| Information Retrieval | | | |
|---|---|---|---|
| Course Code | 22SIT31 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 3 | SEE Marks | 50 |
| Total Hours of Pedagogy | 50 | Total Marks | 100 |
| Credits | 4 | Exam Hours | 03 |

**Course Learning objectives:**

- Use the different information retrieval techniques in various application areas
- Apply IR principles to locate relevant information collections of data
- Analyze the performance of retrieval systems when dealing with unmanaged data sources

| **Module-1** | |
|---|---|
| Boolean retrieval. The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction. Index compression. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-2** | |
|---|---|
| Scoring, term weighting, and the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Relevance feedback and query expansion. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-3** | |
|---|---|
| XML retrieval. Probabilistic information retrieval. Language models for information retrieval. Text classification. Vector space classification. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-4** | |
|---|---|
| Support vector machines and machine learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-5** | |
|---|---|
| Web search basics. Web crawling and indexes, Link analysis. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**


1. Introduction to Information Retrieval , Christopher D. Manning and Prabhakar Raghavan and Hinrich Schütze, Cambridge University Press, 2008.
2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer.
3. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.


**Web links and Video Lectures (e-Resources):**

https://www.youtube.com/watch?v=Q72hzU1Z6aQ

**Skill Development Activities Suggested**

The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Le |
|---|---|---|
| CO1 | Describe models like vector-space, probabilistic and language models to identify the similarity of query and document | L2 |
| CO2 | Implement retrieval systems for web search tasks. | L2 |
| CO3 | Analyze ranked retrieval of a very large number of documents with hyperlinks between them. | L2 |
| CO4 | Demonstrate genesis and diversity of information retrieval situations for text and hyper media. | L3 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | x | | x | | | | | | | | |
| CO2 | | x | | | | x | | | | | | |
| CO3 | | x | | x | | | | | | | | |
| CO4 | | | x | | | | | | | | | x |

| DEEP LEARNING | | | |
|---|---|---|---|
| Course Code | **22SIT22** | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 3:2:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 hours Theory + 10 hours Lab | Total Marks | 100 |
| Credits | 04 | Exam Hours | 03 |

**Course objectives:**

- Figure out the context of neural networks and deep learning
- Know how to use a neural network
- Explore the data needs of deep learning
- Have a working knowledge of neural networks and deep learning
- Explore the parameters for neural networks

| **MODULE-1** | |
|---|---|
| **Machine Learning Basics:** Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimator, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Decent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning. | |
| **Teaching-Learning Process** | Chalk and board /PPT / web contents |

| **MODULE-2** | |
|---|---|
| **Deep Feedforward Networks:** Gradient-Based Learning, Hidden Units, Architecture Design, BackPropagation. Regularization: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, SemiSupervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging, Dropout. | |
| **Teaching-Learning Process** | Chalk and board /PPT / web contents |

| **MODULE-3** | |
|---|---|
| **Optimization for Training Deep Models:** How Learning Differs from Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms. Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates. **Convolutional Networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features. | |
| **Teaching-Learning Process** | Chalk and board /PPT / web contents / Case study |

| **MODULE-4** | |
|---|---|
| **Sequence Modelling:** Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks. Long short-term memory | |
| **Teaching-Learning Process** | Chalk and board /PPT / web contents/ Case study |

| **MODULE 5** |
|---|

| | |
|---|---|
| **Practical Methodology:** Performance Metrics, Default Baseline Models, Determining Whether to Gather More Data, Selecting Hyperparameters, Debugging Strategies, Example: Multi-Digit Number Recognition. Applications: Vision, NLP, Speech. | |
| **Teaching-Learning Process** | Chalk and board /PPT / web contents / Case study. |

**PRACTICAL COMPONENT OF IPCC** *(May cover all / major modules)*

| Sl.NO | Experiments |
|---|---|
| 1 | **Build Machine Learning model to solve real world regression problems.** |
| 2 | Build machine learning model to real world binary classification problems. |
| 3 | Build simple model to understand over fitting and under fitting conditions. |
| 4 | Build simple convolution network to identify hard written character recognition. |
| 5 | Analyze performance metrics of the machine learning model. |

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**CIE for the theory component of IPCC**

1. Two Tests each of **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

**CIE for the practical component of IPCC**

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

.

**SEE for IPCC**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component**).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

**Suggested Learning Resources:**

**Text Books:**

1. Deep Learning Lan Good fellow and YoshuaBengio MIT Press https://www.deeplearn ingbook.org/ 2016.

**Reference Books:**

2. Neural Networks:Asystematic Introduction Raúl Rojas 1996.
3. Pattern Recognition and machine Learning Chirstopher Bishop 2007.

