KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Department of Computer Science & Engineering

M.Tech. Scheme and Syllabus (2020 Scheme)

1st to 2nd Semester M.Tech(Computer Science & Engineering)

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
To be a center of Excellence for Education, Research and Entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society.

MISSION
To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
1.	The graduates will acquire core competence in basic science and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to pursue advanced study.
2.	The graduates will acquire necessary techno-managerial and life-long learning skills to succeed as computer engineering professionals with an aptitude for higher education and entrepreneurship.
3.	The graduates will maintain high professionalism and ethical standards and also develop the ability to work in teams on IT as well as multidisciplinary domains.

PROGRAM OUTCOMES (POs)	
1.	**An ability to independently carry out research /investigation and development work to solve practical problems.**
2.	**An ability to write and present a substantial technical report/document.**
3.	**Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program**.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.

2020-21 Scheme of Teaching and Examination

1st to 4th Semester M. Tech.(Computer Science & Engineering)

Total credits for M.Tech. Program: 88

	Semester	Credits per Sem	Total credits
1st year	1	21	42
	2	21	
2nd year	3	23	46
	4	23	
	Total	**88**	**88**

Curriculum frame work:

Sl. No.	Course		Credits
1	Professional Core	PC	36
2	Professional Elective	PE	12
3	Online Courses (SWAYAM)	PC	09
4	Minor Project / Skill Development / Teaching Assistantship		04
5	Internship	PI	05
6	Project	PR	22
	Total		88

Theory Course Credits		Online Course Credits	
Duration of course	**Credits**	**Online course duration**	**Credits**
50 hours of course content	4	04 weeks	1
40 hours of course content	3	08 weeks	2
Lecture (L) One Hour /week	1	12 weeks	3
Practicals (P) Two hours /week	1		

1st Sem M.Tech												
S.No.	**Course Code**	**Course**		**Contact Hours**	**Contact Hours/ week**	**Credit Allocation**			**Total credits**	**Marks**		
				L -T- P		**L**	**T**	**P**		**CIE**	**SEE**	**TOTAL**
1.	20SCS11	Applied Mathematics	PC1	4 – 0 -0	4	4	0	0	4	50	50	100
2.	20SCS12	Digital Image Processing	PC2	**3 – 0 -2**	5	3	0	1	4	50+25	50+25	150
3.	20SCS13	Data Science & Analytics	PC3	**3 – 0 -2**	5	3	0	1	4	50+25	50+25	150
4.	20SCS14X	Elective-I	PE- I	4 – 0 -0	4	4	0	0	4	50	50	100
5.	20SCS15	SWAYAM Online course	OC						3			
6.	20SCS16	Minor project / Skill Development / Teaching assistantship							2	25		25
		Total							21	275	250	525

- **OC: Student can register for one course of 12 weeks OR two courses (4 weeks+ 8weeks) to earn 3 credits**
- **Maximum TWO courses should be integrated type**

ELECTIVE – I

20SCS141	Advances in Computer Networks
20SCS142	Data Mining & Warehousing
20SCS143	Advanced Algorithms
20SCS144	Advances in operating system

2nd Sem M.Tech												
S.No.	**Course Code**	**Course**		**Contact Hours**	**Contact Hours/week**	**Credit Allocation**			**Total credits**	**Marks**		
				L- T- P		**L**	**T**	**P**		**CIE**	**SEE**	**TOTAL**
1.	20SCS21	Soft Computing Techniques	PC1	4 – 0 - 0	4	4	0	0	4	50	50	100
2.	20SCS22	Advances in Database Management System	PC2	**3 – 0 - 2**	5	3	0	1	4	50+25	50+25	150
3.	20SCS23	Research Methodology and IPR	PC3	**3 – 0 -2**	5	3	0	1	4	50+25	50+25	150
4.	20SCS24X	Elective- II	PE-II	4 – 0 - 0	4	4	0	0	4	50	50	100
5.	20SCS25	SWAYAM Online course	OC						3			
6.	20SCS26	Minor project / Skill Development / Teaching assistantship							2	25		25
		Total							21	275	250	525

- **OC: Student can register for one course of 12 weeks OR two courses (4 weeks+ 8weeks) to earn 3 credits**
- **Maximum TWO courses should be integrated type**

ELECTIVE- II

20SCS241	Artificial Intelligence & Agent Technology
20SCS242	Wireless Communication Technology
20SCS243	Robotic Process Automation
20SCS244	Information Storage Management

First Semester
Detailed Syllabus
Applied Mathematics (Theory)

Subject Code	20SCS11	**Credits**	4
Course Type	PC	**CIE Marks**	50
Hours/Week: L-T-P	4-0-0	**SEE Marks**	50
Total Hours	45	**SEE Duration**	3

Course learning objectives	
1.	To introduce the fundamental concepts of Probability and study their applications
2.	To study various probability distribution functions and their characteristics.
3.	To present statistical approaches and drawing inferences.
4.	To present various regression techniques and study their effectiveness.
5	To study the basics of cryptosystems and their application.

Pre-requisites : Linear Algebra, Set theory, Number systems

Unit – I	**9 Hours**
Introduction, Collection of Data, Mean, Median, Standard deviation, Statistical modeling, Scientific interpretation, Graphical diagnostics, Role of Probability, Sample space, Events, Counting Sample points, Permutations and Combinations, Probability of events, Rules and Axioms of Probability, Conditional Probability, Baye's Rule.	

Unit – II	**9 Hours**
Concept of random variables, Probability Distributions : Mathematical expectation, Variance and Co-variance, Discrete distributions: Binomial, Poisson distribution and Poisson process, Geometric and their properties. Continuous distributions: Uniform, Normal, Area under the curve, Applications of Normal distribution, Gamma and exponential distributions and their properties.Weibull distribution	

Unit – III	**9 Hours**
Fundamentals of Sampling : Random sampling, Population and samples. Important statistics, Mean, Sample variance. Data display and Graphical methods. Sampling distributions, Mean and Variance, Central Limit theorem, t-Distributions and its Applications. One and Two-Sample hypothesis testing. Null and Alternate hypothesis. Testing a statistical hypothesis. One and two tailed tests.	

Unit – IV	**9 Hours**
Introduction to Regression: Simple, Linear Regression. Least square and fitted model. Properties of Least squares. Inferences covering the regression coefficients. Prediction, Analysis of variance, Simple regression, case-study. Multiple regression. Linear Regression using matrices. Analysis of Variance – ANOVA, Chi-Square and F-test.	

Unit – V	**9 Hours**
Natural numbers and Division Theorem. GCD – Euclid's method. Modular linear equations, Extended Euclid Algorithm. Modulo Inverse and Chinese remainder theorem. Modular exponentiation. Miller-Rabin Primality testing. RSA algorithm, Message Digest and Asymetric Cryptosystem. Elliptic Curves and its applications.	

Self Study Topics	
Unit No.	**Topic description**
I	**Permutation and Combinations, Set theory, Probability computation**
II	**Multinomial and Hyper-geometric distributions**
III	**BoxPlot, Quantile Plot.**
IV	**Measure of Quality of fit.**
V	**Fermat's theorem and primality testing.**

Books	
	Text Books:
1.	Walpole, Mayers, Ye, Probability and Statistics for Engineering and Scientits. 7th Edition, Pearson.
2.	Corman, Advanced Algorithms, 3rd Edition, PHI, 2007.
	Reference Books:
1.	Purnachandra, Biswal, Probability and Statistics, PHI, 2007.
2.	Murray and Spiedel, John Schiller, Probability and Satatistics, 2nd Edition, Schaum's Series, Tata McGraw Hill.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.udemy.com/course/mathematics-for-data-science-and-machine-learning-using-r/
2.	https://nptel.ac.in/courses/106/106/106106221/ Cryptography

Course delivery methods		Assessment methods	
1.	**Chalk and Talk**	1.	**Quiz**
2.	**PPT**	2.	**IA Tests**
3.	**Online Presentation through Gmeet**	3.	**Assignments**
4.		4.	

Course Outcome (COs) At the end of the course, students will be able to		
At the end of the course, the student will be able to		Bloom's Level
1.	**Apply** basic principles of probability and theorems to a wide variety of applications	3
2	**Demonstrate** the use of all the Probability distribution function tables and Compute the probability of occurrence of events	3
3.	**Apply** statistical models to problems in different domains and draw inferences.	3
4	Design appropriate regression models and evaluate the accuracy for a given application scenario	5
5	Apply number theory to build and analyze cryptosystems	3

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development	**1**

	work to solve practical problems.	
2.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.	**3**

Program Specific Outcome of this course (PSOs)		**PSO No.**
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	**Target**
1	**>80 % of the total marks is scored by 60% of the students.**
2	**Between 60 % and 79% of the total marks is scored by 60% of the students.**
3	**<60 % of the total marks is scored by 60% of the students.**

CO-PO Mapping (planned)				**CO-PSO Mapping(planned)**		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**			**2**		
CO2	**2**		**3**	**3**		
CO3	**1**		**2**	**3**		**3**
CO4	**2**		**3**	**1**		
CO5	**3**			**2**		
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Digital Image Processing (integrated)

Course Code	**20SCS12**	**Credits L-T-P**	3- 0- 1
Course type	**PC**	**Total credits**	4
Hours/week: L-T-P	3- 0- 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40 Hrs; T = 0 Hrs;P = 24Hrs Total = 64 Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning Objectives	
1.	To understand the importance and applications of Digital Image Processing
2.	To understand the image representation and image formation in Gray.
3.	To understand the image fundamentals and mathematical transforms necessary for image processing and study the image enhancement techniques.
4.	To introduce the various image processing techniques in spatial and frequency domains.

Pre-requisites : Basics of Mathematical Analysis, Vectors, Matrices, Probability & Statistics Computer Programming

Unit – I	**8 Hours**
Introduction: What is Digital Image Processing, origins of digital image processing, examples of fields that use DIP., fundamental steps in digital image processing, components of a digital processing system.	
List of Experiments: 1. Introduction to Matlab /Scilab with focus on Digital Image Processing.	

Unit - II	**8 Hours**
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	
List of Experiments: 2.Implement the following basic gray level transformations on the given image(s): i) Image Negative ii) Log transformation iii) Power Law transformation iv) Contrast stretching **v)** Gray level slicing	

Unit - III	**8 Hours**
Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters	

List of Experiments:

3. Implement the following basic gray level transformations on the given image(s):

i) Bit plane slicing

ii) Histogram plotting

iii) Histogram equalization

iv) Arithmetic operation like image subtraction

v) AND /OR logic operations

Unit - IV	8 Hours
Image Restoration: A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only –Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering.	
List of Experiments: 4. Implementation of Low-pass Butterworth filters in the frequency domain for various cut off frequencies and comment on their performance.	

Unit – V	8 Hours
Image Transforms: Introduction, Need for transforms, Classification of Image transforms, Walsh transform, Hadamard Transform, HAAR transform	
List of Experiments: 5. i) Compute the edges of the given image using the following edge detectors and comment on their performance: i) Roberts ii) Prewitt **ii.** Compute the edges of the given image using the following edge detectors and comment on their performance: i) Sobel ii) Canny	

Self Study Topics	
Unit No.	**Topic description**
1.	Structure of human eye and image formation in the eye.
3.	Relationship between sampling and frequency intervals.
4.	Linear position invariant degradations.
5.	Applications of image transformations.

Books	
	Text Books:
1.	Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing PHI 2nd Edition 2005.
2.	S. Jayaraman S. Esakkirajan, T.Veerakumar: Digital Image Processing, McGraw Hill Ed. (India) Pvt. Ltd. 2013.
	Reference Books:
1.	A.K.Jain: Fundamentals of Digital Image Processing Pearson, 2004..
2.	Scott E. Umbaugh: Digital Image Processing and Analysis, CRC Press, 2014.

