activity recourse estimation, activity duration estimation, , Gantt Charts, network planning model, representation of lagged activities, adding the time dimension, backward and forward pass, identifying critical path, activity throat, shortening project , precedence networks, Programme evaluation & review technique (PERT) and CPM, concept of slack time, schedule control.

Risk Management: Introduction, the nature of risk, managing risk, risk identification, risk analysis, reducing the risks, evaluating risks to the schedule, calculating the z values, qualitative risk analysis, using probability impact matrixes, expert judgement, qualitative risk analysis, decision trees & expected monetary value, simulation, sensitivity analysis, risk response planning, risk monitoring & control.

Section-C

Resource allocation & monitoring the control: Introduction, the nature of resources, identifying resource requirements, scheduling resources creating critical paths, counting the cost, being specific, publishing the resource schedule, cost schedules, the scheduling sequence.

Monitoring the control: Introduction, creating the frame work, collecting the data, visualizing progress, getting the project back to target, change control, cost monitoring, Basis principles of cost management, Cost estimating, type of cost estimate, cost estimate tools & techniques, COCOMO, Putnam/ SLIM model Estimating by Analogy, cost budgeting, cost control, earned value management, project portfolio management.

Managing contracts and people: Introduction, types of contract, stages in contract, placement, typical terms of a contract, contract management, acceptance, Procurement management plans, Managing people and organizing terms: Introduction, understanding behavior, organizational behavior: a back ground, selecting the right person for the job, instruction in the best methods, motivation, working in groups, becoming a team, decision making, leadership, organizational structures, conclusion, further exercises.

Section-D

Software quality: Introduction, the place of software quality in project planning, the importance of software quality, defining software quality, ISO 9126, Practical software quality measures, product versus process

quality management, Quality Planning, quality Assurance, Quality control, external standards, techniques to help enhance software quality, Tool & techniques for quality control, Pareto Analysis, Six Sigma, CMM, Juran Methodology

Study of Any Software Project Management software: viz Project 2000 or equivalent.

LAB:

SOFTWARE TOOLS USED: -PROJECT LIBRE (OPEN SOFTWARE)

Work Breakdown Structure

Resource Breakdown Structure

Activity Networks

Gantt chart

PERT chart

Precedence Network Diagram (Activity on Arrow)

Precedence Network Diagram (Activity on Node)

Network after the Forward pass and Backward pass.

Calculate Albrecht function point

Calculating Costs-Development costs, Setup costs, Operational costs.

Text Books:

Kathy Schwalbe; Information Technology Project Management fourth edition, Thomson Course Technology.

Bob Hughes and Mike Cotterell, Software Project Management, Third Edition, Tata McGraw-Hill.

Software Project Management, Walker Royce, 1998, Addison Wesley.

Reference Books:

Project Management Body Of Knowledge. [PMBOK].

Pankaj Jalote, Software Project Management in Practice, Pearson Education.

Software Engineering – A Practitioner’s approach, Roger S. Pressman (5th edi), 2001, MGH.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	2	2							3	2	
CO2	3	2	3	3	2	3						2	2	
CO3	3	3	2			3				2	3	3	2	

CO4	3		2	2	3	2						3	2	
CO5	3	3	2	2	3	2	3	3	3	3	3	2	2	2

Course Title/ Code	INTRODUCTION TO BLOCKCHAIN TECHNOLOGY (CSH423B-T) & (CSH423B-P)
Course Type:	Domain Elective
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Students will be familiar with blockchain and cryptocurrency concepts. Also, they can build their application using the learned concepts.

CO	CO STATEMENT	Mapping
CO1	Understand the basics of blockchain systems and its working.	Employability & Skill development
CO2	Understand various consensus algorithms and cryptocurrencies	Employability
CO3	Design, build, and deploy smart contracts and distributed applications	Employability & Skill development
CO4	Integrate ideas from blockchain technology into their own projects	Employability & Skill development

Section-A

Basics: Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance.
 Cryptography: Hash function, Digital Signature, Zero Knowledge Proof.

Blockchain: Introduction, Advantage over a conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Section-B

Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, difficulty Level, Sybil Attack, Energy utilization, and alternate.

