# Autonomous Program Structure of 
Third Year B. Tech. Sixth Semester 
(Information Technology) 
Academic Year: 2022-2023 Onwards

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Scheme Hours /Week</th>
<th>Examination Scheme</th>
<th>Total Marks</th>
<th>Credit</th>
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<tr>
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<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
<td>In Sem</td>
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|             |                                                 |             |             |             |             |             |       | No Credits |
|             |                                                 |             |             |             |             |             |       |            |
|             | **Total**                                       | **18**      | **1**       | **8**       | **375**    | **300**    | **50** | **25**     | **750** | **22**  |
|             | **Grand Total**                                 | **27**      |             |             |             |             |       |            |

**Programme Elective – III**
- 20PEIT 601 A Advanced Computer Network
- 20PEIT 601 B Natural Language Processing
- 20PEIT 601 C Multimedia Techniques

**Programme Elective – III Lab**
- 20PEIT 601L A Advanced Computer Network
- 20PEIT 601L B Natural Language Processing
- 20PEIT 601L C Multimedia Techniques
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<tr>
<th>Sr. No.</th>
<th>Course Code</th>
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20IT 601 Information Security

Teaching Scheme: 
Lectures: 3 hours/week

Examination Scheme: 
In-Semester: 50 Marks 
End-Semester: 50 Marks 
Credits: 3

Prerequisites: Network Fundamentals, Computer Networks

Course Objectives:
Familiarize students with
1. Information Security course surveys central concepts in applied information security and cyber security.
2. Make students aware of the major security risks and attack vectors.
3. Provides tools and practices for building secure systems.
4. Design, develop and support a global security system using the state of mind and reasoning on software systems security.

Course Outcomes:
Students should be able to
1. Apply knowledge of mathematical background and different cryptographic techniques to provide security in the computer networks.
2. Apply the knowledge to draft the security goals clearly in the networks.
3. Apply the concept of end-to-end security.
4. To compare merits and demerits of different cryptographic techniques/protocols and take decisions while securing a network.

Unit – I Classical Encryption Techniques 8 Hours
Classical Encryption Techniques, Block Ciphers and DES, Basic Concepts in Number Theory and Finite Fields, Advanced Encryption Standard (AES), Block Ciphers Operations

Unit – II Modern Cryptographic Techniques 8 Hours
Pseudo Random Number Generation and Stream Ciphers, Public Key Cryptography, Cryptographic Hash Functions Message Authentication Codes

Unit – III Key Management Techniques 9 Hours
Digital Signatures, Public-Key Certificates PKI, PKIX, and X.509, CA Hierarchy, User Authentication Protocols Public-Key Certificates PKI, PKIX, and X.509, CA Hierarchy

Unit – IV Network and Transport Layer Security 8 Hours

Unit – V Cyber Security 9 Hours

Text Books


Reference Books

20IT 602 Cloud Computing

Teaching Scheme:  
Lectures: 3 hours/week  
Tutorial: -

Examination Scheme:  
In-Semester: 50 marks  
End-Semester: 50 marks  
Credits: 3

Prerequisites: Operating Systems and Computer Networks

Course Objectives:  
Familiarize students with  
1. Distributed Systems and its ecosystem.  
2. Basics of virtualization and its importance.  
3. In-depth analysis of cloud computing capabilities.  
4. Overview of cloud programming and services.

Course Outcomes:  
Students should be able to  
1. Recognize need of cloud based solutions.  
2. Justify the importance of distributed systems.  
3. Determine effective techniques to program cloud systems.  
4. Evaluate current challenges and trade-offs in cloud computing.