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Assignments and Open Book Assignments
2.	NPTEL/ Edusat	2.	Quizzes
3.	PowerPoint Presentation	3.	Internal Assessment Tests
4.	Videos	4.	Semester End Examination

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Explain the importance of DIP and its applications.	[L1]
2.	Explain the image formation and representation of digital images .	[L1]
3.	Apply the spatial and frequency domain image processing techniques in gray & color.	[L3]

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research/investigation and development work to solve practical problems.	**PO 1**
2.	An ability to write and present a substantial technical report/ document.	**PO 2**
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	**PO 3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:**Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:**Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	50 % of the total marks is scored by 60% of the students.
2	60 % of the total marks is scored by 70% of the students.
3	70 % of the total marks is scored by 80% of the students.

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3
CO2	3	2	2	2	2	2
CO3	2	3	2	2	1	2
CO4	2	2	1	3	2	2
CO5	2	2	2	1	1	1
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.

Lab component:

Components	Conduct of the lab	Journal submission	Lab Test	TotalMarks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks

Minimum score to be eligible to SEE for this course : 40% in each component

Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):

Theory Component:

1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

<table>
<tr><td colspan="4">Lab component:</td></tr>
<tr><td rowspan="4">1.</td><td>Initial write up</td><td>10 marks</td><td rowspan="4">50 marks</td></tr>
<tr><td>Conduct of experiment(s), result and conclusion</td><td>20 marks</td></tr>
<tr><td>One marks question</td><td>10 marks</td></tr>
<tr><td>Viva-voce</td><td>10 marks</td></tr>
<tr><td>2.</td><td colspan="3">It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.</td></tr>
<tr><td>3.</td><td colspan="3">Viva-voce is conducted for individual student.</td></tr>
<tr><td colspan="4">Total SEE: 50(T) +25(L) = 75 marks</td></tr>
<tr><td colspan="4">Minimum score for passing this course : 40% in each component compulsory</td></tr>
<tr><td colspan="4">Not eligible in any one of the component will be considered as NOT eligible for the Course</td></tr>
</table>

Data Science & Analytics (Integrated)

Course Code	**20SCS13**	**Credits L-T-P**	3 - 0- 1
Course type	PC	**Total credits**	4
Hours/week: L-T-P	3 – 0 – 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40 Hrs; T = 0 Hrs; P = 24 Hrs Total = 64 Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning objectives	
1.	To introduce the fundamentals of Data Analytics life cycle
2.	To understand the functioning of unsupervised learning algorithms and their data analysis process.
3.	To analyze the functioning of supervised learning algorithms and their data processing cycle

Pre-requisites : Design and Analysis of Algorithms, Artificial intelligence, Probability and Statistics

Unit – I	**08 Hours**
Introduction to Big Data Analytics: Big Data Overview, State of the Practice in Analytics, Key Roles for the New Big Data Ecosystem, Examples of Big Data Analytics. Data Analytics Lifecycle: Data Analytics Lifecycle Overview, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize.	
List of Experiments: **1**.Basics of Language R **2.** Review of Basic Data Analytic Methods using R	

Unit – II	**08 Hours**
Clustering: Overview of Clustering, K-means, Use Cases, Overview of the Method, Determining the Number of Clusters	
List of Experiments: **3.** Demonstrate the use of K-means clustering algorithm with suitable data set.	

Unit – III	**08 Hours**
Association Rules: Overview, Apriori Algorithm, Evaluation of Candidate Rules, Applications of Association Rules	
List of Experiments: **4.** Demonstrate the Apriori algorithm using suitable example.	

Unit – IV	**08 Hours**
Regression: Linear Regression, Use Cases, Model Description, Diagnostics, Logistic Regression, Use Cases, Model Description, Diagnostics, Reasons to Choose and Cautions,	
List of Experiments: **5.** Demonstrate the application of Linear Regression model with suitable data set **6**. Demonstrate the application of Logistic Regression model with suitable data set	

Unit – V	08 Hours
Classification: Decision Trees, Overview of a Decision Tree, The General Algorithm, Decision Tree Algorithms, Evaluating a Decision Tree , Naive Bayes, Bayes' Theorem, Naïve Bayes Classifier, Smoothing, Diagnostics,	
List of Experiments: 7. Demonstrate the use Decision Tree algorithm with the help of a suitable example. 8. Demonstrate the use Naïve Bayes algorithm with the help of a suitable example.	

Self Study Topics	
Unit No.	**Topic description**
1	Global Innovation Network and Analysis (GINA)
2	Diagnostics, Reasons to Choose and Cautions, Additional Algorithms
3	Transactions in a Grocery Store, Validation and Testing, Diagnostics
4	Additional Regression Models.
5	Diagnostics of Classifiers, Additional Classification Methods

Books	
	Text Books:
1.	Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data. by EMC Education Sevices(Editor), Wiley 2015 and above.
	Reference Books:
1.	Data Science from Scratch: Joel Grus, O'reilly Publication.
2.	Data Science for Business: Foster Provost.
3.	Doing Data Science - Cathy O'neil.
	E-resourses (NPTEL/SWAYAM)
1.	https://nptel.ac.in/courses/106/106/106106212/
2.	https://swayam.gov.in/nd1_noc19_cs60/preview
3.	https://nptel.ac.in/courses/110/106/110106072/

Course delivery methods		**Assessment methods**	
1.	**Lecture**	1.	**IA**
2.	**Chalk and Board**	2.	**Seminar/Course Project**
3.	**PPT**	3.	
4.	**Online mode**	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1	Define, Understand and explain concepts of Data Science and Analytics subject	L1
2	Apply machine learning and Statistics to find solutions to broad range of problem statements	L2
3	Analyze various machine learning and statistical inference methods for a given problem statement	L4
4	Validate the data and identify the anomalies through testing	L5

5	Demonstrate experiments of data science using modern tools like R and Python	L3

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	An ability to write and present a substantial technical report/document.	**2**
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**>70 % of the total marks is scored by 60% of the students.**
2	**Between 60 % and 79% of the total marks is scored by 60% of the students.**
3	**<60 % of the total marks is scored by 60% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1			**2**			
CO2	**2**			**2**		**2**
CO3		**3**			**3**	
CO4			**3**			**3**
CO5	**2**		**2**			
						2
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:					
Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50**)	50
■ 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.					

Lab component:				
Components	Conduct of the lab	Journal submission	Lab Test	Total Marks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks
Minimum score to be eligible to SEE for this course : 40% in each component
Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):			
Theory Component:			
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.		
2.	**Minimum marks required in SEE to pass: 40 out of 100**		
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.		
Lab component:			
1.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
2.	It will be conducted for 50 marks having 3 hours/2 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.**		
3.	Viva-voce is conducted for individual student.		
Total SEE: 50(T) +25(L) = 75 marks			
Minimum score for passing this course : 40% in each component compulsory			
Not eligible in any one of the component will be considered as NOT eligible for the Course			

Advances in Computer Networks

Course Code	20SCS141	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4 – 0 – 0	**CIE Marks**	50 marks
Total Hours:	45 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To become familiar with Computer Networks and the concepts of protocols.
2.	To learn the concepts Wired and Wireless LANs
3.	To learn the concept of Logical Addresses, Address Mapping, Error Reporting and Multicasting
4.	To understand the aspects of Network Security.

Pre-requisites: Knowledge of Computer Networks.

Unit – I	**9 Hours**

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Performance.

Advanced Internetworking

The Global Internet**:** Routing Areas, Interdomain Routing (BGP)

Unit – II	**9 Hours**

End-to-End Protocols

Simple De-multiplexer (UDP); Reliable Byte Stream(TCP): End-to-End Issues, Segment Format, Connecting Establishment and Termination, Triggering Transmission, Adaptive Retransmission, TCP Extensions; Remote Procedure Call: RPC Fundamentals, RPC Implementations (SunRPC, DCE)

Congestion Control and Resource Allocation

Issues in Resource Allocation: Network Model, Taxonomy and Evaluation Criteria; Queuing Disciplines: FIFO, Fair Queuing; TCP Congestion Control: Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

Unit – III	**9 Hours**

Data Link Layer

Wired LANs: Ethernet:

IEEE Standards: Data Link Layer, Physical Layer; Standard Ethernet: MAC Sublayer, Physical Layer; Changes in the Standard: Bridged Ethernet, Switched Ethernet, Full Duplex Ethernet; Fast Ethernet: Mac Sublayer, Physical Layer;

Wireless LANs:

IEEE 802.11: Architecture, Mac Sublayer, Addressing Mechanism, Physical Layer; Bluetooth: Architecture, Bloetooth Layers, Radio Layers, Baseband Layers, L2CAP.

Unit – IV	**9 Hours**

Network Layer

Logical Addresses: IPv4 Addressing: Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation; IPv6Addresses: Structure, Address Space.

Address Mapping, Error Reporting and Multicasting:

Address Mapping: Mapping Logical to Physical Address: ARP, Mapping Physical to Logical Addressing: RARP,BOOTP and DHCP; ICMP: Types of Messages, Message Format, Error

Reporting, Query, Debugging; IGMP: Group Management, IGMP Messages, Message Format, IGMP Operation, Encapsulation, Netsat Utility.

Unit – V	**9 Hours**
Network Security Security Services: Message Confidentiality, Integrity, Authentication, Nonrepudiation, Entity Authentication; Message Confidentiality: with Symmetric and Asymmetric Key Cryptography; Message Authentication; Digital Signature: Comparison, Need for Key, Process, Services, Signature Schemes; Entity Authentication: Password, Challenge-Response; Key Management: Symmetric Key Distribution, Public Key Distribution.	

Self Study Topics	
Unit No.	**Topic description**
1	Introduction to IP Version 6
2	TCP Performance, Remote Procedure Call.
3	Gigabit Ethernet
4	ICMPv6
5	Message Integrity.

Books	
	Text Books:
1.	Larry Peterson and Bruce S Davis “Computer Networks :A System Approach” 5th Edition, Elsevier -2014
2.	Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill, 4th Edition and onwards
	Reference Books:
1.	Andrew S. Tenenbaum, “Computer Networks”, Pearson, 4th Edition and onwards.

Course delivery methods		**Assessment methods**	
1.	**Lecture**	1.	**IA**
2.	**Chalk and Board**	2.	**Seminar/Course Project**
3.	**PPT**	3.	

Course Outcome (COs)

At the end of the course, the student will be able to		Bloom’s Level
1.	Classify different types of computer network and their protocol structures.	L1
2.	Demonstrate the knowledge of basic fundamental protocols used for communication and networking.	L3, L4
3.	Explain the use of TCP for routing in Ad-hoc networks.	L2
4.	Elucidate basic working of SDN and Block Chains.	L1

Program Outcome of this course (POs)

		PO No.
1.	**Scholarship of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesis existing and new knowledge, and integration of the same for enhancement of knowledge.	**1**
2.	**Critical Thinking**: Analyze complex engineering problems critically, apply	**2**

independent judgment for synthesizing information to make intellectual and /or creative advances for conducting research in a wider a wider theoretical, practical and policy context

Program Specific Outcome of this course (PSOs)	PSO No.
1. **Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2. **Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3. **Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**>70 % of the total marks is scored by 60% of the students.**
2	**Between 50 % and 69% of the total marks is scored by 60% of the students.**
3	**<50 % of the total marks is scored by 60% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**			**1**		
CO2	**1**		**2**			**1**
CO3			**2**	**1**		
CO4	**1**		**1**			**1**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Data Mining and Data Warehousing

Course Code	**20SCS142**	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	45Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To introduce the basic concepts and techniques of data mining and data warehousing.
2.	To develop the skills using recent data mining software for solving practical problems.
3.	To assess the strengths and weaknesses of various data mining methods and algorithms.