Cryptocurrency: History, Distributed Ledger, Bitcoin protocols – Mining strategy and rewards

Section-C

Ethereum – Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

Cryptocurrency Regulation: Stakeholders, Roots of Bitcoin, Legal Aspects – Cryptocurrency Exchange, Black Market, and Global Economy.

Section-D

Blockchain Applications: Internet of Things, Medical Record Management System, Banking, Finance, copyrights, digital resources etc. and future of Blockchain.

Lab: © Blockchain construction, Solidity Programming, Working with Remix (Ethereum), Metamask Smart Contract Construction, Applications using Blockchain.

TEXT BOOKS /REFERENCE BOOKS:

- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
- Wattenhofer, The Science of the Blockchain
- Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
- Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
- DR. Gavin Wood, ETHEREUM: A Secure Decentralized Transaction Ledger,”Yellow paper.2014.
- Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	3
CO3	2	2	2	2	2	2	-	-	-	-	-	-	3	3
CO4	2	2	2	2	2	2	-	-	-	-	-	-	3	3

Course Title/ Code	ENVIRONMENTAL ETHICS & SUSTAINABLE DEVELOPMENT(CHS234)
Course Type:	Elective (Allied)
L-T-P Structure	(1-0-2)
Credits	2
Objectives	<p>The students would be able to describe, explain and analyses the sustainable development concerns and challenges. At the end of the course, the students would be able to</p> <ul style="list-style-type: none"> • develop an inter-disciplinary understanding of sustainable development concerns; • recognize the challenges of sustainable development; the opportunities and limits in meeting these challenges; and • defend or criticize the sustainability initiatives adopted by different enterprises.

CO STATEMENT	Mapping
CO1: Develop an inter-disciplinary understanding of sustainable development concerns and challenges	Skill development
CO2: Propose and implement sustainable solutions to environmental issues (grow oyster mushrooms, develop a composting bin)	Employability
CO3: Understand the concept of sustainability initiatives & sustainability reporting and defend, criticize or compare the sustainability initiatives adopted by different enterprises	Employability
CO4: Discuss the importance of contemporary issues like consumption, indigenous knowledge, gender issues, population in achieving sustainable development	Skill development

Section A

Introduction to Sustainable Development

Definition of Sustainable Development; Triple Bottom Line, Components of TBL, Changing Perspective & Debates in Sustainable Development – Need for Sustainable Development, Evolution of the concept of Sustainable Development: Stockholm Conference, The Brundtland Commission, Earth Summit, Agenda 21; Millennium Development Goals

Section B

Challenges to Sustainable Development and Sustainable Development Goals (SDGs)

Challenges to Sustainable Development – Agriculture, Population & Food Security, Public Health and Nutrition, Education, Natural Resources (Forests, Energy, Water), Climate Change Sustainable Development Goals (SDGs) – Introduction, Challenges to SDGs, Indian Scenario.

Section C

Sustainability Strategies & Reporting

Sustainability Strategies & Reporting – Introduction, Rationale and Mechanisms, Key Principles, Sustainability Strategies Adopted by Different Enterprises – Case Studies

Section D

Sustainable Development and Contemporary Issues

Sustainable Consumption, Indigenous Knowledge, Gender Issues, Population & Sustainable Agriculture, Sustainable Tourism

Tools: Video lecture; research papers or articles, survey, presentations, white board

LAB EXPERIMENTS/ACTIVITIES

Survey – Business and non-business students' perception towards TBL (based on the readings listed above); inferences on the basis of survey; <http://www.aabri.com/manuscripts/121249.pdf>

Workshop based – Sustainable agriculture- Mushroom farming

Workshop based – Back to nature – DIY composting bin

Review – Sustainable Consumption in India: Challenges and Opportunities; Divesh Kumar, Praveen Goyal, Zillur Rahman, Ishwar Kumar; IJMBS Vol. 1, Issue 3, September 2011; <http://www.ijmbs.com/13/devesh.pdf>

Calculate Carbon Footprint/Ecological footprint

Stimulus Activity (Piece of writing) – Sustainable Consumption

CSR - Workshop for Village school children

Simulation Activity - Challenges to Sustainable Development

Case Studies – Sustainability initiatives @ TATA Motors, CAIRN INDIA, Mahindra & Mahindra, Subaru Isuzu, Disney, Novo Nordisk, etc.