**Web links and Video Lectures (e-Resources):**

- https://www.simplilearn.com/tutorials/deep-learning-tutorial
- https://www.kaggle.com/learn/intro-to-deep-learning
- https://www.javatpoint.com/deep-learning

**Skill Development Activities Suggested**

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains. | L1 |
| CO2 | Implement deep learning algorithms and solve real-world problems.(can be attained through assignment and CIE) | L4 |
| CO3 | Execute performance metrics of Deep Learning Techniques. (can be attained through assignment and CIE) | L4 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | x | | x | | | | | | | | | |
| **CO2** | x | x | | | | | | | | | | |
| **CO3** | x | | x | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| | Web Engineering | | | |
| | Course Code | 22SIT322 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 2:0:2 | SEE Marks | 50 |
| | Total Hours of Pedagogy | 40 | Total Marks | 100 |
| | Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Explore the different characteristics of web applications
- Describe learning techniques and evaluation metrics for ensuring the proper operability, maintenance and security of a web application.
- Explain the testing techniques for web applications

**Module-1**

**Introduction To Web Engineering And Requirements Engineering :**Motivation, Categories of Web Applications, Characteristics of Web Applications, Product-related Characteristics, Usage related Characteristics, Development-related Characteristic, Evolution of web engineering - Requirements Engineering Activities RE Specifics in Web Engineering, Principles for RE of Web Applications, Adapting RE Methods to Web Application Development, Requirement Types, Notations, Tools

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

**Module-2**

**Web Application Architectures & Modelling Web Applications :**Introduction- Categorizing Architectures, Specifics of Web Application Architectures, Components of a Generic Web Application Architecture, Layered Architectures, 2-Layer Architectures, N-Layer Architectures Data-aspect Architectures, Database-centric Architectures, Architectures for Web Document Management, Architectures for Multimedia Data Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

**Module-3**

**Web Application Design:** Introduction, Web Design from an Evolutionary Perspective, Information Design, Software Design: A Programming Activity, Merging Information Design and Software Design, Problems and Restrictions in Integrated Web Design, A Proposed Structural Approach, Presentation Design, Presentation of Nodes and Meshes, Device-independent Development, Approaches, Inter action Design, User Interaction User Interface Organization, Navigation Design, Designing a Link Representation, Designing Link Internals, Navigation and Orientation, Structured Dialog for Complex Activities, Interplay with Technology and Architecture, Functional Design.

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

**Module-4**

| | | |
|---|---|---|
| | **Testing Web Applications:** Introduction, Fundamentals, Terminology, Quality Characteristics, Test Objectives, Test Levels, Role of the Tester, Test Specifics in Web Engineering, Test Approaches, Conventional Approaches, Agile Approaches, Test Scheme, Three Test Dimensions, Applying the Scheme to Web Applications, Test Methods and Techniques, Link Testing, Browser Testing, Usability Testing, Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, Test Automation, Benefits and Drawbacks of Automated Test, Test Tools. | |
| | **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
| | **Module-5** | |
| | **Web Project Management:** Understanding Scope, Refining Framework Activities, Building a Web Team, Managing Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets. | |
| | **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**

*1. Gerti Kappel, Birgit Proll, "Web Engineering", John Wiley and Sons Ltd*

*2. Roger S. Pressman, David Lowe, "Web Engineering", Tata McGraw Hill Publication*

*3. Guy W. Lecky-Thompson, "Web Programming", Cengage Learning, 2008.*

**Web links and Video Lectures (e-Resources):**

- https://www.youtube.com/watch?v=JsbxB2l7QGY
- https://www.geeksforgeeks.org/web-technology
- https://youtu.be/HorJOe2yl8Q
- https://youtu.be/pWG7ajC_OVo?list=PL4cUxeGkcC9gksOX3Kd9KPo-O68ncT05o
- https://youtu.be/6EukZDFE_Zg
- https://youtu.be/xr6uZDRTna0

**Skill Development Activities Suggested**

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Le |
|---|---|---|
| CO1 | Employ techniques to analyze and evaluate software architectures on a real-world large-scale web-based software systems. | L2 |
| CO2 | Analyze and design comprehensive systems for the creation, dissemination, storage, retrieval, and use of electronic records and documents | L3 |
| CO3 | Develop solutionto complex problems using appropriate method, technologies, framework, web services and content management. | L4 |
| CO4 | Illustrate the usage of web servers and use this to develop webpage and store data in database in JSP on Web server. | L3 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | x | | | x | | | | x | | | |
| CO2 | | | x | | x | | | | | | x | |
| CO3 | x | | | x | | | | | | | | x |
| CO4 | | | | x | | x | | | | | | |

| Blockchain Technology | | | |
|---|---|---|---|
| Course Code | 22SIT323 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 2:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Explain the strong technical knowledge of Blockchain technologies.
- Analyze the blockchain decentralization and cryptography concepts.
- Explore the driving force behind the cryptocurrency Bitcoin, along with the Decentralization.