Pre-requisites : Database Management System, Information Management.

Unit – I	**9 Hours**
Introduction and Data Preprocessing :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining .Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.	

Unit – II	**9 Hours**
What is a Data Warehouse?, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, From Data warehousing to Data Mining.	

Unit – III	**9 Hours**
Classification and Prediction: Issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification, Rule-Based classification, Classification Based on the concepts from association rule mining. Other classification methods, prediction.	

Unit – IV	**9 Hours**
Cluster Analysis: What is Cluster Analysis? Types of data in cluster Analysis: a Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density-Based Methods, Model-Based Clustering Methods: Statistical Approach, Neural Network Approach Outliner Analysis.	

Unit – V	**9 Hours**
Application and Trends in Data Mining: Data mining application, Data mining system Products research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Trends in Data Mining.	

Self Study Topics	
Unit No.	**Topic description**
1	Real life examples of data mining.
2	Case study of Data warehousing.
3	Genetic Algorithm, KNN classifier
4	Outlier Detection Methods
5	Multidimensional Data Analysis in Cube Space

Books	
	Text Books:
1.	Jiawei Han, Michelin Kamber, "Data Mining Concepts and Techniques", Morgan KaufMann Publishers, 3rd edition, July 2011.
	Reference Books:
1.	Alex Berson and Stephen J Smith, "Data Warehousing, Data Mining and OLAP" (Data Warehousing/Data Management). New Delhi : Tata Mcgraw- Hill, 2004.
2.	Arun K Pujari, "Data Mining Techniques", Universities Press, Oct 2013.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	
2.	

Course delivery methods		Assessment methods	
1.	**Lecture**	1.	**IA**
2.	**Chalk and Board**	2.	**Seminar/Course Project**
3.	**PPT**	3.	
4.		4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	**Demonstrate** storing voluminous data for online processing and preprocess the data for mining applications.	[L3]
2.	**Design and deploy** appropriate classification techniques.	[L4]
3.	**Apply** clustering the high dimensional data for better organization of the data.	[L3]
4.	**Demonstrate** the classification, Regression & clustering technique.	[L3]
5.	**Describe** the basic principles and algorithms used in practical data mining and understand their strengths and weaknesses.	[L2]

	Program Outcome of this course (POs)	PO No.
1.	**Scholarship of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	**1**
2.	**Critical Thinking**: Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and /or creative advances for conducting research in a wider a wider theoretical, practical and policy context.	**2**
3.	**Usage of modern tools**: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.	**3**

	Program Specific Outcome of this course (PSOs)	PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**50 % of the total marks is scored by 60% of the students.**
2	**80% of the total CIE is scored by 90% of the students.**
3	**60% of the total SEE is scored by 80% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**				**2**	
CO2		**2**	**1**	**2**		
CO3			**2**		**1**	
CO4		**3**		**2**		
CO5	**3**		**2**			**3**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Advanced Algorithms (Theory)

Course Code	**20SCS143**	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	50 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To review various techniques for analysis of algorithms.
2.	To study graph search algorithms.
3.	To gain an understanding of Number Theoretic Algorithms
4.	To learn algorithms for matching string
5	To get an awareness of polynomial algorithms and study probabilistic and randomized algorithms

Pre-requisites : Design and Analysis of Algorithms.

Unit - I	**10 Hours**
Review of Analysis Techniques: Growth of Functions: Asymptotic notations; standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting .	

Unit - II	**10 Hours**
Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method..	

Unit - III	**10 Hours**
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing;	

Unit - IV	**10 Hours**
String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm;.	

Unit - V	**10 Hours**
Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms;	

Self Study Topics	
Unit No.	**Topic description**
1	**Potential Methods**
2	**Maximum bipartite matching**
3	**Integer factorization.**
4	**Boyer – Moore algorithms**
5	**Probabilistic numeric algorithms.**

Books	
	Text Books:
1.	T.H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2.	Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.and onwards
	Reference Books:
1.	1. EllisHorowitz,SartajSahni,S.Rajasekharan:FundamentalsofComputerAlgorithms,2ndEdition,Universitiespress,2007.
2.	2. Anany Levitin, Introduction to the Design & Analysis Of Algorithms 2nd Edition, Pearson, 2009

Course delivery methods		Assessment methods	
1.	**Lecture**	1.	**IA**
2.	**Chalk and Board**	2.	**Seminar/Course Project**
3.	**PPT**	3.	
4.		4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	**Analyze the complexity of a given algorithm by applying algorithm analysis technique**	**[L4].**
2.	**Demonstrate the working of shortest path algorithms on directed graphs**	**[L3].**
3.	**Compute modulo inverse of a given number using extended Euclid technique**	**[L3]**
4.	**Design & demonstrate an algorithm to test the primality with lowest probability of error**	**[L6].**
5	**Design an efficient string search algorithm & demonstrate its working**	**[L6].**

Program Outcome of this course (POs)		PO No.
1.	Critical Thinking: Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and /or creative advances for conducting research in a wider a wider theoretical, practical and policy context.	**2**
2.	Problem Solving: Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.-	**3**
3.		

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills: Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.**	**1**
2.	**Develop Research Aptitude: Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.**	**2**
3.	**Professional skills and Entrepreneurship: Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.**	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	80% of the total CIE marks is scored by 90% of the students.
2	60% of the total SEE marks is scored by 80% of the students
3	

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1		**1**	**1**	**1**		**1**
CO2			**1**	**2**	**1**	**1**
CO3		**2**	**2**	**1**	**2**	
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Advances in Operating System (Theory)

Course Code	**20SCS144**	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	45 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	Introduce the fundamentals of Operating System.
2.	Present the concepts of distributed operating system that includes Architecture, Mutual Exclusion Algorithms, Deadlock Detection Algorithms and Agreement Protocols.
3.	Discuss distributed resource management components including algorithms for implementation of distributed shared memory, recovery and commit protocols.
4.	Identify the components and management aspects of Real time, Mobile operating Systems.

Pre-requisites: Computer Concepts & Programming, Computer Organization.

Unit – I	**9 Hours**
Operating System Overview, Process description & Control: Operating System Objectives and Functions, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, What is a Process?, Process States, Process Description, Process Control, Execution of the Operating System, Security Issues.	

Unit – II	**9 Hours**
Threads, SMP, and Microkernel, Virtual Memory: Processes and Threads, Symmetric Multiprocessing (SMP), Micro Kernels, Windows Vista Thread and SMP Hours Management, Linux Process and Thread Management. Hardware and Control Structures, Operating System Software, UNIX Memory Management.	

Unit – III	**9 Hours**
Multiprocessor and Real-Time Scheduling: Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling, UNIX PreclsSl Scheduling, Windows Vista Hours Scheduling, Process Migration, Distributed Global States, Distributed Mutual Exclusion.	

Unit – IV	**9 Hours**
Embedded Operating Systems: Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS, Computer Security Concepts, Threats, Attacks, and Assets, Intruders.	

Unit – V	**9 Hours**
Kernel Organization: Using Kernel Services, Daemons, Starting the Kernel, Control in the Machine , Modules and Device Management, MODULE Organization, MODULE Installation and Removal, Process and Resource Management, Running Process Manager, Creating a new Task , IPC and Synchronization, The Scheduler , Memory Manager , The Virtual Address Space, The Page Fault Handler , File Management. The windows NT/2000/XP kernel: Introduction, The NT kernel, Objects , Threads, Multiplication Synchronization, Traps, Interrupts and Exceptions, The NT executive , Object Manager, Process and Thread Manager , Virtual Memory Manager, I/o Manager.	

Self Study Topics	
Unit No.	**Topic description**
1	The Evolution of Operating Systems.
2	Windows Vista Memory Management, Summary.
3	Distributed Deadlock.
4	Malicious Software Overview, Viruses, Worms, and Bots, Rootkits.
5	The cache Manager Kernel local procedure calls and IPC, The native API, subsystems.

Books	
	Text Books:
1.	William Stallings: Operating Systems: Internals and Design Principles, 6th Edition, Prentice Hall, 2013.
2.	Gary Nutt: Operating Systems, 3rd Edition, Pearson, 2014.
	Reference Books:
1.	Silberschatz, Galvin, Gagne: Operating System Concepts, 8th Edition, Wiley, 2008
2.	Andrew S. Tanenbaum, Albert S. Woodhull: Operating Systems, Design and Implementation, 3rd Edition, Prentice Hall, 2006.
3.	Pradeep K Sinha: Distribute Operating Systems, Concept and Design, PHI, 2007.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106/106/106106144/
2.	https://www.cse.iitb.ac.in/~mythili/os/

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Demonstrate the Mutual Exclusion, Deadlock Detection and Agreement Protocols of Distributed Operating System.	**L3**
2.	Explain the various resource management techniques for distributed systems.	**L2**
3.	Identify the different features of real time and mobile operating system.	**L4**
4.	Modify existing open source kernels in terms of functionality or features used.	**L4**

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	An ability to write and present a substantial technical report/document.	**2**
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)	PSO

		No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**Internal Assessments: 50 % of the total marks is scored by 60% of the students. (It is example)**
2	**Assignments: 60 % of the total marks is scored by 70% of the students.**
3	**Quiz/ Seminar/ Course Project: 60 % of the total marks is scored by 70% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**	**-**	**2**	**2**	**-**
CO2	**1**	**2**	**-**	**1**	**1**	**-**
CO3	**3**	**3**	**1**	**2**	**2**	**1**
CO4	**2**	**2**	**2**	**2**	**2**	**1**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Second Semester
Detailed Syllabus
SOFT COMPUTING TECHNIQUES (Theory)

Course Code	**20SCS21**	**Credits L-T-P**	4- 0- 0
Course type	PC	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	50 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To introduce the principles behind soft computing techniques.
2.	To design and develop system that use Neural Network and Fuzzy Logic.
3.	To introduce genetic approach in solving computationally hard problems.

Pre-requisites : Discrete Mathematical Structures, Probability and Statistics.

Unit – I	**10 Hours**
Introduction: Neural networks, Application Scope of Neural Networks, Fuzzy Logic, Genetic Algorithm, Hybrid Systems, Soft Computing. **Artificial Neural Network: An Introduction,** Fundamental Concepts, Evolution of Neural Networks, Basic Models of Artificial Neural Networks, Important Terminologies of ANNs, McCulloch- Pitts Neuron, Linear Separability, Hebb Network.	

Unit – II	**10 Hours**
Supervised Learning Network: Perceptron Networks: Perceptron Learning Rule, Perceptron Training Algorithm for single Output Classes, Adaptive Linear Neuron (Adaline): Delta Rule for Single Output Unit, Back-Propagation Network.	

Unit – III	**10 Hours**
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Introduction to Fuzzy Logic, Classical Sets (Crisp Sets), Fuzzy Sets, Properties of Fuzzy sets. **Classical Relations and Fuzzy Relations:** Classical Relation: Operations on Classical Relations, Fuzzy Relations: Cardinality of Fuzzy Relations, Operations on Fuzzy Relations, Properties of Fuzzy Relations, Fuzzy Composition	

Unit – IV	**10 Hours**
Membership Functions: Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments. **Defuzzification:** Defuzzification Methods.	