Unit – I Introduction to Distributed Systems  

Unit – II Computer Clusters for Scalable Parallel Computing  

Unit – III Virtual Machines and Virtualization of Clusters and Data Centers  
Implementation Levels of Virtualization, Virtualization Structures/Tools: Hypervisors and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation

Unit – IV Cloud Platform Architecture over Virtualized Data Centers  
Unit – V Cloud Programming and Software Environments 7 Hours
Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments,

Unit – VI Grids, P2P, and the Future Internet 7 Hours

Text Books


Reference Books

20IT 603 Object Oriented Software Engineering

Teaching Scheme:  
Lectures: 3 hours/week  
Tutorial: 1 hour/week

Examination Scheme:  
In-Semester: 50 marks  
End-Semester: 50 marks  
Credits: 4

Prerequisites: Object oriented analysis and design laboratory

Course Objectives:  
Familiarize students with
1. Basic concepts of object oriented software engineering and process models.
2. Requirements elicitation and analysis activities.
3. Concepts of system and object design.
4. Software coding and testing techniques.

Course Outcomes:  
Students should be able to
1. Choose appropriate software development process models for real life projects.
2. Analyze requirements with use cases.
3. Develop design models using the UML notations.
4. Apply appropriate coding and testing methods according to requirements.

Unit – I: Introduction to Software engineering  
7 Hours  
Software life cycle, Processes and activities, Life cycle models: Sequential activity-centered models, Iterative activity-centered models, Entity centered models, Agile Process, Principles, Extreme programming, XP values, XP process, Industrial XP, Scrum

Unit – II: Requirements gathering and analysis  
7 Hours  
Requirement elicitation, functional and nonfunctional requirements, Elicitation activities, identifying actors, scenarios, use-cases, refinement, Requirements analysis concept, Analysis Object Models and Dynamic Models, Entity, Boundary, and Control Objects, Generalization and Specialization, Analysis Activities: From Use Cases to Objects, Requirement Analysis document

Unit – III: System Design  
7 Hours  
System Design Concept, Subsystem and classes, Services and Subsystem Interfaces, Coupling and Cohesion, Layers and Partitions, Architectural Styles, System Design Activities: From Objects to Subsystems, addressing design goals.

Unit – IV: Object Design  
7 Hours  
Reuse concepts: Solution Objects, Inheritance, and Design Patterns, reuse activities: Selecting Design Patterns and Components, managing reuse, Specifying interface, interface specification, interface specification activities, managing object design.

Unit – V: Construction  
7 Hours  
Mapping models to code, overview of mapping, mapping concept, Model transformation Refactoring, Forward and reverse engineering, mapping activities, mapping implementation
Unit – VI: Software Testing

Overview of testing, testing concepts, Faults, Erroneous States, and Failures, test cases, Test Stubs and Drivers, testing activities, component inspection, usability testing, unit testing, integration testing, system testing, managing testing

Text Books:

Reference Books:
20HS 601 Green Computing

Teaching Scheme:
Lectures: 3 hours/week

Examination Scheme:
In-Semester : 50 Marks
End-Semester : 50 Marks
Credits : 3

Prerequisites: Basic Sciences

Course Objectives:
Familiarize students with
1. Knowledge of green computing practices to minimize negative impacts on the environment.
3. Green Computing and how it can help improve environmental sustainability.

Course Outcomes:
Students should be able to
1. Relate to the socio-cultural aspects of green computing.
2. Create awareness about green computing and promote a green agenda in their working environments leading to the green movement.
3. Apply green computing skills such as energy efficiency, IT assets disposal, carbon footprint estimation, reporting and development of green products.
4. Justify green initiatives while developing applications and services in enterprises.