| **Module-1** | |
|---|---|
| Blockchain 101: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-2** | |
|---|---|
| Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-3** | |
|---|---|
| Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-4** | |
|---|---|
| Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101:Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts. | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

| **Module-5** | |
|---|---|
| Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media | |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books:**


1. *Bitcoin and Cryptocurrency Technologies,*Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016
2. *Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017*
3. *Blockchain Basics: A Non-Technical Introduction in 25 Steps*, Daniel Drescher, Apress, First Edition, 2017
4. *Mastering Bitcoin: Unlocking Digital Cryptocurrencies,* Andreas M. Antonopoulos, O'Reilly Media, First Edition, 2014


**Web links and Video Lectures (e-Resources):**

- https://nptel.ac.in/courses/106105184
- https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall-2018/video_galleries/video-lectures/

**Skill Development Activities Suggested**

The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Explore the emerging abstract models for Blockchain Technology and to familiarise with the functional/operational concepts. | L1 |
| CO2 | Analyze the various consensus mechanisms, applications, research challenges and future directions. | L3 |
| CO3 | Practical implementation of Blockchain operations and solutions using Ethereum | L3 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | x | | x | | | x | | | | | |
| CO2 | x | | | x | | | | | | | | |
| CO3 | | x | | | | | | | | x | | |

| SOCIAL NETWORK ANALYSIS | | | |
|---|---|---|---|
| Course Code | 22SIT324 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 2:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 3 | Exam Hours | 03 |

**Course Learning objectives:**

- Explore the knowledge on various secure mechanisms through set of protocols.
- Design a new set of protocols.
- Define the Security issues and overcome means with protocols.

| **Module-1** | |
|---|---|
| Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores | |
| **Teaching-Learning Process** | **Chalk and Talk method /PPT/ Case study** |

| **Module-2** | |
|---|---|
| Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS. | |
| **Teaching-Learning Process** | **Chalk and Talk method /PPT/ Case study** |

| **Module-3** | |
|---|---|
| Network communities and Affiliation networks: Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems | |
| **Teaching-Learning Process** | **Chalk and Talk method /PPT/ Case study /Simulation** |

| **Module-4** | |
|---|---|
| Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections | |
| **Teaching-Learning Process** | **Chalk and talk method / PowerPoint Presentation/Case study** |

| **Module-5** | |
|---|---|
| Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, retweets. | |
| **Teaching-Learning Process** | **Chalk and talk method / PowerPoint Presentation/Simulation** |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**


5. Networks, Crowds, and Markets: Reasoning About a Highly Connected World, David Easley and John Kleinberg, Cambridge University Press,2010
6. Statistical Analysis of Network Data with R, Eric Kolaczyk, Gabor Csardi, Springer,2014
7. Social Network Analysis. Methods and Applications, Stanley Wasserman and Katherine Faust, Cambridge University Press


**Web links and Video Lectures (e-Resources):**

- https://youtu.be/v3JaWbAdTTg

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Define notation and terminology used in network science (can be attained through assignment or CIE) | L3 |
| CO2 | Demonstrate, summarize and compare networks | L2 |
| CO3 | Explain basic principles behind network analysis algorithms. (can be attained through assignment or CIE) | L3 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | X | | | | | X | | | | |
| CO2 | X | | | | | | | | | | | X |
| CO3 | | | X | | X | | | X | | | | |

| Advances in Software Testing | | | |
|---|---|---|---|
| Course Code | 22SIT325 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 2:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Apply software testing knowledge and engineering methods.
- Finding defects which may get created by the programmer while developing the software.
- Explore information about the level of quality.