Unit – V	**10 Hours**
Genetic Algorithm: Introduction, What are Genetic Algorithm?, Why Genetic Algorithms?, Genetic Algorithm and Search Space: Evolution and Optimization, Basic Terminologies in Genetic Algorithms, Operators in Genetic Algorithms: Encoding, Selection, Crossover (Recombination), Mutation.	

Self Study Topics	
Unit No.	**Topic description**
I	**Associative Memory Networks:** Bidirectional Associative Memory (BAM), Hopfield Networks
II	Radial Basis Function Networks
III	Applications of Fuzzy systems
IV	Application of Defuzzification
V	Case study on Genetic Algorithm

Books	
	Text Books:
1.	S.N. Sivanandam, S.N. Deepa , Principles of Soft Computing, 2nd Edition Wiley Publisher.
	Reference Books:
1.	Patnaik**, Srikanta,** Zhong**, Baojiang (Eds.), Soft Computing Techniques in Engineering Applications, Springer 2014.**
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106/105/106105173
2.	https://lecturenotes.in/subject/124/soft-computing-sc

Course delivery methods		Assessment methods	
1.	**Lecture and Board**	1.	Internal Assessments
2.	**Power point presentations**	2.	Assignments
3.	**Videos**	3.	Quiz/ Seminar/ Course Project
4.	**Classroom Exercises**	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Design Neural Network to solve problems in a variety of engineering domains	L5
2.	Design systems that employ fuzzy control approach	L5
3.	Device systems that employ genetic algorithm and demonstrate their working.	L3

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	An ability to write and present a substantial technical report/document.	**2**

3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)		**PSO No.**
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	**Target**
1	**80% of the total CIE marks is scored by 90% of the students.**
2	**60% of the total SEE marks is scored by 80% of the students**
3	

CO-PO Mapping (planned)				**CO-PSO Mapping(planned)**		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**		**1**	**2**	
CO2	**1**		**1**		**1**	**1**
CO3	**1**	**2**	**2**	**1**	**1**	
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:40**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Advances in Database Management System (Integrated)

Course Code	**20SCS22**	**Credits L-T-P**	3 - 0- 1
Course type	PC	**Total credits**	4
Hours/week: L-T-P	3 – 0 – 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40 Hrs; T = 0 Hrs;P = 24Hrs Total = 64 Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning objectives	
1.	Define parallel and distributed databases and its applications.
2.	Show applications of Object Oriented database.
3.	Explain basic concepts, principles of intelligent databases.
4.	Utilize the advanced topics of data warehousing and mining.
5	Extend knowledge in research topics of databases.

Pre-requisites : Database Management System.

Unit – I	**8 Hours**
Introduction **Review of Relational Data Model and Relational Database Constraints:** Relational model concepts; Relational model constraints and relational database schemas; Update operations, anomalies, dealing with constraint violations, Types and violations. Overview of Object-Oriented Concepts – Objects, Basic properties. Advantages, examples, Encapsulation, class hierarchies, polymorphism, examples.	
Self learning topics: Abstract data types	

Unit – II	**8 Hours**
Object and Object-Relational Databases: Overview of OOP; Complex objects; Identity, structure etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Conceptual design of Object database. Overview of object relational features of SQL; Object-relational features of Oracle; Implementation and related issues for extended type systems; syntax and demo examples.	
Self learning topics: Nested relational model	

Unit – III	**8 Hours**
Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Distributed transactions; Distributed Concurrency control and Recovery.	
Self learning topics: Updating distributed data.	

Unit – IV	8 Hours
Data Warehousing, Decision Support and Data Mining: Introduction to decision support; OLAP, multidimensional model; Window queries in SQL; Finding answers quickly; Implementation techniques for OLAP; Data Warehousing; Views and Decision support, View materialization, Maintaining materialized views. Introduction to Data Mining; Counting co-occurrences.	
Self learning topics: Mining for rules.	

Unit - V	8 Hours
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems.	
Self learning topics: Genome data management.	

Unit – VI		18 Hours
List of experiments		
1.	**Implementation of different constraint violations in relational model.**	
2.	**Develop a database application to demonstrate storing and retrieving of BLOB and CLOB objects.** a. Write a binary large object (BLOB) to a database as either binary or character (CLOB) data, depending on the type of the field in your data source. To write a BLOB value to the database, issue the appropriate INSERT or UPDATE statement and pass the BLOB value as an input parameter. If your BLOB is stored as text, such as a SQL Server text field, pass the BLOB as a string parameter. If the BLOB is stored in binary format, such as a SQL Server image field, pass an array of type byte as a binary parameter. b. Once storing of BLOB and CLOB objects is done, retrieve them and display the results accordingly.	
2.	**Develop a database application to demonstrate the representation of multi valued attributes, and the use of nested tables to represent complex objects. Write suitable queries to demonstrate their use.** Consider Purchase Order Example: This example is based on a typical business activity: managing customer orders. Need to demonstrate how the application might evolve from relational to object-relational, and how you could write it from scratch using a pure object-oriented approach. a. Show how to implement the schema -- Implementing the Application under the Relational Model -- using only Oracle's built-in data types. Build an object-oriented application on top of this relational schema using object views.	

3.	**Design and develop a suitable Student Database application by considering appropriate attributes. Couple of attributes to be maintained is the Attendance of a student in each subject for which he/she has enrolled and Internal Assessment Using TRIGGERS, write active rules to do the following:** a. Whenever the attendance is updated, check if the attendance is less than 85%; if so, notify the Head of the Department concerned. b. Whenever, the marks in an Internal Assessment Test are entered, check if the marks are less than 40%; if so, notify the Head of the Department concerned.
4.	**Mini- Project: (Each student must implement one mini project using ADBMS concepts)**

Books	
	Text Books:
1.	Elmasri and Navathe: Fundamentals of Database Systems, Pearson Education, 2013.
2.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition,McGraw-Hill, 2013.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106/106/106106095/
2.	

Course delivery methods		**Assessment methods**	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Select the appropriate high performance database like parallel and distributed database	L3
2.	Infer and represent the real world data using object oriented database	L3
3.	Interpret rule set in the database to implement data warehousing of mining	L4
4	Discover and design database for recent applications database for better interoperability	L4

Program Outcome of this course (POs)		**PO No.**
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.	**3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**>70 % of the total marks is scored by 60% of the students.**
2	**Between 60 % and 79% of the total marks is scored by 60% of the students.**
3	**<60 % of the total marks is scored by 60% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO3**		**PSO1**	**PSO2**	
CO1	**1**	**2**		**2**	**2**	
CO2	**2**	**2**		**2**	**2**	
CO3	**2**	**3**		**2**	**3**	
CO4	**2**	**3**		**2**	**3**	
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50**)	50

■ 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.

Lab component:

Components	Conduct of the lab	Journal submission	Lab Test	TotalMarks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks

Minimum score to be eligible to SEE for this course : 40% in each component

Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):

Theory Component:

<table>
<tr><td>1.</td><td colspan="3">It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.</td></tr>
<tr><td>2.</td><td colspan="3">Minimum marks required in SEE to pass: 40 out of 100</td></tr>
<tr><td>3.</td><td colspan="3">Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.</td></tr>
<tr><td colspan="4">Lab component:</td></tr>
<tr><td rowspan="4">1.</td><td>Initial write up</td><td>10 marks</td><td rowspan="4">50 marks</td></tr>
<tr><td>Conduct of experiment(s), result and conclusion</td><td>20 marks</td></tr>
<tr><td>One marks question</td><td>10 marks</td></tr>
<tr><td>Viva-voce</td><td>10 marks</td></tr>
<tr><td>2.</td><td colspan="3">It will be conducted for 50 marks having 3 hours/2 hours duration. It will be reduced to 25 marks for the calculation of SGPA and CGPA.</td></tr>
<tr><td>3.</td><td colspan="3">Viva-voce is conducted for individual student.</td></tr>
<tr><td colspan="4">Total SEE: 50(T) +25(L) = 75 marks</td></tr>
<tr><td colspan="4">Minimum score for passing this course : 40% in each component compulsory</td></tr>
<tr><td colspan="4">Not eligible in any one of the component will be considered as NOT eligible for the Course</td></tr>
</table>

RESEARCH METHODOLOGY AND IPR

Course Code	20SCS23	**Credits L-T-P**	3- 0- 1
Course type	**PC**	**Total credits**	4
Hours/week: L-T-P	3- 0- 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40 Hrs; T = 0 Hrs;P = 24Hrs Total = 64 Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning Objectives	
1.	Understand the basic concepts of research and its methodologies
2.	Identify and select the appropriate research/sampling design methods.
3.	Analyze and interpret the data to enable hypothesis testing
4.	Create the awareness about Intellectual Property Rights for the protection of inventions.

Pre-requisites : NIL

Unit – I	**10 Hours**
Research Methodology: Introduction Meaning, Objectives, types, Research Approaches. Significance of Research, Research Methods versus Methodology, Research and scientific method, research Process, Criteria of good research, Problems encountered by researchers. **Research Problem:** Defining a research problem, Selecting a research problem, necessity and techniques involved in defining the research problem.	
List of Experiments: 1. Identify the research problem and apply suitable approach for various parameters involved.	

Unit – II	**12 Hours**
Research Design: Meaning, need for research design, features of a good design, important concepts relating to research design, different research designs, Basic principles of experimental designs, developing a research plan. **Sampling design:** Implications of a sample design, Steps in sample design, criteria of selecting a sampling procedure, characteristics of a good sample design, different types of sample designs, Random Sample and complex random sample designs.	
List of Experiments: 1.Selection of sample design for a given research problem using different sample design procedures. **2.** Research design techniques, like: factorial design, L S design, randomized block design, response surface methodology.	

Unit – III	**16 Hours**
Data Collection Methods: Collection of Primary Data, Observation Method, Interview Method, Questionnaires, Schedules, Other Methods of Data Collection, Collection of Secondary Data, Case study method. **Processing and Analysis of Data** Processing operations, Elements/ types of analysis, Statistics in research- measures of central tendency or statistical averages, measures of dispersion, measures of asymmetry (skewness),	

measures of relationship, Simple regression analysis, Multiple correlation and regression, Partial correlation, Association in case of attributes,

List of Experiments:

1. Techniques for data collection [Primary, Secondary].
2. Data Analytics relevant to various applications
3. Data Analytics relevant to various applications under probability theory.
4. Regression and Correlation analysis.

Unit – IV	**12 Hours**

Testing of hypotheses- Basic concepts, procedure for hypothesis testing, flow diagram, Test of hypothesis, procedure for hypothesis testing, Hypothesis for means, difference between means, comparing two related samples, proportions, difference between proportions, comparing a variance to some hypothesized population variance, power of test,.

Chi-square test: $\chi 2$ test and their applications in research studies.

Analysis of variance: Basic principles of ANOVA, ANOVA technique, setting up of analysis of variance table, one way, ANOVA, two way ANOVA, ANOVA in Latin square Design.

List of Experiments:

1. Research design techniques, like: factorial design, L S design, randomized block design, response surface methodology.
2. Testing an Hypothesis using ANOVA (1 way and 2 way ANOVA) and other Multivariate analysis

Unit – V	**10 Hours**

Intellectual Property Rights – IPR- Invention and Creativity- Intellectual Property- Importance and Protection of Intellectual Property Rights (IPRs)- A brief summary of: Patents, Copyrights, Trademarks, Industrial Designs- Integrated Circuits-Geographical Indications- Establishment of WIPO-Application and Procedures. Research ethics, Plagiarism, Prior art search.

Interpretation and Report Writing: Meaning of interpretation, Why interpretation, Technique of interpretation, Precaution in interpretation, Significance of report writing, Different steps in writing report, Layout of the research report, Types of reports, Mechanics of writing research report.