VIDEO LECTURES:

- Triple Bottom Line (TBL) - <https://www.youtube.com/watch?v=2f5m-jBf81Q>
 How Humans Made Malaria So Deadly – <https://www.youtube.com/watch?v=64pvlCtH-O>
 Ocean Confetti! – https://www.youtube.com/watch?v=qVoFeELi_Vq&spfreload=5
 Sustainability explained through animation – <https://www.youtube.com/watch?v=B5NiTN0chj0>
 SDGs – <https://www.youtube.com/watch?v=uHEfRAooih8>
 Micro-plastics – <https://www.youtube.com/watch?v=UpGt5L3GC7o>
 Sustainable Consumption – <http://www.ijmbs.com/13/devesh.pdf>.

BOOKS/READING MATERIAL

- Environmental Management for Sustainable Development; C.J. Barrow; Routledge Publishers
 Roberts, J.T., and Hite, A., 2000, From Modernization to Globalization – Perspectives on Development and Social Change, Blackwell Publishing
 Sachs, J., 2004, Stages of Development, Speech at the Chinese Academy of Arts and Sciences
 Giddings, B., Hopwood, B., and Geoff O’Brien, 2002, Environment, Economy and Society: Fitting Them Together into Sustainable Development, Published online in Wiley Inter Science (www.interscience.wiley.com). DOI: 10.1002/sd.199
 IPCC, Adaptation to Climate Change in the context of Sustainable Development and Equity, www.ipcc.ch/ipccreports/tar/wg2/pdf/wg2TARchap18.pdf
 Brundtland Commission, 1987, “Our Common Future”, Oxford University Press
 Food Insecurity Atlas of Rural India (2001) MS Swaminathan Research Foundation and World Food Programme.
<http://home.wfp.org/stellent/groups/public/documents/ena/wfp076968.pdf>.
 Maternal and Child Undernutrition 1 Maternal and child undernutrition: global and regional exposures and health consequences http://www.who.int/nutrition/topics/Lancetseries_Undernutrition1.pdf.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1						3	3		3	3		3	2	
CO2						3	3		3	3		3	3	
CO3						3	3		3	3		3	3	
CO4						3	3		3	3		3	2	

Course Title/Code	E-Waste Management (ECS306B)
Course Type:	Domain Elective (Allied)
L-T-P Structure	1-0-2
Credits	2
Course Objectives	Gain a better understanding and appreciation for the challenges related to waste management. Create awareness about environmental impacts of e-waste. Identify various components of e-waste

CO	CO STATEMENT	Mapping
CO1	Analyze and demonstrate the scale of the e-waste problem and the legal framework for managing e-waste in your geographical or professional context.	Skill development
CO2	Identify the environmental, health and climate-related risks posed by e-waste as well as the potential value of e-waste.	Employability
CO3	Develop a project proposal to address an e-waste problem or opportunity that demonstrates some positive impact on environment, health, and climate change	Skill development
CO4	Apply practical actions from your learning of the course into the real world and help to raise public awareness.	Employability

SECTION A

INTRODUCTION: E-Waste; Indian and global scenario of e-Waste; Growth of Electrical and Electronics industry in India; E-waste generation in India; Composition of e-waste; Possible hazardous substances present in e-waste; Environmental and Health implications;

SECTION B

E-WASTE LEGISLATION: Regulatory regime for e-waste in India; The hazardous waste (Management and Handling) rules 2003; E- waste management rules 2015; Regulatory compliance including roles and responsibility of different stakeholders – producer; manufacturer; consumer etc;; Proposed reduction in the use of hazardous substances (RoHS) & REACH; Extended producer responsibility (EPR);

SECTION C

END OF LIFE MANAGEMENT OF E-WASTE: Historic methods of waste disposal – dumping; burning; landfill; Recycling and recovery technologies – sorting; crushing; separation; Life cycle assessment of a product – introduction; Case study – optimal planning for electronic waste;