**Module-1**

Basics of Software Testing and Examples: Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Error and fault taxonomies, Levels of testing. Examples: Generalized pseudocode, The triangle problem, The NextDate function, The commission problem, The SATM (Simple Automatic Teller Machine) problem.

| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
|---|---|

**Module-2**

Decision Table-Based Testing: Decision tables, Test cases for the triangle problem, Test cases for the NextDate function, Test cases for the commission problem, Guidelines and observations. Data Flow Testing: Definition-Use testing, Slice-based testing, Guidelines and observations. Levels of Testing: Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing. Integration Testing: A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations, Case study.

| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
|---|---|

**Module-3**

System Testing: Threads, Basic concepts for requirements specification, Finding threads, Structural strategies and functional strategies for thread testing, SATM test threads, System testing guidelines, ASF (Atomic System Functions) testing example. Interaction Testing: Context of interaction, A taxonomy of interactions, Interaction, composition, and determinism, Client/Server Testing,.Issues in Object-Oriented Testing: Units for object-oriented testing, Implications of composition and encapsulation, inheritance, and polymorphism, Levels of objectoriented testing, GUI testing, Dataflow testing for object-oriented software, Examples. Class Testing: Methods as units, Classes as units.

| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
|---|---|

**Module-4**

Object-Oriented Integration Testing: UML support for integration testing, MM-paths for object-oriented software, A framework for object-oriented dataflow integration testing.GUI Testing: The currency conversion program, Unit testing, Integration Testing and System testing for the currency conversion program. Object-Oriented System Testing: Currency converter UML description, UML-based system testing, Statechart-based system testing.

| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
|---|---|

**Module-5**

Exploratory Testing: The context-driven school, Exploring exploratory testing, Exploring a familiar example, Exploratory and context-driven testing observations. Model-Based Testing: Testing based on models, Appropriate models, Use case-based testing, Commercial tool support for model-based testing. Test-Driven Development: Test-then-code cycles, Automated test execution, Java and JUnit example, Remaining questions, Pros, cons, and open questions of TDD, Retrospective on MDD versus TDD.

| | | |
|---|---|---|
| | **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |

## Assessment Details (both CIE and SEE)

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### Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**


1. *Software Testing*:A Craftsman's Approach, Paul C. Jorgensen, Auerbach Publications, 3rd Edition, 2013.
2. *Foundations of Software Testing*, Aditya P Mathur, Pearson.
3. *Software Testing and Analysis: ProcessPrinciples and Techniques*, Mauro Pezze, Michal Young, John Wiley & Sons.


**Web links and Video Lectures (e-Resources):**

- https://www.testingxperts.com/knowledge-center/latest-trends/
- http://venkatramakrishnan.com/software-testing/
- https://www.softwaretestinghelp.com/software-testing-trends/

**Skill Development Activities Suggested**

The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Le |
|---|---|---|
| CO1 | Compare and pick out the right type of software testing process for any given real world problem | L2 |
| CO2 | Automate the testing process by using several testing tools | L3 |
| CO3 | Improve the quality procedures based on the past experience | L3 |
| CO4 | Identify various software testing problems, and solve these problems by designing and selecting software. | L2 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | x | | | | | | | | | |
| CO2 | | | x | | x | | | | | | | |
| CO3 | x | | | | | x | | | | | | |
| CO4 | | x | | | | | | | | | | x |

| | | | | |
|---|---|---|---|---|
| | Advanced Database Management System | | | |
| | Course Code | 22SIT331 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 3 | SEE Marks | 50 |
| | Total Hours of Pedagogy | 40 | Total Marks | 100 |
| | Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Explore the knowledge on combination of functionalities and services of networking
- Explain the definition and significance of the Internet of Things.
- Discuss the architecture, operation and business benefits of an IoT solution.

**Module-1**

What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples-Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, OverThe-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk<br>PPT |

**Module-2**

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards-Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP),IPSO

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk<br>PPT |

**Module-3**

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6

| | |
|---|---|
| **Teaching-Learning Process** | Chalk and talk<br>PPT |

**Module-4**

Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.

| | | |
|---|---|---|
| | **Teaching-Learning Process** | Chalk and talk<br>PPT |
| | **Module-5** | |
| | Data Analytics for IoT – Introduction, Apache Hadoop, Using HadoopMapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study. | |
| | **Teaching-Learning Process** | Chalk and talk<br>PPT |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**
**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**
**Books**

- Suggested Learning Resources:
- Books
- Fundamentals of Database Systems,Elmasri and Navathe, Pearson Education2013.
- Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 3rd Edition, 2013.
- Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw Hill, 6th Edition, 2010

**Web links and Video Lectures (e-Resources):**

1. https://link.springer.com/book/10.1007/978-3-7091-2704-9
2. https://www.youtube.com/watch?v=ywTn9qHyI9I
3. https://www.youtube.com/watch?v=_qbKMdqQS6E
4. https://www.youtube.com/watch?v=PqPkYmRSQ_w