List of Experiments: Case study on IPR and Report writing.

Self Study Topics	
Unit No.	**Topic description**
1.	Significance of Research Methodology.
2.	Implications of a sample design.
3.	Other measures- Index numbers, Time series analysis.
4.	Limitations of test of hypothesis.
5.	Precautions for writing research reports.

Books	
	Text Books:
1.	C R. Kothari, Research Methodology, New Age International Publishers, 2nd edition, 2007.
	Reference Books:
1.	Panneer Selvam, Research Methodology, PHI Learning Pvt. Ltd., 2007.
2.	Dr. B.L. Wadhera -Intellectual Property Rights, Universal Law Publishing Co. Ltd.. 2002

	William G Zikmund, Business Research Methods, Indian edition, South western Publishers, 8th Indian Reprint – 2009.
	E-resourses (NPTEL/SWAYAM. Any Other)- mention links
1.	https://onlinecourses.swayam2.ac.in/cec20_ge37 (Research Methodology)

Course delivery methods		**Assessment methods**	
1.	Lecture and Board	1.	Assignments and Open Book Assignments
2.	NPTEL/ Edusat	2.	Quizzes
3.	PowerPoint Presentation	3.	Internal Assessment Tests
4.	Videos	4.	Semester End Examination

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Identify and select an appropriate methodology for research.	[L1]
2.	Design and Apply suitable research/sampling procedure for the research problem.	[L3]
3.	Analyze and interpret data collected.	[L4]
4.	Evaluate various approaches for hypothesis testing.	[L5]
5.	Discuss the significance of Intellectual Property Rights & report writing.	[L2]

Program Outcome of this course (POs)		**PO No.**
1.	An ability to independently carry out research/investigation and development work to solve practical problems.	**PO 1**
2.	An ability to write and present a substantial technical report/ document.	**PO 2**
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	**PO 3**

Program Specific Outcome of this course (PSOs)		**PSO No.**
1.	Post graduates shall develop an ability to identify, formulate and apply knowledge of machine design to solve mechanical engineering problems pertaining to economical, environmental and social context.	**1**
2.	Post graduates shall develop knowledge of contemporary issues and an ability to use the techniques, skills and modern engineering tools necessary to engage in lifelong learning in the field of Machine Design.	**2**
3.	The graduate shall develop an ability to work on projects using multidisciplinary tools professionally and ethically.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	**Target**
1	**50 % of the total marks is scored by 60% of the students. (It is example)**
2	**60 % of the total marks is scored by 70% of the students.**
3	**70 % of the total marks is scored by 80% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**2**	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**3**	**2**	**2**	**2**	**2**
CO4	**2**	**2**	**2**	**2**	**2**	**2**
CO5	**2**	**2**	**2**	**1**	**1**	**1**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:					
Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50**)	50
■ 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.					
Lab component:					

Components	Conduct of the lab	Journal submission	Lab Test	TotalMarks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks
Minimum score to be eligible to SEE for this course : 40% in each component
Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):			
Theory Component:			
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.		
2.	**Minimum marks required in SEE to pass: 40 out of 100**		
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.		
Lab component:			
1.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
2.	It will be conducted for 50 marks having 3 hours/2 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.**		
3.	Viva-voce is conducted for individual student.		
Total SEE: 50(T) +25(L) = 75 marks			
Minimum score for passing this course : 40% in each component compulsory			
Not eligible in any one of the component will be considered as NOT eligible for the Course			

Artificial Intelligence and Agent Technology (Theory)

Course Code	20SCS241	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	45 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To understand different logical systems for inference over formal domain representations and trace how a particular inference algorithm works on a given problem specification
2.	To understand various artificial intelligence techniques and agent technology
3.	To Understand and apply appropriate game playing and planning strategies for a given problem specification

Pre-requisites: Discrete Mathematical Structures, Probability.

Unit – I	**09 Hours**
Introduction to Artificial Intelligence: Introduction, What is AI, Strong Methods and weak Methods. Uses and Limitations: **Knowledge Representation:** Need for good representation, semantic nets, Frames, Search Spaces, Semantics Tress, Search Trees, Combinatorial Explosion, Problem reduction, Goal Trees, Combinatorial Explosion	

Unit – II	**09 Hours**
Search Methodologies: Introduction, Problem solving as search, Data driven or goal driven search, Generate and test, Depth First Search, Breadth First Search, Properties of search methods, Implementing Depth-First and Breadth-First Search, Using Heuristics for Search, Hill Climbing, Best-First Search, Identifying Optimal Paths, Constraint Satisfaction search, Forward Checking, Local Search and Meta heuristics, Simulated Annealing. Genetic Algorithms for search, Real time A*, Bidirectional search	

Unit – III	**09 Hours**
Game Playing: Game Trees, Minimax, Alpha beta pruning, Checkers, Chess **Prepositional and Predicate Logic:** Introduction, What is Logic, Why Logic is used in Artificial Intelligence, Logical Operators, Translating between English and Logic Notation, Truth Tables: Not, And, Or, Implies, if, Complex Truth Tables, Tautology, Equivalence, Propositional logic, Deduction, The deduction Theorem, Soundness, Completeness, Decideability, Monotonicity, Abduction and Inductive reasoning,	

Unit – IV	**09 Hours**
Planning: Planning as a search, situation calculus, Frame problem, Means ends analysis Inference and Resolution for Problem Solving: Introduction, Resolution in prepositional logic: Applications of Resolution, Resolution in Predicate Logic, Normal forms for predicate logic, Skolemization, Resolution Algorithms, Resolution for problem solving, Rules for knowledge representation, Rule-Based systems, Rule based expert systems, CLIPS	

Unit – V	**09 Hours**
Advanced Knowledge Representation: Representations and semantics, Blackboard Architecture, Scripts, Copycat Architecture, Nonmonotonic Reasoning, Reasoning about change, Case-based Reasoning,	

Intelligent Agents: Properties of Agents, Agent Classification, Reactive Agents, Interface Agents, Mobile Agents, Information Agents, Multiagent Systems, Collaborative agents, Agent architectures, Accessibility, Learning Agents, Robotic Agents

Self Study Topics	
Unit No.	**Topic description**
I	Inheritance, Object Oriented Programming
II	Nondeterministic search, non-chronological backtracking
III	Modal logics and possible worlds, Dealing with change
IV	Backward Chaining, CYC
V	Braitenberg Vehicles

Books	
	Text Books:
1.	Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett Publishers, 1st Edition, 2004 onwards
	Reference Books:
1.	Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition 2013 onwards
2.	Stuart Russel, Peter Norvig: Artiificial Intelligence A Modern Approach, Pearson 3rd edition 2013 onwards
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106/105/106105077/

Course delivery methods		**Assessment methods**	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	**Design** intelligent agents for problem solving, reasoning, planning, decision making and learning for specific design and performance constraints and when needed, design variants of existing algorithms.	L4
2.	**Apply** AI techniques on current applications.	L3
3.	**Demonstrate** ability for problem solving, knowledge representation, reasoning and learning.	L3

Program Outcome of this course (POs)		**PO No.**
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**60 % of the total marks is scored by 70% of the students**
2	**70 % of the total marks is scored by 80% of the students**
3	**80% and above of the total marks is scored by 90% of the students**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO3**		**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**		**2**	**2**	**1**
CO2	**2**	**1**		**2**	**2**	**1**
CO3	**2**	**1**		**2**	**1**	**1**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Wireless Communication Technology

Course Code	20SCS242	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	50 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To understand the evolution of wireless technologies from 1G to 5G.
2.	To learn the requirements of 5G communication technology in the present industry applications.
3.	To understand the need of Multi-type and Device-to-Device (D2D) Communications in the 5G wireless Systems
4.	To illustrate the mode of multiple access in 5G technologies.
Pre-requisites: Concept of Computer Networks and wireless communication.	

Unit – I	**10 Hours**
Introduction: Historical background: Industrial and technological revolution: from steam engines to the Internet, Mobile communications generations: from 1G to 4G, From mobile broadband (MBB) to extreme MBB, IoT: relation to 5G. From ICT to the whole economy. Rationale of 5G: high data volume, twenty-five billion connected devices and wide requirements, Security. Global initiatives: METIS and the 5G-PPP, China: 5G promotion group, Korea: 5G Forum, Japan: ARIB 2020 and Beyond Ad Hoc,	

Unit – II	**10 Hours**
5G use cases and system concept: 5G Use cases and requirements: Use cases, Requirements and key performance indicators. 5G system concept: Concept overview, Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication, Dynamic radio access network.	

Unit – III	**10 Hours**
The 5G architecture: Introduction: NFVand SDN, Basics about RAN architecture. High-level requirements for the 5G architecture, Functional architecture and 5G flexibility: Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, Enhanced Multi-RAT coordination features. Physical architecture and 5G deployment: Deployment enablers.	

Unit – IV	**10 Hours**
Machine-type communications: Introduction: Use cases and categorization of MTC, MTC requirements. Fundamental techniques for MTC: Data and control for short packets, Non-orthogonal access protocols. Massive MTC: Design principles,	

Unit – V	10 Hours
The 5G radio-access technologies: Access design principles for multi-user communications: Orthogonal multiple-access systems, Spread spectrum multiple-access systems, Capacity limits of multiple-access methods. Multi-carrier with filtering: a new waveform: Filter-bank based multi-carrier, Universal filtered OFDM. Non-orthogonal schemes for efficient multiple access: Non-orthogonal multiple access (NOMA).	

Self Study Topics	
Unit No.	**Topic description**
1	Other 5G activities, IoT activities, Standardization activities: ITU-R, 3GPP, IEEE
2	Lean system control plane, Localized contents and traffic flows.
3	Flexible function placement in 5G deployments.
4	MTC Technology components and 5G D2D RRM concept: an example.
5	Sparse code multiple access (SCMA), Interleave division multiple access (IDMA).

Books	
	Text Books:
1.	Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, Edition 1/year 2016 and onwards
	Reference Books:
1.	Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley Publishing, Inc., Indianapolis, Indiana, 2003 and onwards
2.	Raj kamal: Mobile Computing, Oxford University Press, 2007 and onwards.
3.	Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc19_ee48/preview

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Demonstrate the Growth of wireless communication till 5G	[L3]
2.	Elucidate the need of 5G in latest communication requirements	[L2]
3.	Explore the futuristic communication technologies like Multi-type and Device-to-Device (D2D) Communications in the 5G wireless Systems	[L3]
4.	Illustrate the mode of multiple accesses in 5G communication technologies	[L2]

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development work to solve practical problems	**1**
2.	An ability to write and present a substantial technical report/document	**2**
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics: The rubrics for this cours would be through CIE performance

Levels	Target
1	60 % of the total marks is scored by 70% of the students
2	70 % of the total marks is scored by 80% of the students
3	80% and above of the total marks is scored by 90% of the students

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**			**1**		
CO2	**2**			**1**		
CO3	**2**			**1**		
CO4	**2**			**1**		
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Robotic Process Automation Design and Development (Theory)

Course Code	20SCS243	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	45 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To understand Basic Programming concepts and the underlying logic/structure
2.	To Describe RPA , where it can be applied and how its implemented
3.	To Describe the different types of variables, Control Flow and data manipulation techniques
4.	To Understand Image, Text and Data Tables Automation
5.	To Describe automation to Email and various types of Exceptions and strategies to handle

Pre-requisites : Basics of Programming

Unit – I	**09 Hours**
PROGRAMMING BASICS & RECAP Programming Concepts Basics - Understanding the application - Basic Web Concepts - Protocols - Email Clients -. Data Structures - Data Tables - Algorithms - Software Processes - Software Design - Scripting - .Net Framework - .Net Fundamentals - XML - Control structures and functions - XML Variables & Arguments	