SECTION D

ENVIRONMENTALLY SOUND E-WASTE MANAGEMENT: Emerging recycling and recovery technologies; Guidelines for environmentally sound management of e-waste; Environmentally sound treatment technology for e-waste; Guidelines for establishment of integrated e-waste recycling and treatment facility; Case studies and unique initiatives from around the world;

LAB EXPERIMENTS:

- Identify the hazardous materials present in printed circuit boards.
- Extraction of copper of printed circuit boards in etching solution.
- Demo of recycling process through videos.
- Extraction of precious metal from e Waste.
- Invited guest lecture.
- Field visit to a waste management initiative in NCR.
- Activity based learning: survey of the household practice of e-waste disposal and awareness.
- Case study – presentation and group discussion.
- Websites/ Apps/ Models for E-waste management awareness and proper disposal and reduction

REFERENCE BOOKS:

- Electronic Waste Management, R E Hester, R M Harrison, RSC publishing.
- E Waste: Implications, Regulations and Management in India and current global practices, Rakesh Johri, TERI PRESS.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	3	3		3		3	3	3				3		3
CO2		3				3	3	3	3			3		3
CO3	3	3	3	3		3	3	3	3	2		3		3
CO4	3	3	3	3		3	3	3	3	3		3		3

Course Title/Code	Computer Vision& Data Visualization CSH416B-T & CSH416B-P
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	The course objective is (A)to help students learn the basic concepts, (B)understand the image computing, and (C)practice computer vision techniques and (D)data visualization approaches.

Course Outcome	Mapping
CO1-Able to establish fundamental concept and understanding of computer vision and data visualization systems	Employability
CO2-Understand standard methods to image creation and demonstrating	Employability & Skill development
CO3-Analyze and design a variety of algorithms for computer vision and data visualizations	Employability & Skill development
CO4-Develop and evaluate solutions to real life problems using computer vision techniques	Employability & Skill development

Section-A

Introduction to Computer Vision and Image Processing

Image Processing, Elements of Image Processing System, Computer Vision, Computer Graphics, Application Areas, Imaging Geometry, Image Sampling, Mathematical Tools, Image transformations: 2D and 3 D Transformation, Image Enhancements-Intro, Image Segmentation-Intro, Cognitive Aspects of Color, VR/AR, Object Recognition, Object Tracking

Section-B

Introduction to Open CV

Introduction, GUI Features, Operations: Pixel Editing, Geometric Transformations, Feature Detection, Video Analysis and Tracking, Stereo Imaging, Calibration, OpenCV-Python, Visualizations, Image Denoising, Object Detection, Transformation and Spatial Filtering Introduction, Functions, Histogram, Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing, Using Histogram Statistics for Image Enhancement Introduction to Spatial Filtering, Smoothing & Sharpening Image Filters

Section-C

Image compression & Segmentation

Fundamentals, Coding Redundancy, Spatial Redundancy, Irrelevant Information, Models, Compression Methods, Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding, Symbol-Based Coding, Bit-Plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding, Human Vision, Applications, Point Line and Edge Detection, Shot Boundary Detection, Interactive Segmentation, Visual Appearance, Image Segmentation by Clustering Pixels, Basic Clustering Methods, The Watershed Algorithm, Segmentation Using K-means, Graphs, Fitting, Motion Segmentation, Model Selection, Case Studies

Section-D

Object Recognition & Tracking

Shape correspondence and shape matching, Sliding Window Method, Patterns, Structural Methods, Deformable Objects, Tracking, Strategies, Matching, Tracking with Filters, Data Association, Particle Filtering

Section-E

Motion Estimation

Regularization theory, Optical computation, Stereo Vision, Motion estimation, Structure from motion

Computer Vision & Data Visualization Lab

List of Objectives

Discuss about important transformations used in imaging.

Write a code to detect car from image.

Write a program that will detect a change in the video feed.

Explain the 4 variations of image denoising in OpenCV, using Python.

How to perform histogram matching using OpenCV?

Compress an image without losing the quality of the image.

Analyze an image using histogram and enhance the image using Histogram statistics.

Detect Lane lines from images or video, primarily by using edge detection.

Implement image segmentation using edge detection segmentation and python.

Implement image segmentation using clustering and python.

Implement image segmentation using CNN.

Write a program to calculate the distance from an object to the camera using stereo vision.