**Skill Development Activities Suggested**

The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Le |
|---|---|---|
| CO1 | Infer and represent the real-world data using object-oriented database | L2 |
| CO2 | Interpret rule set in the database to implement data warehousing of mining | L3 |
| CO3 | Discover and design database for recent applications database for better interoperability | L4 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | X | X | | | | | | | | | |
| CO2 | | | X | X | | | | | | | | |
| CO3 | | X | X | | | | | | | | | |

| | | | | |
|---|---|---|---|---|
| | **Predictive Analytics** | | | |
| | Course Code | 22SIT332 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 3:0:0 | SEE Marks | 50 |
| | Total Hours of Pedagogy | 40 | Total Marks | 100 |
| | Credits | 03 | Exam Hours | 03 |

Course Learning objectives:

- **Develop theoretical understanding of modelling techniques in data science.**
- **Formulate complex decision-making problems with data for predictive analysis in business context**.
- Analyze and evaluate predictive model outcomes for informing decision-making.

| | |
|---|---|
| | Module-1 |
| | Linear Methods for Regression and Classification: Overview of supervised learning,Linear regression models and least squares, Multiple regression, Multiple outputs, Subset selection , Ridge regression, Lasso regression , Linear Discriminant Analysis , Logistic regression , Perceptron learning algorithm. |
| Teaching-Learning Process | Teaching-Learning Process |
| | Module-2 |
| | Model Assesment and Selection : Bias,Variance,and model complexity,Bias-variance trade off, Optimisim of the training error rate ,Esimate of In-sample prediction error,Effective number of parameters, Bayesian approach and BIC, Cross- validation ,Boot strap methods, conditional or expected test error. |
| Teaching-Learning Process | Teaching-Learning Process |
| | Module-3 |
| | .Additive Models,Trees,and Boosting: Generalized additive models, Regression and classification trees , Boosting methods-exponential loss and AdaBoost, Numerical Optimization via gradient boosting ,Examples ( Spam data, California housing , New Zealand fish, Demographic data) |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
| | **Module-4** |
| | Neural Networks(NN) , Support Vector Machines(SVM),and K-nearest Neighbour: Fitting neural networks, Back propagation, Issues in training NN, SVM for classification, Reproducing Kernels, SVM for regression, K-nearest –Neighbour classifiers( Image Scene Classification) |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content |
| | **Module-5** |
| | Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis. |
| **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content: |

**Assessment Details (both CIE and SEE)**

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**Continuous Internal Evaluation:**

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**
**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**


1. **Trevor Hastie, Robert Tibshirani, Jerome Friedman , The Elements of Statistical Learning-Data Mining, Inference, and Prediction ,Second Edition , Springer Verlag, 2009..**
2. **G.James,D.Witten,T.Hastie,R.Tibshirani-An introduction to statistical learning with applications in R,Springer,2013..**
3. **E.Alpaydin, Introduction to Machine Learning, Prentice Hall Of India,2010.**
4. **C.M.Bishop –Pattern Recognition and Machine Learning,Springer,2006.**
5. **L.Wasserman-All of statistics.**


**Web links and Video Lectures (e-Resources):**

1. https://www.ibm.com/in-en/analytics/predictive-analytics
2. https://www.youtube.com/watch?v=Kd0C-8q0HkI
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**Skill Development Activities Suggested**

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | **Know the fundamentals of statistical methods and predictive strategies.** | **L3** |
| CO2 | **Know how to validate models and analyse outcomes.** | **L4** |
| CO3 | **Solving analytics difficulties by using systems and critical thinking.** | **L4** |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | PO1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **x** | | | | X | | | | | | | |
| **CO2** | | **x** | | | X | | | | | | | |
| **CO3** | | | | **x** | | | | | | | | |
| **CO4** | | | **x** | | X | | | | | | | |

| | | | | |
|---|---|---|---|---|
| | **PATTERN RECOGNITION** | | | |
| | Course Code | 22SIT333 | CIE Marks | 50 |
| | Teaching Hours/Week (L:P:SDA) | 3:0:0 | SEE Marks | 50 |
| | Total Hours of Pedagogy | 40 | Total Marks | 100 |
| | Credits | 03 | Exam Hours | 03 |

Course Learning objectives:

- To develop the mathematical tools required for the pattern recognition

| | | |
|---|---|---|
| | **Module-1** | |
| | Introduction: Definition of PR, Applications, Datasets for PR, Different paradigms for PR, Introduction to probability, events, random variables, Joint distributions and densities, moments. Estimation minimum risk estimators, problems | |
| | Chalk and Talk/ PPT | Chalk and talk/PPT/case study/web content: https://youtu.be/iANBytZ26MI |
| | Module-2 | |
| | Representation: Data structures for PR, Representation of clusters, proximity measures, size of patterns, Abstraction of Data set, Feature extraction, Feature selection, Evaluation of Classifiers and Clustering | |
| | **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content: https://youtu.be/KqaPMCMHH4g |
| | **Module-3** | |
| | Nearest Neighbour based classifiers & Bayes classifier: Nearest Neighbour Algorithm, Variants of NN Algorithm, Use of NN for Transaction Databases, Efficient Algorithms, Data Reduction, Prototype Selection, Bayes theorem, Minimum Error Rate Classifier, Estimation of Probabilities, Comparison with NNC, Naive Bayes classifier, Bayesian belief network. | |
| | **Teaching-Learning Process** | Chalk and Talk/ PPT / Web resources : https://www.youtube.com/watch?v=ygwgm7oxKhs |
| | **Module-4** | |