Unit – II	**09 Hours**
RPA CONCEPTS RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document	

Unit – III	**09 Hours**
RPA TOOL INTRODUCTION & BASICS Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data	

Unit – IV	**09 Hours**
ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging	

- Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

Unit – V	**09 Hours**
EMAIL AUTOMATION & EXCEPTIONAL HANDLING Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools	

Self Study Topics	
Unit No.	**Topic description**
I	HTML, CSS
II	Industries best suited for RPA - Risks & Challenges with RPA and emerging ecosystem.
III	Data Manipulation - Gathering and Assembling Data
IV	Excel and Data Table basics - Data Manipulation in excel
V	Strategies for solving issues - Catching errors

Books	
	Text Books:
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018ISBN: 9781788470940
	Reference Books:
1.	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2.	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3.	Srikanth Merianda,Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.uipath.com/rpa/robotic-process-automation

Course delivery methods		**Assessment methods**	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	**Apply** and Implement RPA	L3
2.	**Explain** Image, Text and Data Tables Automation, E-mail automation and various types of exceptions and strategies to handle	L2
3.	**Design** RPA solution for real world problems	L5

Program Outcome of this course (POs)		PO No.
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	**3**

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**60 % of the total marks is scored by 80% of the students.**
2	**50 % of the total students certified by UiPath RPA Developer certification**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**		**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**		**3**	**1**	**2**
CO2	**2**	**2**		**1**	**1**	**1**
CO3	**2**	**2**		**1**	**1**	**1**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Information Storage Management (Theory)

Course Code	**20SCS244**	**Credits L-T-P**	4- 0- 0
Course type	PE	**Total credits**	4
Hours/week: L-T-P	4-0-0	**CIE Marks**	50 marks
Total Hours:	45 Hrs	**SEE Marks**	50 marks

Course learning objectives	
1.	To identify the components of managing the data centre.
2.	To understand logical and physical components of a storage infrastructure.
3.	To evaluate storage architectures, including storage subsystems SAN, NAS, IPSAN and CAS.
4.	To understand the business continuity, backup and recovery methods.

Pre-requisites : Knowledge of Networking and Operating systems.

Unit – I	**9 Hours**
Introduction to Information Storage Management, Data Center Environment, Application, DBMS, Host, Connectivity, Storage, Disk Drive Components & Performance, Host access to Storage, DAS, Intelligent Storage System, Components of an Intelligent Storage System, Storage Provisioning, Types of Intelligent Storage Systems.	

Unit – II	**9 Hours**
Fiber Channel: Overview, SAN and Its Evolution, Components of FC SAN, FC Connectivity, switched fabric ports, FC Architecture, fabric services, login types, zoning, Topologies.	

Unit – III	**9 Hours**
NAS: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File Sharing Protocols, Object-Based Storage Devices.	

Unit – IV	**9 Hours**
Business Continuity, Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, Backup and Archive, Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Topologies, Backup Targets.	

Unit – V	**9 Hours**
Information Security Framework, Risk Triad, Storage Security Domains, Security Implementations in Storage Networking, Securing storage infrastructure in virtualized and cloud infrastructure, Monitoring the Storage Infrastructure, Storage Infrastructure Management Activities, Storage Infrastructure Management challenges.	

Self Study Topics	
Unit No.	**Topic description**
I	iSCSI, FCIP, FCoE

II	Virtualization in SAN.
III	Content-Addressed Storage, CAS Use Cases, Unified Storage.
IV	Data De duplication, Backup in virtualized environment.
V	developing ideal solution, ILM, storage tiering.

Books	
	Text Books:
1.	EMC Corporation, "Information Storage and Management", Wiley India, 2nd Edition, 2011.
	Reference Books:
1.	Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
2.	Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2nd Edition, 2003.
3.	Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Limited, 2002.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	
2.	

Course delivery methods		**Assessment methods**	
1.	**Chalk and Talk**	1.	**Quiz**
2.	**PPT**	2.	**IA Tests**
3.	**Online Presentation through Gmeet**	3.	**Assignments**
4.		4.	

Course Outcome (COs)		
At the end of the course, the student will be able to		Bloom's Level
1.	Distinguish various data storage management systems [L4] .	
2.	Build storage area networks [L3].	
3.	Ensure business continuity using backup and archive [L4].	
	Manage and secure data centres [L3].	

Program Outcome of this course (POs)		**PO No.**
1.	An ability to independently carry out research /investigation and development work to solve practical problems.	**1**
2.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program.	**3**

Program Specific Outcome of this course (PSOs)		**PSO No.**
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**

2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Mapping through Direct Assessment:

Rubrics:

Levels	Target
1	**>70 % of the total marks is scored by 60% of the students.**
2	**Between 50 % and 69% of the total marks is scored by 60% of the students.**
3	**<50 % of the total marks is scored by 60% of the students.**

CO-PO Mapping (planned)				CO-PSO Mapping(planned)		
	PO1	**PO2**	**PO3**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**		**2**	**2**	**1**	**1**
CO2	**2**		**2**	**3**	**2**	**2**
CO3	**1**		**2**	**3**	**2**	**2**
levels: Low- 1, Medium- 2, High-3						

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50
➢ Writing two IA test is compulsory. ➢ **Minimum marks required to qualify for SEE : 20 out of 50**					

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Department of Computer Science & Engineering

M.Tech. Scheme and Syllabus (2020 Scheme)

3rd to 4th Semester M.Tech(Computer Science & Engineering)

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
To be a center of Excellence for Education, Research and Entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society.

MISSION
To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
1.	The graduates will acquire core competence in basic science and engineering fundamentals necessary to formulate, analyze and solve engineering problems and to pursue advanced study.
2.	The graduates will acquire necessary techno-managerial and life-long learning skills to succeed as computer engineering professionals with an aptitude for higher education and entrepreneurship.
3.	The graduates will maintain high professionalism and ethical standards and also develop the ability to work in teams on IT as well as multidisciplinary domains.

PROGRAM OUTCOMES (POs)	
1.	**An ability to independently carry out research /investigation and development work to solve practical problems.**
2.	**An ability to write and present a substantial technical report/document.**

3.	**Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program**.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.

3rd Sem M.Tech												
S.No.	**Course Code**	**Course**		**Contact Hours**	**Contact Hours/week**	**Credit Allocation**			**Total credits**	**Marks**		
				L – T - P		**L**	**T**	**P**		**CIE**	**SEE**	**TOTAL**
1.	20SCS31	Cloud Computing	PC 1	4 – 0 - 0	4	4	0	0	4	50	50	100
2.	20SCS32	Big Data Management	PC 2	**3 – 0 - 2**	5	3	0	1	4	50+25	50+25	150
3.	20SCS33	Cyber Security	PC 3	**3 – 0 -2**	5	3	0	1	4	50+25	50+25	150
4.	20SCS34X	Elective-III	PE-III	4 – 0 - 0	4	4	0	0	4	50	50	100
5.	20SCS35	SWAYAM Online course	OC						3			
6.	20SCS36	Project Phase-1	PR 1						4	50		50
		Total							23			

- **OC: Student can register for one course of 12 weeks OR two courses (4 weeks+ 8weeks) to earn 3 credits**
- **Maximum TWO courses should be integrated type**

ELECTIVE – III

20SCS341	Internet of Things
20SCS342	Information Retrieval
20SCS343	Natural Language Processing and Text Mining
20SCS344	Multicore Architecture & Programming

Cloud Computing

Course Code	20SCS31	**Credits**	4
Course type	PC	**CIE Marks**	50 marks
Hours/week: L-T-P	4 – 0 – 0	**SEE Marks**	50 marks
Total Hours:	45	**SEE Duration**	3

Course learning objectives

1. To understand various basic concepts related to cloud computing technologies.
2. To learn how to use Cloud Services.
3. To apply Map-Reduce concept to applications.
4. To understand role of Virtualization and resource management in enabling Cloud Computing.

Pre-requisites: Distributed Computing.

Unit I **9 Hours**

Evolution of Computing, Cloud Computing Basics

Introduction to Mainframe architecture; Client-server architecture; Cluster Computing; Grid Computing; Parallel Computing and Distributed Computing; Evolution of sharing on the Internet; Utility Computing; Autonomic Computing; Cloud Computing; Introduction of Cloud Computing; Service Models; Deployment Models; Characteristics of Cloud Computing; Advantages and Obstacles in cloud computing; Ethical issues in cloud computing.

Unit II **9 Hours**

Cloud Infrastructure

Cloud Vulnerabilities, NIST reference model, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements.

Unit III **9 Hours**

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Grep The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research.

Unit IV **9 Hours**

Cloud Resource Virtualization

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, The dark side of virtualization.

Self-Study: vBlades: Performance comparison of virtual machines.

Unit V **9 Hours**

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two level resource allocation architecture, Feedback control based on dynamic thresholds, Resourcing bundling: Combinatorial auctions for cloud resources ,Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud; scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling.

Self-Study: Introduction to Cloud Simulator.

Text Books:

1. Cloud Computing by Dr. Kumar Saurabh, Wiley India, 2011 and onwards.
2. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier (MK) 2013 and onwards.

Reference Books:

1. Cloud Computing Principles and Paradigms by Rajkumar Buyya, Wiley India 2011 and onwards.
2. John W Rittinghouse, James FRansome: Cloud Computing Implementation, Management and Security, CRC Press 2013.

Course delivery methods	**Assessment methods**
1. Chalk and board	1. Internal assessment
2. PPT	2. Assignment
3. Video lectures	3. Quiz
	4. Seminar / project

Course Outcomes (COs)

At the end of the course, the student will be able to,	**Bloom's Level**
1. **Discuss** cloud computing and control considerations within cloud computing environments.	L2
2. **Identify** various cloud services.	L2
3. **Explain** various concepts related to virtualization.	L2
4. **Apply** Map-Reduce concept	L3
5. **Analyze** resource allocation and scheduling algorithms in cloud computing	L3
6. **Demonstrate** working of cloud simulator.	L3

Program Outcome of this course (Cos)	**PO No.**
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.	3

	Program Specific Outcome of this course (PSOs)	**PSO No.**
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical	**1**

	concepts and algorithms along with tools to solve real world problems.	
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
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Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Big Data Management

Course Code	**20SCS32**	**Credits L-T-P**	3 - 0- 2
Course type	PC	**Total credits**	4
Hours/week: L-T-P	3 – 0 - 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40 Hrs; T = Hrs; P = Hrs Total = Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning objectives	
1.	To understand big data dimensions and its applications.
2.	To understand NoSQL big data management.
3.	To become aware of the Map Reduce paradigm and the Hadoop framework.
4.	To explore various Big Data Tools and Technologies.

Pre-requisites : Database Management System, Basic Commands of UNIX Operating System.

Unit - I	**9 Hours**
Understanding Big Data: What is big data? : Characteristics of Big Data, Data in the Warehouse and Data in Hadoop; Why is Big Data Important? : When to consider a Big Data solution? Big Data Use Cases: IT log analytics, Fraud detection, Social Media, Risk Management and Energy Sector.Patterns for Big Data Deployment. Big Data Frameworks:Hadoop, Spark, Flink,Storm.	
Self learning topics: Big Data Challenges.	

Unit - II	**9 Hours**
NoSQL Data Management: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication.	
Self learning topics: Self-Study: Map-reduce partitions and combining-composing map-reduce calculation.	