Perform motion estimation in videos.

Course Learning Outcomes (CLOs):

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

Understand the computer Vision Techniques

Learn image Segmentation using Python

Computer Vision & Data Visualization Lab

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO2	3	2	3	2	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	2
CO4	3	2	3	3	3	-	-	-	-	-	-	-	3	3

Course Title/Code	Virtualization – Containers/Cloud (CSH414B-T) & (CSH414B-P)
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	Students shall be able to understand and apply the techniques of virtualization & containerization in real time scenarios.

Course Outcome	Mapping
CO1-Students will be able to understand the need of Containers	Employability
CO2-Understand the concept of virtualization and containerization	Employability
CO3-Creating and deploying virtual machines	Employability
CO4-Analyze containers using Docker, Kubernetes	Employability

Section-A

Application Containerization

Understanding Containers: Transporting Goods Analogy, Problems in Shipping Industry before Containers, Shipping Industry Challenges, Container: The Saviour, Solution by Containers in the Shipping Industry, Challenges in the Software Industry, Problems in Software Industry Before Containers, Put that in Container! Solution by containers in the Software Industry

Section-B

Virtualization & Containerization

Introduction, Hypervisor, Scope of Virtualization, Containers vs Virtual Machines, Understanding Containers, Containerization Platform, Runtime and Images, Container Platform, Container Runtime, The Chroot System, FreeBSD Jails, Linux Containers (LXC), Docker, Docker architecture, Docker Daemon (Container Platform), Docker Rest API , CLI Different environments: (Dev, QA and Prod), Overcoming issues with different environments, Development Environment , Testing Environment, Staging

Environment, Production Environment, Virtual machines for dev/deployments, Containers for dev/deployments, Advantages and drawbacks of containerization

Section-C

Orchestration Tools on Cloud

What is orchestration? Need of orchestration, Case study: Need of Orchestration, Need of Orchestration: Container and Microservices, Docker Swarm and Kubernetes, Architecture, AWS (ECS, EKS), AWS Elastic Container Services Architecture, Azure Kubernetes Services, OpenShift, KUBERNETES ON CLOUD, monitoring of container, how to monitor?

Section-D

System Provisioning

What is Provisioning – Basic Definition, Software Definition, Concepts of Provisioning, Why Provisioning Should be Exclusive, Configuration Management, Configuration Management Tools, Why Provisioning is not Configuration Management, Provisioning Tools, Test Machines for Provisioning, Deployment, Relationship between Deployment and Provisioning

Section-E

Provisioning on Cloud

Introduction, Cloud Providers, Benefits of Cloud Computing, Types of Cloud Computing, Types of Deployment Model, Types of Service Model, Life Cycle of Provisioning on Cloud, Automated Provisioning on Cloud, what is Cloud Automation? Benefits of Cloud Automation, what is Sonarqube? Code Quality Checks Performed

Virtualization & Cloud Lab

1. Playing with Vagrant
2. Understanding Vagrant File and Configuration of Sandbox
3. Installation and Configuration of Docker Machine
4. Working with Docker Images and running Docker Containers
5. Dockerfile: Working with Containerization Application
6. Docker Extras – Docker Port Binding, Docker Volumes, Docker Linking, Monitoring
7. DTR : Working with Docker Hub and Publishing Images
8. Working with Docker Compose
9. Docker-Swarm : spin up 3 virtual machines (vagrant in our case) and setup swarm cluster with one manager and 2 node.
10. Working with Kubernetes –Minikube
11. Deploying Pods and Services on Minikube

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	-	-	3	2	-	-	-	-	2	2	2	2
CO2	3	2	2	3	2	2	-	-	-	-	-	2	2	2
CO3	3	2	3	2	3	-	-	-	-	2	-	3	3	2
CO4	3	3	3	3	3	-	2	-	2	2	2	3	3	2

Course Title/Code	Continuous Integration & Continuous Delivery (CSH415B-T) & (CSH415B-P)
Course Type:	Elective
L-T-P Structure	3-1-2
Credits	5
Objective	The students will be able to Identify the practices associated with CI and the working mechanism