| | | |
|---|---|---|
| | Hidden Markov models: Markov Models for Classification, Hidden Markov Models and Classification Using HMMS. Decision Trees: Introduction, Decision Trees for Pattern Recognition, Construction of Decision Trees, Splitting at the Nodes, Over fitting & Pruning, Example of Decision Tree Induction. | |
| | **Teaching-Learning Process** | Chalk and Talk/ PPT / Web Resources: https://www.ukessays.com/essays/engineering/hmm-pattern-recognition-9997.php#:~:text=A%20Hidden%20Markov%20Model%20HMM,of%20a%20set%20of%20observations. |
| | **Module-5** | |
| | Clustering: Hierarchical (Agglomerative, single/complete/average linkage, wards, Partitional (Forgy's, k-means, Isodata), Clustering Large Data Sets, examples, An application: Handwritten Digit recognition. | |
| | **Teaching-Learning Process** | Chalk and talk/PPT/case study/web content: https://youtu.be/Ihl7DPBAZ1g |

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:
Books

1. Pattern Recognition, V Susheela Devi, M Narsimha Murthy, Universities Press 2011
2. Pattern Recognition and Image Analysis, Earl Gose, Richard Johnsonbaugh, Steve Jost, PHI 1996
1. Pattern Classification, Duda R. O., P.E. Hart, and D. G. Stork, Wiley 2000.

**Web links and Video Lectures (e-Resources):**

- https://www.youtube.com/watch?v=ygwgm7oxKhs
- https://hagan.okstate.edu/25_PattRecogCaseStudy.pdf

**Skill Development Activities Suggested**

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Develop algorithms for Pattern Recognition. | L4 |
| CO2 | Develop and analyse decision tress. | L4 |
| CO3 | Apply Decision tree and clustering techniques to various applications | L4 |

| Program Outcome of this course | | |
|---|---|---|
| **Sl. No.** | **Description** | **POs** |
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | PO1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
| 10 | Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. | PO10 |
| 11 | Project management and finance: Demonstrate knowledge and understanding of the engineering, business and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | PO11 |
| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **x** | | X | | | | | | | | | **x** |
| **CO2** | | **x** | X | | X | | | | | | | |
| **CO3** | | | | | X | X | | | | | **x** | |

| High Performance Computing | | | |
|---|---|---|---|
| Course Code | 22SIT334 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 3:0:0 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Determine the methods, costs, and frequency models for I/O performance concerns.
- Appreciate communication latencies, parallel designs, and connectivity networks.
- Set a performance model with the appropriate scaling baseline refinement.

**Module-1**

**Modern processors and Basic optimization techniques for serial code:** Stored-programcomputer architecture, General-purpose cache-based microprocessor architecture, Vector processors. Scalar profiling, Common sense optimizations, Simple measures, large impact, The role of compilers, C++ optimizations.

| **Teaching-Learning Process** | **Teaching-LearningProcess** |
|---|---|

**Module-2**

**Data access optimization and Parallel computers:** Balance analysis and light speed estimates, Case study: The Jacobi algorithm, Case study: Dense matrix transpose, Algorithm classification and access optimizations, Case study: Sparse matrix-vector multiply. Taxonomy of parallel computing paradigms, Shared-memory computers, Distributed-memory computers, Hierarchical (hybrid) systems, Networks.

| **Teaching-Learning Process** | Chalk and Talk/ PPT / Web resources |
|---|---|

**Module-3**

**Basics of parallelization and Shared-memory parallel programming with OpenMP:** Parallelism, Parallel scalability, Factors that limit parallel execution, Scalability metrics, Simple scalability laws, Parallel efficiency, Serial performance versus strong scalability, Refined performance models, Choosing the right scaling baseline, Case study: Can slower processors compute faster?, Load imbalance. Shared-memory parallel programming with OpenMP: Short introduction to OpenMP, Case study: OpenMP-parallel Jacobi algorithm.

| **Teaching-Learning Process** | Chalk and Talk/ PPT / Web resources |
|---|---|