Unit - III	**9 Hours**
Basics of Hadoop: The History of Hadoop, Components of Hadoop, Application Development in Hadoop, Getting your data into Hadoop, Other Hadoop Components Dataformat–analyzingdatawithHadoop–scalingout–Hadoopstreaming–Hadooppipes.Design of HDFS	
Self learning topics: HDFS commands	

Unit - IV	**9 Hours**
Mapreduce Applications: MapReduce work flows–unit tests with MRUnit–test data and local tests–anatomy of MapReduce job run–classic Map-reduce–YARN–failures	

in classic Map-reduce and YARN–job scheduling Map Reduce on Spark using Scala programming a case study.
Self learning topics:

Unit - V	**9 Hours**
Hadoop Related Tools Pig–Grunt–pig datamodel–PigLatin–developing and testing PigLatin scripts.Hive–data types and file formats–Hive QLdatadefinition–HiveQL datamanipulation–HiveQLqueries.	
Self learning topics: Hbase –data model and implementations- Hbase clients –Hbase examples, Cassandra –Cassandra data model –Cassandra examples-Cassandra clients-Hadoop integration.	

Unit – VI	
List of experiments	
1.	Download, Configure and Install Hadoop on Windows. Experiment with few basis Hadoop file system commands like. Execute commands to transfer files from local file system to HDFS file system.
2.	Download, install Pig and perform load and store operations on files of various types.
3.	Write a Pig-Latin script to perform Word-Count on a text file.
4.	Perform the following operation on a given dataset a. Grouping b. Co-grouping c. Filtering d. Sorting
5.	Download and Install Mongo-DB and create a database of Customer Orders using the document data-model and perform the basic insert, update and querying on the data stored.
6	Down-load and install Cassendra, create, populate and Query the database using various commands provided in Cassendra.
7	Down-load and install Hive and experiment with HQL on the data stored.
8	Download and install Tableau and Visualize the data using various options provided in the Tool.
9	Down-load and install Spark, and write a Scala program to perform Word-Count on a text document
10	Write a Scala program to implement Linear Regression using Spark-ML library.

Books	
	Text Books:
1.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data,

	McGraw Hill, 2012.
2.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3.	TomWhite,"Hadoop: The Definitive Guide",Third Edition,O'Reilly,2012.
4.	EricSammer,"HadoopOperations",O'Reilly,2012.
	Reference Books:
1.	Vignesh Prajapati,BigdataanalyticswithRandHadoop,SPD2013.
2.	E.Capriolo,D.Wampler,andJ.Rutherglen,"ProgrammingHive",O'Reilly,2012.
3.	LarsGeorge,"HBase:TheDefinitiveGuide",O'Reilly, 2011.
4.	Alan Gates,"ProgrammingPig", O'Reilly, 2011.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	
2.	

Course delivery methods		**Assessment methods**
Lecture and Board		Internal Assessments
Power point presentations		Assignments
Videos		Quiz/ Seminar/ Course Project
Classroom Exercises		

Course Outcome (COs)

Outcomes usually follow the format: "At the end of the course, students will be able to*'insert action verb here + insert knowledge, skills, or attitudes the student is expected to develop']*(Highlight the **action verb** representing the Bloom's level.)

At the end of the course, the student will be able to		Bloom's Level
1.	Describe bigdata and use cases from selected business domains.	L1
2.	Justify use of data model in BigData.	L5
3.	Install, configure, and run Hadoop and DFS.	L3
4	Demonstrate Hadoop related tools such as Pig and Hive for big data analytics.	L3

Program Outcome of this course (Cos)	**PO No.**
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and	3

arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.

Lab component:

Components	Conduct of the lab	Journal submission	Lab Test	TotalMarks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks

Minimum score to be eligible to SEE for this course : 40% in each component

Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):

Theory Component:

1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.		
2.	**Minimum marks required in SEE to pass: 40 out of 100**		
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.		

Lab component:

1.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	

	One marks question	10 marks	
	Viva-voce	10 marks	
2.	It will be conducted for 50 marks having 3 hours/2 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.**		
3.	Viva-voce is conducted for individual student.		
Total SEE: 50(T) +25(L) = 75 marks			
Minimum score for passing this course : 40% in each component compulsory			
Not eligible in any one of the component will be considered as NOT eligible for the Course			

Cyber Security(Integrated)

Course Code	20SCS33	**Credits L-T-P**	3 - 0- 1
Course type	PC	**Total credits**	4
Hours/week: L-T-P	3 – 0 - 2	**CIE Marks**	50(T)+25(L) = 75 marks
Total Hours:	L = 40Hrs; T = Hrs; P = 10Hrs Total = 50Hrs	**SEE Marks**	50(T)+25(L) = 75 marks

Course learning objectives	
1.	To understand key issues plaguing the information security world, incident management process, and penetration testing
2.	To understand Social Engineering techniques, identify theft, and social engineering countermeasures
3.	To perform vulnerability analysis to identify security loopholes in the target organization's network, communication infrastructure, and end systems.
4.	To understand different types of attacks, application hacking methodology, and countermeasures

Pre-requisites : Networks, Information Security, Operating Systems

Unit - I	**_08__Hours**
Ethical Hacking: Overview of Ethics,Overview of Ethical Hacking,Methodology of Ethical Hacking,**Networking Foundations:**Communications Models,Topologies,PhysicalNetworking,IP,TCP,UDP,Internet Control Message Protocol,Network Architectures,Cloud Computing, **Security Foundations:**The Triad,Risk, Policies, Standards, and Procedures, Security Technology, Being Prepared	
Self learning topics:	

Unit - II	**__08_Hours**
Footprinting and Reconnaissance: Open-Source Intelligence,Domain Name System,Passive Reconnaissance,Website Intelligence,Technology Intelligence,**Scanning Networks**:Ping Sweeps,Port Scanning, Vulnerability Scanning, Packet Crafting and Manipulation,Evasion Techniques, **Enumeration:**Service Enumeration, Remote Procedure Calls,Server Message Block, Simple Network Management Protocol,Simple Mail Transfer Protocol, Web-Based Enumeration	
Self learning topics:	

Unit - III	**_08__Hours**
System Hacking: Searching for Exploits,System Compromise,Gathering Passwords, Password Cracking,Client-Side Vulnerabilities,Post Exploitation, **Malware:**Malware Types,Malware Analysis,Creating Malware,Malware Infrastructure, Antivirus Solutions, **Sniffing:** Packet Capture, Packet Analysis,Spoofing Attacks	
Self learning topics:	

Unit - IV	_08__Hours
Social Engineering: Social Engineering,Physical Social Engineering,Phishing Attacks, Website Attacks, Wireless Social Engineering, Automating Social Engineering, **Wireless Security:** Wi-Fi, Bluetooth,Mobile Devices, **Attack and Defense:** Web Application Attacks,Denial of Service Attacks, Application Exploitation,Lateral Movement, Defense in Depth/Defense in Breadth, Defensible Network Architecture	
Self learning topics:	

Unit - V	_08 Hours
Cryptography: Basic Encryption,Symmetric Key Cryptography, Asymmetric Key Cryptography, Certificate Authorities and Key Management, Cryptographic Hashing, PGP and S/MIME, **Security Architecture and Design:** Data Classification, Security Models, Application Architecture, Security Architecture, Database Attacks,IDS, Firewalls, And Honeypots,IoT, And Botnets, applications of cyber security for blockchain	
Self learning topics:	

Unit – VI	10 Hours
List of experiments	
1.	Install Kali Linux and explore various tools (Audit)
2.	Participate in Capture The Flag events (Audit)
3.	Understand and participate in Bug Bounty programs (Audit)
4.	Install, configure and learn Python security packages for writing scripts (Audit)
5.	Write a Python script to use HIBP APIs to check whether your account has been compromised. List all accounts whose password has been compromised. Also use HIBP APIs to check whether your new password has been compromised.
	Write a Python script to prevent SQL and XPath injection attacks.
	Write a Python script to perform arbitrary computations of encrypted data.
	Write a Python script to hack ciphers such as Caesar cipher or Transposition Cipher.
	Write a Python script to perform programmatic packet analysis using PyShark.
	Write a Python script to perform packet sniffing using Scapy

Books	
	Text Books:
1.	Ric Messier, CEH v10 Certified Ethical Hacker Study Guide, Sybex, 2019
2.	Michael Gregg, Omar Santos, Certified Ethical Hacker (CEH) Version 10 Cert Guide, Pearson IT Certification, 3rd Edition, 2019
3.	
4.	
	Reference Books:
1.	Matt Walker, CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition, McGraw-Hill, 4th Edition, 2019
2.	
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	

2.	

Course delivery methods		Assessment methods
Lecture and Board		Internal Assessments
Power point presentations		Assignments
Videos		Quiz/ Seminar/ Course Project
Classroom Exercises		

Course Outcome (COs)

Outcomes usually follow the format: "At the end of the course, students will be able to*'insert action verb here + insert knowledge, skills, or attitudes the student is expected to develop']*(Highlight the **action verb** representing the Bloom's level.)

At the end of the course, the student will be able to		Bloom's Level
1.	**Perform** vulnerability analysis to identify security loopholes in the target organization's network, communication infrastructure, and end systems	4
2.	**Understand** mobile platform attack vector, android vulnerabilities, mobile security guidelines, and tools	2
3.	**Implement** wireless encryption, wireless hacking methodology, wireless hacking tools, and Wi-Fi security tools	5

Program Outcome of this course (Cos)	PO No.
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.	3

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE)

Theory Component:

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- 100 marks will be reduced to 50 marks for the calculation of SGPA and CGPA.

Lab component:

Components	Conduct of the lab	Journal submission	Lab Test	TotalMarks
Lab	10	10	5	25

Total CIE: 50 (T) +25(L) = 75 marks

Minimum score to be eligible to SEE for this course : 40% in each component

Not eligible in any one of the component will be considered as NOT eligible for the Course

Scheme of Semester End Examination (SEE)

Scheme of Semester End Examination (SEE):			
Theory Component:			
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.		
2.	**Minimum marks required in SEE to pass: 40 out of 100**		
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.		
Lab component:			
1.	Initial write up	10 marks	50 marks
	Conduct of experiment(s), result and conclusion	20 marks	
	One marks question	10 marks	
	Viva-voce	10 marks	
2.	It will be conducted for 50 marks having 3 hours/2 hours duration. **It will be reduced to 25 marks for the calculation of SGPA and CGPA.**		
3.	Viva-voce is conducted for individual student.		
Total SEE: 50(T) +25(L) = 75 marks			
Minimum score for passing this course : 40% in each component compulsory			
Not eligible in any one of the component will be considered as NOT eligible for the Course			

Internet of Things

Course Code	**20SCS341**	**Credits**	4
Course type	PE	**CIE Marks**	50 marks
Hours/week: L-T-P	4-0-0	**SEE Marks**	50 marks
Total Hours:	50 Hrs	**SEE Duration**	3 Hours for 100 marks

Course learning objectives	
1.	To understand the physical, logical design and the protocols in IOT.
2.	To understand the IOT architecture and protocol stack.
3.	To learn the various components and modes of communications with IOTs.
4.	To understand the address capabilities and mobile technologies of IOT.
5	To discuss about the cloud and IOT environment.

Pre-requisites:1. Fundamentals of Basic Electronics.

2. Fundamentals of Communication and Computer Network.

Unit – I	**10 Hours**
INTRODUCTION TO INTERNET OF THINGS: What is the Internet of Things? Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies: WSN, cloud computing, Big data Analytics, communication Protocols, Embedded systems, IoT levels and Deployment templates: Level 1 to Level 5.	