Course Outcome	Mapping
CO1-Students would be able to Identify the practices associated with CI and the working mechanism	Employability
CO2-Student would be able to Explain the core CI process and advanced CI process	Employability
CO3-Students would be able to deploy an application to production	Employability
CO4-Students would be able to Continuous test and deploy an application before sending it for production	Employability

Section-A

Overview

Introduction to CI, Continuous Integration Workflow, Benefits of Continuous Integration, How CI Benefits Distributed Teams, Continuous Delivery, Steps Involved in CICD, Pipelines, Prerequisites, Checklist, Business Drivers for Continuous Deployment, Benefits of Continuous Deployment, CD – The HP Laserjet Case Study

Section-B

Stages of Continuous Integration and Continuous Delivery

Core CI Process, VCS, Merging Local Changes to Integration Branch, Fork & Pull, Code Review, Automated code builds – Key metrics, Static Code Analysis, Snapshot, Sample Bug Report, Automated Unit Testing- JUNIT, Test Frameworks, Automated Unit Testing Process

Section-C

Stages Extended

Code Coverage analysis, Code Coverage Methods, Condition Coverage, Line Coverage, Publishing Code Coverage reports to Jenkins, uploading build artifact to a repository, Advanced CI process, Automated Functional Testing, Publish Report to the Development Team, Google Canary release Case study

Section- D

Anatomy of a Continuous Delivery Pipeline

Simple Delivery Pipeline, Continuous Deployment Pipeline, releasing an application to Production, Zero-Downtime Releases, Rolling back deployments, Blue-Green Deployments, Canary Releasing, Emergency Fixes, Continuous Delivery engineering practices, Continuous Development/Integration

Section- E

Continuous Testing

Deploying and Promoting your Application, Modeling Your Release Process and Promoting Builds, Continuous Deployment to successive environments until before Production, Continuous monitoring for the delivery pipeline, Nagios sampler report, Continuous Feedback rules

Continuous Integration and Continuous Delivery Lab

Introduction to Jenkins and setup/configuration

Installation and Configuration of git/Java/maven on Build server (Windows)

Jenkins job, parameters, build, post-build actions and Pipeline

Jenkins Agent/Slave configuration with Windows/Ubuntu master hosts

Configuring Jenkins with git plugin

Create a new Jenkins pipeline

Merging local changes to the version control system (Git)

Installing/Configuring Nexus

Use Jenkins as a Continuous Integration server

Deploying the application to staging/prod environment

Merging feature branch code (V 2.0) to existing application created in step 1.6

Uploading plugins manually in Jenkins

Backup Management in Jenkins Server

Text Books:

Pathania, N. (2017). Learning Continuous Integration with Jenkins: A Beginner's Guide to Implementing Continuous Integration and Continuous Delivery Using Jenkins 2. Packt Publishing Ltd.

Humble, J., & Farley, D. (2010). Continuous delivery: reliable software releases through build, test, and deployment automation. Pearson Education.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	-	3	-	2	-	-	-	-	-	-	3	3
CO2	3	2	3	2	2	-	-	-	3	3	-	-	-	-
CO3	3	3	3	-	-	3	-	-	3	-	3	-	3	3
CO4	3	3	3	3	3	-	-	-	3	-	3	-	3	3

Course Title/ Code	Malware Analysis and Reverse Engineering (CSH420B-T & CSH420 P)
Course Type	Elective
L-T-P Structure	(2-0-3)
Credits	3.5
Objectives	Students will be able to understand the core technologies behind malware analysis and malware behavior. Students will have the hands on experience on Secure Development and practical Malware Analysis.

Course Outcome	Mapping
CO1: To describe reverse engineering perspective for finding the working of windows core and Assembly Language.	Employability/Skill Development
CO2: To demonstrate the core technologies behind malware analysis and malware behavior.	Employability/Skill Development
CO3: To analyze the security risks, threats and potential vulnerabilities in the enterprise networks environment.	Employability/Skill Development
CO4: To perform independent analysis of modern malware samples using behavioral, code analysis and memory forensic techniques.	Employability/Skill Development
CO5: To apply the learned techniques to protect, reduce the security risks and avoid malicious software attacks on computer systems or networks.	Employability/Skill Development

Section-A

C/C++ from Reverse Engineering Perspective: What is Reverse Engineering, Data Types and Memory layout, How MARE Works Memory Layouts Explained.