**Module-4**

**Efficient Open MP programming and Locality optimizations on ccNUMA architectures:** Profiling OpenMP programs, Performance pitfalls, Case study: Parallel sparse matrix-vector multiply. Locality optimizations on ccNUMA architectures: Locality of access on ccNUMA, Case study: ccNUMA optimization of sparse MVM, Placement pitfalls, ccNUMA issues with C++.

| **Teaching-Learning Process** | Chalk and Talk/ PPT / Web resources |
|---|---|

**Module-5**

Distributed-memory parallel programming with MPI and Efficient MPI programming: Message passing, A short introduction to MPI, Example: MPI parallelization of a Jacobi solver. Efficient MPI programming: MPI performance tools, Communication parameters, Synchronization, serialization, contention, Reducing communication overhead, Understanding intra node point-to-point communication.

| **Teaching-Learning Process** | Chalk and Talk/ PPT / Case Study |
|---|---|

**Assessment Details (both CIE and SEE)**

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**Continuous Internal Evaluation:**

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Books**


1. Georg Hager and Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Taylor & Francis Group.
2. "High Performance Computing A Chapter Sampler", Taylor & Francis Group, CRC Press.


**Web links and Video Lectures (e-Resources):**

1. https://www.udacity.com/course/high-performance-computing--ud281
2. https://shorturl.at/guSX1

**Skill Development Activities Suggested**

- The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Level |
|---|---|---|
| CO1 | Identify performance issues and Techniques, Cost and frequency models for I/O. | L2 |
| CO2 | Recognize parallel architectures and interconnection networks, communication latencies. | L3 |
| CO3 | Choose the right scaling baseline refined performance model. | L4 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
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| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | X | X | | | X | | | | | | | x |
| CO2 | | X | X | | | | | | | | | |
| CO3 | | | X | X | | | | | | | | |

| Advances in Computer Networks | | | |
|---|---|---|---|
| Course Code | 22SIT335 | CIE Marks | 50 |
| Teaching Hours/Week (L:P:SDA) | 2:0:2 | SEE Marks | 50 |
| Total Hours of Pedagogy | 40 | Total Marks | 100 |
| Credits | 03 | Exam Hours | 03 |

**Course Learning objectives:**

- Students will be able to explain various network protocols of their respective layers.

**Module-1**

Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

| **Teaching-Learning Process** | Chalk and Talk<br>PPT |
|---|---|

**Module-2**

Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels.

| **Teaching-Learning Process** | Chalk and Talk<br>PPT |
|---|---|

**Module-3**

Internetworking- II: Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP

| **Teaching-Learning Process** | Chalk and Talk<br>PPT |
|---|---|

**Module-4**

| | | |
|---|---|---|
| | End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery | |
| | **Teaching-Learning Process** | Chalk and Talk<br>PPT |
| | **Module-5** | |
| | Congestion Control and Resource Allocation Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP) | |
| | **Teaching-Learning Process** | Chalk and Talk<br>PPT |

## Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

### Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

**Suggested Learning Resources:**

**Text Books:**

- *Computer Networks: A System Approach,* Larry Peterson and Bruce S Davis, Elsevier, 5th Edition 2014
- *Internetworking with TCP/IP, Principles, Protocols and Architecture,* Douglas E Comer, PHI, 6th Edition 2014.

**Reference Books:**

- *Computer Networks, Protocols, Standards and Interfaces,* Uyless Black , PHI, 2 nd Edition
- *TCP /IP Protocol Suite,* Behrouz A Forouzan, Tata McGraw-Hill, 4 th Edition

**Web links and Video Lectures (e-Resources):**

- https://www.udemy.com/course/computer-networks-for-beginners-from-zero-to-hero/
- https://www.youtube.com/watch?v=f5ksLu5Xjnk&list=PLG9aCp4uE-s3Mmbn4q5J87OriIN3CuFDS
- https://sites.google.com/site/computernetworksfall2009/course-outline

**Skill Development Activities Suggested**

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

**Course outcome (Course Skill Set)**

At the end of the course the student will be able to :

| Sl. No. | Description | Blooms Le |
|---|---|---|
| CO1 | List and classify network services, protocols and architectures, explain why they are layered. | L1 |
| CO2 | Choose key Internet applications and their protocols and apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API. | L3 |
| CO3 | Develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery Etc. | L2 |
| CO1 | List and classify network services, protocols and architectures, explain why they are layered. | L1 |