Unit – I  Introduction to Green Computing  7 Hours
Environmental Impacts of IT, Need of green computing, Green IT Standards, Enterprise Green IT Strategy, Hardware: Reuse, Recycle and Dispose, present scenario in industry, health issues relevance, Software: Energy-Saving Software Techniques

Unit – II  Software Development and Green Data Centers  7 Hours
Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics

Unit – III  Green Data Storage and Networks  7 Hours
Unit – IV  Enterprise Green IT Strategy  7 Hours
Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information

Unit – V  Green Computing Services and Roles  7 Hours
Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise

Unit – VI  Regulating Green Computing  7 Hours
The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Green Data Centres, Social Movements

Text Books

Reference Books
20PEIT 601A Advanced Computer Networks

Teaching Scheme: Lectures: 3 hours/week

Examination Scheme: In-Semester: 50 Marks
End-Semester: 50 Marks

Credits: 3

Prerequisites: Network Fundamentals, Computer Networks

Course Objectives:
Familiarize students with
1. Basic functions and concepts of advanced computer networks.
3. Mechanisms to handle congestion and routing.
4. Introduction to seminal research papers.

Course Outcomes:
Students should be able to
1. Compare resource allocation mechanisms.
2. Evaluate the performance measures in TCP/IP networks.
3. Analyze routing algorithms.
4. Comprehend a few seminal research papers.

Unit – I  Internet architecture and performance modeling  7 Hours

Unit – II  Applications: architectures and examples  7 Hours
Application layer architectures: client-server vs. P2P, Socket interface: TCP vs. UDP semantics, Application types: elastic vs. real-time, WWW and HTTP. Persistent vs. non-persistent connections, HTTP message formats, headers, Caching, cookies, FTP, SMTP

Unit – III  Transport protocols  7 Hours
Basic function of transport - multiplexing and demultiplexing, UDP- simple transport, TCP connection basics: handshake, reliability, pipelining, congestion control, flow control, Ideal window size and bandwidth delay product, Buffer sizing for TCP, Simple model for TCP throughput, Understanding TCP fairness, RED gateways, Resource allocation, QoS, and fairness, QoS architectures: Intserv and Diffserv, Admission control: Token Bucket Filter

Unit – IV  Internet routing  7 Hours
Router scheduling, common router scheduling policies / queuing disciplines Hierarchical (intradomain and interdomain) routing, IPv6, IP-in-IP tunneling, MPLS, BGP and advanced BGP concepts
Unit – V   Link layer  7 Hours
Link layer functions: Link layer addresses, ARP, Shared broadcast, multiple access protocols, the original Ethernet, spanning tree protocol, VLANs, NAT traversal.

Unit – VI   Advanced topics  7 Hours

Text Books
3. “Data Networks” 2nd edition Bertsekas and Gallager, Prentice hall publisher (mainly Chapter 3.3 on basic queuing theory

Reference papers
1. The design philosophy of the DARPA internet protocols, David Clark.
2. Chord: A Scalable Peer-to-peer Lookup Service for Internet Applications, Stoica et al
4. Sizing Router Buffers, Appenzeller et al
5. Bufferbloat: Dark Buffers in the Internet, Gettys and Nichols
6. The Macroscopic Behavior of the TCP Congestion Avoidance Algorithm, Mathis et al.
8. Random Early Detection Gateways for Congestion Avoidance, Floyd and Jacobson
20PEIT 601B Natural Language Processing

Teaching Scheme:
Lectures: 3 hours/week  
Tutorial:-

Examination Scheme:
In-Semester: 50 Marks  
End-Semester: 50 marks  
Credits: 3

Prerequisites: Probability Basics, Automata theory

Course Objectives:
Familiarize students with
1. Core concepts of Natural language processing (NLP)
2. Levels of language analysis
3. Language modeling and Parsing techniques used in natural language processing
4. State of art NLP areas

Course Outcomes:
Students will be able to:
1. Identify challenges involved in developing natural language processing system
2. Apply natural language processing techniques
3. Recommend Natural Language Processing techniques for language modeling, syntax and semantic parsing
4. Analyze Natural Language Processing systems for different applications

Unit – I  Introduction to Natural Language Processing  7 Hours
Introduction: Natural Language Processing (NLP) and Natural Language Understanding (NLU)  
NLP applications, Brief history of field, Challenges in developing NLP system, Evaluating Natural Language Understanding Systems, The Different Levels of Language Analysis, representation and understanding, NLP tasks in syntax, semantics and pragmatics