Windows Internals: Windows Environment - User mode, Windows APIs, File System, Windows Registry, Process and Threads, Memory Management, Network functions, x86 Assembly Language, Registers, Instruction Types, Stack Basics,

Dynamic Link Libraries, Windows Services, Synchronization Objects and Windows Kernel mode.

Windows Executable (PE) file format: Understanding PE Structure Headers, DOS, Essentials, PE File Header Sections, Data Directions and Imports and Exports.

x86 Assembly Language: Registers, Instruction Types, Stack Basics, Dynamic Link Libraries, Windows Services, Synchronization Objects and Windows Kernel mode.

Advance Assembly Language: Introduction to assembly language, Basic Computer Architecture, Closest forms of Communication Defined and Track the flow of data and Execution on Computers and 64-bit Assembly Language.

Section-B

Malware Analysis Lab Setup - Part 1: Listing the lab Requirement, Setting Up the Lap for Malware Analysis, Troubleshooting the Malware Analysis Lab, Malware Analysis for: Ransomware, Trojans, Worm, Backdoor, Virus, Spyware and Keylogger. Static Malware Analysis and Dynamic Malware Analysis.

Debugger - Part 1: Debugging for Malware Analysis, Basics of debugging using OllyDbg, Ransomware.

Network Analysis - Part 1: TCP/IP network stack, Common network protocols - SMTP, POP, FTP, HTTP, HTTPS and Network Monitoring tools – Wireshark

Automated Malware Analysis Tools: Introduction to Sandboxes, Open Source Tools: Cuckoo Sandboxes, Google Rapid Response and Remnux Etc.

Section-C

Malware Analysis Lab Setup - Part 2: Listing the lab Requirement, Setting Up the Lap for Malware Analysis

Troubleshooting The Malware Analysis Lab Ransomware, Adware & Potentially Unwanted Applications

Obfuscation Techniques: Understanding different Packers & Installers, Compression Algorithms - Zlib, ApLib,

Debugger - Part 2: Methods to Reverse Binary and Static v/s Dynamic Debugger.

Malware Analysis - Part 3: Android Malware Analysis, ELF file format and Linux Malware, Using Python for Malware Analysis, Anti-Reverse Engineering techniques, Anti-debug, Anti VM techniques, Defeat Anti-Reverse Engineering techniques, Encryption Algorithms, RSA, AES etc and Social Engineering, Phishing, Spamming.

Section-D

Malware Analysis - Part 4: Analysing Visual Basic, Delphi, .NET compiled programs, Rootkit, Bootkit Analysis, Advanced Persistent Threats How Crypto-Currency works, Bitcoins etc., mining.

Vulnerabilities Exploit Analysis: File format vulnerabilities & exploits, Buffer Overflow, Stack Overflow, Memory Corruption, User after free vulnerabilities, PDF, SWF, RTF & OLE file analysis & tools,

Script based malware analysis: Usage of Script a Complete Overview: Javascript, Powershell, Bash Scripting

And Python Scripting.

Fuzzing Techniques, Brute Force: Introduction to Black Box Testing Techniques, Fuzzer Implementations Application Fuzzing, Why Fuzz? Brute Force Techniques.

**Training and Evaluation of this module will be based on following distribution

25% of Malware Analysis and 75% of Allocated QHA Project

LIST OF EXPERIMENTS:

Malware Analysis and remote execution of malware in insolated environment. (Static and Dynamic Analysis)

Reverse Engineer and understand the functioning of a malware.

Solve the CTF challenges presented with relation to malware analysis.