**Program Outcome of this course**

| Sl. No. | Description | POs |
|---|---|---|
| 1 | Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and computer science and business systems to the solution of complex engineering and societal problems. | Po1 |
| 2 | Problem analysis: Identify, formulate, review research literature, and analyze complex engineering and business problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. | PO2 |
| 3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. | PO3 |
| 4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. | PO4 |
| 5 | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations | PO5 |
| 6 | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering and business practices. | PO6 |
| 7 | Environment and sustainability: Understand the impact of the professional engineering solutions in business societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | PO7 |
| 8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering and business practices. | PO8 |
| 9 | Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. | PO9 |
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| 12 | Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | PO12 |

**Mapping of COS and POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | x | | | x | | x | | | | | | |
| CO2 | | | x | | x | | | | | | x | |
| CO3 | | x | x | | | | | | | | | x |
| CO4 | x | | | x | | x | x | | | | | |

| PROJECT WORK PHASE – 1 | | | |
|---|---|---|---|
| Course Code | 22SCN34 | CIE Marks | 100 |
| Number of contact Hours/Week | 6 | SEE Marks | -- |
| Credits | 03 | Exam Hours | -- |

**Course objectives:**

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

**Project Phase-1** Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.
**Seminar:** Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

**Course outcomes:**
At the end of the course the student will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

**Continuous Internal Evaluation**
CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

| Societal Project | | | |
|---|---|---|---|
| Course Code | 22SCN35 | CIE Marks | 100 |
| Number of contact Hours/Week | 6 | SEE Marks | |
| Credits | 3 | Exam Hours | 03 |

**Course objectives:**

- Build creative solutions for development problems of current scenario in the Society.
- Utilize the skills developed in the curriculum to solve real life problems.
- Improve understanding and develop methodology for solving complex issues.

**Some of the domains to choose for societal projects:**

- Infrastructure
- Health Care
- Social security
- Security for women
- Transportation
- Business Continuity
- Remote working and Education
- Digital Finance
- Food Security
- Rural employment
- Water and land management
- Pollution
- Financial Independence
- Agricultural Finance
- Primary Health care
- Nutrition
- Child Care
- E-learning
- Distance parenting
- Mentorship Etc

**Course outcomes:**

At the end of the course the student will be able to:

- Building solution for real life societal problems.
- Improvement of their technical/curriculum skills

**Continuous Internal Evaluation:**

**Identifying the real life problems and producing literature report : 20 marks**

**Data sampling and Cleaning :10 Marks**

**Establishing the right Objective: 10 Marks**

**Developing the solution : 20 Marks**

Propagating the solution to the stake holders 1)Lectures 2)Social Meetings 3)Social media 4)Street plays 5)Advertisement Either of the 3(evidence of the work through geo tag photo) certified by stake holders and authorized by concerned government authorities

**Project Report:** 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

**Project Presentation:** 10 marks.

The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

**Evalution:** 10 marks.

The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

| INTERNSHIP / PROFESSIONAL PRACTICE | | | |
|---|---|---|---|
| Course Code | 22SCNI36 | CIE Marks | 50 |
| Number of contact Hours/Week | 3 | SEE Marks | 50 |
| Credits | 06 | Exam Hours | 03 |

**Course objectives:**

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

To put theory into practice.

To expand thinking and broaden the knowledge and skills acquired through course work in the field.

To relate to, interact with, and learn from current professionals in the field.

To gain a greater understanding of the duties and responsibilities of a professional.

To understand and adhere to professional standards in the field.

To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.

To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently.

**Internship/Professional practice:** Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

**Seminar:** Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

**Course outcomes:**

At the end of the course the student will be able to:

- Gain practical experience within industry in which the internship is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- Expand intellectual capacity, credibility, judgment, intuition.
- Acquire the knowledge of administration, marketing, finance and economics.

**Continuous Internal Evaluation**

CIE marks for the Internship/Professional practice report (30 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

**Semester End Examination**

SEE marks for the internship report (20 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.

| PROJECT WORK PHASE -2 | | | |
|---|---|---|---|
| Course Code | 22SIT41 | CIE Marks | 100 |
| Number of contact Hours/Week | 8 | SEE Marks | 100 |
| Credits | 18 | Exam Hours | 03 |

**Course objectives:**

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

**Project Work Phase - II:** Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

- Follow the Software Development life cycle
- Data Collection ,Planning
- Design the Test cases
- Validation and verification of attained results
- Significance of parameters w.r.t scientific quantified data.
- Publish the project work in reputed Journal.

**Course outcomes:**

At the end of the course the student will be able to:

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

**Continuous Internal Evaluation:**

**Project Report:** 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

**Project Presentation:** 20 marks.

The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

**Project Execution:** 50 Marks

The Project Execution marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

**Question and Answer:** 10 marks.

The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.

**Semester End Examination**

SEE marks for the project report (60 marks), seminar (30 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.