Unit – II  Syntactic Parsing  7 Hours
Grammar and sentence structure, A Top-Down Parser, A Bottom-Up Chart Parser, Top-Down Chart Parsing, Human Preferences in Parsing, Morphology analysis –survey of English Morphology, Inflectional morphology & Derivational morphology, finite state transducers (FST), Finite state models and Morphological processing

Unit – III  Features and Augmented Grammars  7 Hours

Unit – IV  Language Modeling  7 Hours
Unit – V  Semantic Analysis  7 Hours
Semantics and Logical Form : Word Senses and Ambiguity, The Basic Logical Form Language, Encoding Ambiguity in Logical Form , Verbs and States in Logical Form, Case Relations Lexical Resources: WordNet, Semantic web Ontologies

Unit – VI  Future of NLP  7 Hours
Role of Machine learning in NLP applications, Opinion mining, Sentiment Analysis. Machine Translation(MT), MT evaluation tools such as Bleu, WER (Word Error Rate), Information Extraction, Question answering, Automatic speech recognition, Deep Learning for Natural Language Processing

Text Books

Reference Books
2. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval
3. Daniel M. Bikel, ImedZitouni, Multilingual Natural Language Processing Applications
20PEIT 601C Multimedia Techniques

Teaching Scheme:  
Lectures: 3 hours/week

Examination Scheme:  
In-Semester: 50 Marks  
End-Semester: 50 marks  
Credits: 3

Prerequisites: Algebra and Geometry

Course Objectives:  
Familiarize students with  
1. Variety of multimedia data modification algorithms  
2. Capturing and using multimedia components for presenting a concept  
3. Multimedia data processing for its size reduction  
4. Usage of multimedia in variety of domain applications

Course Outcomes:  
Students will be able to:  
1. Apply multimedia components in multimedia production.  
2. Apply data processing techniques on multimedia data  
3. Apply compression techniques on multimedia data  
4. Choose different multimedia components for multimedia system design

Unit – I  Multimedia Overview and basics of still Image  7 Hours  
Multimedia Overview: Introduction, multimedia presentation and production, characteristics of multimedia presentation, hardware and software requirements, uses of multimedia, analog and digital representation, digitization, Nyquist theorem, quantization error, visual display systems, enterprise data and multimedia component.  

Unit – II  Image Processing  7 Hours  
Binary image processing, grey scale image processing, colored image processing. Image output on monitors, image output on printers, image file formats both lossless and lossy.

Unit – III  Audio data as multimedia component  7 Hours  
Introduction, acoustics, sound waves, types and properties of sound, psycho acoustics, components of an audio system, digital audio, synthesizers, MIDI, audio processing.

Unit – IV  Audio transmission and broadcasting  7 Hours  
Speech, sound card, audio transmission, digital audio broadcasting, surround sound system, audio file formats both lossless and lossy.

Unit – V  Video data as multimedia component  7 Hours  
Motion video, digital video, digital video processing, video recording and storage formats both lossless and lossy, and video editing concepts.
Unit – VI  Data compression  7 Hours
Image compression technique, audio compression technique, video compression technique.

Text Books

Reference Books
20OE 601F Open Elective II: Design Thinking

Teaching Scheme:  
Lectures: 3 hours/week  
Tutorial: -

Examination Scheme:  
In-Semester: 50 marks  
End-Semester: 50 marks  
Credits: 3

Prerequisites: -

Course Objectives:
Familiarize students with
1. Design thinking process
2. User centric approach for designing a solution
3. Problem analysis with various methods
4. Applications of Design Thinking

Course Outcomes:
Students should be able to
1. Analyze problems with various methods
2. Recommend a solution based on empathy, ideation, prototyping, and playful testing
3. Apply design thinking methods to generate innovative and user centric solutions
4. Test designed prototypes to reduce risks and accelerate organizational learning