Books

Practical Malware Analysis – The Hands–On Guide to Dissecting Malicious Software – Michael Sikorski

Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation

The Security Development Lifecycle: SDL: A Process for Developing Demonstrably More Secure Software (Developer Best Practices)

Practical Malware Analysis – The Hands–On Guide to Dissecting Malicious Software – Michael Sikorski

Help Pages

Malware Analysis:

<https://niccs.us-cert.gov/training/search/defense-cyber-investigation-training-academy/malware-analysis>

Malware Analysis Submission: <https://www.malware.us-cert.gov/>

Wikipedia Pages

Malware Analysis: https://en.wikipedia.org/wiki/Malware_analysis

Malware Research: https://en.wikipedia.org/wiki/Malware_research

Tool Web Sites (Tools may vary or added as per current situation)

Static Malware Analysis

Virus Total: <https://www.virustotal.com/>

Hybrid Analysis: <https://www.hybrid-analysis.com/>

Windows Sysinternal Tools: <https://docs.microsoft.com/en-us/sysinternals/>

Dynamic Malware Analysis

IDA Pro: <https://www.hex-rays.com/products/ida/>

Ollydbg: <http://www.ollydbg.de/>

Web tutorials

https://www.blackhat.com/presentations/bh-dc-07/Kendall_McMillan/Paper/bh-dc-07-Kendall_McMillan-WP.pdf

<https://www.csee.umbc.edu/courses/undergraduate/CMSC491malware/docEng2017.html>

<https://www.begin.re>

<https://hakin9.org/download/reverse-engineering-tutorials-hakin9-ondemand/>

<http://fumalwareanalysis.blogspot.com/p/malware-analysis-tutorials-reverse.html>

<https://zeltser.com/reverse-engineering-malware-methodology/>

<https://www.sans.org/course/reverse-engineering-malware-malware-analysis-tools-techniques>

<https://www.onlinefreecourse.net/expert-malware-analysis-and-reverse-engineering-udemy-free-download/>

Course Outcomes	Program Outcomes											Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3	-	2	2	-	-	-	3	2	2	2
CO2	2	2	2	3	-	2	2	-	-	-	3	3	2	2
CO3	2	2	-	3	-	2	-	-	-	-	3	-	2	2
CO4	3	2	-	1	-	-	-	2	-	-	-	2	-	-
CO5	2	2	-	3	-	-	-	2	-	-	-	2	-	-

Course Title/Code	Internet Of Things (CSH417B-T & CSH417B-P)
Course Type	Elective
L-T-P Structure	(3-0-2)
Credits	4
Objectives	Student will be able to do understand the application areas of IOT. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks. Able to understand building blocks of Internet of Things and characteristics.

Course Outcome	Mapping
CO1: Identify the Internet of Things components and able to understand the application areas of IOT.	Skill development
CO2: Analyse basic architecture of IOT with its wireless sensors.	Employability
CO3: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks	Employability
CO4: Designing IoT security applications in different domain and be able to analyse their performance.	Skill development

Section-A

Introduction to IoT: Definition of IoT, Evolution of IoT, IoT and related terms, Business Scope. Effects of adverse parameters for the living being for IOT

Section-B

Elements of IoT: Elements of IoT, Basic Architecture of an IoT Application Sensors & Actuators, Edge Networking (WSN), Gateways, IoT Communication Model – WPAN & LPWA. Importance and Adoption of Smart Sensors.

Section-C

Communication and Connectivity Technologies: Cloud Computing in IoT, IoT Communication Model – Cloud Connectivity, Big Data Analytics, Data Visualization, IoT Platforms.

Section-D

Concerns and Future Trends: Different Players of IoT, Security Concerns and Challenges, Future Trends, Standards. Hands-On Projects

LIST OF EXPERIMENTS:

1. IOT and Acoustic and Sound Sensors.
2. IOT and Chemical Sensors
3. IOT and Optical Sensors
4. IOT and Mechanical Sensors
5. IOT and Electromechanical Sensors
6. IOT and Thermal Sensors
7. IOT and Proximity Sensors
8. IOT and Pressure Sensors
9. IOT and Magnetic Sensors
10. Mini Project

Text Books:

A Practical Approach Cloud Computing: By Anthony T Velte, Toby J Velte, Robert C Elsenpeter.
 Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Jack Dongarra and Geoffrey Fox, Morgan Kaufmann, 2011.

Course Outcomes	Program Outcomes												Program Specific Outcomes	
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO1 2	PSO 1	PSO2
CO1	3		3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	3	-	2	-	-	-	2	-	-	-	-	-
CO3	3	-	3	-	-	-	=	-	-	-	-	-	2	-
CO4	3	3	3	3	2	-	-	-	2	-	2	2	-	-