Unit – II	**10 Hours**
IoT NETWORK ARCHITECTURE AND DESIGN: The one M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, IoT protocol stack, The Core IoT Functional Stack, IoT Data Management and Compute Stack: Fog Computing, Edge Computing, The Hierarchy of Edge, Fog, and Cloud IoT and M2M: Introduction to M2M, Difference between IoT and M2M, SDN and NFV for IoT.	

Unit – III	**10 Hours**
SMART OBJECTS: THE "THINGS" IN IoT : Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN.	

Unit – IV	**10 Hours**
ADDRESSING TECHNIQUES FOR THE IoT: Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6, Mobile IPV6 technologies for the IoT: Protocol Details, IPv6 over low-power WPAN (6LoWPAN).	

Unit – V	10 Hours
IoT PLATFORMS AND CLOUD OFFERINGS: What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, Other IoT Devices: pcDuino, Beagle Bone Black, CubieBoard, ARDUINO, Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework.	

Books	
	Text Books:
1.	Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2.
2.	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
3.	Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications Daniel Minoli Willy Publication s - 2013 978-1-118- 47347-4, 466.
4.	
	Reference Books:
1.	Smart Internet of things projects Agus Kurniawan Packt - Sep 2016 978-1- 78646- 651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978
2.	Applications and protocols Hersent s 119- 99435-0, 3 The Internet of Things Connecting Objects to the Web Hakima Chaouchi, Willy Publications 978-1- 84821-140-7.

Course Outcome (COs)

Outcomes usually follow the format: "At the end of the course, students will be able to *'insert action verb here + insert knowledge, skills, or attitudes the student is expected to develop']* (Highlight the **action verb** representing the Bloom's level.)

At the end of the course, the student will be able to		Bloom's Level
1.	Identify the various components and explain the policies, challenges and issues in the field of IOT	[L1, L2]
2.	Apply the basic principles and demonstrate the skill of proposing suitable solutions to design problems relating to IOT	[L3]
3.	Propose the design of IOT systems and develop the software for sensors and controllers	[L5]
4.	Develop schemes for the applications of IOT in real time scenarios	[L5]

Program Outcome of this course (Cos)	PO No.
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to	1

discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.

2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise. 3

	Program Specific Outcome of this course (PSOs)	PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

INFORMATION RETRIEVAL

Subject Code:	20SCS342	**Credits:**	04
Course Type:	PE-C	**CIE Marks:**	50
Hours/Week: L-T-P	4-0-0	**SEE Marks :**	50
Total Hours:	50	**SEE Duration:**	3 Hours

Course Learning Objectives:

1. To understand the basics of Information Retrieval with pertinence to modeling, query operations and indexing
2. To get an understanding of machine learning techniques for text classification and clustering
3. To understand the various applications of Information Retrieval giving emphasis to Multimedia IR, Web Search
4. To understand the concepts of queries specification judgment and search engines

Prerequisite: Web Programming, Database Management System.

UNIT-I **10 Hours**

Introduction: Motivation, Basic concepts, Past, present, and future, The retrieval process. **Modeling:** Introduction, A taxonomy of information retrieval models, Retrieval**:** Adhoc and filtering, A formal characterization of IR models, Classic information retrieval, Alternative set theoretic models, Alternative algebraic models, Alternative probabilistic models, Structured text retrieval models, Models for browsing.

UNIT-II **10 Hours**

Retrieval Evaluation: Introduction, Retrieval performance evaluation, Reference collections. **Query Languages:** Introduction, keyword-based querying, Pattern matching, Structural queries, Query protocols. **Query Operations:** Introduction, User relevance feedback, Automatic local analysis, Automatic global analysis.

UNIT-III **10 Hours**

Text and Multimedia Languages and Properties: Introduction, Metadata, Text, Markup languages, Multimedia. **Text Operations:** Introduction, Document preprocessing, Document clustering, Text compression, Comparing text compression techniques.

UNIT-IV **10 Hours**

Indexing and Searching: Introduction; Inverted Files; Other indices for text; Boolean queries; Sequential searching; Pattern matching; Structural queries; Compression.

Parallel and Distributed IR: Introduction, Parallel IR, Distributed IR.

UNIT-V **10 Hours**

User Interfaces and Visualization: Introduction, Human-Computer interaction, The information access process, Starting pints, Query specification, Context, Using relevance judgments, Interface support for the search process. **Searching the Web:** Introduction, Challenges, Characterizing the web, Search engines, Browsing, Meta searchers, Finding the needle in the haystack, Searching using hyperlinks.

TEXT BOOKS:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto: Modern Information Retrieval, Pearson, 1999. (Chapter 1.1 to 1.4, Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8, Chapter 9, Chapter 10, Chapter 13)

REFERENCE BOOKS:

1. David A. Grossman, Ophir Frieder: Information Retrieval Algorithms and Heuristics, 2nd Edition, Springer, 2004.

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcomes:

Upon completion of the course, the students would be able to

1. **Identify** the taxonomy of an Information Retrieval system [L1]
2. **Explain** various machine learning techniques for text classification and clustering [L2]
3. **Demonstrate** the working of search engine [L3]
4. **Analyze** the Web content structure [L4]

Program Outcome of this course (Cos)	PO No.
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.	3

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**

2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

NATURAL LANGUAGE PROCESSING AND TEXT MINING

Subject Code:	20SCS343	**Credits:**	4
Course Type:	PE	**CIE Marks:**	50
Hours/week: L – T – P	4 – 0 – 0	**SEE Marks:**	50
Total Hours:	50	**SEE Duration:**	3 Hours

Course Objectives:
1. Learn the techniques in natural language processing.
2. Familiar with the natural language generation.
3. Be exposed to Text Mining.
4. Analyze the information retrieval techniques

Prerequisite: Introductory course on mobile computing

UNIT I **10 Hours**

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

UNIT II **10 Hours**

WORD LEVEL AND SYNTACTIC ANALYSIS: Word Level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. Syntactic Analysis: Contextfree Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III **10 Hours**

Extracting Relations from Text: From Word Sequences to Dependency Paths: Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. Mining Diagnostic Text Reports by Learning to Annotate Knowledge Roles: Introduction, Domain Knowledge and Knowledge Roles, Frame Semantics and Semantic Role Labeling, Learning to Annotate Cases with Knowledge Roles and Evaluations. A Case Study in Natural Language Based Web Search: InFact System Overview, The GlobalSecurity.org Experience.

UNIT IV **10 Hours**

Evaluating Self-Explanations in iSTART: Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems, Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures: Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments. Automatic Document Separation: A Combination of Probabilistic Classification and Finite- State Sequence Modeling: Introduction, Related Work, Data Preparation, Document Separation as a Sequence Mapping

Problem, Results. Evolving Explanatory Novel Patterns for Semantically-Based Text Mining: Related Work, A Semantically Guided Model for Effective TextMining.

UNIT V **10 Hours**

INFORMATION RETRIEVAL AND LEXICAL RESOURCES: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame Net- Stemmers-POS Tagger- Research Corpora.security

Text Books

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
2. Anne Kao and Stephen R. Poteet (Eds), "Natural LanguageProcessingandText Mining",Springer Verlag London Limited 2007.

References

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
2. James Allen, "Natural Language Understanding", 2nd edition, Benjamin/Cummingspublishingcompany, 1995.
3. Gerald J. Kowalski and Mark.T. Maybury, "Information Storage and Retrieval systems", Kluwer academic Publishers, 2000.
4. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python," Publisher: O'Reilly Media, June 2009
5. Christopher D.Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcomes:

The students will be able to

1. Analyze the natural language text. [L4]
2. Generate the natural language. [L2]
3. Demonstrate Text mining. [L2]
4. Apply information retrieval techniques. [L3]

Program Outcome of this course (Cos)	PO No.
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine	3

ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50**)	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Multi-Core Architecture and Programming

Subject Code	18SCS344		**Credits**	4
Course Type	PE		**CIE Marks**	50
Hours/Week: L-T-P	4-0-0		**SEE Marks**	50
Total Hours	50		**SEE Duration**	3

Course Objectives:

1. To understand the recent trends in the field of computer architecture and identify performance related parameters.
2. To study the concepts of parallel programming.
3. To understand the concepts of multi threading and OPENMP.
4. To analyze the solutions to Common Parallel Programming Problems.

Prerequisite: Computer Organization, Operating System, Advanced computer Architecture

Unit I **10 Hours**

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

Unit II **10 Hours**

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

Unit III **10 Hours**

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. Threading APIs, Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread

Synchronization, Signaling, Compilation and Linking.

Unit IV **10 Hours**

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

Unit V **10 Hours**

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention.

A Case Study: Threading on Intel Multi-core Processors. .

Text Books

1. Shameem Akhther and Jason Roberts, "Multicore Programming, Increasing Performance through Software Multi-threading", Intel Press, 2006.
2. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.

Reference Books

1. Rohit Chandra, Leonardo Dagum, Dave Kohr etc. "Parallel Programming in Openmp", 2000.
2. John L. Hennessey and David A. Patterson, "Computer architecture – A quantitative approach", Morgan Kaufmann/Elsevier Publishers, 5th. Edition, 2011.

Course delivery methods		Assessment methods	
1.	Lecture and Board	1.	Internal Assessments
2.	Power point presentations	2.	Assignments
3.	Videos	3.	Quiz/ Seminar/ Course Project
4.	Classroom Exercises	4.	

Course Outcomes:

The students should be able to:

1. Identify the limitations of ILP and the need for multi-core architectures [L1].
2. Analyze the issues related to multiprocessing [L4].
3. Develop the solutions using parallel programming [L3].

4. Demonstrate the use of synchronization technique in threads [L3].

Program Outcome of this course (Cos)	PO No.
1. **Application of Knowledge**: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.	1
2. **Problem Solving**: Think laterally and originally, conceptualize and solve engine ering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.	3

Program Specific Outcome of this course (PSOs)		PSO No.
1.	**Analyzing and Modeling skills:** Ability to analyze and use of mathematical concepts and algorithms along with tools to solve real world problems.	**1**
2.	**Develop Research Aptitude:** Ability to identify research problem statement, carryout experimentation, draw inferences and present them at national and international level.	**2**
3.	**Professional skills and Entrepreneurship:** Ability to demonstrate professional and leadership qualities required to pursue innovative career in Information Technology, self-employment and research activities.	**3**

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two assignments	Seminar/ Mini Project	Total Marks	Final marks
Theory	30+30	10+10	20	100 **(reduced to 50)**	50

- Writing two IA test is compulsory.
- **Minimum marks required to qualify for SEE : 20 out of 50**

Self Study topics shall be evaluated during CIE (Assignments and IA tests) and 10% weightage shall be given in SEE question paper.

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass:**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

4th Sem M.Tech								
S.No.	**Course Code**	**Course**		**Contact Hours/week**	**Total credits**	**Marks**		
						CIE	**SEE**	**TOTAL**
1.	20SCS41	#Internship	PI	6 – 8 weeks	5	50	50	100
2.	20SCS42	Project Phase -2	PR2		4	50(25+25)	--	50
3.	20SCS43	Project Phase -3	PR3		4	50(25+25)	--	50
4.	20SCS44	Evaluation of Project and Viva-voce	PR5		10	--	150(50+100)	150
		Total			23	150	200	350

#Internship: 6 to 8 weeks either in one slot or multiple slots during vacation between 2nd and 3rdsem / between 3rd and 4thsem

Project Phase 2: CIE- 50 marks (25 marks –Internal guide + 25 marks- presentation)

Project Phase 3: CIE- 50 marks (25 marks –Internal guide + 25 marks- presentation)

Project Viva-voce: SEE- 150 marks (50 marks for report evaluation (**Avg. of Internal & external examiner marks**) + 100 marks viva- voce)