Unit – I: Design and Design Problems 8 Hours

What is Design? The components of design problems; measurement, criteria and judgement in design

A model of design problems – Defining problems: Selecting goals and diverse teams, creating a unified vision and scope, mapping stakeholders and personas; Analysing design problems, generators of design problems, roles of generators, design constraints

Unit II: Design Solutions 8 Hours

Solutions to Design Problems: Designer’s response: procrastination, non-committal design and throw away design, design problems and solutions

Design Process: define, search, ideate, prototype, select, implement, learn, Refresher and restate the challenge, getting inspiration, understanding innovation ambition, Solution ideation, Narrowing solution choice, Solution evaluation, Road map

Unit III: Design Thinking 9 Hours

Types and Styles of Thinking – theories of design, types of thinking; creative thinking - what is creativity? creativity in design, Principles of design thinking
Unit IV: Design Philosophies and Strategies

Theory and practice, three early phases of working on the same problem

Prototype Creation: Choosing a prototype approach, user interface prototypes, applications vs custom build, reference architectures, prototype and solution evaluation

Unit V: Design Tactics and Traps

Methods and Tactics, understanding the problem, the model of problems, One or many solutions? Common traps and ways of avoiding them

Text Books:


Reference Books:

1. Ben Crothers, “Design Thinking Fundamentals”, O'Reily
3. Susan Weins Chenk, “Hundred things every designer needs to know about people”, New Riders Publication
7. Bala Ramadurai, “Karmic Design Thinking”
20IT 601L Information Security Laboratory

Teaching Scheme:  
Practical: 2 hours/week

Examination Scheme:  
In-Semester: - 25 Marks  
Practical: 25 marks  
Credits: 1

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:
Familiarize students with
1. Learn to implement the algorithms DES, RSA, MD5, SHA-1 etc.
2. Make students aware of the major security risks and attack vectors.
3. Provides tools and practices for building secure systems.
4. Learn to use network security tools like GnuPG, KF sensor, Net Strumbler

Course Outcomes:
Students will be able to:
1. Implement the cipher techniques
2. Analyse the security algorithms and protocols
3. Use different open source tools for network security and analysis
4. A mini project implementation

Suggested list of laboratory assignments:

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts (any 2):
   a. Caesar Cipher
   b. Playfair Cipher
   c. Hill Cipher
   d. Vigenere Cipher
   e. Rail fence – row & Column Transformation

2. Implement the following algorithms (any 3)
   a. DES
   b. RSA Algorithm
   c. Diffie-Hellman
   d. MD5
   e. SHA-1

3. Implement the Digital Signature Scheme

4. Demonstrate intrusion detection system (IDS) using any tool (snort or any other s/w)

5. Analysis of the Security Vulnerabilities of E-commerce services / Analysis of the security vulnerabilities of E-Mail Application

6. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
7. Study assignment: (any 1)
   A. Study of different wireless network components and features of any one of the Mobile Security Apps.
   B. Study of the features of firewall in providing network security and to set Firewall Security in windows.
   C. Study of different types of vulnerabilities for hacking websites / Web Applications.

8. Implementation of a mini-project (Case study on college network for security).

Text Books


Reference Books

20IT 603L Object Oriented Software Engineering Laboratory

Teaching Scheme:
Practical: 2 hours/week
Tutorial: -

Examination Scheme:
In-Semester: 25 marks
Oral: 25 marks
Credits: 1

Prerequisites: Object oriented analysis and design laboratory

Course Objectives:
Familiarize students with
1. Various Object Oriented concepts along with their applicability contexts using agile
development approach.
2. Various domain objects, their properties and relationships among them for given
problem domain.
3. Modeling techniques to model different perspectives of object-oriented software design
(UML)
4. Object oriented design solutions for the recurring problems

Course Outcomes:
Students should be able to
1. Identify use cases from project requirements.
2. Identify potential classes from use case specifications.
3. Design models using the UML notations.
4. Produce industry standard documentation from requirements analysis and design
through testing and verification

Software engineering diagrams will be drawn based on some problem statement (Agile
Approach)

1. Use-case Diagrams
2. Class Diagrams
3. Sequence Diagram
4. Activity Diagrams
5. Package Diagrams
6. Component Diagrams
7. Deployment diagrams
8. State Machine Diagrams

Text Books:
edition, Prentice Hall.

Reference Books:
20PEIT 601L A Advanced Computer Network Laboratory

Teaching Scheme: Practical: 2 hours/week

Examination Scheme: In-Semester: 25 Marks
Oral: 25 marks
Credits: 1

Prerequisites: Foundations of Computer Networks, Computer Networks

Course Objectives:
Familiarize students with
1. Basic functions and concepts of advanced computer networks.
3. Mechanisms to handle congestion and routing.
4. Introduction to seminal research papers.

Course Outcomes:
Students should be able to
1. Compare resource allocation mechanisms.
2. Evaluate the performance measures in TCP/IP networks.
3. Analyze routing algorithms.
4. Implement basic functions of SDN

Implementation of a mini-project on any of the following topics (Use NS2/NS3, packet Tracers etc. simulators).

1. BGP implementation
2. VLAN implementation
3. Wireless adhoc networks
4. Evaluate QoS in a network

Text Books
20PEIT 601L B Natural Language Processing Laboratory

Teaching Scheme: Practical: 2 hours/week

Examination Scheme: In-Semester: 25 Marks
Oral: 25 marks
Credits: 1

Prerequisites: Probability Basics, Automata theory

Course Objectives:
Familiarize students with
1. Implementation of Natural language processing (NLP) techniques
2. Application of various libraries to develop NLP system
3. Language modeling and Parsing techniques used in natural language processing
4. State of art NLP areas

Course Outcomes:
Students will be able to:
1. Implement various NLP techniques
2. Apply various library functions to develop NLP applications
3. Choose NLP techniques for language modeling, syntax and semantic parsing
4. Develop NLP system for different applications

Assignments:
1. Choose any NLP application and design and implement NLP system for the same. The developed system should demonstrate implementation of following NLP concepts:
   a. Analyse morphological features of a word.
   b. Perform syntactic parsing to check acceptance of a sentence
   c. Calculate bigrams from a given corpus and calculate probability of a sentence.
   d. Perform Part of Speech Tagging
   e. Use lexical resources to implement word sense disambiguation
   f. Integrated NLP application

Text Books

Reference Books
2. Tanveer Siddiqui, US Tiwary, Natural Language Processing and Information Retrieval
3. Daniel M.Bikel, ImedZitouni, Multilingual Natural Language Processing Applications
20PEIT 601L C Multimedia Techniques laboratory

Teaching Scheme: 2 hours/week

Examination Scheme: In-Semester: 25 Marks
Oral: 25 marks
Credits: 1

Prerequisites: Algebra and Geometry

Course Objectives:
Familiarize students with
1. Implementation of Multimedia techniques
2. Use of multimedia library for Image data
3. Use of multimedia library for Audio data
4. Use of multimedia library for Video data

Course Outcomes:
Students will be able to:
1. Implement various Image processing techniques
2. Implement various Audio processing techniques
3. Implement various Video processing techniques
4. Develop Multimedia system for different applications

Assignments:
Design and implement a Multimedia system for the chosen application. The developed system should demonstrate implementation of following
1. Use of text media
2. Image processing techniques such as edge detection, histogram plotting, grey scaling but not limited to using library files
3. Use of Animation media
4. Audio processing techniques such as load, play, crop, rewind, forward but not limited to using library files
5. Video processing techniques such as load, play, crop, rewind, forward but not limited to using library files

Text Books

Reference Books